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March 2007

Vienna ENERGY EFFICIENCY and CLIMATE MEETINGS

19-20 March 2007
Vienna International Centre

Industrial Energy Efficiency Projects in the Clean Development Mechanism and Joint Implementation

A seminar organized jointly by UNIDO, the Climate Technology Initiative and UK Trade and Investment to discuss how the Kyoto Protocol can increase the efficiency of energy use in industry.

21-22 March 2007
Vienna International Centre

Energy Management Standards in Industry

How to make energy efficiency "business as usual" in the industry sector. The UNIDO Expert Group Meeting brings together energy efficiency and standards experts to discuss linking energy efficiency to global competitiveness, cost reduction, increased productivity and environmental compli-

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V.07-80375–February 2007–10

Proceedings of the UNIDO/CTI Seminar on Energy Efficiency and CDM

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna, 2007

Contents

I. Introduction

1.1 Brief description

The Seminar on Industrial Energy Efficiency Projects in the Clean Development Mechanism and Joint Implementation took place at the Vienna International Centre, Vienna, Austria, from 19-20 March 2007. An initiative of the United Nations Industrial Development Organization (UNIDO), in partnership with the Climate Technology Initiative (CTI) and UK Trade and Investment, the seminar provided a forum for business and industry to discuss energy efficiency projects under the Kyoto Protocol's Clean Development Mechanism (CDM) and barriers to their development and implementation. It also created an opportunity for discussion among countries hosting CDM and Joint Implementation (JI) projects, and countries interested in purchasing emissions reductions to meet emissions reduction targets.

The objective of the seminar was to provide a forum for business and industry to advance their understanding of the methodological issues surrounding energy efficiency, including small-scale energy efficiency projects/programmes within the CDM and the barriers for their development and implementation. The seminar provided an opportunity for expert discussions and knowledge sharing among countries hosting CDM and JI projects and those that are interested in buying emissions reductions to meet the emissions reduction targets. The Seminar provided a forum for project developers and other stakeholders in industry who are directly involved in the development of energy efficiency projects such as CDM or JI projects.

Over the course of the two-day seminar, participants and speakers, representing governments, industry, international organizations, financial and legal entities, and research institutions attended. The event provided a networking and knowledge-sharing opportunity for business and industry as well as for government experts and other stakeholders involved in the implementation of emissions trading and the project-based mechanism. Full details of the seminar schedule are included in Annex IV.

1.2 Clean Development Mechanism (CDM) and Joint Implementation (JI)

The Kyoto Protocol introduces two project-based mechanisms that allow Parties with national emissions caps to achieve emissions reductions outside their borders. Article 6 of the Protocol introduces JI and sets the ground for the transfer of emissions reduction units (ERUs) among Annex I Parties.

The CDM allows legal entities in developing countries to undertake cooperative projects with partners from Annex I countries in order to generate certified emissions reduction units (CERUs). CERUs are transferable to Annex I investor countries and can be used to augment the allocated amounts of emissions in the first budget period (2008-2012). CDM projects are to be undertaken for the benefit of both parties and should lead to emissions reductions that are real, measurable and long-term. Such projects are also expected to result in demonstrable non-GHG benefits (i.e. environmental and socio-economic benefits) to the recipient developing country.

The modalities for the implementation of the CDM have yet to be developed and clarified through negotiations. To receive recognition as credits, project-based emissions reductions have to be additional to any that would have taken place in the absence of CDM or JI investment. Establishing additionality and baselines for project-based emissions reductions is one of the most challenging problems that have to be addressed in order to make the CDM and JI workable.

Additionality determination (in particular financial additionality) is a particularly challenging task for energy-efficiency projects, as these projects are regarded most cost-effective in reducing emissions. It will be difficult to make a distinction between cost-effective (and hence competitive) projects and those that are not financially additional.

1.3 Industrial energy efficiency

The industrial sector accounts for some 41 per cent of global primary energy demand and approximately the same share of CO_2 emissions. GHG emissions can be substantially cut in this sector through policies and initiatives that stimulate market transformation and new technologies which would help improve end-use energy efficiency by recovering waste heat (in the case of cogeneration).

Although industrial energy efficiency has improved greatly in industrialized countries, efficiency gains have remained low in developing countries and economies in transition. In some cases, the energy intensity and carbon intensity of industrial output has increased despite an economic slow down. The promotion of cogeneration and end-use efficiency in the industrial sector can not only reduce emissions but also contribute to improvements in productivity and competitiveness and in the security of energy supply.

These economic, environmental and social benefits of cogeneration suggest that there is a potential for developing CDM or JI projects which would support the introduction of cogeneration and promote industrial end-use efficiency as a climate change mitigation option in industry.

Although the benefits of Industrial Energy Efficiency (IEE) are well known, IEE projects represent only 3.4 per cent of registered CDM projects (19 of 563 CDM projects approved, as of 22 March 2007). Additionally, only 5 of 277 large-scale and 6 of 286 small-scale projects are aimed at improving the efficiency of energy end-use, or energy demand. UNIDO believes that energy efficiency CDM and JI projects are underrepresented in both processes, and seeks to highlight the potential of demand-side IEE projects to significantly reduce carbon dioxide emissions. Specifically, UNIDO seeks to promote a “systems approach” to energy efficiency (analyzing the whole system), as opposed to making specific components more efficient.

1.4 Agenda

The Seminar on Energy Efficiency Projects in the CDM and JI took place from 19-20 March 2007. The seminar was organized as a series of interactive panel sessions, where speakers provide short 10-15 minute slide presentations followed by a question-and-answer period. Speakers and participants included renowned international experts, project and methodology developers and a wide-range of high-profile institutions and industry representatives. On Monday, 19 March, panel sessions were held on:

I. An overview of carbon markets
II. The status of energy efficiency under the CDM and JI, and
III. Lessons learned and barriers to energy efficiency in the CDM/JI.

On Tuesday, 20 March, there were panel sessions on:

IV. New approaches to CDM and JI
V. Methodologies for electric motor systems, and
VI. Transforming markets for energy efficiency.

In between Sessions V and VI, five discussion groups were formed to discuss the following topics:

- Programmes of activities (PoAs) and energy efficiency
- Energy efficiency methodology issues and tools
- CHP in CDM
- Linking Montreal and Kyoto: chiller demonstration projects and CDM, and
- Linking the IEE and CDM/JI expert communities: CDM EE Network.

2. Conclusions and recommendations

2.1 General

The objective of the seminar was to provide a forum for business and industry to advance their understanding of the methodological issues surrounding energy efficiency projects/programmes within the CDM/JI and the barriers for their development and implementation. The seminar provided an opportunity for expert discussion and knowledge sharing among countries hosting CDM and JI projects and countries that are interested in buying emissions reductions to meet their own emissions reduction targets.

The seminar was organized as a series of interactive panel sessions, where speakers provided short 10-15 minute slide presentations followed by a question-and-answer period. Speakers and participants included renowned international experts, project and methodology developers and a wide range of high-profile representatives from institutions and industry.

The event provided an excellent networking and knowledge-sharing opportunity for business and industry as well as for government experts and other stakeholders involved in the implementation of emissions trading and project-based JI/CDM mechanisms.

2.2 Energy efficiency projects in CDM and JI

Energy efficiency projects are in general underrepresented in CDM and JI. While the potential of energy efficiency as a mitigation option is widely recognized and acknowledged, the mechanisms of the Kyoto Protocol have so far failed so far to live up to their expectations in terms of their potential to promote more efficient technologies. Among the 563 CDM projects approved up to 22 March 2007, industrial CHP and the use of waste heat recovery projects are well-represented, but only five large-scale and six small-scale projects – out of a total number of 277 and 286, respectively – are aimed at improving the efficiency of energy end-use (i.e. “Sectoral Scope 3” projects).

There are 19 approved energy efficiency projects in the industrial sector representing only 3 per cent of the total number of registered CDM projects. The estimated GHG reductions from these projects are < 300 kilo tonnes CO_2 equivalent per year, which is a miniscule share of global energy efficiency potential. The projects are also limited in terms of their geographical distribution (all but two projects are in India) and the range of applied technologies and energy efficiency know-how.

The international climate change community expressed its concern at the limitations encountered by energy efficiency projects, and with demand-side industrial energy efficiency projects in particular. Their underrepresentation in the CDM pipeline is not only a lost opportunity in terms of CER volumes, but is also a growing challenge to the CDM itself, particularly in the light of the uncertainties with the post-2012 regulatory framework and the growing demand for projects with shorter pay-back periods and the potential for the delivery of quality emission reductions. In August 2006, there was a call for public input on the issue of small-scale energy efficiency projects and some changes to the definition of the eligibility limits were introduced for small-scale energy efficiency projects.

The purpose of the UNIDO seminar was to provide an input for global discourse on the issue of energy efficiency in CDM and JI and to examine methodological and other barriers that hinder the development of such projects.

The following sections and subsections highlight the main substantive issues addressed by the seminar.

2.3 New approaches to CDM: Programmatic CDM (PoA)

The panel session IV and a discussion group on day two of the Seminar considered the very new approach to CDM, i.e. programme of activities (PoA). The group discussions and presentations provided an exchange of views on a number of issues in a fruitful discussion.

The following are some highlights from the discussions:

The implementation of CDM activities under a programme of activities (PoA) may reduce some barriers to energy efficiency but not all.

Energy efficiency requires a conducive economic environment. This environment relates to (*a*) electricity tariffs and related subsidies, (*b*) the size of the emission factors and (*c*) the capacity to recover costs. Electricity tariffs need to be sufficiently high in order to create an economic incentive for energy efficiency. Subsidies on electricity may make energy efficiency projects unviable. High emission factors (through low grid efficiency and/or high shares of fossil fuel in the fuel mix) result in higher generation of CER per unit of end-use energy saved and therefore make efficiency projects more viable. The last issue relates to illegal access to the grid. If electricity users do not pay for the electricity in the first place, there is no incentive to invest in energy efficiency measures. Therefore, cost recovery is essential. These conditions for successful energy efficiency project activities apply to “normal” CDM projects as well as to PoAs. That is, PoAs too work only under certain circumstances that relate to the general economic framework. PoAs may be particularly useful if they lead to enhanced cost recovery.

The restriction to one technology in PoA is perceived as a barrier.

Increasing end-use energy efficiency often relates to dispersed micro-activities (light bulbs, refrigerators, air conditioning, insulation etc.). Currently, distinct baseline and monitoring methodologies are required for each technology in order to be able to prove the additionality of the respective technology or measure. Furthermore, there is no definition of the term “technology”. An alternative would be the implementation of several technologies as a package. A standardized package of technologies as a “typical” project activity under a PoA would enable emission reductions to be attributed to this package. This would reduce transaction costs and increase the financial viability of PoAs. Among the participants of the discussion group there was a perceived need for further guidance from the CDM Executive Board on this issue. Metering was regarded as a prerequisite in order to measure electricity savings. At the same time it was also considered an obstacle as metering is not widespread in many developing countries.

Policies as a PoA

Policies as a PoA have been ruled non-eligible by COP/MOP as actions where considered non-additional in the event of binding legislation. However, legislation is often not enforced. Therefore, participants of the discussion group generally welcomed the specification of the CDM Executive Board that the actual implementation of an otherwise not enforced legislation is additional and may be therefore eligible.

Labelling under the CDM.

Labelling refers to the provision of information on energy use of, for instance, appliances. Among the participants, labelling was felt to be a vital measure to increase the uptake of energy efficient equipment. However, there has been a very recent rejection of a methodology that introduces the labelling of air conditioners as a CDM activity. Participants in the discussion group attributed this to the problem of being unable to prove cause-and-effect relationships when submitting CDM methodologies. It was felt that the ability to do so is vital when submitting CDM methodologies. However, the ability to show these cause-and-effect relationships is particularly difficult in the labelling of energy-using appliances since it relates to measuring behavioural change.

Taken together, many participants in the group felt that PoAs may make an important contribution to the increased uptake of energy efficiency in the CDM. However, the instrument is still new. In addition, there are still some clarifications necessary in order to unfold the full potential of PoAs.

2.4 Existing energy efficiency expertise, protocols and best practices should play a greater role in the CDM

The participants concluded that it was crucial to build on the large body of existing knowledge on international protocols/best practice that has been built since the 1973 oil crisis. This requires engaging government regulators and industry energy efficiency experts (e.g. utilities, ESCOs, technology providers, end-users) with experience in the implementation and evaluation of public and private energy efficiency, regulatory, incentive, contracting, training and audit programmes. Ideally, a "community of practice" on energy efficient CDM would be built.

There is an urgent need for top-down guidance on key energy efficiency design issues, including:

- Emission reduction quantification methodologies: Most energy efficiency programmes/protocols offer a menu of approved options that can be selected by the project proponents, typically including (*a*) use of default abatement factors ("deemed savings" approach), (*b*) calculated (engineering) methods for discrete equipment/systems, sometimes in conjunction with default efficiencies and other parameters, (*c*) before/after metering/modeling, typically applied to more complex systems such as buildings and (*d*) sometimes, reliance on energy monitoring plans audited by third parties (this is the approach followed under JI Track 2).

- Baseline adjustment requirements/techniques for routine and non-routine factors.

- Decisions on whether it is necessary and, if so, how to treat "gross-to-net" energy saving issues (including leakage, rebound effects, free riders, spillovers).

- Definition of related default abatement factors, efficiencies and other parameters to enhance transparency, consistency and certainty.

Such issues are not new to CDM, and regulators have made decisions in the context of existing regulatory programmes about how to handle them. This experience could be synthesized to come up with common methodologies, tools and default factors for Sectoral Scope 3 CDM. The previous practice under the CDM–with the exception of small-scale and sink-related methodologies–has been to derive guidance and tools based on bottom-up submissions. However, since there are so few approved Sectoral Scope 3 methodologies to draw from, and the approval process has been inconsistent, a top-down approach that draws on methodologies for demand-efficiency projects already available outside of the CDM world is urgently needed.

A great deal of work has been done internationally, by national governments, energy agencies, utilities and other private actors, and by NGOs to devise measurement and verification protocols for energy efficiency activities, and these have been used in a range of regulatory programmes. All of these stakeholders need to be brought together in a rapid process to propose good practice monitoring and verification approaches for key sectors and technologies under the CDM.

The role of UNIDO and other international organizations, programmes and agencies could be instrumental in supporting and catalyzing this process.

2.5 Linking Montreal and Kyoto: Chiller demonstration projects

The panel session and the discussion group addressed the issue of carbon finance and its potential role for the implementation of the chiller demonstration project under the Montreal Protocol.

Barriers

The participants perceived the following as barriers for chiller replacement projects:

- Owners lack trust in the reliability of new equipment and its maintenance requirements;

- The financial viability of chiller replacement is one of the barriers, but in many cases it could be overcome by commercial financing arrangements and the involvement of ESCOs;

- Co-funding by the Multilateral Fund under the Montreal Protocol and GEF to complement CDM revenues provides a limited window of opportunity for implementing demonstration projects. At the end of this limited period, CDM methodologies and financing models must be available which reach the entire chiller market, including smaller markets in developing countries.

Monitoring

- Monitoring concepts have to be developed in view of how revenues from CERs will be assigned to project stakeholders. In contrast to large-scale chiller projects where a strong implementing entity may take a major role in ensuring the efficient operation of new chillers, small-scale projects may need to provide a direct revenue stream to owners as an incentive to operate the units efficiently;

- Detailed metering during project implementation will also provide relevant information for developing energy efficiency policies;

- The stringent monitoring requirements as foreseen under NM0197 will not be suitable for projects implemented in small developing countries. Approaches applicable for addressing chiller replacement in such countries need to be developed.

Baseline and project emissions

- If methodology NM0197 is approved, the baseline procedures set out are also very likely to be useful for other projects and methodologies, including chiller projects;

- In NM0197, the aspect of future change (increase/decrease) in cooling load may need to be addressed in more detail. The basic provisions for including load variations however are included in NM0197. Over the project implementation period, changes in load will be the standard case and the methodology should not restrict improvements in the overall building systems.

Application of chiller methodologies to other technologies

- CDM approaches would be beneficial for addressing other relevant technologies in relation to Montreal Protocol compliance, such as air-conditioners, domestic and commercial refrigerators;

- Existing chiller methodologies will not suit the requirements for addressing a large numbers of small appliances because such monitoring requirements are too stringent for application to large volumes of appliances.

Financing options

- Co-financing by MF under the Montreal Protocol and GEF to complement CDM revenues provides only a limited opportunity for chiller demonstration projects. At the end of this limited period, CDM methodologies and financing models must be available which reach the entire chiller market, including units in smaller developing countries;

- GEF supports approaches that look at the entire building system in an integral way. While chiller-related CDM activities will need to focus on the chiller units, GEF co-financing may be used for enlarging the project scope to an integrated system approach;

- Participants suggested the development of national carbon funds which can be used as revolving funds for the replication of projects.

2.6 Cogeneration projects in CDM: a success story

Cogeneration projects have been successful in the Clean Development Mechanism to date: about 20 per cent of all registered projects have involved some kind of CHP application. Most projects have been in the sugar sector, but there have also been projects using industrial waste heat in the iron and cement sector. India and Brazil have been the most active countries.

The additionality of these cogeneration projects has sometimes been questioned, because many are economically viable in their own right, due to considerable efficiency improvement and fuel savings. However, industrial CHP projects in developing countries face many other barriers, including:

- High up-front investment costs;

- Internal rate of return insufficient for commercial loans;

- Lack of skills available locally, particularly for gas-turbine cogeneration;

- Inadequate access to the electricity network for exporting electricity;

- Unfamiliarity with the power sector.

The initial success of CHP in the CDM does not show the whole picture. Cogeneration project activities have mostly been limited to a few countries, and a few sectors. Most projects use well-established technology for cogeneration in the food processing industry, using biomass wastes. For CHP projects to remain successful in the CDM, it is therefore necessary to widen the application of the types of projects to more countries and sectors. In addition, other technologies, fuel types and application sites must be developed. The most important opportunities for new industrial cogeneration projects are:

- Grid-connected gas-turbine cogeneration;

- Building-integrated CCHP;

- Biomass cogeneration in industries other than food processing.

To enable the expansion of the applications of CHP in the CDM, a number of new baseline methodologies for the types of application listed above must be developed. At the moment most methodologies are for biomass CHP, so a particular need exists for gas-fired cogeneration methodologies. Similarly, no methodologies for building-integrated CCHP are available, despite the considerable potential of such applications in developing countries. These projects face the additional barrier of being small, so that they would need to be bundled to become attractive for the CDM. It is important that experience with such bundling is developed, and disseminated.

The interest in such baseline methodologies would be considerable, and many project developers are developing such projects. However, these project developers normally prefer to use an existing methodology, rather than proposing one themselves, so they are all waiting for others to develop the methodology. This suggests a possible role for organizations such as UNIDO, WADE and other technical agencies and programmes.

2.7 CDM methodology issues related to energy efficiency projects

It was noted that energy efficiency methodologies suffer the highest rate of rejection by the EB. The participants called for more top-down guidance from the EB and Meth Panel on methodologies for energy efficiency project activities. Some common reasons for the rejection of energy efficiency methodologies were highlighted:

- Failure to provide method/procedure for selecting the baseline scenario;
- Lack of clear definition of project boundary;
- Lack of justification for the appropriateness of benchmark period
- Failure to consider variables that would affect future emissions (i.e. autonomous energy efficiency improvements);
- Inadequate monitoring and verification plans;
- Deficiencies in accounting for leakage;
- Lack of distinction between discretionary retrofit, planned replacement and new equipment projects;
- Lack of methodological specificity to allow DOE to verify reductions.

2.8 Findings/recommendations

The following findings and recommendations were noted:

- Energy efficiency driven by CDM could help developing countries to achieve tremendous economic and sustainable development benefits of energy efficiency.

- Greater efforts are needed to ensure that the existing expertise, programmes and protocols developed and practised by utilities, ESCOs, technology providers and other energy efficiency stakeholders are synthesized to come up with common methodologies and best practices for Sectoral Scope 3 CDM projects.

- Statistical sampling is a very important tool for energy efficiency projects to estimate baseline and project emissions. More guidance is needed on the use of such methods. Similarly, methodologies using conservative benchmarking could be a great asset in facilitating energy efficiency CDM projects.

- Rigour must be balanced against results: at present the level of rigour demanded by the EB and Meth Panel has prevented the approval of numerous industrial energy efficiency methodologies and hence meaningful volumes of GHG emission reductions being generated from end-use energy efficiency projects. Sometimes, getting a better estimate might be more costly than the value of extra CERs generated.

- Using standardized PDDs would be a major facilitating factor for energy efficiency projects.

- To improve the status of demand-side energy efficiency projects, both top-down and bottom-up efforts are needed. Better quality PDDs must be developed and submitted, but guidance is necessary from the EB/Meth Panel on key energy efficiency issues, such as the "deemed savings" approach, calculated (engineering) methods for discrete equipment/systems, sometimes in conjunction with default efficiency and other parameters, before/after metering/modeling applied to complex energy efficiency systems; treatment of rebound effects, uncertainty, free riders, etc., and the definition of related default abatement factors, efficiencies and other parameters.

- Greater use of measurement and verification protocols (e.g. IPMVP), energy management standards, evaluation guidebooks on DSM and energy audits and other technical and engineering tools is needed in order to improve transparency, consistency and certainty of energy efficiency methodologies and consequently, energy efficiency projects in CDM.

3. Keynote presentations/statements

3.1 Opening session

Mr. Dmitri Piskounov, Managing Director, UNIDO, said that IEE is a core activity of UNIDO and noted that the seminar represents another step in the dialogue on carbon mechanisms and IEE initiated by UNIDO in 2003. He said that although the benefits of IEE are well known, IEE projects represent only 3 per cent of registered CDM projects. He invited participants to consider the bottlenecks that hinder the development of demand-side energy efficiency projects and ways to overcome the high transaction costs of these projects.

Mr. John Macgregor, Ambassador, UK Trade and Investment, highlighted the increased level of public and governmental concern about climate change, and said energy efficiency CDM and JI projects represent practical avenues to addressing climate change.

Welcoming delegates, Mr. Karl Fiala, Director, CTI, highlighted Austria's role in the CTI and noted that the CTI brings together stakeholders for technology transfer and information dissemination.

Ms. Gertraud Wollansky, Deputy Head of the Climate Unit, Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria, underscored that energy efficiency and climate change are being discussed in numerous forums, including the UN Commission on Sustainable Development. She noted that although the CDM and JI provide excellent opportunities for implementing energy efficiency initiatives, there are not currently many energy efficiency projects, and suggested participants focus on identifying opportunities to increase their number.

3.2 Keynote statement

Dr. Peter Jenkins, REEEP

Mr. Peter Jenkins, Special Representative, Renewable Energy and Energy Efficiency Partnership (REEEP), presented the activities of REEEP and processes for obtaining approval for energy efficiency projects under the CDM and JI. He cited three significant barriers to achieving CDM or JI status for energy efficiency projects: the small number of established methodologies for energy efficiency projects; the few business models that can be used for energy efficiency projects; and difficulties with ensuring adequate legal frameworks, given uncertainties surrounding the enforceability of contractual arrangements for some projects. He noted that REEEP sees industry as the most promising sector for energy efficiency gains.

reeep

renewable energy & energy efficiency partnership

Vienna, 19 March 2007

Seminar on Energy Efficiency Projects in CDM and JI: Transforming Markets for Energy

Peter Jenkins

Special Representative of REEEP

reeep

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REEEP is a Partnership for Delivery

1. REEEP is one of the fastest-growing global partnerships for clean energy and energy efficiency
2. REEEP aims to reduce market barriers and financial obstacles for renewables and energy efficiency systems and to improve access to energy for the poor
3. REEEP believes in action on the ground via project activities that are targeted on policy improvements and innovative finance mechanisms

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REEEP acts as a facilitator and enabler

- Empowering locals through capacity building, trainings, awareness raising
- Providing information tools which give access to the world’s best data sources on REES, incl. technologies
- Assisting governments in implementing favorable policies, tariffs, standards and labels
- Providing finance tools to attract local and international investors, including CDM and JI
- Removing international law barriers to technology trading

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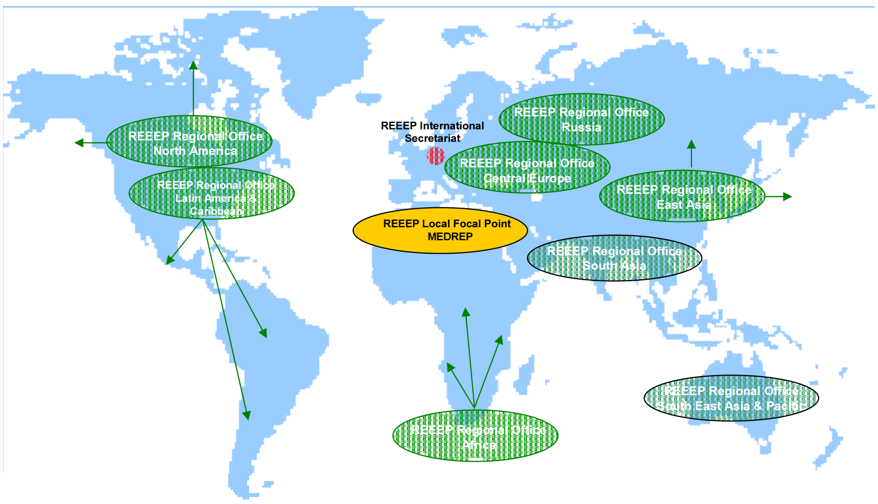
REEEP is driven by regional and local demand



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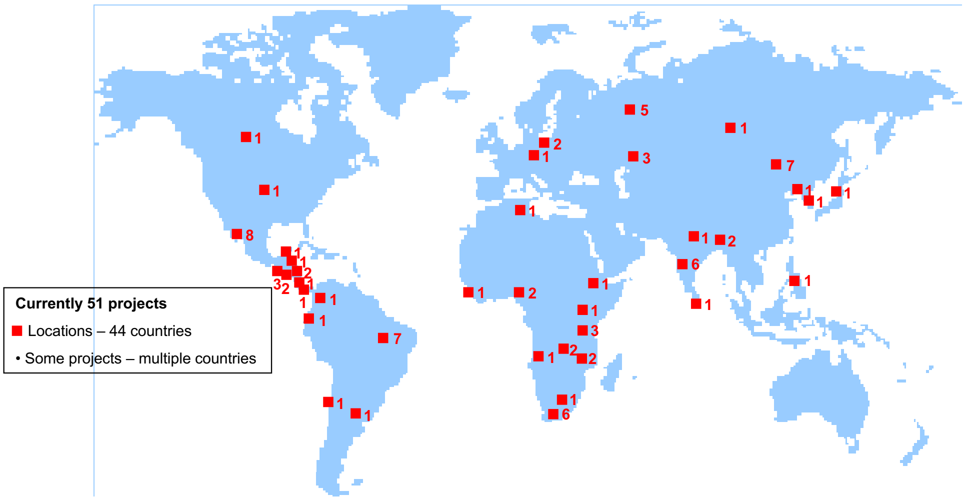
The 51 REEEP projects encourage local initiatives in 44 countries



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renewable energy & energy efficiency partnership

REEEP JI Project: Financing Biomass-Fuelled District Heating Systems in Irkutsk and Khabarovsk in Russia

1. Development of a mechanism to finance new district heating plants fuelled with sustainable biomass
2. Project conducted in partnership with local and international financiers
3. The replacement of fossil fuels will reduce greenhouse gas emissions and improve air quality

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REEEP CDM Projects: Support for Gold Standard CDM RE/EE Projects in Southern Africa

1. Workshops in Mozambique and Tanzania to raise capacity and awareness around carbon financing
2. Financing secured for two Gold Standard projects
3. Publication and distribution of a CDM Financing Guide by SouthSouthNorth

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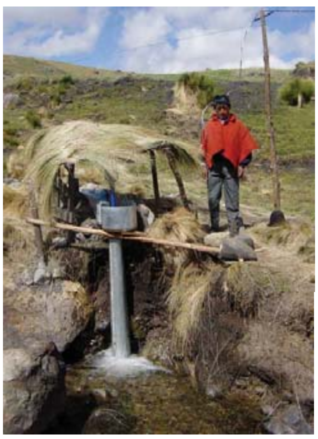
REEEP CDM Projects: Increasing the Supply of Gold Standard CDM Projects



1. Capacity building and coaching for project developers in Brazil, China and the Philippines
2. Training workshops/project clinics for a better understanding of the Gold Standard methodology and benefits
3. Attraction of carbon finance to Gold Standard project portfolios through “buyers’ forums” at Carbon Expos

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Prospects for CDM and JI funding for Energy Efficiency projects

1. Potential of CDM and JI not in doubt
2. Current number of EE projects in CDM and JI portfolios very low
3. Barriers to an increased share of EE in CDM and JI include
   - methodological complexities
   - lack of business models
   - lack of facilitating legal frameworks
4. The number of EE projects starting to grow. Most of the growth is in the industrial sector

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3.3 Introduction of agenda, Ms. Marina Ploutakhina, UNIDO/PTC/Energy efficiency and climate change

Ms. Marina Ploutakhina, Industrial Development Officer, UNIDO, outlined the seminar agenda and noted that a wide spectrum of CDM and carbon market stakeholders were represented among seminar participants, including developers, buyers, traders, academics and analysts of the carbon industry.

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Energy Efficiency Projects *in CDM and JI*

Seminar by UNIDO/CTI/UK Trade and Investment

M. Ploutakhina
UNIDO/PTC/ECB/EEC
19 March, 2007

www.unido.org

Objectives

- To advance the understanding of methodological issues surrounding energy efficiency projects/programmes and barriers to their uptake under the CDM and JI
- To create a discussion forum for business and industry on end-use energy efficiency and on CDM/JI projects in this category
- To highlight the importance of industrial energy efficiency CDM in terms of CER volumes and contribution to sustainable industrial development

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Introducing the Agenda

Panel Session1: Overview of Carbon Markets
(led by Edwin Aalders, IETA)

Themes:

- Market structure, participants, assets traded;
- Current trends and development
- Asset classes and price determination
- Interaction between energy markets and carbon markets
- Outlook and interaction with energy markets

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Introducing the Agenda

Panel Session2: Status of Energy Efficiency Projects in CDM and JI
(led by Marina Ploutakhina, UNIDO)

Themes:

- Overview of CDM/JI pipeline;
- Approved methodologies and challenges
- Developments in the work of Executive Board and Meth Panel; calls for public inputs/comments on EE projects
- Country views on energy projects developments

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Introducing the Agenda

Panel Session 3: Lessons Learned and Barriers to Energy Efficiency in CDM/JI
(led by Bob Williams, UNIDO)

Themes:

- Review of barriers
- Methodologies, data availabilities, additionality: pitfalls in development
- Systems approach to industrial energy efficiency
- Views from validators, project developers, buyers and energy experts

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Introducing the Agenda

Panel Session 4: New Approaches to CDM/JI
(led by Dr. Patrick Matshoss, German Advisory Council on the Environment)

Themes:

- Programmes of activities (PoA): Advantages for Energy Efficiency projects;
- Bundling, other approaches
- Methodology development for programmatic activities
- Scope for aggregation under Type II SSC project category
- Other

Introducing the Agenda

Panel Session 5: Methodologies for Electric Motor Driven Systems
(led by Dr. Anne Arquit Niederberger, A+B International)

Themes:

- Potential GHG reductions from electric motor systems in industry and building
- Proposed methodologies
- Key methodological challenges
- Prospects under SSC and PoA
- CDM/JI program & project design

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Introducing the Agenda

Panel Session 6: Transforming Markets for Energy Efficiency
(led by Mr.Paolo Bertoldi, EU-JRC)

Themes:

- Scenarios of role of energy efficiency in realizing mitigation potential
- Key ingredients to a market transformation
- Future prospects to EE in CDM/JI
- Financing energy efficiency in CDM/JI

Introducing the Agenda

Discussion Groups (Day Two: 13:30-15:00, Rooms CO2-17 CO2-20 CO2-21 CO2-23)

Group 1: *Programs of Activities and Energy Efficiency:*
Facilitator, Dr. Patrick Matschoss, German Advisory Council on the Environment

Group 2: *Energy efficiency methodology issues & tools. Facilitator: Mr. Sudhir Sharma, UNFCCC Secretariat*

Group 3: *CHP in CDM, Facilitator: Mr. Sytze Dijkstra, WADE*

Group 4: *Linking Montreal and Kyoto: chiller demonstration projects & CDM, Facilitator*: Mr. Stefan Kessler, Infras

Group 5: Linking the EE & CDM/JI expert communities: CDM EE Network, *Facilitator*: Dr. Anne Arquit Niederberger, A+B International *(Sustainable Energy Advisors)*

Logistics

Coffee breaks: as announced in Agenda, 30 min (please be back on time)
Lunch: Staff Cafeteria/Restaurant and the ground flow in G building
Rooms CO2-19 (office, Ms. Z.Sheety) CO2-17 CO2-20 CO2-21 CO2-23
Cocktail reception hosted by the UK Embassy at Mozart Room/Restaurant area 19:00 (as announced in the Agenda)

Team of IISD reporters:	UNIDO Team:	
Ms. Melanie Ashton	Mr. Robert Williams	Ext.3956
Mr. Jonathan Manley	Mr. Abraham Kuruttuparambil	Ext.4805
Ms. Ingrid Bannsley	Ms. Marina Ploutakhina	Ext.5051
	Ms. Zalfa Sheety	Ext.3511
	Ms. Anne Arquit Niederberger	UNIDO consultant
	Mr. Patrick Matschoss	UNIDO consultant

www.unido.org

For more information

Issue Papers/Presentations/Logistics

http://www.unido.org/en/doc/61189

Contacts:

m.ploutakhina@unido.org

Thank you!

4. Panel session I: Overview of carbon markets

Mr. Edwin Aalders, Director, International Emissions Trading Association (IETA), moderated the discussion and introduced panel participants.

4.1 Presentations
An overview of the CDM and JI markets

Mr. Hervé Gueguen, EDF Trading

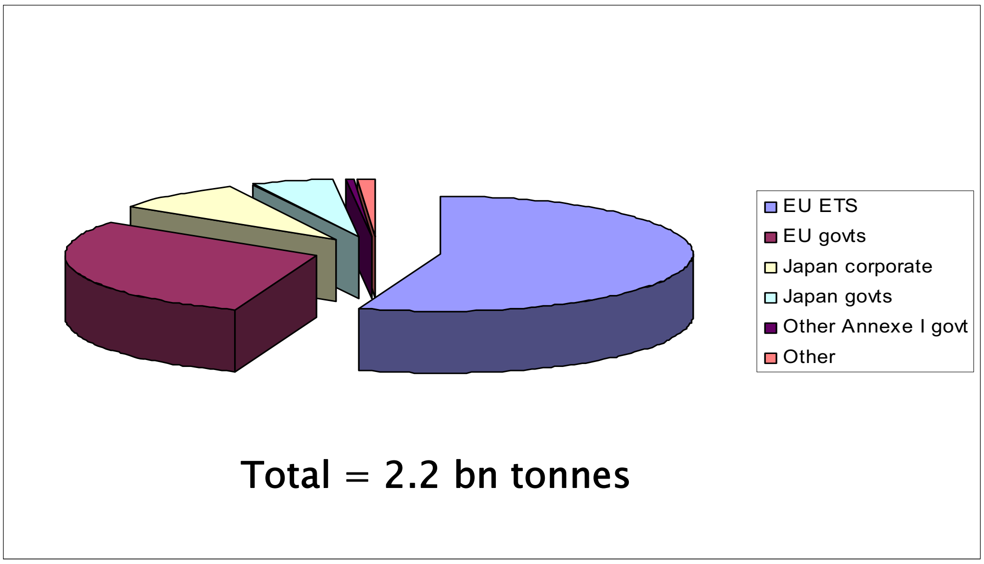
Mr. Hervé Gueguen, Environmental Product Manager, EDF Trading, provided an overview of his organization and presented the cumulative supply and demand of CERs and ERUs, noting the possibility of CDM and JI projects exceeding demand. He said this is dependent on the number of projects that are successfully implemented and the number of new countries that enter the market. Gueguen explained that, as buyers, EDF Trading determines the prices of CERs and ERUs by assessing project risk.

EDFT carbon brief overview

- EDFT is a 100 % owned subsidiary of the EDF group, the largest power utility in Europe in charge of wholesale markets
- EDF Group has yearly EUA allowance of circa 100 Mt/y
- EDFT activity in the carbon sector revolves around the optimisation of EDF assets, the supply of risk-management services to large industrials, the procurement of carbon credits and proprietary trading
- EDFT has developed a portfolio of 40 projects in 12 countries representing a potential of over 30 MCER
- EDFT is managing a carbon fund of 290 M€
  - Limited to EDF affiliates (EDFE, Edison, EnBW, EDF SA)
  - Backed by compliance buyers
  - EDFT is the counterpart of record of project developers)

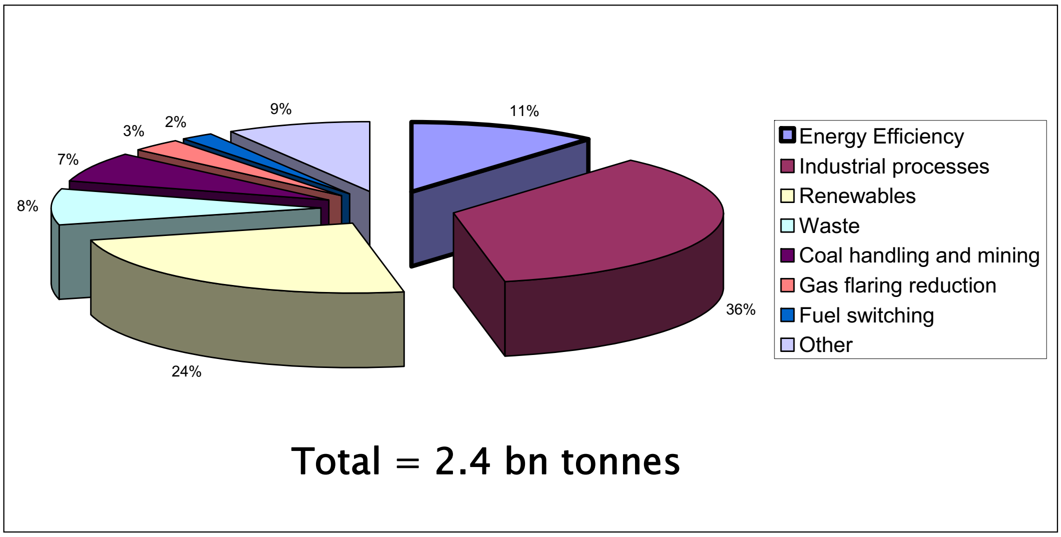
EDF Trading 2

CER/ERU demand from around the world

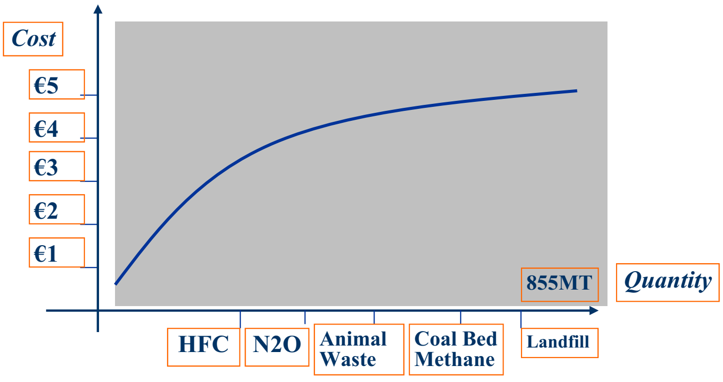


EDF Trading 3

CER/ERU supply 2000 - 2012

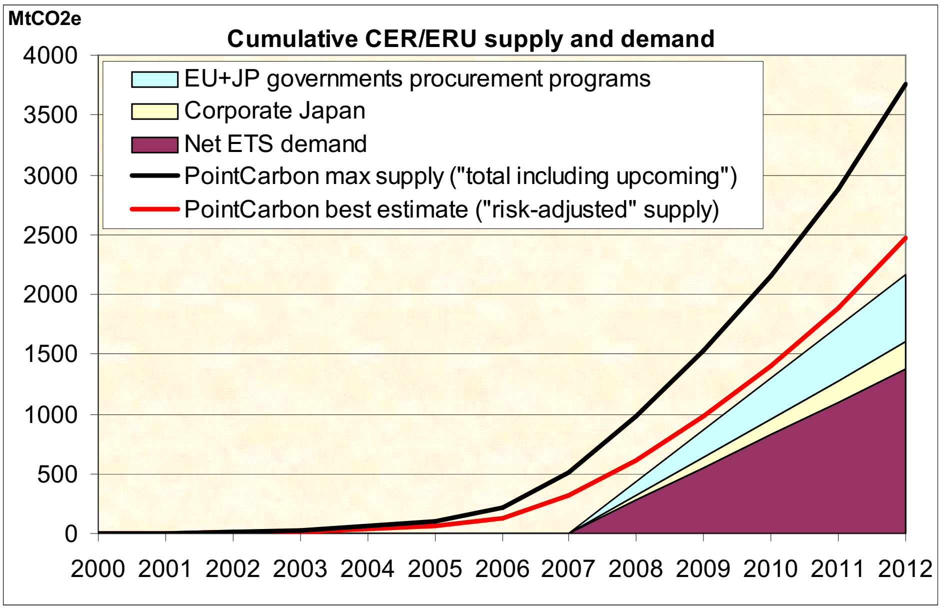


Low cost CDM project have been a catalyst

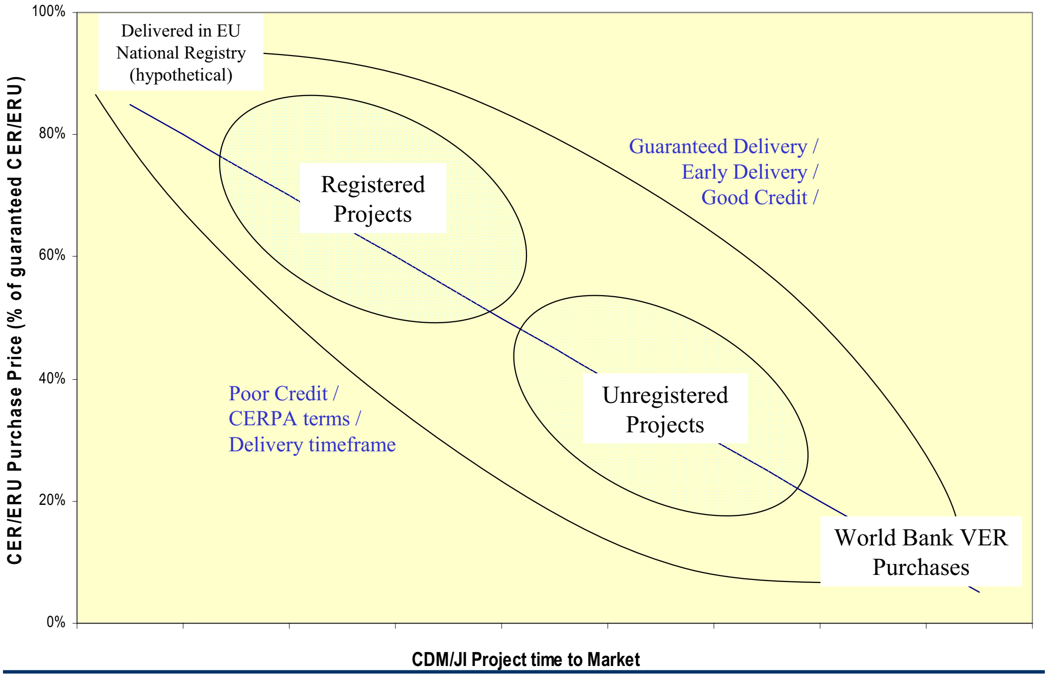


- "Low hanging fruit" such HFC 23 and N2O from chemical plant have been largely identified
- Next wave of projects will have more barrier (technological, cost…) imply new challenges

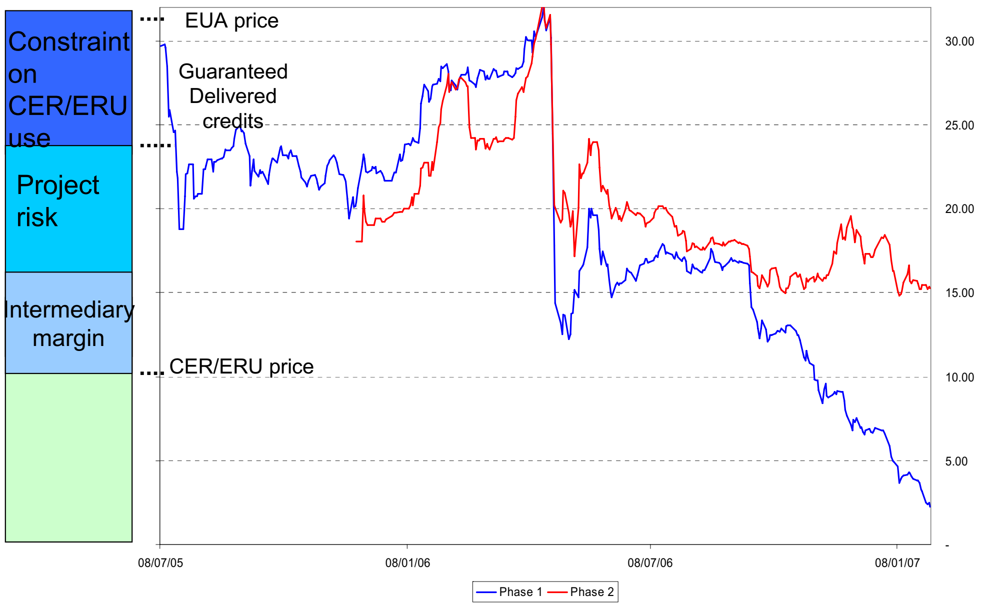
Too many CDM and JI projects ?



Main CER/ERU price determinants



Main CER/ERU price determinants



Thank You!

Hervé Gueguen

herve.gueguen@edftrading.com

Telephone: +44-20-7061-4214

Where we stand in the market

Ms. Eva Snajdrova, Carbon Capital Markets

Ms. Eva Šnajdrová, Policy Advisor, Capital Carbon Markets, outlined various CDM technologies. She highlighted the success of renewable energy CDM projects; the fact that CERs generated in Africa may attract price premiums in the future; and the large future potential for carbon dioxide capture and storage CDM projects. She said that when the International Transaction Law for CERs and ERUs is introduced, trading will be standardized and traded volumes will increase.

CARBON CAPITAL MARKETS™
Emissions Compliance Solutions & Carbon Finance

Content

- About Carbon Capital Markets
- Where we stand in the market
- Successful and less successful technologies
- Technologies not (yet) part of the market

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Carbon Capital Markets

- Carbon Capital Markets® ("CCM") launched in 2005 with €16 million in equity capital.
- CCM's business areas are carbon emissions trading and carbon finance.
- CCM is authorised and regulated by the Financial Services Authority to trade as principal and to undertake asset management activities.
- The successful European trading desk; over 20 million allowances traded.

Carbon Asset Fund

- €100m vehicle investing equity in global CDM projects
- Invests in diversified portfolio of CDM developed and registered projects framework to generate low cost CERs
- Vertically integrated along the carbon value chain. Our activities range from:
  - Project development
  - Private equity and finance
  - Knowledge of CDM policy and regulations
  - Local presence: employees and offices in Latin America and partnerships around the world.
  - International deal origination

CARBON CAPITAL MARKETS™
Emissions Compliance Solutions & Carbon Finance

Content

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CARBON CAPITAL MARKETS™
Emissions Compliance Solutions & Carbon Finance

Where we stand in the market

- Direct trades/OTC only
- No standardisation ➔ variety of contract conditions ➔ variety of prices
- ITL not operational (end of 2007?)
- Expected increase in liquidity and standardisation in the future

7

Content

- About Carbon Capital Markets
- Where we stand in the market
- Successful and less successful technologies
- Technologies not (yet) part of the market

CARBON CAPITAL MARKETS™
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Successful and less successful technologies – projects registered by CDM EB

- Renewable energy (biomass, wind, solar, hydro) - 280
- Waste mitigation projects - 152
- Energy efficiency projects – 57
- Fuel switching - 16
- Projects connected to industrial processes – 33
- LULUCF – 1
- CCS - 0

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Destruction of HFC 23 - Successful technology but…

- HFC 23 is a by-product of HCFC-22 (refrigerant used in air-conditioning)
- Low cost project generating many CERs (some project almost 10mil CO2eq annually)
- Nature magazine called it immoral – generates GHG and then destroys it

➔CERs from such projects are traded at discount of around €0.20

➔What if market is significantly short in the future?

➔Will some projects gain price premium?

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Content

- About Carbon Capital Markets
- Where we stand in the market
- Successful and less successful technologies
- Technologies not (yet) part of the market

11

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Carbon Capture and Storage Projects

- Methodology submitted to CDM EB but not yet approved
- Issues to be solved
  - Leakage (during and after the end of the project)
  - Project and national boundary
  - Long term responsibility for monitoring
- COP/MOP 2 decided to continue discussions about the issues in the future

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Thank you for your attention

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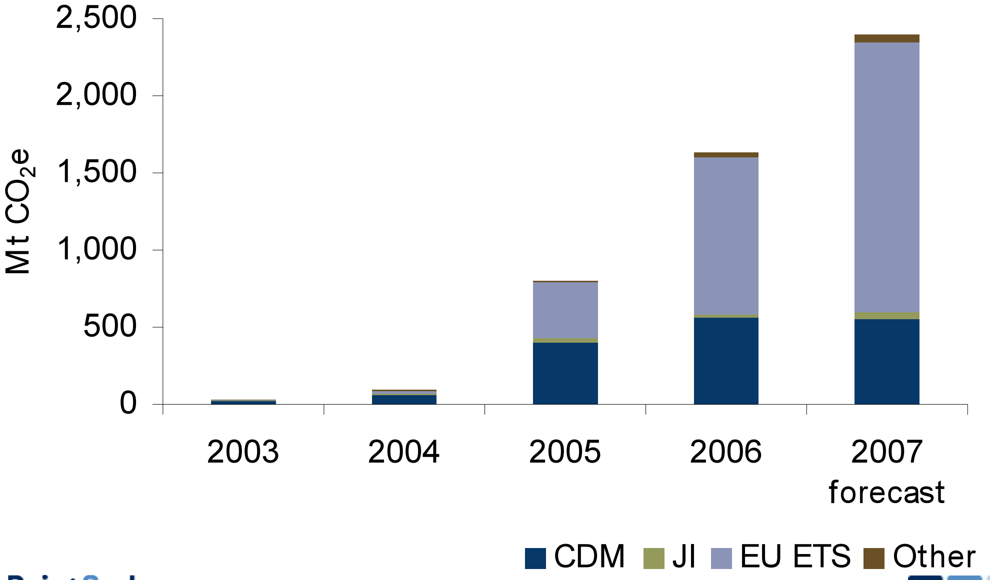
Carbon market 2007

Ms. Olga Gassan-zade, PointCarbon

Ms. Olga Gassan-zade, Managing Director, Point Carbon, discussed the outlook for the carbon trading market. She said the volume of carbon transactions is expected to increase by 50 per cent in 2007, but that much of this growth will occur in the European Union Greenhouse Gas Emission Trading Scheme (EU ETS). She explained that primary CDM projects for 2007 are expected to decrease, while secondary CDM and JI transactions are likely to increase.

Stairway to 07

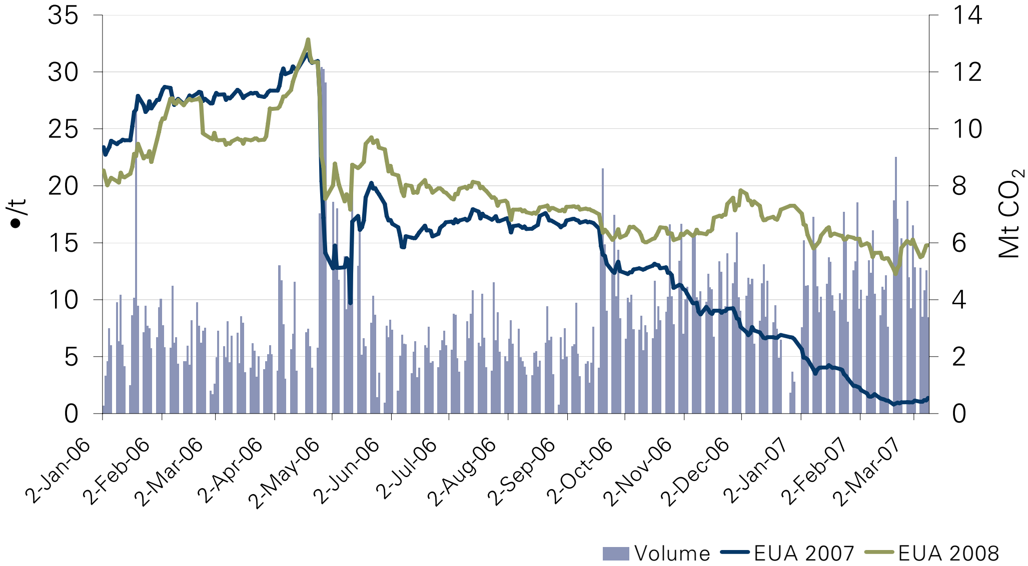


PointCarbon

Providing critical insights into energy and environmental markets

www.pointcarbon.com

A sort of goodbye...



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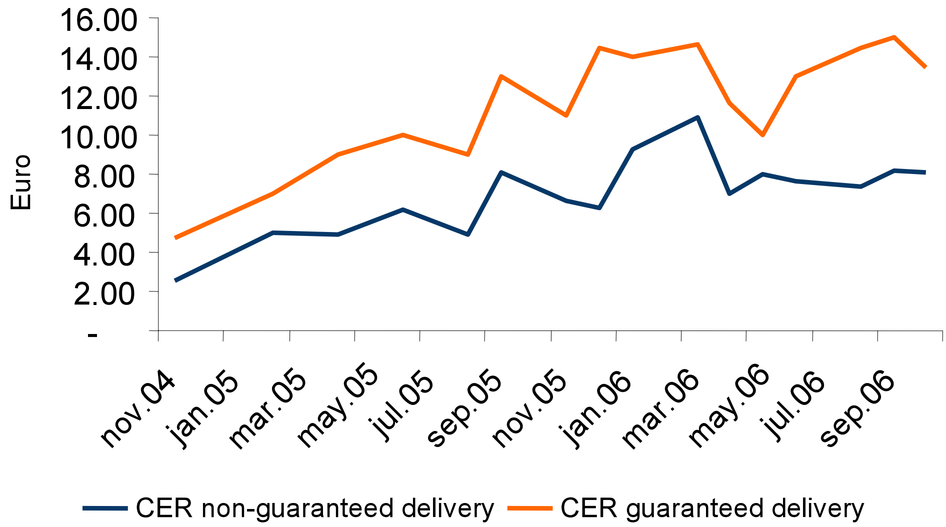
CER prices



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CER and ERU price categories (March 2007)

Contract category	CDM (€/t)	JI (€/t)
1. Non-firm volume; buyer assumes regulatory risk	€ 5 – 7	€ 5 – 6
2. Standard off take, non-firm volume	€ 6 – 10	€ 6 – 9
3. Firm volume, compensation upon non-delivery	€ 10 – 12	€ 6 – 12
4. Guaranteed delivery, seller assumes all delivery risk	€ 11 – 13	n.A

Lower risk for the seller

Higher risk for the seller

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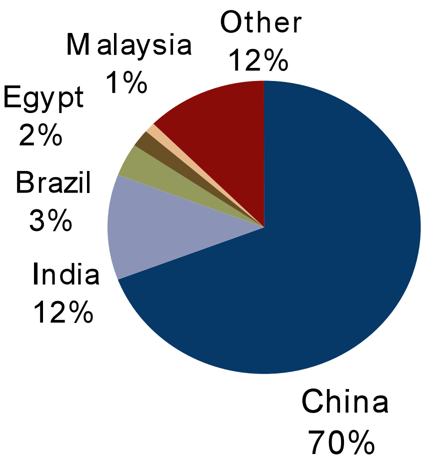
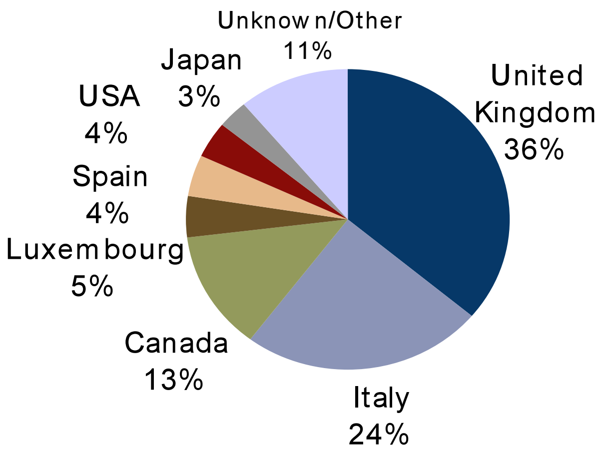
Overview of Project Activities

	CDM		JI	
	# Projects/ transactions	Total volume -2012 (MtCO2e)	# Projects/ transactions	Total volume -2012 (MtCO2e)
Projects (total)	3,951	3,190	733	427
Projects (PDD)	1,891	2,147	260	226
Issued	141	37	N/A	N/A

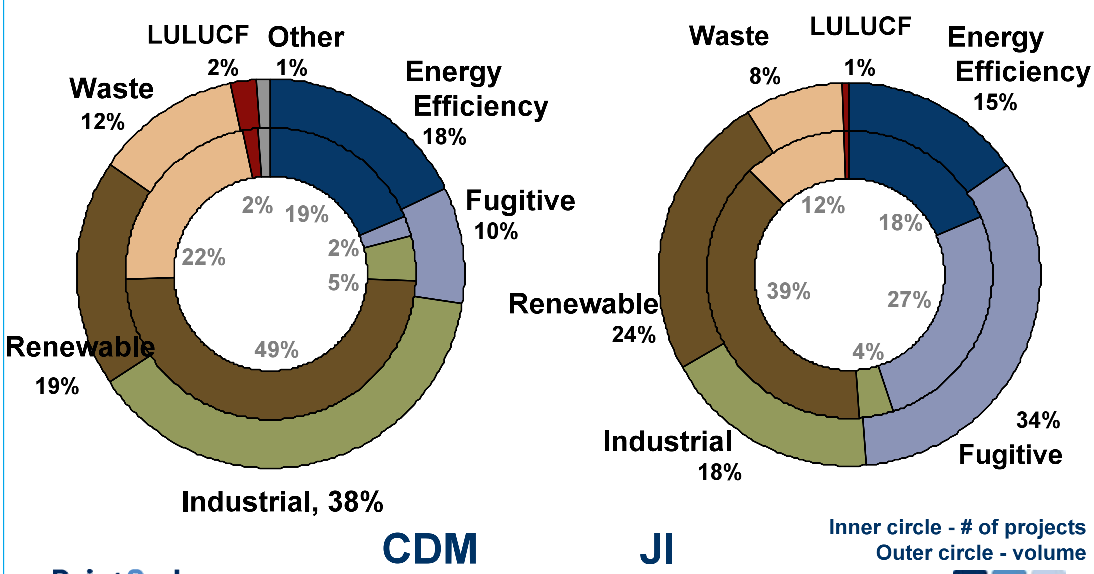
Made in China...





Source: Carbon Project Manager

Project Types, CDM and JI



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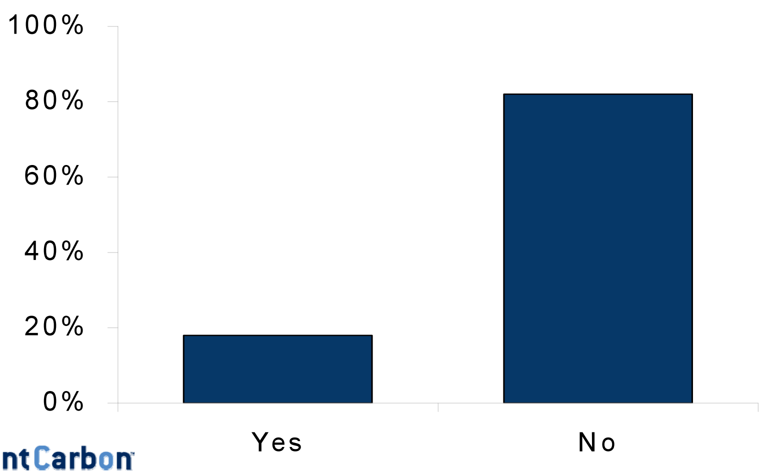
Enough CERs/ERUs?

Q

Will the credit flows from CDM/JI projects eliminate the need for internal abatement in EU ETS phase 2?



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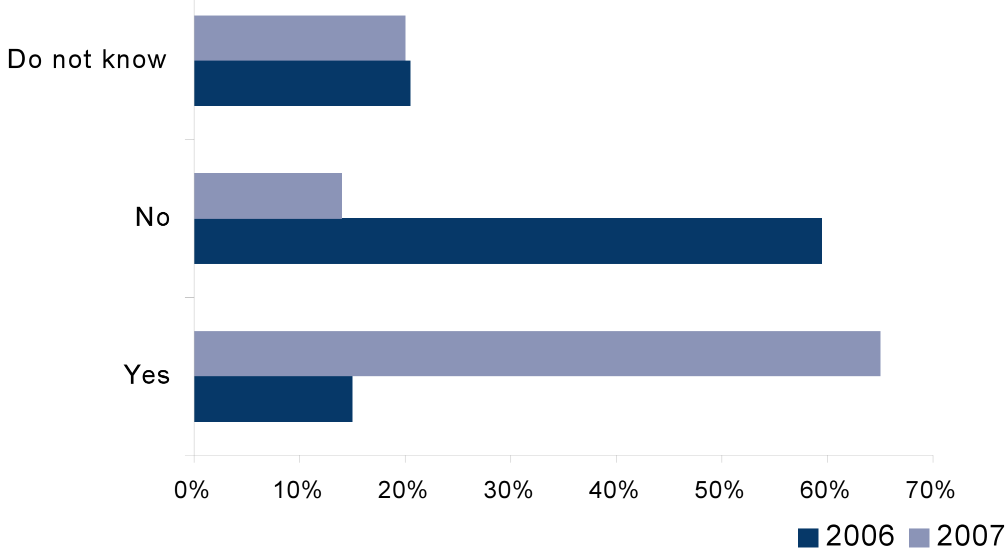
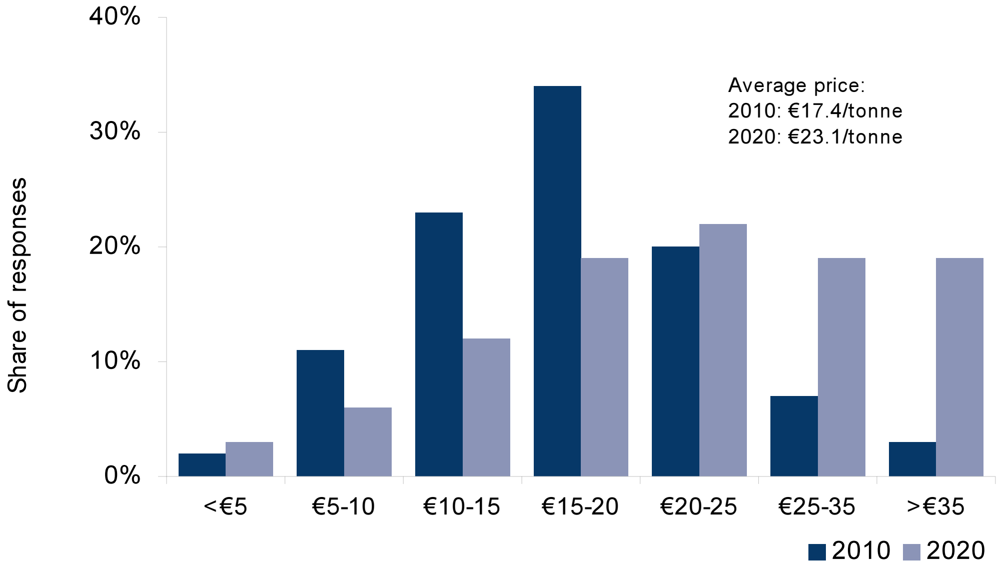
Has the EU ETS initialised internal abatement?

Filter: Organisations governed by the EU ETS



Prices in the long run?



What do we expect in 2007

- Volumes expected to grow by 50% in 2007
- Main increase in the EU ETS
  - From 1,017 billion tonnes CO_2 in 2006 to 1,750 billion in 2007
  - Primary CDM transactions slightly down from 523 Mt CO_2e to 456 Mt CO_2e in 2007
  - Secondary CDM transactions and JI transactions expected to increase considerably

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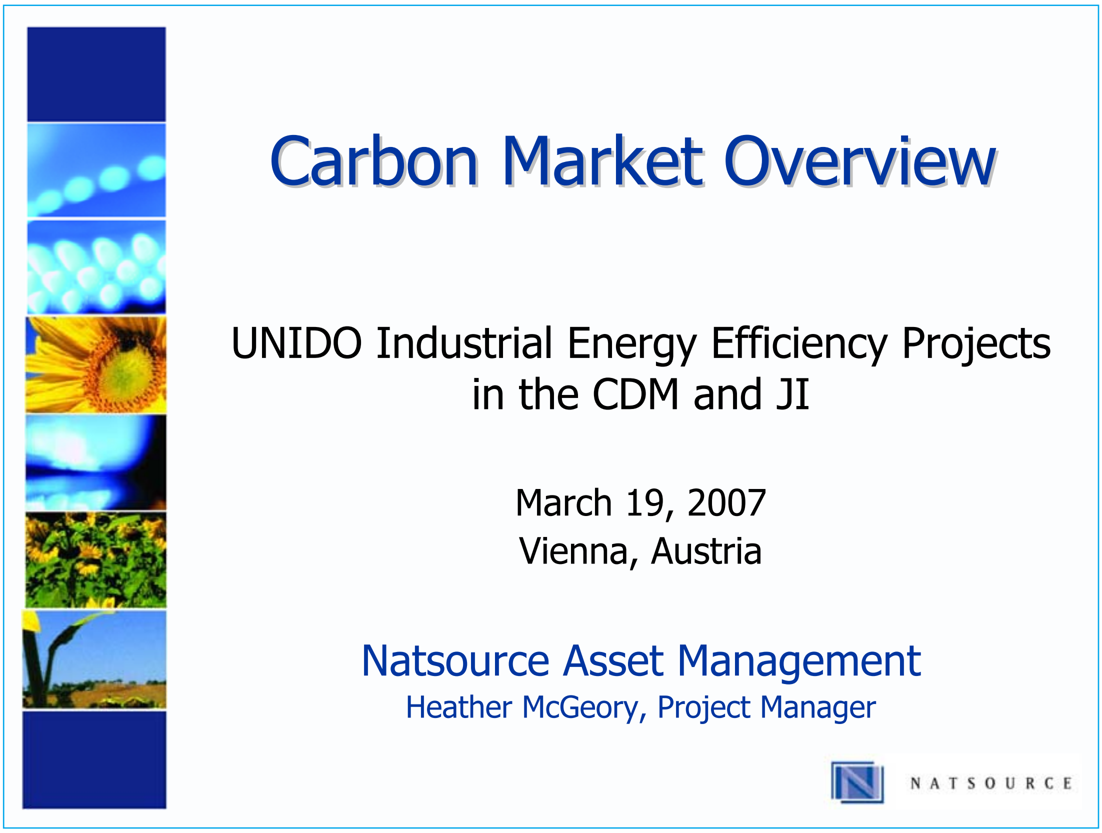
Carbon market overview

Ms. Heather McGeory, Natsource

Ms. Heather McGeory, Project Manager, Natsource, explained that Natsource is one of the largest private sector environmental asset managers. She noted that investors have a strong interest in fuel switching, renewable energies and non-carbon dioxide projects, and observed that as investors become more experienced, they become more willing to invest in new locations and to invest for longer terms, including post-2012.



Natsource Overview

- Natsource's global business is comprised of three integrated business units:
  1. Asset Management
  2. Transaction Services
  3. Advisory and Research Services

- One of the largest private-sector environmental asset managers worldwide
  - **Compliance Buyers: GG-CAP** ~ $US820 million from 24 participants to purchase and manage a large pool of emissions reductions from 2005-2012
  - **Private Investors: Aeolus Funds and Managed Accounts** in emissions and renewable energy markets to achieve superior returns for their investors

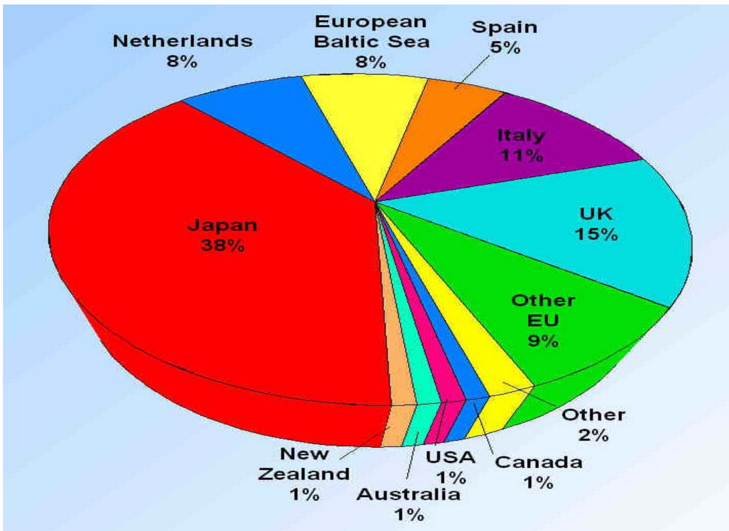
NATSOURCE

Investor Profile: Who are our private investors?

- More US-based, non-compliance, private sector investors
- Looking for higher than average returns based on a mixture of allowances and project-based credits
- Interest in taking equity positions and buying securities
- Willing to take risks – have not shrunk away from the market when the market has dropped off

NATSOURCE

CDM Primary Market Buyers



NATSOURCE

Market Technologies: What are investors interested in?

PAST

- N2O
- HFC
- Non-CO2 Projects
  - Landfill methane capture/destruction, Anaerobic digestion of agricultural wastes, Coal mine methane, Repair pipeline leakages, Capture/destroy process emissions; chemical process changes; capture and use of fugitive emissions

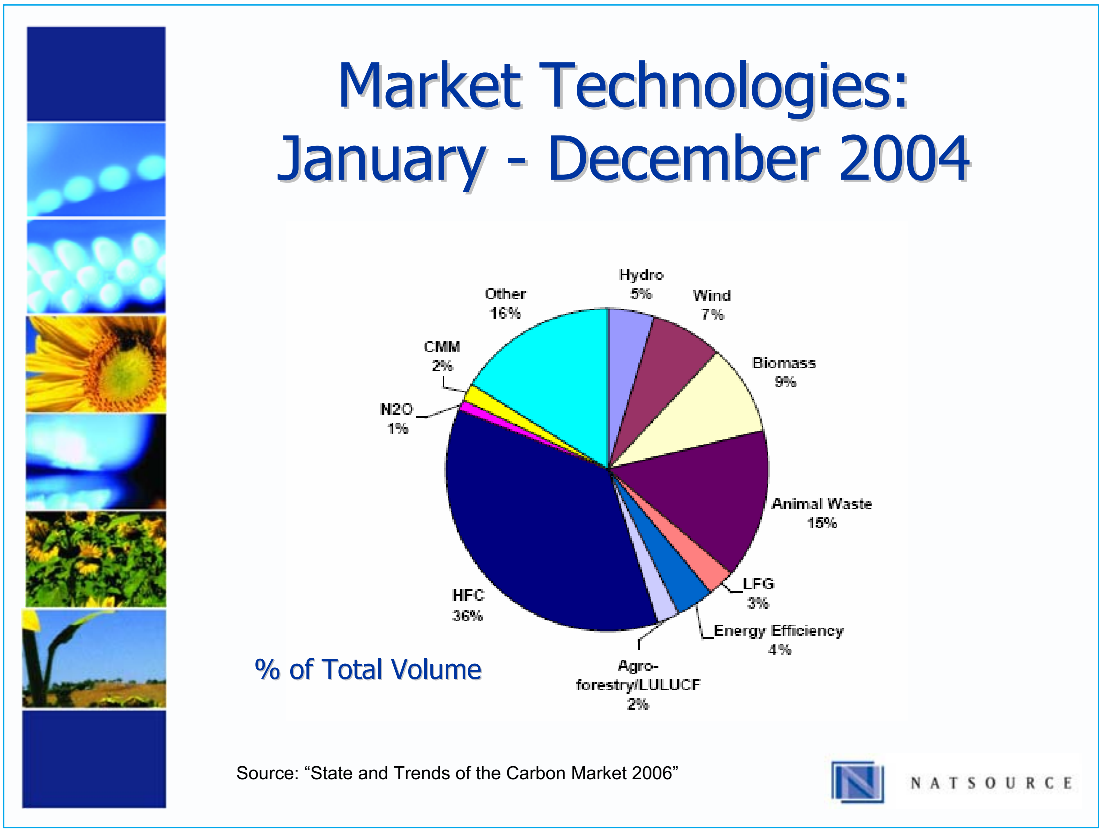
PRESENT

- Fuel Switching
  - fossil fuel to biomass
  - **Ethanol and biodiesel**
- Renewable Energy
  - Wind, Biomass, Landfill gas to energy
- Non-CO2 Projects (as above)

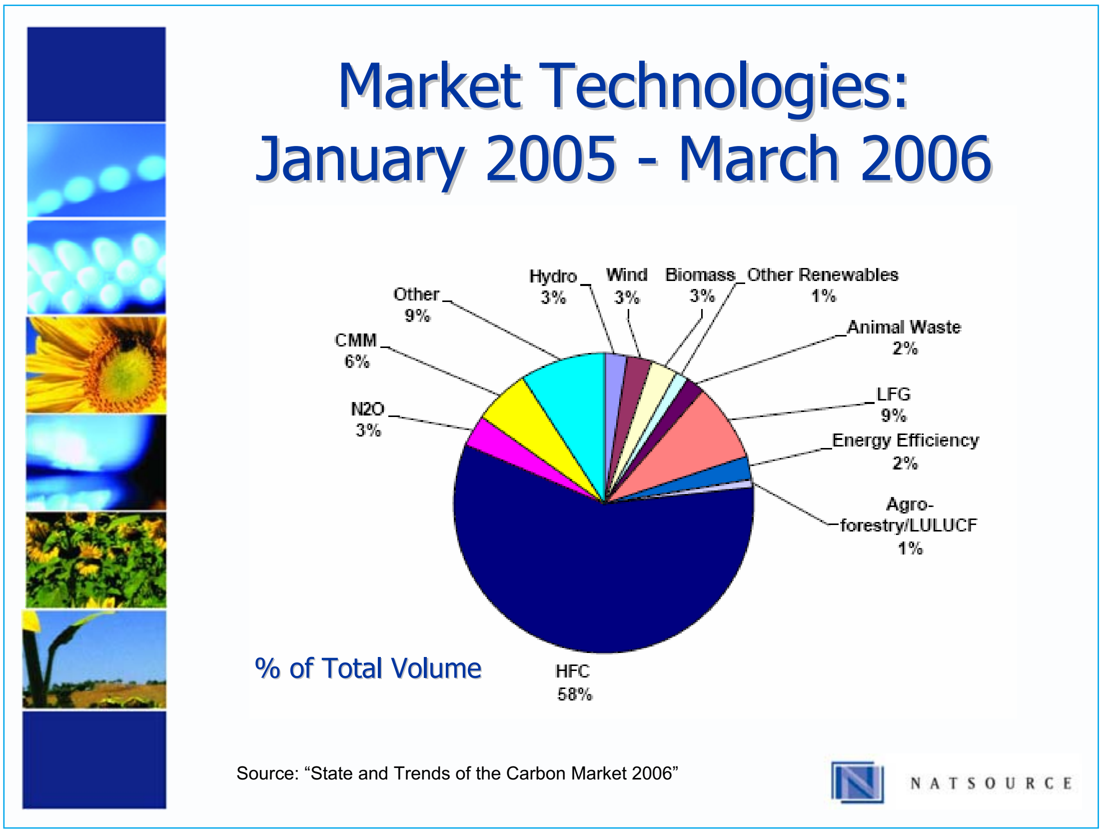
FUTURE

- Energy Efficiency
  - Generation Efficiency Upgrades, End-user efficiency upgrades
- Land Use and Forestry sequestration
- Mobile Source
  - Fleet changes, modernization, fuel switches, biodiesel

NATSOURCE

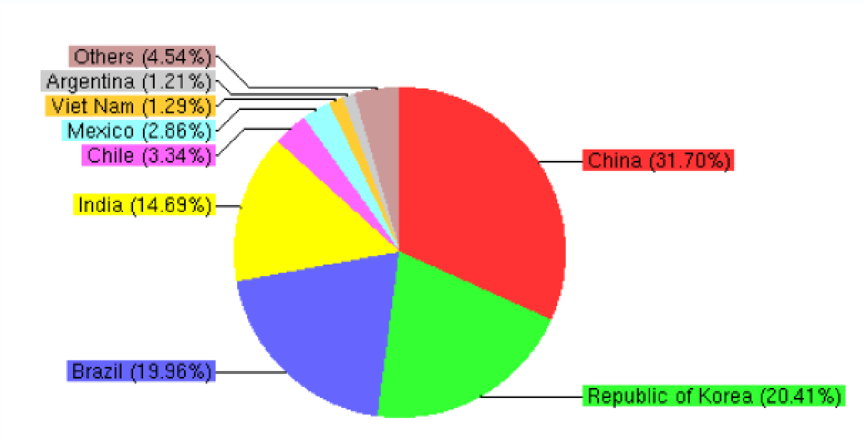


Market Technologies:
January - December 2004
Hydro
5%
Wind
7%
Biomass
9%
Animal Waste
15%
LFG
3%
Energy Efficiency
4%
Agro-
forestry/LULUCF
2%
HFC
36%
N2O
1%
CMM
2%
Other
16%
% of Total Volume
Source: "State and Trends of the Carbon Market 2006"
NATSOURCE



Market Technologies:
January 2005 - March 2006
Hydro
3%
Wind
3%
Biomass
3%
Other Renewables
1%
Animal Waste
2%
LFG
9%
Energy Efficiency
2%
Agro-
forestry/LULUCF
1%
HFC
58%
N2O
3%
CMM
6%
Other
9%
% of Total Volume
Source: "State and Trends of the Carbon Market 2006"
NATSOURCE

CDM Project Geography: Where have our investors been?



Source: UNFCCC 2006

NATSOURCE

Timeline: What timeframe are investors willing to transact for?

- Phase One (EU ETS), Phase Two (Kyoto) and Post 2012 combinations
- Post-2012 Issues:
  - How to bring the current large industrial non-participants that have refused to ratify Kyoto (i.e., U.S., Australia and Canada) under a carbon cap
  - How to bring large industrializing countries under a carbon cap (i.e., China and India)

NATSOURCE

Typical CDM Transaction Structures: How do investors want to do deals?

- Forward stream of reductions credits
- Payment on delivery for CERs
- Transactions may include upside market participation for sellers
- Investor may also take equity positions in or make loans to the underlying project
- Invest in large projects because of fixed transaction costs
- Invest in replicable projects because of fixed transaction costs

NATSOURCE

CDM Deal Structure Negotiations

- Realistic expectations from seller
  - Firm offer price or clear price indications
  - Discreet negotiations
  - Understand prices linked to EUA indexes can have a downside risk as well
  - See the value of a creditworthy buyer and the expert assistance offered by an experienced buyer
- Investor wants seller to be happy with the commercial terms
  - Long term confidence of project and CER delivery
- Investor desire to do business where there is transparency and ease of doing business

NATSOURCE

In Summary:

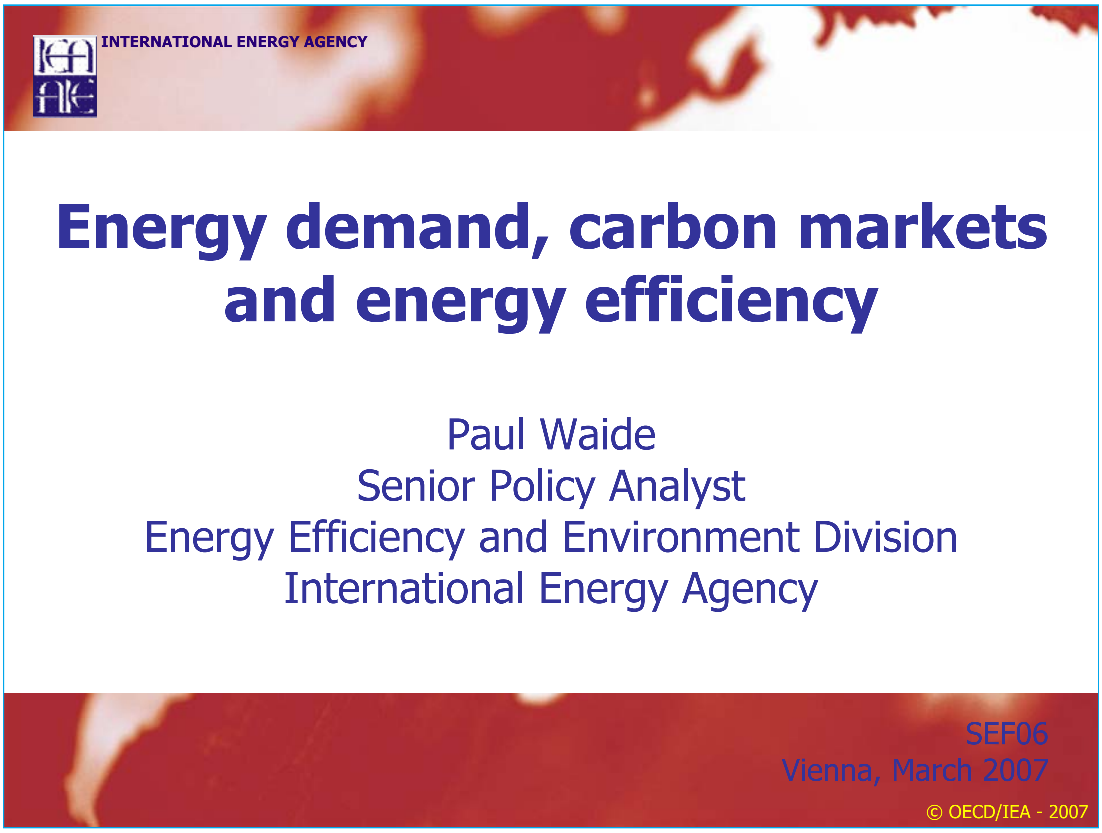
- Non-Compliance investors are getting more comfortable with the risks associated with the carbon market.
  - Willing to take Post-2012 positions
  - Technologies and Methodologies – as the "low-hanging fruit" disappears, interest in biodiesel, renewables and energy efficiency has increased
  - Geography – Africa, FSU
  - Transaction Structure – forward contracts still most common but seeing some debt/equity structures

NATSOURCE

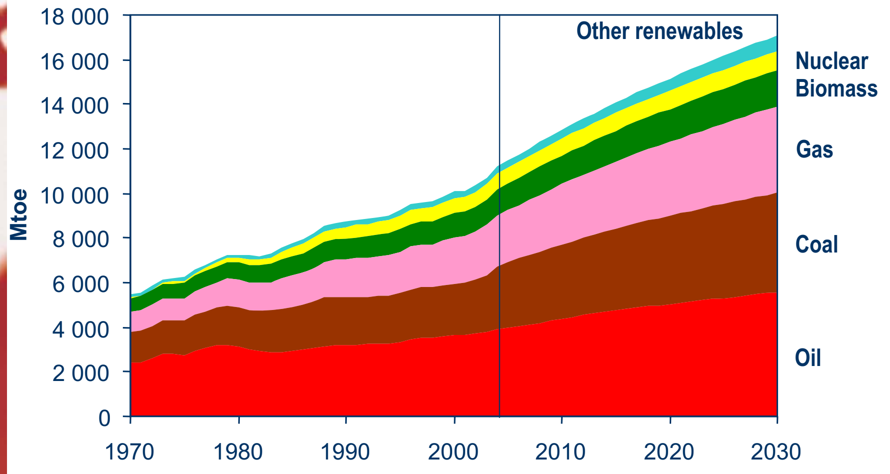
Energy demand, carbon markets and energy efficiency

Mr. Paul Waide, IEA

Mr. Paul Waide, Senior Policy Analyst, IEA, discussed the global energy outlook and demands for the future. He highlighted that in an alternative policy scenario, energy efficiency will account for two thirds of carbon emission avoidance in 2030, and that it is a measure that makes economic sense. He identified barriers to growth of the energy efficiency sector, including the isolation of demand from pricing in parts of the energy industry; the lack of commonly used metrics for measuring energy efficiency; and inadequate financing of technical and administrative capacity.



Reference Scenario: World Primary Energy Demand



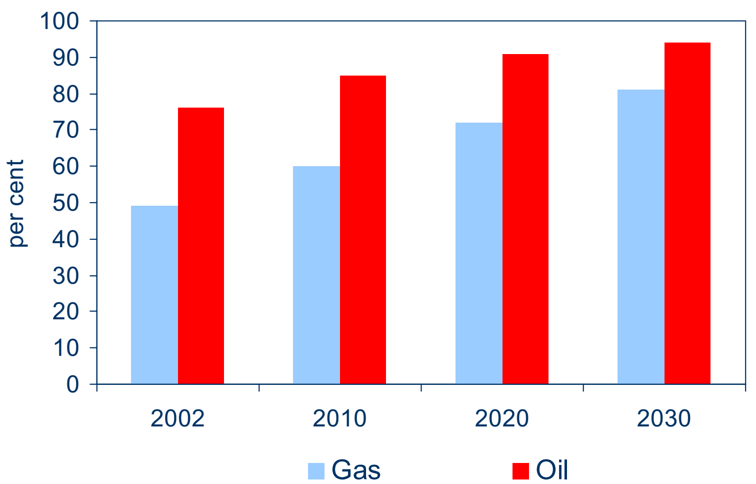
Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms

WORLD ENERGY OUTLOOK

INTERNATIONAL ENERGY AGENCY

Energy security concerns

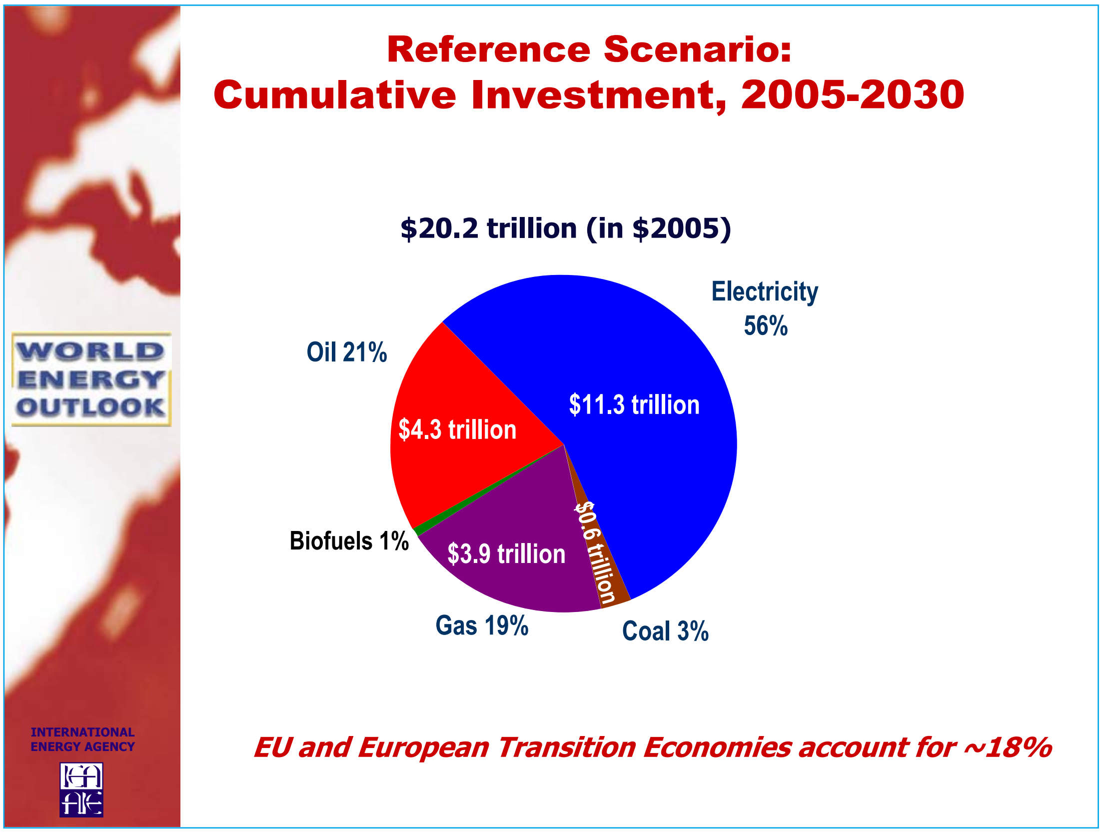
e.g. growing European Union Oil and Gas Import Dependence



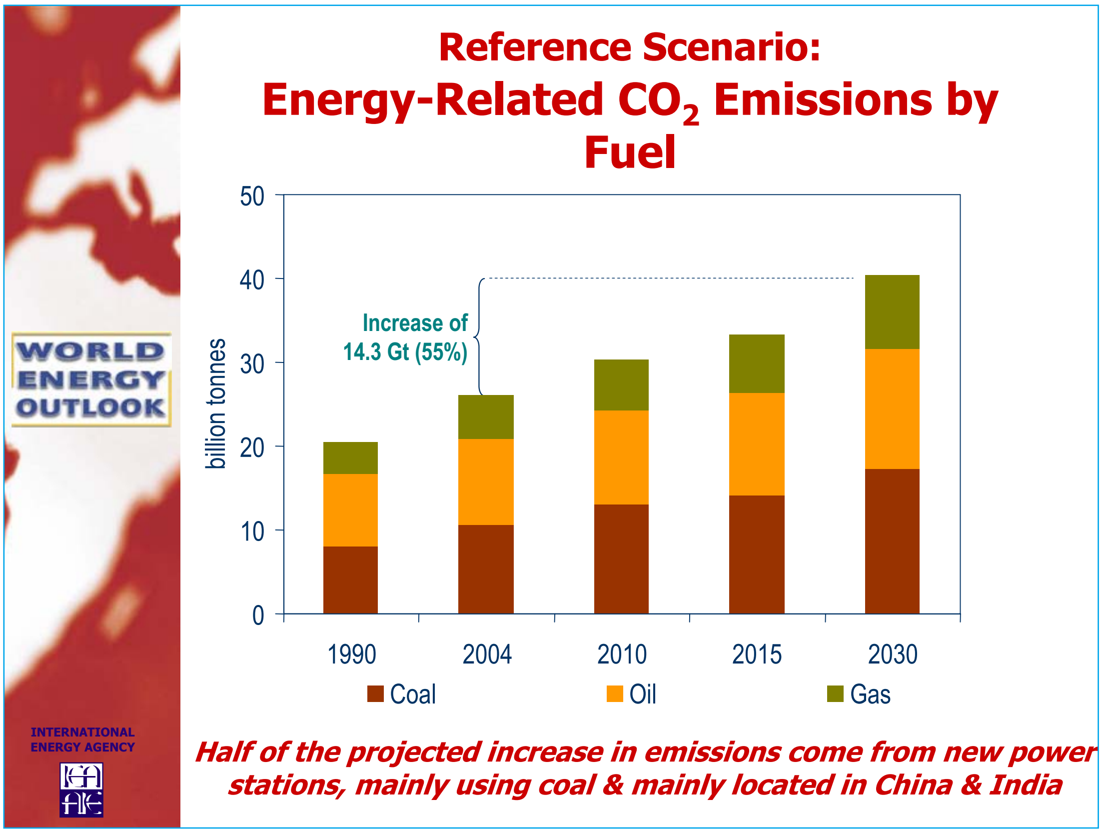
EU oil import dependence will reach 94% by 2030 and gas import dependence will increase from 49% in 2002 to 81% in 2030

WORLD ENERGY OUTLOOK

INTERNATIONAL ENERGY AGENCY

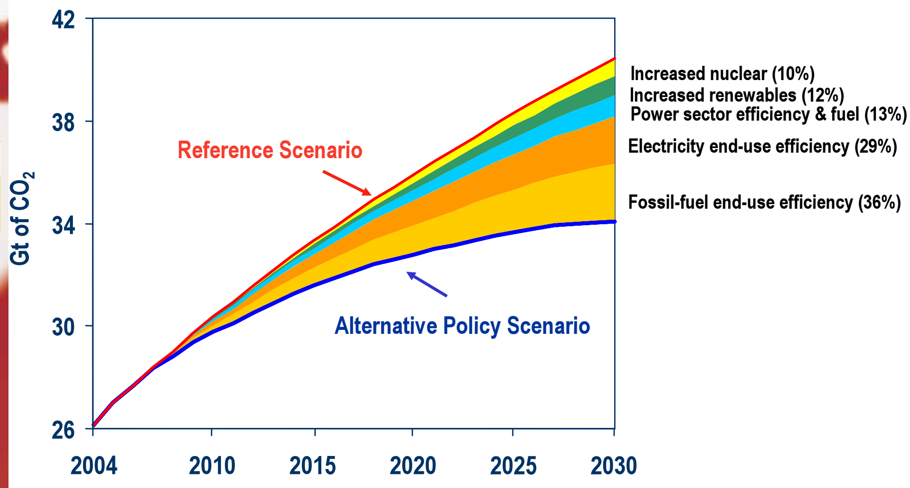


Reference Scenario:
Cumulative Investment, 2005-2030
$20.2 trillion (in $2005)
Electricity 56%
$11.3 trillion
Oil 21%
$4.3 trillion
Biofuels 1%
$3.9 trillion
$0.6 trillion
Gas 19%
Coal 3%
EU and European Transition Economies account for ~18%
WORLD ENERGY OUTLOOK
INTERNATIONAL ENERGY AGENCY



Reference Scenario:
Energy-Related CO_2 Emissions by Fuel
billion tonnes
50
40
30
20
10
0
Increase of 14.3 Gt (55%)
1990
2004
2010
2015
2030
Coal
Oil
Gas
Half of the projected increase in emissions come from new power stations, mainly using coal & mainly located in China & India
WORLD ENERGY OUTLOOK
INTERNATIONAL ENERGY AGENCY

Alternative Policy Scenario: Key Policies for CO_2 Reduction



Improved end-use efficiency accounts for <u>two-thirds</u> of avoided emissions in 2030 in the APS

WORLD ENERGY OUTLOOK

INTERNATIONAL ENERGY AGENCY

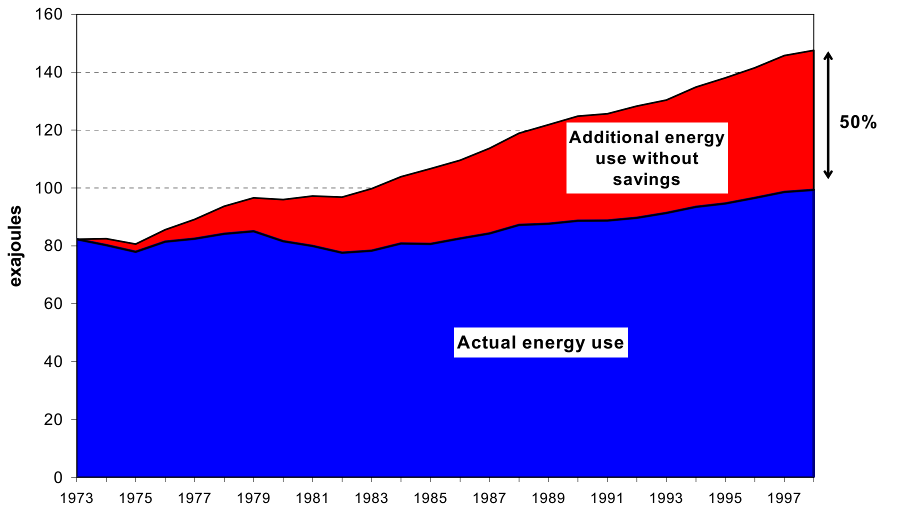
Alternative Policy Scenario: Cost Effectiveness of Policies

- Total energy investment – from production to consumption – is lower than in the RS
- Consumers spend $2.4 trillion *more* in 2005-2030 in more efficient cars, refrigerators etc
- ..but over $3 trillion *less* investment is required on the supply side
  - *Each $1 invested in more efficient electrical appliances saves $2.2 in investment in power plants & networks*
  - *Each $1 invested in more efficient oil-consuming equipment (mainly cars) saves $2.4 in oil imports to 2030*
- The higher initial investment by consumers is more than offset by fuel-cost savings

WORLD ENERGY OUTLOOK

INTERNATIONAL ENERGY AGENCY

Actual energy use and hypothetical energy use without savings: OECD-11



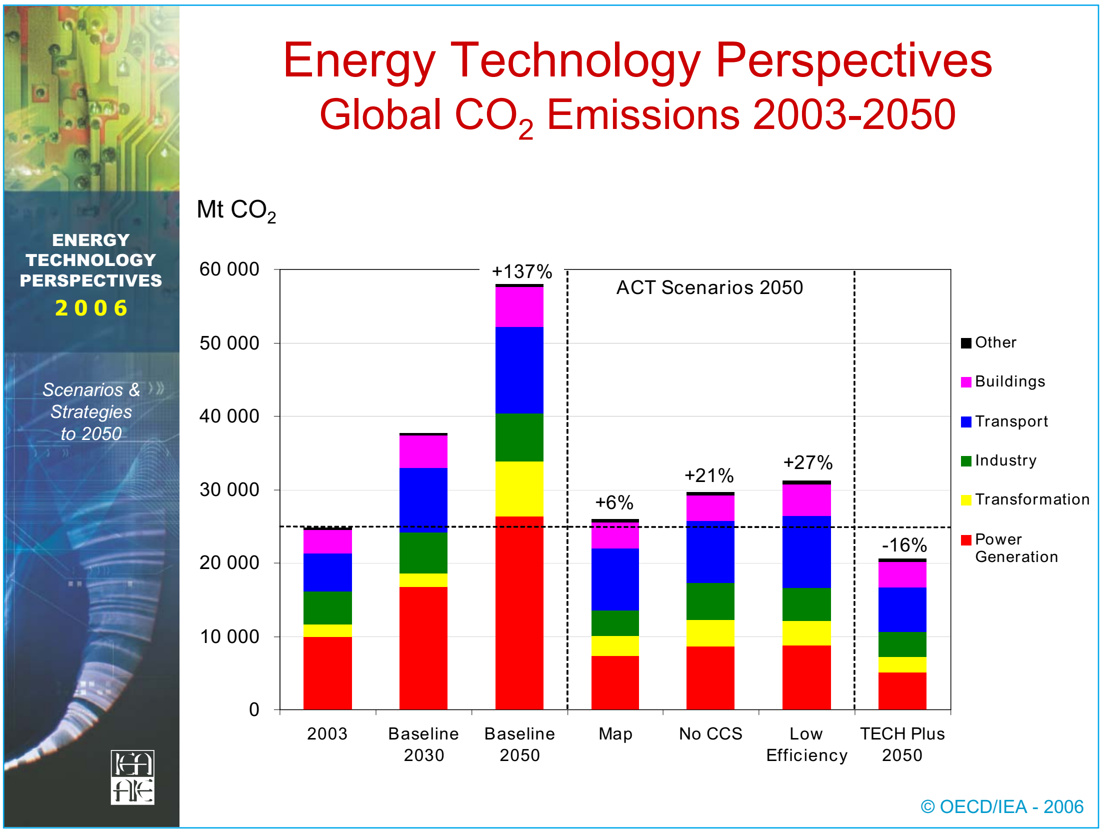
Without energy savings achieved since 1973 energy demand in 1998 would have been 50% higher

Avoiding 1 billion tons of CO_2 per year

Coal	Replace 300 conventional, 500-MW coal power plants with "zero-emission" power plants, or ...
CO_2 Sequestration	Install 1000 Sleipner CO_2 sequestration plants
Wind	Install 200 x current US wind generation in lieu of unsequestered coal
Solar PV	Install 1300 x current US solar generation in lieu of unsequestered coal
Nuclear	Build 140 1-GW power plants in lieu of unsequestered coal plants

To meet the energy demand & stabilize CO_2 concentrations unprecedented technology changes must occur in this century

INTERNATIONAL ENERGY AGENCY AGENCE INTERNATIONALE DE L'ENERGIE


ENERGY TECHNOLOGY PERSPECTIVES
2006
Scenarios & Strategies to 2050
Energy Technology Perspectives
Global CO_2 Emissions 2003-2050
Mt CO_2
60 000
50 000
40 000
30 000
20 000
10 000
0
+137%
ACT Scenarios 2050
+6%
+21%
+27%
-16%
Other
Buildings
Transport
Industry
Transformation
Power Generation
2003
Baseline 2030
Baseline 2050
Map
No CCS
Low Efficiency
TECH Plus 2050
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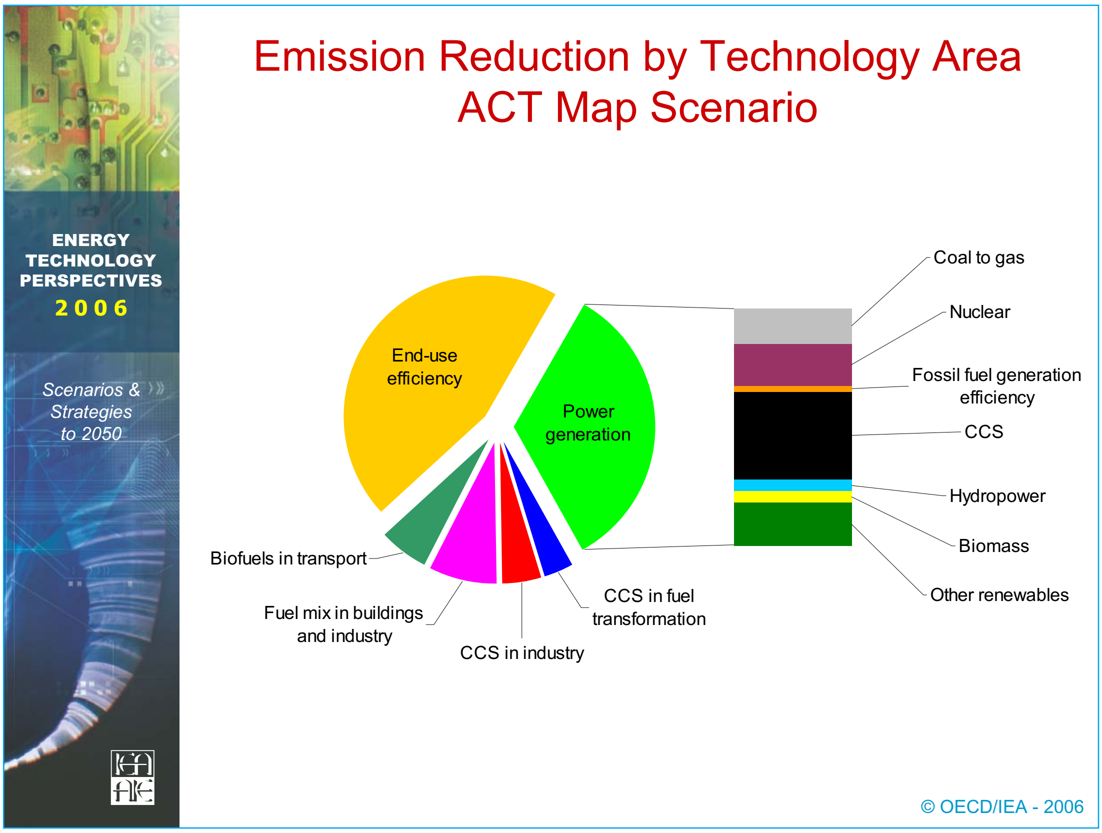
ENERGY TECHNOLOGY PERSPECTIVES
2006
Scenarios & Strategies to 2050
Emission Reduction by Technology Area
ACT Map Scenario
End-use efficiency
Power generation
Biofuels in transport
Fuel mix in buildings and industry
CCS in industry
CCS in fuel transformation
Coal to gas
Nuclear
Fossil fuel generation efficiency
CCS
Hydropower
Biomass
Other renewables
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The market does not fully deliver cost-effective savings autonomously

- Missing or partial information on EE performance and lack of common metrics
- Lack of awareness re cost-effective savings potentials
- Split incentives: Landlord-Tenant issue
- EE often a minor determinant of capital-acquisition decisions
- EE is bundled-in with more important capital decision factors
- All result in emphasis on 1st not Life-cycle costs

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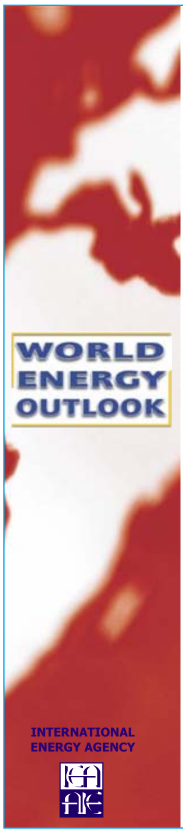


Role for carbon finance?

- Help fund the transition to more sustainable energy choices, uses and practices
- Promoting energy efficiency should be the highest priority
- Finance is needed for technical and administrative capacity and infrastructure as much as for incremental technology costs
- Much stronger coordination needed between international assistance schemes
- Simpler and more transparent project support mechanisms required

4.2 Discussions

Participants focused on speculation surrounding post-2012 prices and Ms. Eva Šnajdrová cited the decision of the EU to reduce its emissions by 20 per cent by 2012 as an important signal to industry. On questions from participants from non-Annex I countries regarding the types of CDM and JI projects to focus on, panellists suggested, inter alia, developing appropriate institutions and letting the market decide; reviewing approved methodologies and selecting the most appropriate; and taking note of the general interest in increasing the number of energy efficiency projects.

5. Panel session II: Status of energy efficiency under CDM and JI

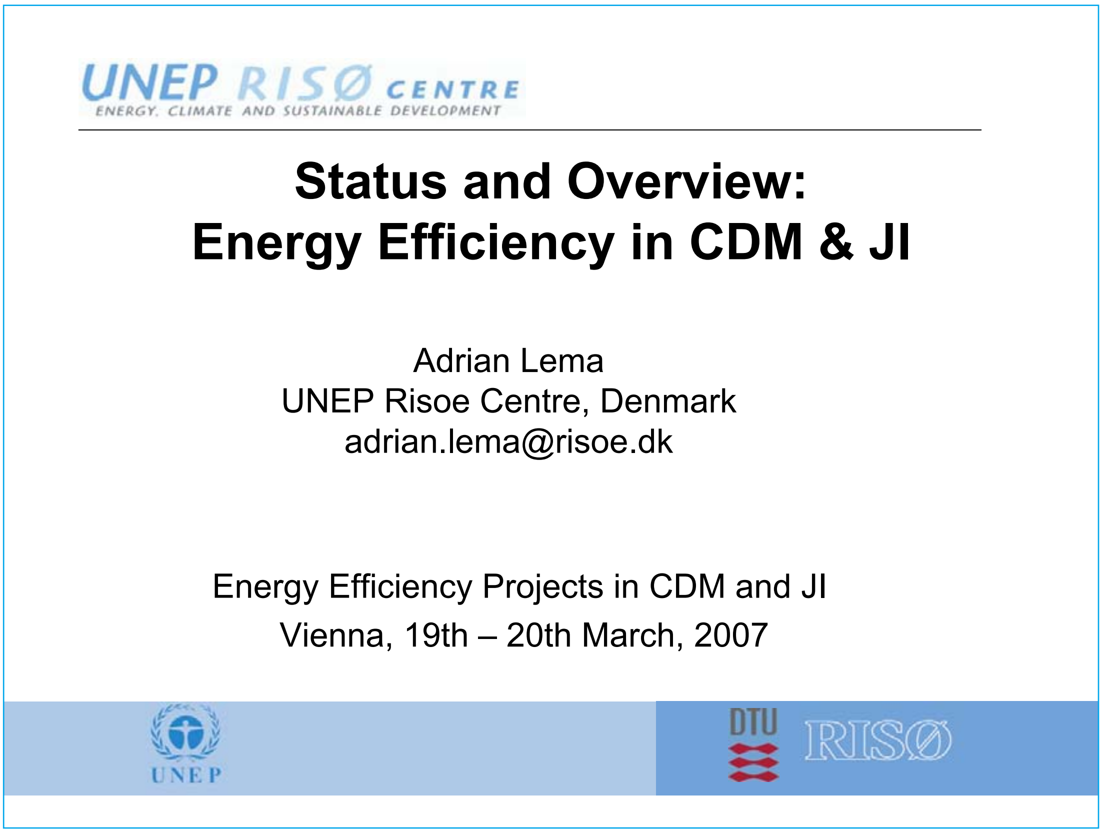
Marina Ploutakhina moderated the discussion and introduced panel participants.

5.1 Presentations

Status and overview: Energy efficiency in CDM & JI

Mr. Adrian Lema, UNEP Risoe Centre on Energy, Climate and Sustainable Development

Mr. Adrian Lema, Research Assistant, UNEP Risø Centre on Energy, Climate and Sustainable Development, outlined the data collated on CDM and JI projects currently in the pipeline. He said that as of 14 March 2007, 1743 projects were in the pipeline and that energy efficiency projects would generate 7.3 per cent of the total CERs until 2012. He explained that 91 per cent of the 194 energy efficiency projects in the CDM pipeline are located in China or India, and that the iron, steel and cement industries account for more than half of all energy efficiency projects.



UNEP RISØ CENTRE
ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Contents

- **CDM projects**
  - Overview
  - Sectoral distribution
  - Geographical distribution
- **CDM Energy efficiency projects**
  - Definitions
  - Methods
  - EE Industry Sub-Sectors
  - Demand side projects
- **JI projects**
  - Overview
  - EE projects in JI

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Status of CDM projects: 1727 in the pipeline

Status	Number
At validation	**1047**
Request for registration	108
Request for review	10
Correction requested	10
Under review	5
Total in the process of registration	**133**
Withdrawn	4
Rejected by EB	12
Registered, no issuance requested	391
Registered, request for CERs	16
Registered, correction requested	1
Registered, request for CER issuance review	1
Registered, under review	0
Registered. CER issued	138
Total registered	**547**
Total number of projects (incl. rejected & withdrawn)	1743

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Small-scale projects

- 962 projects in the pipeline are small-scale
- 56 % of all CDM projects are small-scale

Project types	Small-scale CDM project activity categories	Number
Type I: Renewable energy projects <15 MW	A. Electricity generation by the user	13
	B. Mechanical energy for the user	4
	C. Thermal energy for the user	75
	D. Renewable electricity generation for a grid	506
Type II: Energy efficiency improvement projects	A. Supply side energy efficiency improvements - transmission and distribution	0
	B. Supply side energy efficiency improvements - generation	13
	C. Demand-side energy efficiency programmes for specific technologies	8
	D. Energy efficiency and fuel switching measures for industrial facilities	63
	E. Energy efficiency and fuel switching measures for buildings	14
<60 GWh savings	F. Energy efficiency and fuel switching measures for agricultural facilities and activities	1
Type III:	A. Agriculture (no methodologies available)	0
	B. Switching fossil fuels	22
EB27: <60 ktCO2 reduction	C. Emission reductions by low-greenhouse emission vehicles	2
	D. Methane recovery	167
	E. Avoidance of methane production from biomass decay through controlled combustion	47
	F. Avoidance of methane production from biomass decay through composting	7
	G. Landfill methane recovery	1
	H. Methane recovery in wastewater treatment	17
	I. Avoidance of methane production in wastewater treatment through replacement of anaerobic lagoons by aerobic systems	1
	J. Avoidance of fossil fuel combustion for carbon dioxide production to be used as raw material for industrial processes	0
	K. Avoidance of methane release from charcoal production by shifting from pit method to mechanized charcoaling process	1
Note: some projects use more than one category.		962

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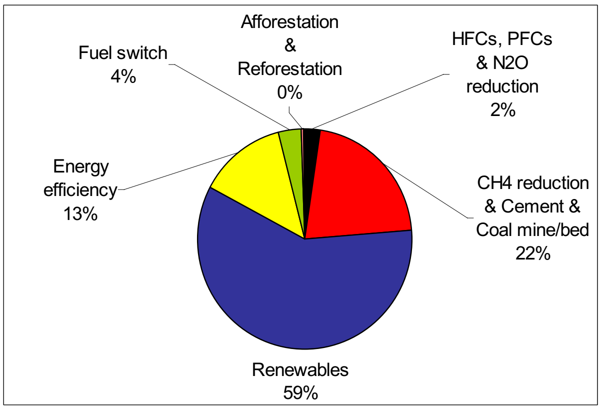
Number of CDM projects in each sector



Type	Number		CERs/yr (000)	
HFCs, PFCs & N2O reduction	41	2%	123189	40%
CH4 reduction & Cement & Coal mine/bed	372	22%	64583	21%
Renewables	1015	59%	71885	24%
Energy efficiency	**230**	**13%**	**23835**	**7,8%**
Fuel switch	63	4%	20682	7%
Afforestation & Reforestation	6	0%	615	0%

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Large emerging countries dominate the pipeline

- China has 370 projects in the pipeline (21.4 %)
- India has 586 projects in the pipeline (33.9 %)
- Brazil has 219 projects in the pipeline (12.7 %)

- These three countries account for 74.6 % of CERs to be issued by 2012

Total in the CDM Pipeline	Number		kCERs	2012 kCERs	
Latin America	518	**30,0%**	49296	319182	**16,9%**
Asia & Pacific	1145	**66,3%**	237226	1450070	**76,8%**
Europe and Central Asia	16	**0,9%**	941	5668	**0,3%**
Sub-Sahara Africa	25	**1,4%**	11189	75294	**4,0%**
North Africa & Middle-East	23	**1,3%**	6138	36879	**2,0%**
Total	1727	**100%**	304789	1887093	**100%**

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EE definitions in CDM/JI Pipeline

- EE covers industry, supply side, households and service (+ distribution and transport)
- EE Industry covers both demand-side efficiency *and* generation projects at industrial facilities (e.g. co-generation).
- EE Industry is distributed on 17 sub-sectors in the CDM/JI Pipeline

- The UNFCCC ”sectoral scopes” are translated into ”Types” in the CDM/JI Pipeline

Sectoral Scope	UNEP Risoe CDM/JI Pipeline Types
Energy distribution (2)	Energy distribution
Energy demand (3)	EE households. EE service. EE industry
Manufacturing industries (4)	EE industry. EE supply. Cement. Fossil fuel switch. Biomass energy

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Large scale

	Energy efficiency, Supply side	
ACM7	Conversion from single cycle to combined cycle power generation	4
AM14 (ver 2)	Natural gas-based package cogenereation	40
	Energy efficiency, Industry:	
AM17 (ver 2)	Steam system efficiency improvement by replacing steam traps and returning condensate	0
AM18	Baseline methodology for steam optimization systems	12
ACM3 (ver 4)	Emission reduction through partial substitution of fossil fuels with alternative fuels in cement	9
ACM4 (ver 2)	Waste gas and/or heat for power generation	109
AM32	Waste gas or waste heat based cogeneration system	0
AM24	Waste gas recovery and utilization for power generation at cement plant	3
AM38	Improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn	1
AM44	Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors	0
	Energy efficiency, Households:	
AM46	Replacement of incandescent lamps by compact fluorescent lamps	
	Energy efficiency, Service:	
AM20	Water pumping efficiency improvement	0

Small scale

Type II: **Energy Efficiency Improvement projects** **<60 GWh savings**	A. Supply side energy efficiency improvements - transmission and distribution	0
	B. Supply side energy efficiency improvements - generation	13
	C. Demand-side energy efficiency programmes for specific technologies	8
	D. Energy efficiency and fuel switching measures for industrial facilities	63
	E. Energy efficiency and fuel switching measures for buildings	14
	F. Energy efficiency and fuel switching measures for agricultural facilities and activities	1

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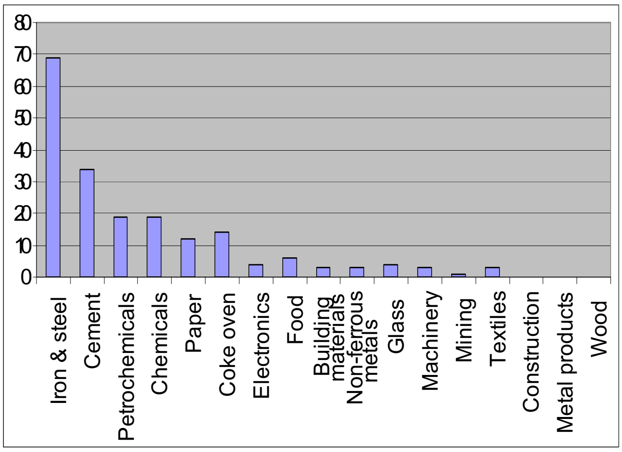
EE Industry distributed by 17 sub-sectors



EE Industry sectors	At Validation	Request registration	Registered	Total	MW
Iron & steel	43	6	20	**69**	1610
Cement	23	5	6	**34**	371
Petrochemicals	10	2	7	**19**	26
Chemicals	10	3	6	**19**	61
Paper	6	1	5	**12**	0
Coke oven	11	1	2	**14**	294
Electronics	2	0	2	**4**	5
Food	5	1	0	**6**	22
Building materials	1	0	2	**3**	0
Non-ferrous metals	1	2	0	**3**	9
Glass	4	0	0	**4**	0
Machinery	3	0	0	**3**	0
Mining	0	1	0	**1**	0
Textiles	2	0	1	**3**	16
Construction	0	0	0	**0**	0
Metal products	0	0	0	**0**	0
Wood	0	0	0	**0**	0

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An estimate of demand side EE Industry projects

Demand side EE Industry projects are very few…

- AM 18 (Baseline methodology for steam optimization systems) = **12 projects**
- AM 14 (Natural gas-based package cogeneration) =**1 project**
- AM 38 (Improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn) = **1 project**

… but there are more within small-scale

- AMS II.C. (Demand-side energy efficiency programmes for specific technologies) **= 8 projects**
- AMS II.D. (Energy efficiency and fuel switching measures for industrial facilities) **= 58 projects**

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Geograhical distribution of EE projects

- India's share of all EE Industry projects in the pipeline is 66 %
- China's share of all EE Industry projects in the pipeline is 25 %

	EE households	EE industry	EE service	EE supply side
Latin America	0	**4**	8	3
Brazil	0	**2**	8	0
Asia & Pacific	1	**186**	2	13
China	0	**48**	1	0
India	0	**129**	1	11
Europe and Central Asia	2	**0**	1	0
Sub-Sahara Africa	1	**2**	0	0
World	4	**194**	11	16

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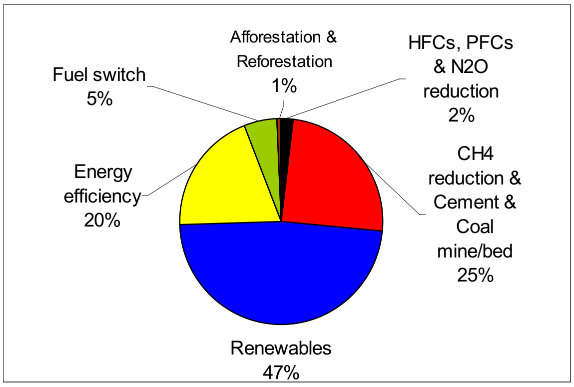
Status of JI Track II projects: 155 in the pipeline

Status of CDM projects	Number
Early movers	111
At determination	43
Request for registration	1
Request for review	0
Correction requested	0
Under review	0
Total in the process of registration	**1**
Withdrawn	0
Rejected by EB	0
Registered, no issuance requested	0
Registered, request for CERs	
Registered, correction requested	
Registered, request for CER issuance review	
Registered, under review	
Registered. CER issued	
Total registered	**0**
Total number of projects (incl. rejected & withdrawn)	155



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Geographical distribution of JI projects

	Total Number		kERUs	2012 kERUs	
Russia & Ukraine	48	31%	18965	94174	66%
Russia	31	20%	14468	72446	51%
Ukraine	17	11%	4497	21728	15%
Eastern Europe	99	64%	8968	44890	31%
Bulgaria	20	13%	3245	16224	11%
Czech Republic	21	14%	814	4070	3%
Romania	15	10%	1590	8093	6%
Poland	13	8%	802	3971	3%
Hungary	11	7%	1437	7078	5%
Estonia	11	7%	602	3063	2%
Latvia	0	0%	0	0	0%
Lithuania	5	3%	193	966	1%
Slovakia	3	2%	285	1425	1%
Others	8	5%	705	3525	2%
Germany	3	2%	194	972	1%
New Zealand	5	3%	511	2553	2%
Total JI countries	155	100%	28638	142589	100%

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Geographical distribution of EE projects in JI

	EE households	EE industry	EE service	EE supply side
Russia & Ukraine	**0**	**5**	**0**	**4**
Russia	0	2	0	4
Ukraine	0	3	0	0
Eastern Europe	**1**	**7**	**0**	**5**
Bulgaria	1	4	0	2
Czech Republic	0	0	0	0
Romania	0	2	0	3
Poland	0	0	0	0
Hungary	0	1	0	0
Estonia	0	0	0	0
Latvia	0	0	0	0
Lithuania	0	0	0	0
Slovakia	0	0	0	0
Others	**0**	**0**	**0**	**0**
Germany	0	0	0	0
New Zealand	0	0	0	0
Total JI countries	**1**	**12**	**0**	**9**

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Source: CDM/JI Pipeline Overview, Unep Risoe Centre, 14th March 2007

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The Status of energy efficiency: Approved methodologies and lessons learned

Mr. Sudhir Sharma, UNFCCC Secretariat

Mr. Sudhir Sharma, Programme Officer, UNFCCC Secretariat, presented on approved supply and demand-side energy efficiency methodologies and lessons learned. On the demand side, he outlined two methods for defining reductions, namely, the “black box” approach, involving the ratio of energy output to energy input, and theoretical modelling. He said the key challenges include differentiating between project-related gains and business as usual gains; identifying boundaries to isolate the effects on efficiency of processes under consideration; and how to address efficiency due to load variations.

The Status of Energy Efficiency: Approved methodologies and lessons learned

Sudhir Sharma

UNFCCC

UNFCCC

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Contents

I. Key CDM Statistics

II. Approved methodologies

III. Key issues in Energy Efficiency Methodology

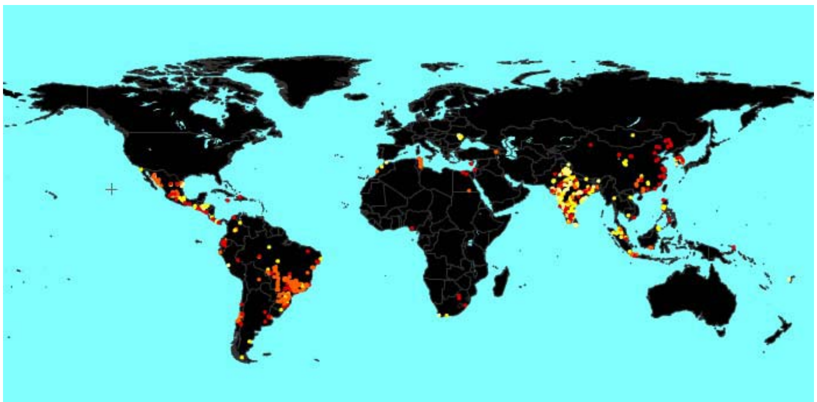
IV. Structure of CDM Secretariat

V. Information sources CDM

Score Board: CDM

526 registered CDM project activities,
- expected 115 million CERs annual,
- expected: 0.75 billion CERs till 2012

+ 121 Project activities requesting registration,
- expected total 26 million CERs annual,
- expected total 150 million CERs till 2012



More than 1600 activities in the CDM pipeline (incl. above),
- more than 1.9 billion CERs expected by end of 2012 ,

(assumption: no extension of crediting period)

Approved Methodologies

- All approved methodologies can be seen at:
  - ✓ http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

✓ **69** **(non A&R)**
- ✓**38 AM**
- ✓**10 ACM**
- ✓**21 SSC**

✓ **6 A&R**
- ✓**5 ARAM**
- ✓**1 SSC A&R**

Approved Methodologies

- ✓ *Supply side efficiency methodologies*
  - ✓ *ACM0006 – certain scenarios*
  - ✓ *AM0014 – package cogeneration methodology*
  - ✓ *AM0044 – Boiler rehabilitation or replacement*
  - ✓ *ACM0007 – single cycle to combined cycle power generation*
- ✓ *Demand side efficiency methodology*
  - ✓ *AM0017 – steam system use efficiency in refinery*
  - ✓ *AM0018 – steam optimization projects*
  - ✓ *AM0020 – efficiency improvement in water delivery system*
  - ✓ *AM0038 – Efficiency improvement in electrical arc furnace*
  - ✓ *AM0045 – Use of efficient lamps in households*

Key challenges in EE methodologies (1)

- Defining reductions in Industrial DSM meths
  - ✓Black Box Approach:
    - EE defined as ratio of energy output to energy input in the part of the process/equipment where EE measure implemented.
  - ✓Theoretical models:
    - Gains based not on actual changes in energy consumption but theoretical estimates.
    - Difficult to isolate and measure actual energy input, output to system under consideration.

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Key challenges in EE methodologies (2)

- ✓Differentiating b/n project related gains and BAU gains.
- ✓Identifying system boundaries to isolate outside effects on efficiency of process/equipment under consideration.
- ✓Addressing efficiency variations due to load variations.
- ✓Issue of signal to noise ratio (more relevant of theoretical models).
- ✓Rebound effect – accounting for emission leakages due to rebound affect.

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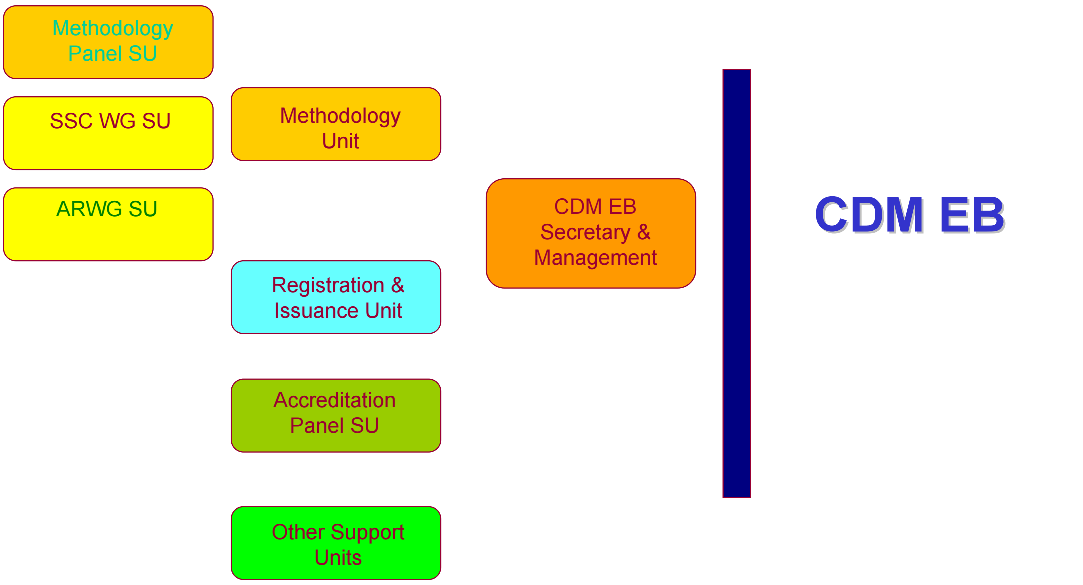
Key challenges in EE methodologies (3)

- Small scale appliance project activities
  - ✓Linkage between project activity and emission reductions.
  - ✓Additionality/real reductions – Identifying free riders
    - Those who would have anyway used the appliance.
    - Those who are part of other diffusion programs.
  - ✓Monitoring – robust sampling procedures
    - to assess actual impact on energy consumption.
    - Monitoring whether the equipment is operational and in use.

Structure of CDM Secretariat



INFORMATION SOURCE
Keep up to date

- ✓ CDM project search *(http://cdm.unfccc.int/Projects/projsearch.html)*
- ✓ Interactive map with registered project activities *(http://cdm.unfccc.int/Projects/MapApp)*
- ✓ UNFCCC CDM **website** *(http://unfccc.int/cdm)*
- ✓ UNFCCC CDM **News Facility** *(Requirement to register as a UNFCCC CDM web site user (join) -> automatically subscribed)*
- ✓ CDM EB meetings are **web cast (internet)**,
- ✓ **Reports of the EB to COP/MOP**

10

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We Invite you to be on our Roster of Experts – one can apply through http://cdm.unfccc.int/Panels/meth/CallForExperts

Thanks

Contact: ssharma@unfccc.int

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Joint Implementation and energy efficiency

Ms. Daniela Stoycheva, JISC

Ms. Daniela Stoycheva, Member, Joint Implementation Supervisory Committee (JISC), explained how the JISC is similar to the CDM EB and said that it expects to receive 125 new project design documents in 2007. She stated that energy efficiency projects comprise 25 per cent of the total number of JI projects and account for 49 per cent of ERUs generated by JI projects. She also highlighted the capture of fugitive emission gases as an area for future growth.

Joint implementation

- **Art. 6 of the Kyoto Protocol** – "F*or the purpose of meeting their commitments under art. 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy…"*

Requirements for participation in Track 2 / Track 1 – *Marrakech accords eligibility criteria*:

✓ Party to the Kyoto Protocol;
✓ has calculated and recorded its AAUs;
✓ has in place a national registry;
============ JISC =================
✓ has in place a national system for estimation of GHG's;
✓submits annually GHG inventory report;
✓ has submitted supplementing information on AAUs.

Potential of JI projects

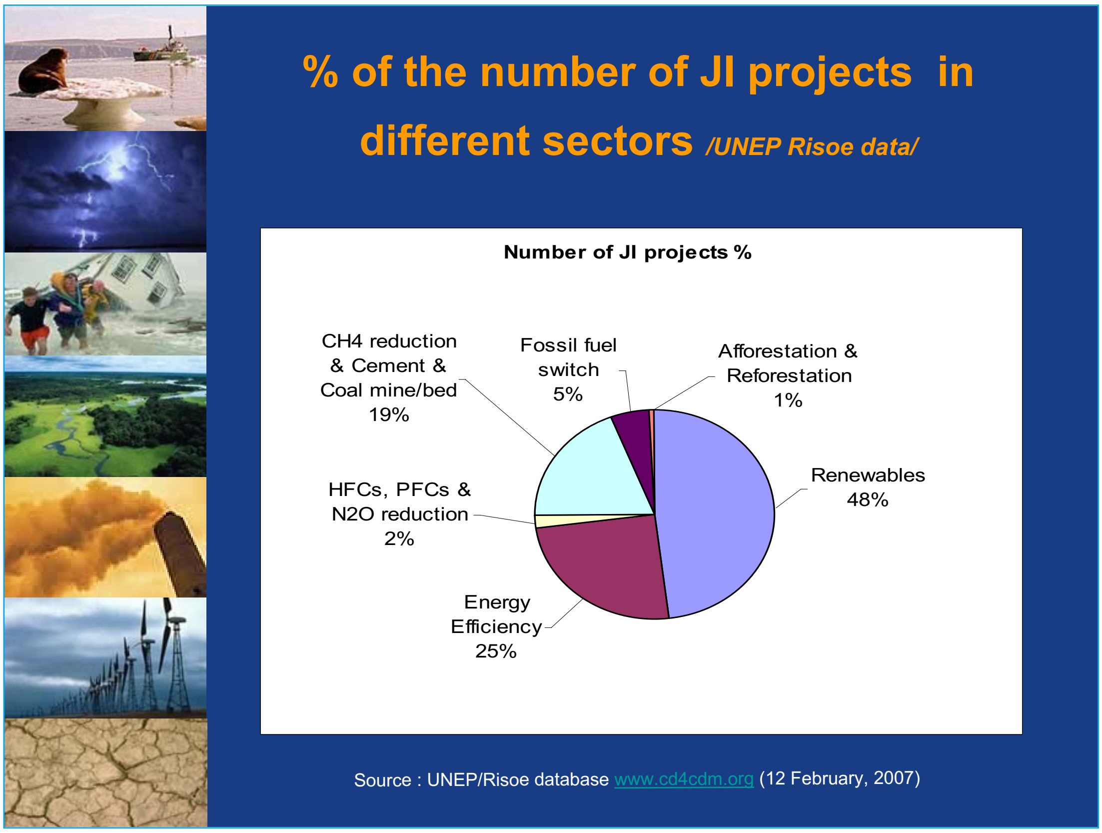
- **Host countries**: Russia is estimated to have the greatest JI potential (600 Mt CO2 per annum) followed by the Ukraine (150 Mt CO2 p.a.). Poland and Romania are the next biggest players (94-100 Mt CO2 per year), with Bulgaria ranking fifth (11-20 Mt CO2 per year)
- **Buyers:** EC countries the largest purchasers Japan is the second largest buyer
- **Imbalance sectoral distribution** of JI projects in the pipeline hydro and wind projects are strongly prevalent as are methane gas and biomass energy projects, followed by EE (manufacturing industries, district heating). In contrast, there are only a very limited number of afforestation, agriculture, coal bed/methane, and EE household projects.

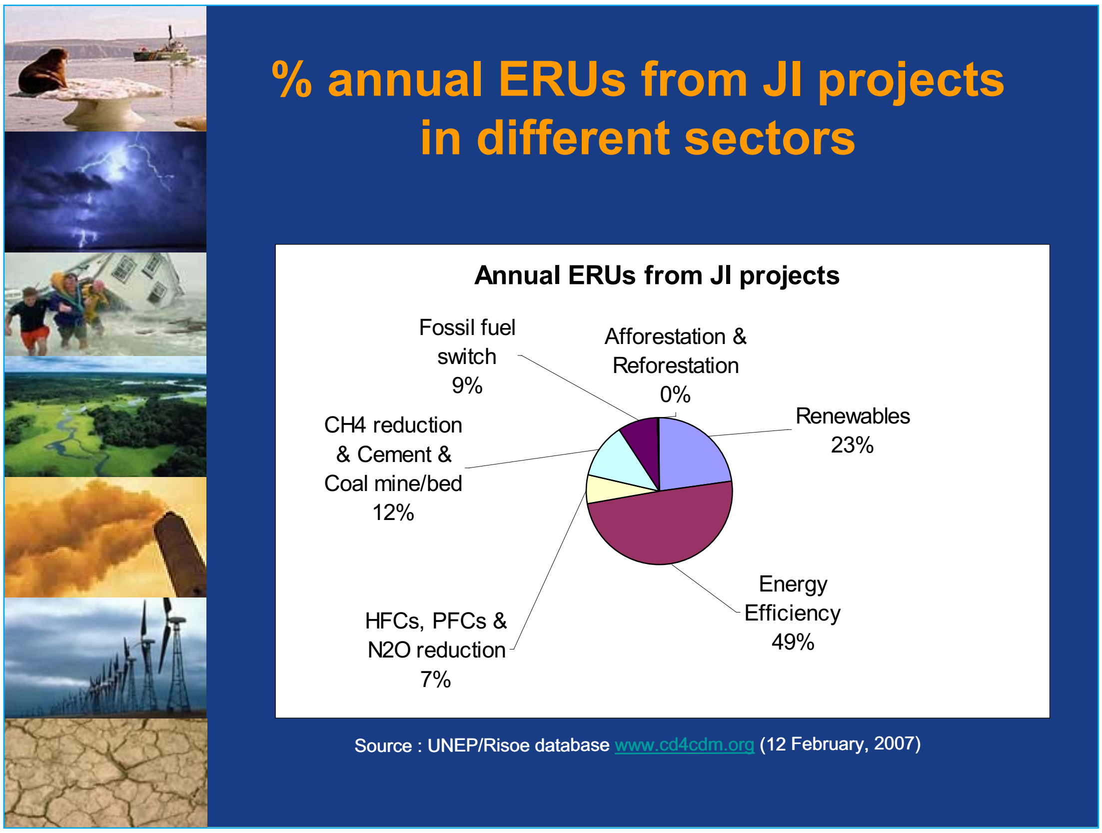
- In EU member states
- In non EU states
- International emission trading - GIS

Number of expected JI projects by country

	All JI tracks		JI Track 2	
Host country for JI projects	**Number of Projects**	**kERUs per year**	**Number of Projects**	**kERUs per year**
Russia	28	13912	16	11145
Bulgaria	21	3297	3	327
Czech Republic	21	814	0	0
Ukraine	17	2900	3	991
Romania	16	2054	2	223
Poland	13	802	3	192
Hungary	11	1437	1	141
Estonia	11	602	3	212
New Zealand	5	511	0	0
Lithuania	5	193	3	104
Slovakia	3	285	0	0
Germany	3	224	0	0
Latvia	0	0	0	0
Total	154	27031	34	13335

Source : UNEP/Risoe database www.cd4cdm.org (12 February, 2007)


% of the number of JI projects in
different sectors /UNEP Risoe data/
Number of JI projects %
CH4 reduction & Cement & Coal mine/bed 19%
Fossil fuel switch 5%
Afforestation & Reforestation 1%
Renewables 48%
HFCs, PFCs & N2O reduction 2%
Energy Efficiency 25%
Source : UNEP/Risoe database www.cd4cdm.org (12 February, 2007)


% annual ERUs from JI projects
in different sectors
Annual ERUs from JI projects
Fossil fuel switch 9%
Afforestation & Reforestation 0%
CH4 reduction & Cement & Coal mine/bed 12%
Renewables 23%
Energy Efficiency 49%
HFCs, PFCs & N2O reduction 7%
Source : UNEP/Risoe database www.cd4cdm.org (12 February, 2007)

JI project status in Russia

Project status	Number	Volume until 2012[tCO2e]
ERPAs signed	6	16,000,000
Projects with LoAs	0	0
Projects at PDD stage	32	84,600,000
Projects with LoEs	33	34,000,000

– 123 projects at different stages!

Project types (PDDs)	Number	Volume until 2012[tCO2e]
Energy efficiency	10	6,700,000
Fuel switch	5	7,614,000
Renewable energy	7	8,700,000
Fugitives	9	56,900,000
Waste	3	4,700,000

➔ But no DNFP, no national quidance, no LoA

Source: Point Carbon March 2007

JI project status in Ukraine

Project status	Number	Volume [tCO2e]
ERPAs signed	5	3,400,000
Projects with LoAs	5	14,900,000
Projects at PDD stage	17	23,200,000
Projects with LoEs	49	54,700,000

– 116 projects overall on different stages!

Project types (PDDs)	Number	Volume [tCO2e]
Energy efficiency	5	2,730,000
Fugitive emissions	5	13,380,000
Industrial processes	1	3,087,702
Renewables	2	1.630.432
Waste	4	2,249,083

➔ DNFP, national guidance, LoA, first project to JISC

Source: Point Carbon March 2007

EE related PDDs submitted to JISC – 9 of 40

1. "Rehabilitation of the District Heating System in Donetsk Region", Ukraine
2. "Improvement of efficiency of power generation by Bratsk Hydropower Plant, Irkutsk Oblast ", RF
3. GHG emission reduction through energy efficiency improvement in the communal heating system of Zima town, Irkutsk Oblast, RF
4. Introduction of energy efficiency measures at ISTIL mini steel mill, Ukraine
5. Murmansk District heating Rehabilitation, RF
6. Turceni Energy Efficiency Project, Lithuania
7. Energy conservation at Khimki DHC, RF
8. District Heating System Upgrade and Rehabilitation, Romania
9. Rehabilitation of Dolna Arda Hydropower Cascade, Bulgaria

Main obstacles to EE JI projects

- Buyers prefer "*low hanging fruit*"
- Higher transaction cost
- More complicated monitoring
- Higher investment cost
- Public sector (ownership)
- National quidelines

But EE JI projects have more benefits like new technologies, social and environmental

JI Supervisory committee JISC – Track 2 JI

- Decisions 9/CMP.1 (JI guidelines from Marrakech Accords) and 10/CPM.1 (Montreal decision)
- JISC established
- Results – in 9 mounts JI Track 2 launched – 26 October 2006
- Decisions 2 and 3 / CMP.2 (Nairobi decisions)
- From procedural to operational

JISC's Work programme

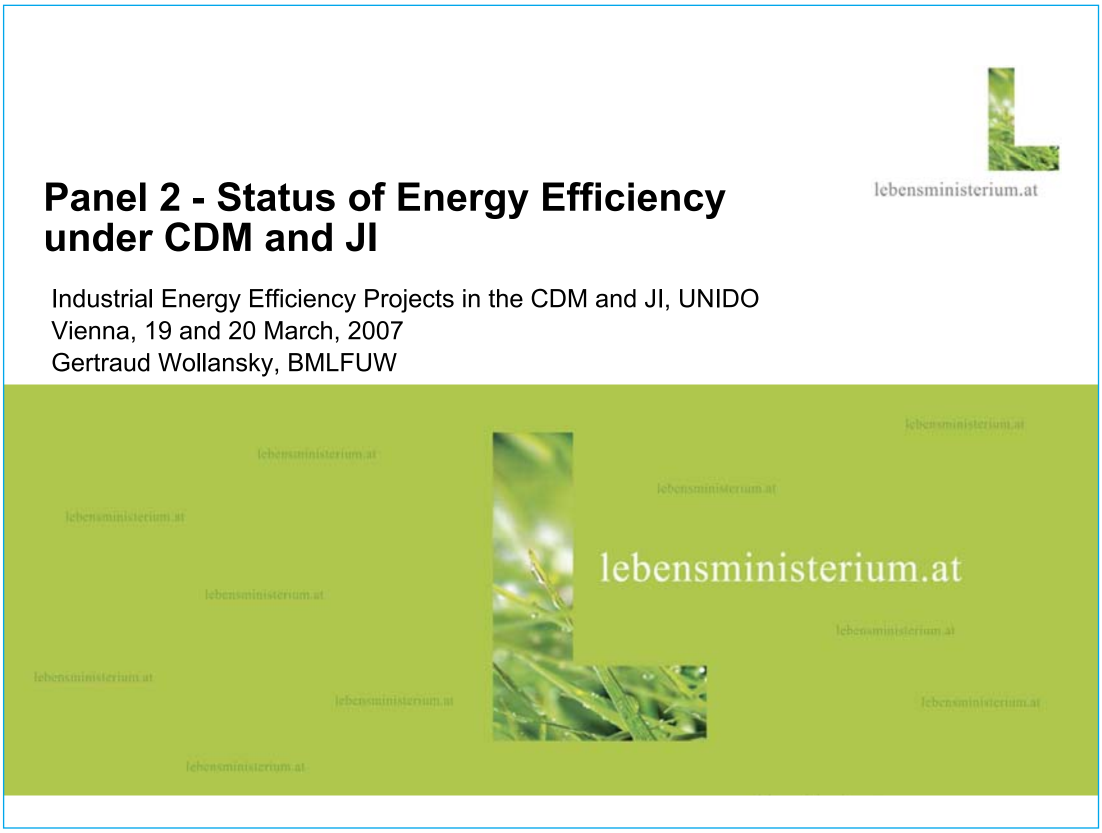
- – Development of **rules of procedure**
- – Development of **JI PDD**
- – Establishment of **accreditation system**
- – Development of **guidelines** on criteria for baseline setting and monitoring
- – Development of **procedures** for making PDDs, monitoring reports and determination reports **publicly available**
- – Development of **procedures for review of determinations**
- – Development of procedures for **charging fees**
- – Development of **management plan**
- – **Accreditation of** IEs (10/25)
- – **Appraisal/Review** of projects (1/40/125)


Thank you!
http://www.ji.unfccc.int
danielast11@yahoo.com

Small-scale CDM energy efficiency project activities

Ms. Gertraud Wollansky, BMLFUW

Ms. Gertraud Wollansky discussed small-scale (SSC) energy efficiency CDM project activities and explained that as a result of the small number of projects being registered, a call for public input had been launched. She noted barriers to attaining registration of energy efficiency CDM projects, including that the 15 Gigawatts hour (GWh) limit for SSC projects affects the financial viability of energy efficiency projects given their transaction costs; the emissions reductions are low when compared with other SSC categories; CER generation is too small to attract carbon funds; and payback periods of more than 2.5 years are not attractive to non-Annex I countries. She explained that the SSC limit had been increased to 60 GWh and encouraged participants to consider if this is sufficient.



Small Scale CDM Energy Efficiency project activities

lebensministerium.at

- Barriers for SSC Energy Efficiency project activities
- Small scale limits – Revision at CMP2

Seite 2 25.06.2007

Barriers to EE project activities (1)

lebensministerium.at

- The Executive Board at 25th meeting noted that very few SSC CDM project activities under type II (energy efficiency) were registered
- EB therefore launched a call for public inputs on the following questions:

a) Does the current definition (15 GWh) of type II SSC CDM project activities pose barriers to developing projects under this type?

b) Are there other barriers in this regard that relate to methodological issues?

Seite 3 25.06.2007

Barriers to EE project activities (2)

lebensministerium.at

Results of the call for public input:

Question a)

➢Definition according to CMP1 decision (limit of 15 GWh) is a barrier, as transaction costs are too high and make SSC type II projects financially unviable

➢Average expected emission reductions of the 4 registered type II project activities 6300 t CO_2/y, range from 3400 to 12000 t/y

➢CER generation too small to be attractive for Carbon Funds

➢Suggestions: introduce common threshold of CERs (30 or 50 kt) for all SSC project activities, increase GWh limit

Seite 4 25.06.2007

Barriers to EE project activities (3)

lebensministerium.at

Results of the call for public input:

Question b)

➢Pay back period of more than 2,5 years not attractive for industries in DCs, increasing limit could help

➢Other barriers not related to the CDM, even for EE measures that are financially viable

Seite 5 25.06.2007

Barriers to EE project activities (4)

lebensministerium.at

Suggestions for revision of SSC type II methodologies

- Change provision that leakage has to be considered if the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity – unrealistic, because it is not possible to keep track of equipment
- Lack of methodologies to address improvements of the EE of systems across sectors, not discrete equipment
- Lack of specificity in SSC methodologies for type II projects, which creates need for better guidance on methodological issues common to EE projects

Seite 6 25.06.2007

Barriers to EE project activities (5)

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Suggestions for revision of SSC type II methodologies (cont.)

- Improvements of the monitoring aspects to make them less strict and costly
- Introduce programmatic CDM
- Open CDM up for standards and labelling programmes
- Less frequent revisions of methodologies

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Change of limits for SSC projects (1)

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- Request by CMP 1 to Executive Board to make a recommendation for the revision of the limits for the SSC categories
- SSC Working Group made a proposal to EB on revision of Type II and Type III limits, based on public input and work done in the SSC WG
- Considerations of SSC WG:

-Energy saving to be obtained by avoiding consumption of an equivalent of 15 MW is in the order of 100 GWh/y

-Typical Type II activities do not qualify as SSC, while activities with similar capacity measured in output could qualify under Type I

-No linear correlation between GWh saved and the emission reductions of the project activity for Type II

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Change of limits for SSC projects (2)

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- EB accepted the structure proposed by SSC WG with modifications to the figures (60 GWh for Type II, 60 kt emission reductions for Type III)
- Recommendation to CMP2 to revise the limit for type II and III
- By decision of CMP 2 the limit for type II was increased from 15 GWh to 60 GWh

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Summary

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➢Limit of 15 GWh was one barrier Type II project activities - however, number of other barriers were identified

➢Other proposals for removing barriers have not yet been implemented in the SSC categories

A few questions:

➢Was raising the limit sufficient to promote SSC Type II project activites?

➢If not, what more needs to be done?

➢What about energy efficiency in the non-renewable biomass context?

➢What role can programmatic CDM play in SSC Type II?

➢……

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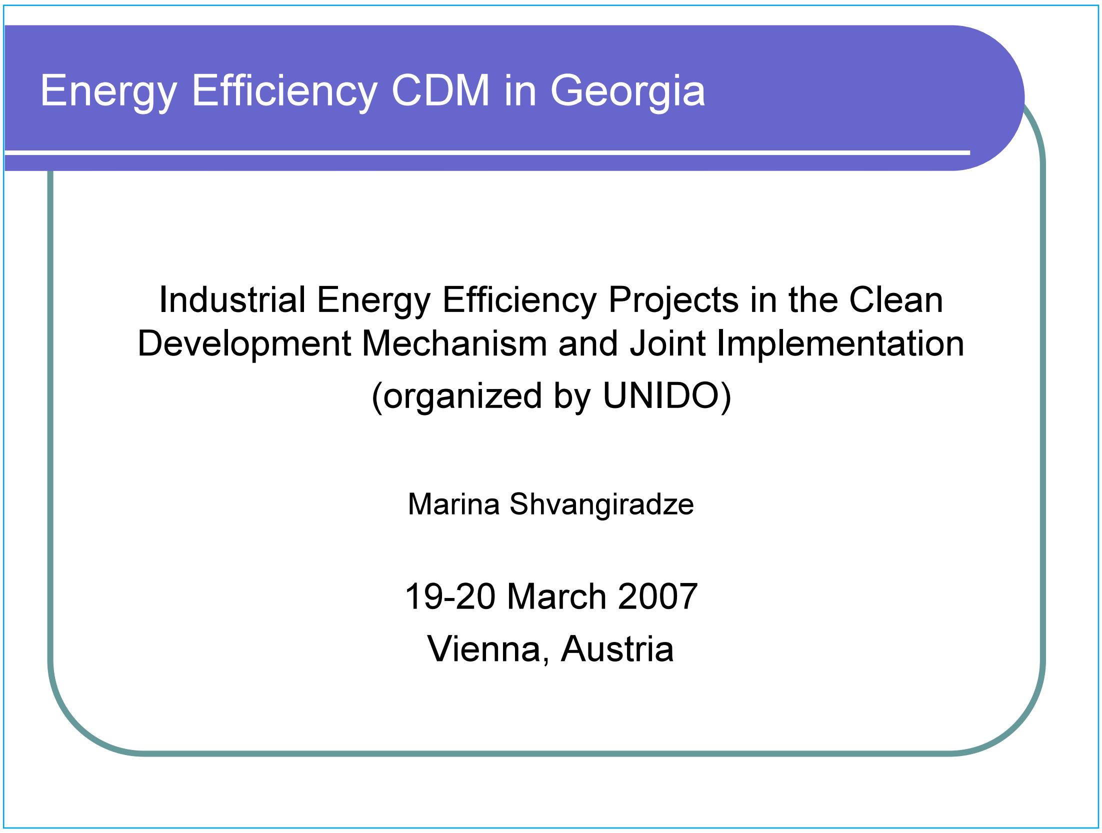
Energy efficiency CDM in Georgia

Ms. Marina Shvangiradze, Coordinator, Second National Communication Project of Georgia

Ms. Marina Shvangiradze, Coordinator, Second National Communication Project of Georgia, discussed Georgia's experience in energy efficiency CDM projects. She highlighted successes in various projects including projects to increase the efficiencies of turbines at the Engury Hydro Power Plant; replace and refurbish gas transmission pipelines; and increase pump efficiencies in municipal water supply systems.



CDM Projects in Georgia Increasing the Energy Efficiency

Electricity Generation

- Refurbishment of Engury Hydro Power Plant
- Small Hydro Rehabilitation Project, Georgia

Energy Transmission

- Methane Leak Reduction from Natural Gas Pipelines
- Rehabilitation of Tbilisi Gas Distribution System

Energy Demand

- Increasing of Water Pumps Energy Efficiency in Municipal Water Supply Systems

Refurbishment of Engury Hydro Power Plant

- Engury HPP is the largest HPP connected to the Georgian power grid with the reservoir of 1.1 billion m^3 and installed capacity 1300 MW (five Francis turbines)
- PDD just has been presented to the local stakeholders and DNA

Goal of CDM project

- Rehabilitation of three (out of five) generating units operation at low efficiency 230 MW (installed capacity 260 MW) each and increase its operating capacity by 120 MW
- Increase the number of full load operating hours
- Reduce leakage to lead to a more efficient use of the hydro resource of the existing reservoir

Cont.

- Annual average of estimated reductions over the crediting period is estimated as 155,901 tones of CO_2eq.
- Crediting period is fixed for 10 years
- Host party participant is Government of Georgia through Engurhesi Ltd.
- Project Developer is EBRD
- Baseline methodology applied is ACM0002/ver.06
- Average historic output of these three units in years 1981-2006 is 2,035 GWh
- Average capacity factor is 2,950 hours
- Additional electricity produced annually is estimated as 485 GWh

Small Hydro Rehabilitation Project, Georgia

Goal of CDM project

- Rehabilitation of existing small HPP and creation of at least 15 MW additional small, run-of-the-river hydro capacity
- In total 24 sites are selected
- Majority of the sites require simple rehabilitation of turbines, generators, lines, transformers, waterways, and other basic components.
- Project developer is the Energy Efficiency Centre Georgia (NGO); Bundling agency responsible for “monitoring” in a sense of CDM.
- Sponsors: Bank of Georgia; USAID;UNDP; WB; EBRD.
- Full implementation of the project is planned for 3 years and should be finished in 2010.
- After full implementation of the project the annual average of estimated reductions should be 32,550 t CO_2e

Cont.

- Total project cost is estimated as $15 mln
- EBRD and BoG pledged to allocate $8.5 mln (construction)
- USAID allocated $4.5 mln (construction)
- WB, UNDP, Local community $2 mln (preparatory stage, CDM component and the rest)

Methane Leak Reduction from Natural Gas Pipelines

- The pipeline considered in the project carries gas predominately from Russia into Georgia and on to Armenia
- PPs:Georgia Gas International Corporation (GGIC), Greenrights (The Netherlands), WB (project developer)
- The following types of activities will be undertaken to reduce leakage:

  -The current system relies on old pipes that have not been designed adequately to stand up to natural corrosive elements in their location. These old lines that are highly prone to leakage will be replaced with modern pipes or relined using advanced materials

  -The gate stations are often sources for major methane emissions and therefore they should be permanently tested for leakage

  -Leaking valves, worn seals, etc. will be identified and replaced.

Cont.

- Annual average over the crediting period of estimated reductions (tones of CO_2e) is 1,836,986
- Fixed crediting period 10 years
- New methodology has been submitted (NM0172)
- Fraction of total gas input that leaks from the pipeline at the last of the three years in which the three-year baseline measurement plan is executed equals to 6.27%

Rehabilitation of Tbilisi Gas Distribution System

- According to the assessments done by National Energy Regulating Commission the loses from Tbilisi gas distribution system reach about 12% (by JSC “TBILGAS” and Polytechnical University it is more than 18%)
- Gas consumption by Tbilisi city population is increasing annually since 1997-98 when the gas supply has been recovered after three years break
- Bilateral CDM project has been launched in 2003 (delay with the preparation of the new methodology and PDD)
- In 2006 the gas distribution system was sold to “Kaztransgas”
- The total length of pipelines now belonging to the new owner “Kaztransgas” is 1950 km. 1550 km of distribution system is underground and needs serious rehabilitation

Cont.

- Initial assessment showed that 15% of obsolete elements are to be replaced and the rest 75% to be repaired
- Rehabilitation of the system will reduce about 800,000 tCO_2e annually
- New owner decided to work with a new investor and in the beginning of 2006 the company started process of feasibility study

Increasing of Water Pumps Energy Efficiency in Municipal Water Supply Systems

- Initial interest expressed by potential PPs from host country has been later lost when necessary data on energy consumption by pumps have been asked from the project developers
- International banks are not expressed enough interest as well

Barriers to the Demand-Side CDM EE Projects

Energy sector security barriers

- Traditional attitude
- Low awareness on economic effects
- Low willingness to conduct energy audit and monitoring (voluntarily)
- Comparatively cheap energy
- Absence of EE targets and programmes
- High initial investment costs
- Limited access to the free capital

CDM related barriers

- Low grid EF (Georgia's case)
- High transaction costs comparing with low CDM income

Cont.

- Non-stability of ownership
- Delay in preparatory phase (development and approval of methodology, preparation of PDD)
- Relatively small size of the CDM projects
- Not reliable statistic (or absence) on historical data

High transaction costs

- Lack of local experts
- Absence of local DOEs

5.2 Discussions

Participants discussed the lengthy approval time for CDM projects, top-down versus bottom-up approaches to CDM methodology development, and the support offered by the Methodology Panel and the CDM EB to project participants. Mr. Sudhir Sharma said the UNFCCC Secretariat will increase communication with project participants and that bottom-up approaches are generally favoured for methodology development.

6. Panel session III: Lessons learned and barriers to energy efficiency in CDM /JI

Mr. Robert Williams, Chief, Energy Efficiency and Climate Change Unit, UNIDO, moderated the discussion and introduced the panel participants.

6.1 Presentations

Barriers to energy efficiency projects in CDM/JI from a validator's perspective

Ms. Ayse Frey, TUV Süd

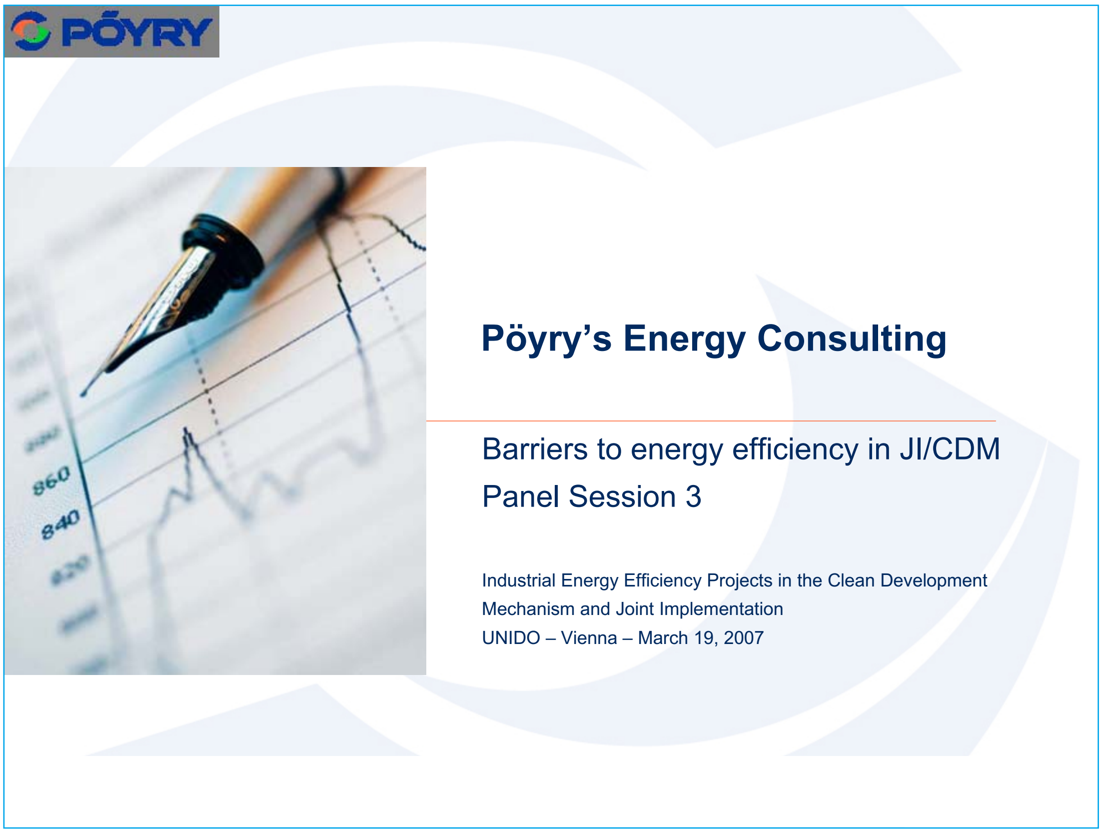
Ms. Ayse Frey, Project Manager, TÜV Süd, discussed barriers to energy efficiency projects under the CDM and JI from the perspective of a certification and inspection agency. She said barriers include the small number of methodologies available and the fact that they tend to be project-specific, along with the challenge of showing additionality. She also suggested that there is an inconsistency between the projects that are accepted by the Methodology Panel and those that receive requests for review, and that the Methodology Panel should increase the clarity and transparency of its decisions.

Slides of Ms. Frey's presentation are unavailable.

Pöyry's Energy Consulting

Mr. Michael Haslinger, Pöyry Energy

Mr. Michael Haslinger, Principal Consultant, Pöyry Energy, discussed additionality with regards to energy efficiency CDM projects. He stated that commodity prices are crucial in assessing a project's additionality and that where fuel prices increase, CERs would account for less than 10 per cent of the savings experienced in oil and gas energy efficiency projects. He also noted that, with high commodity prices, some energy efficiency projects are carried out without being registered as CDM or JI projects, as they are economically viable and therefore unlikely to be considered additional.



We are the management consulting division of Pöyry's Energy business group…

Our focus on the energy sector and integration with our technical experts affords Pöyry's Energy Consulting a unique insight on the energy market

PÖYRY'S ENERGY BUSINESS GROUP

ENERGY CONSULTING	TECHNICAL EXPERTISE

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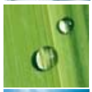
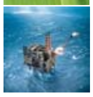
  • Carbon Finance JI/CDM
	• HYDROPOWER
	• POWER & HEAT
	• RENEWABLE ENERGY
	• OIL & GAS

170 Energy market experts **10 offices in Europe**	**1,520 Employees** **Offices worldwide**

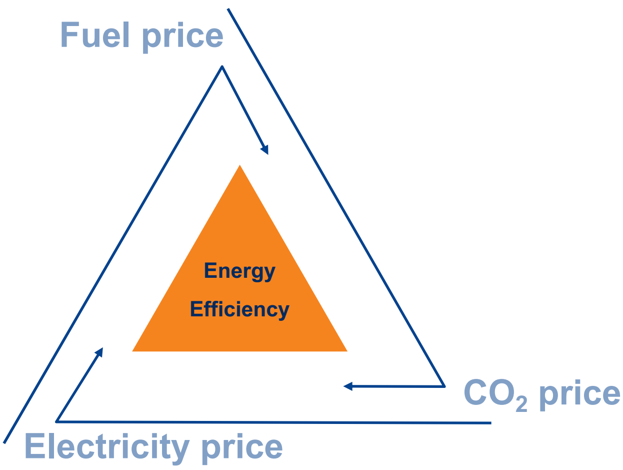




2

PÖYRY

Several factors drive investments in energy efficiency measures

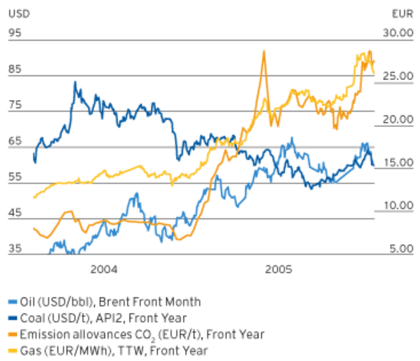


- Energy intensive industry is constantly pursuing measures to decrease production costs through demand and supply side efficiency improvements
- Commodity prices (i.e. fuels, CO_2, electricity, etc.) are main influence factor for feasibility of energy efficiency projects
  ➔ Additionality
- Regulatory framework may cause legal requirement for efficiency measures

3

PÖYRY

Fuel prices and electricity prices are increasing worldwide…



Source: Vattenfall 2006

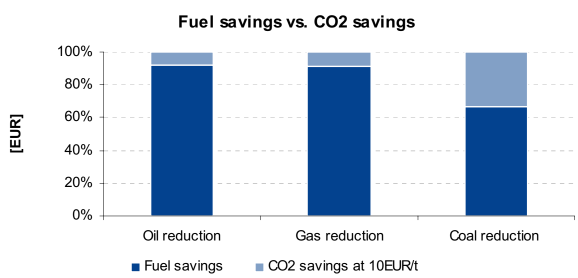
- Oil price again at record levels
- Gas price down again after peaking in 2006
- Coal prices rather stable
- Electricity prices highly volatile

➔ Difficult to argue "Additionality" in times of high commodity prices – BUT: long term expectations are relevant

4

PÖYRY

…therefore representing the major source of income for energy efficiency projects



Source: Pöyry calculations based on current market prices in Europe

- Most industrial energy efficiency projects lead to reductions in oil or gas consumption
- For oil/gas reducing projects, ERUs/CERs contribute only 5 to 10% to the total savings at current commodity prices
- Sale of ERUs/CERs is limited until 2012, whereas fuel savings can be considered throughout project lifetime

➔ Very few energy efficiency projects become economically viable through generation of ERUs/CERs

5

PÖYRY

Role of JI/CDM in energy efficiency projects - Summary

- Many energy efficiency projects are undertaken in the industry – BUT: very few under JI/CDM because high fuel/electricity prices make Additionality argumentation difficult
- JI/CDM would require companies to disclose otherwise confidential production data for monitoring, e.g. efficiency benchmarks, etc.
  This is more critical in EE projects than in greenfield investments
- Efforts for undertaking small scale energy efficiency projects under JI/CDM are even more difficult because of rather fixed Carbon transaction costs
- Lack of required technological process know-how of host country authorities can make the approval process cumbersome

6

PÖYRY

The Austrian JI/CDM programme

Mr. Peter Koegler, Austrian JI/CDM programme

Mr. Peter Koegler, Consultant, Kommunalkredit Austrian JI/CDM Programme, discussed the Austrian JI and CDM Programme. He outlined that Austria only has one JI and no CDM energy efficiency projects and said proving additionality is a challenge because of the financial advantages to project owners. Koegler also discussed obstacles for projects in Russia and the Ukraine, noting that both countries have low energy prices and thus little incentive for improving energy efficiency.

Kommunalkredit Public Consulting (KPC)

- Management of the Austrian JI/CDM Programme on behalf of the **Austrian Ministry of Agriculture,Forestry, Environment and Water Management**
- **KPC** acts as a partner for public sector clients in Austria and other countries around the world. Consultancy Services for public sector clients, international financial institutions, EC, etc. in:
  - Projects
  - Programmes
  - Support instruments
- **100%** subsidiary of Kommunalkredit Austria AG, an Austrian special purpose bank for public finance

Main aim and Means

Main Aim Closing the gap between the Austrian Kyoto target and national emission reduction potential

Means
- **Purchase** of ERUs/CERs from JI/CDM projects
- **Investment** in Carbon Funds and Facilities
- **Facilitate** Project Development by funding project-related immaterial costs (PDD, Monitoring etc.)

Purchasing Volume (2008-2012): 35 mill. t CO_{2e}
Total Budget: € 288 mill.

Memoranda of Understanding – MoU

Kommunalkredit Public Consulting

- **Competence:** Austrian Federal Minister of Agriculture, Forestry, Environment and Water Management & Host Country Ministry
- **Aim:** Basic agreement on co-operation
  Facilitation of project implementation
- **Contents:** Prioritised project categories
  Basic agreement on transfer of CERs & ERUs

MoU:
19 signed: Argentina, Bolivia, Bulgaria, China, Colombia, Czech Republic, Ecuador, Estonia, Hungary, Indonesia, Latvia, Mexico, Morocco, New Zealand, Peru, Romania, Slovakia, Tunisia, Vietnam.
under negotiation/in preparation: Brazil, Chile, Russia, South Africa, Ukraine, ...

161 Projects in Pipeline

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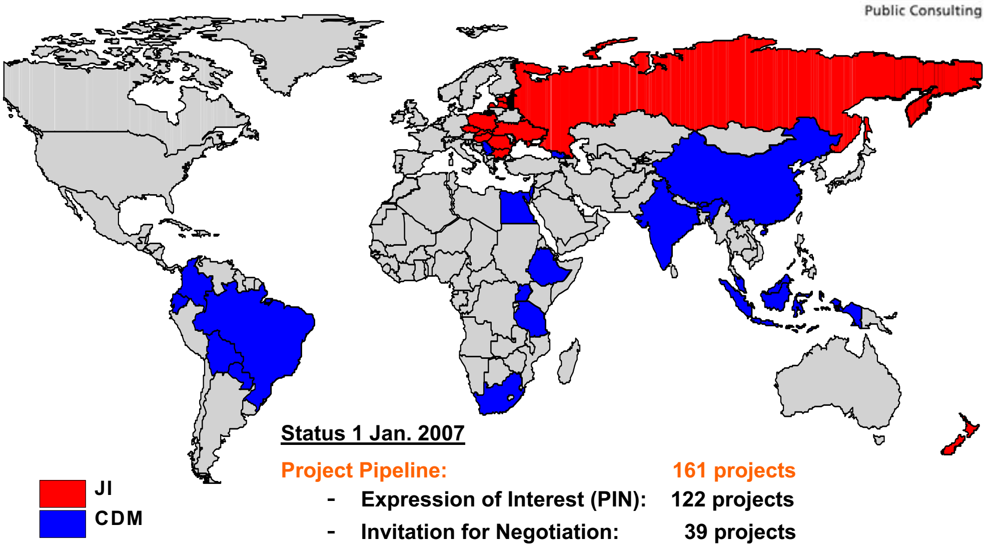

Status 1 Jan. 2007

Project Pipeline:	**161 projects**
- Expression of Interest (PIN):	122 projects
- Invitation for Negotiation:	39 projects
ERPA/finalised negotiation:	**31 projects**

JI ERPA VOLUMES as of 1 January 2007

Joint Implementation Mechanism			
No.	**Technology**	**Host Country**	**Emission Reductions up to 2012***
1	Renewable Energy (agricultural wastes)	Hungary	163.000 t CO_{2e}
2	Renewable Energy (Hydro)	Bulgaria	1.006.000 t CO_{2e}
3	Renewable Energy (Hydro)	Estonia	46.000 t CO_{2e}
4	Renewable Energy (Hydro, Wind)	Bulgaria	777.000 t CO_{2e}
5	Renewable Energy (Wind)	Hungary	358.000 t CO_{2e}
6	Renewable Energy (Wind)	Estonia	266.000 t CO_{2e}
7	Renewable Energy (Wind)	Estonia	88.000 t CO_{2e}
8	Landfill gas	New Zealand	149.000 t CO_{2e}
9	Landfill gas	Czech Republic	150.000 t CO_{2e}
10	Landfill gas	Russia	928.000 t CO_{2e}
11	Landfill gas	Russia	1.067.000 t CO_{2e}
12	N2O Decomposition	Hungary	2.000.000 t CO_{2e}
13	Stripped Casing-head Gas	Ukraine	310.000 t CO_{2e}
			7.308.000 t CO_{2e}

CDM ERPA VOLUMES as of 1 January 2007

Clean Development Mechanism			
No.	**Technology**	**Host Country**	**Emission Reductions up to 2012**
1	Renewable Energy (Hydro)	Colombia	121.000 t CO2e
2	Renewable Energy (Hydro)	China	511.000 t CO2e
3	Renewable Energy (Wind)	China	612.000 t CO2e
4	Renewable Energy (Wind)	China	341.000 t CO2e
5	Renewable Energy (Wind)	China	1.180.000 t CO2e
6	Renewable Energy (Wind)	China	1.015.000 t CO2e
7	Renewable Energy (Wind)	China	1.162.000 t CO2e
8	Renewable Energy (Biomass)	India	147.000 t CO2e
9	Renewable Energy (Biomass)	India	120.000 t CO2e
10	Renewable Energy (Biomass)	India	455.000 t CO2e
11	Renewable Energy (Biomass)	India	244.000 t CO2e
12	Renewable Energy (Biomass)	India	252.000 t CO2e
13	Renewable Energy (Biomass)	Malaysia	285.000 t CO2e
14	Landfill Gas	Brazil	1.500.000 t CO2e
15	Landfill Gas	China	1.125.000 t CO2e
16	Landfill Gas	Israel	240.000 t CO2e
17	N20 Decomposition	Egypt	3.900.000 t CO2e
18	Coal Mine Methane	China	2.000.000 t CO2e
			15.210.000 t CO2e

Funds and Facilities

kommunal KREDIT Public Consulting

Funds & Facilities			
No.	**Type of Fund**	**Manager**	**Investment Volume**
1	Small Scale CDM Projects, various technologies, focus on LDCs and particular focus on LLDCs	World Bank	USD 5.000.000
2	Small Scale CDM Projects, various technologies, focus particularly on Latin America and Caribbean countries	Ecosecurities Ltd.	1.250.000 t CO_{2e}
3	CDM Projects, focus on renewable energy, energy efficiency and methane avoidance projects in Asia and Africa	South Pole	2.000.000 t CO_{2e}

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Regional distribution of Project Pipeline
as of 1 January 2007

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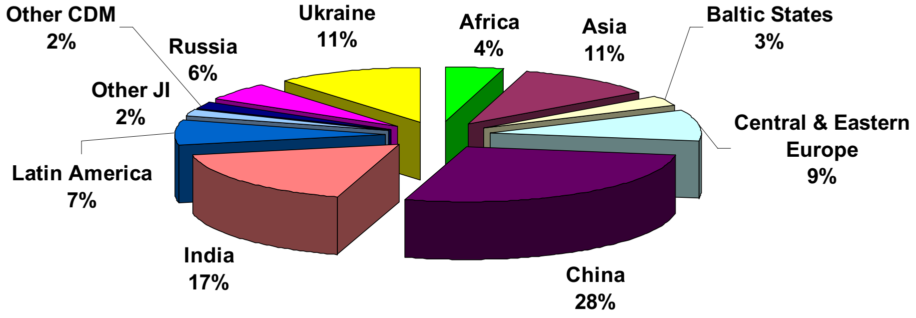

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Eligible Project Categories

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- **Energy efficiency** projects
- **Combined heat and power** installations
- **Fuel switch** to renewables or less carbon intensive fuels
- **Renewable energy production** plants (hydro, wind, biomass, biogas etc.)
- Avoidance or recovery of **landfill gases**
- **Waste management** measures
- Other industrial gases: N_2O, HFC, SF_6

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Specific Features & Benefits

kommunal KREDIT Public Consulting

- Rating **AAA buyer**
- **Excellent relationships** to governments and UNFCCC
- **Flexibility** within the tendering procedure
- **Continuous approval and negotiation procedure**
- **Prepayment** is possible (<u>up to **30%** of contract value</u>)
- Possibility of **financial support** for PDD development, Baseline Study, Monitoring Plan, Validation, etc.
- **No specific country restriction**
- Establishment of **long term relationships** with reliable sellers

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Support for Immaterial Costs (IC)

Application Stage:

- After Invitation for PDD - development

Scope:

- PDD dev.
- Baseline Study
- Monitoring Plan
- Validation etc.

Amount:

- **50%** of immaterial project costs with a cap on **EUR 40,000.**

Energy Efficiency (EE)

Current status:

- Few EE projects in the portfolio
- High investments => ER cover only a small fraction of investment
- Additionality => problematic because of the advantages of EE for the project owner

Outlook for EE Projects:

- Russia & Ukraine => huge potential
- Heavy industry
- Cement
- District heating
- Power plants (hydro, coal)

Energy Efficiency (EE)

kommunal KREDIT Public Consulting

Russia & Ukraine:

- Low energy prices => no necessity for improvement
- Poor municipalities
- Huge investments necessary = financing difficult
- PPP not common or existing
- E.g. district heating => bank guarantees expensive

Possible Solution:

- Banks: temporary ownership of facility

Project Example
Vacha Cascade Hydropower Project, Bulgaria

kommunal KREDIT Public Consulting

Technical Data

- Capacity 80 MW
- Energy Generation 198 GWh/a
- CO_2 Red. 1,000,000 t CO_{2e} **for 5 yrs**

Financial Data

- Investment **EUR 200 Mill.**
- Impact CER app. 5% of inv.

Project Example

Jilin Taonan Wind Power Project, CHINA

kommunal KREDIT Public Consulting

Technical Data

➢ Capacity	50 MWel
➢ Energy Generation	103 GWh/a
➢ Annual CO_2 Red.	94,000 tCO_{2e} **for 6,5 yrs**

Financial Data

➢ Investment	**EUR 50 Mill.**
➢ Impact CER	app. 6% of inv.

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Project Example

Alwar Power Company Ltd. Biomass Project, India

kommunal KREDIT Public Consulting

Technical Data

➢ Capacity	7.5 MWel
➢ Annual CO_2 Red.	**30-36,000tCO_{2e}**

Financial Data

➢ Investment	**EUR 5.4 Mio.**
➢ Financing	30% Equity 70% Debt
➢ Impact CER	20% of Inv.

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Project Example

Palhalma Biogas Plant, Hungary

kommunal KREDIT Public Consulting

Technical Data

- Input Manure 90,000 t/a
- Biogas 13.376 MWh/a P.
  14.944 MWh/a H.
- Annual CO_2 Red. **25-30,000 t CO_{2e}**

Financial Data

- Investment **EUR 6 Mio.**
- Impact ERU app. 10% of Inv.

Project Example

N_2O Destruction Proj. Abu Qir Fertiliser, Egypt

kommunal KREDIT Public Consulting

Technical Data:

- Catalytic destruction for N_2O emissions
- Annual CO_2 Red. **900,000 tCO_{2e}**

Financial Data:

- Investment **EUR 7 Mio**
- Financing Equity, Advance Payment (bank guarantee)
- Impact CER **400-500% of inv.**

Experience & Expectations
First CER Deliveries in March 2007

- **3 CDM Projects delivered so far** (prompt start projects)
  - 1 wind power project in China
  - 2 biomass based cogeneration projects in India
- **94%** of contracted CERs have been delivered out of these 3 projects
- **Approx. 1 month delay** compared to scheduled date of delivery (mostly caused by delays in verification & certification resp. issuance!)
- **Full evaluation of performance is not possible yet!**

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Experience & Expectations
EU-ETS Phase 2 & 3, Kyoto post 2012

- **Growing market on supply and demand side** – project cycle will further accelerate, new entrants like banks & financial institutions, credit and cash return funds for institutional but also for private investors
- **Supply from new markets** – regional as well as from new technologies (CCS, Biofuels)
- **Demand from new markets** – regional as well as tighter EU-ETS Phase 2, extension of scope of EU-ETS Phase 3 (aviation, shipping)
- **Further diversification in market instruments** (Programmatic CDM, Green Investment Schemes, secondary market)
- **Market price** – less volatility due to increased liquidity and know-how of market participants

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Austrian JI/CDM Programme

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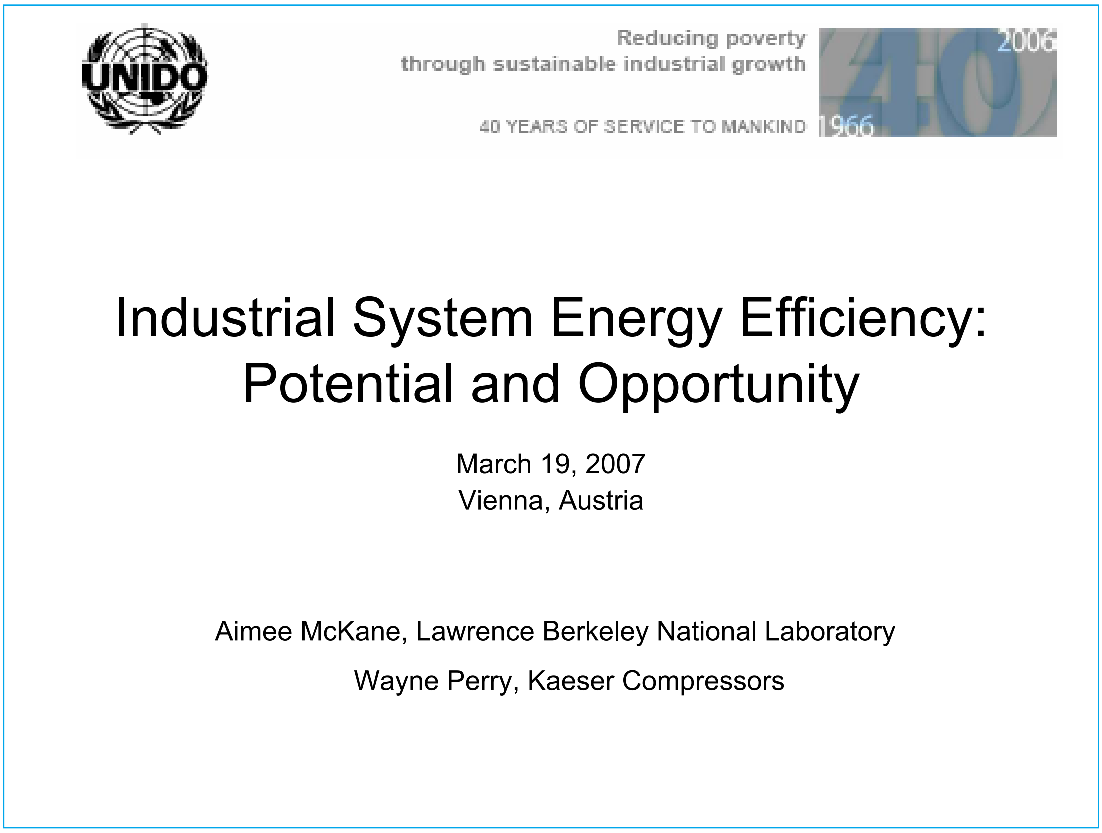
Building a market for industrial energy efficiency services

Ms. Aimee McKane, LBNL/ Mr. Wayne Perry, Kaeser Compressors

Ms. Aimee McKane, Programme Manager, Lawrence Berkley National Laboratory, and Wayne Perry, Technical Director, Kaeser Compressors, discussed the potential and opportunities for industrial system energy efficiency. McKane highlighted that motor and steam-driven systems account for more than 50 per cent of final manufacturing systems energy use worldwide. Perry outlined the challenges of increasing industrial system energy efficiency, including that some developing countries are rapidly industrializing, but that new facilities are not more energy efficient. To overcome challenges, McKane suggested, inter alia, standardizing practice through energy management standards; making capacity-building a part of the CDM tool kit; and developing sample procedures and training on their integration into management systems.



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through sustainable industrial growth

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Why are industrial systems important?

- Steam and motor-driven systems account for more than 50% of final manufacturing energy use worldwide
- Energy savings potential from cost-effective optimization of these systems for energy efficiency is estimated at 10-12 EJ of primary energy[1]
- A global effort to cost-optimize industrial systems for energy efficiency could achieve these energy savings through
  – the application of commercially available technologies
  – in existing and new industrial facilities

1 2007 IEA Statistics

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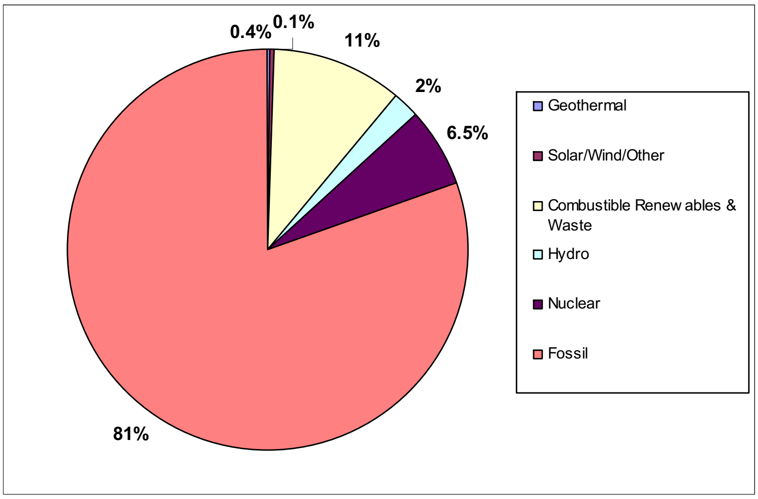
World Primary Energy



2004 IEA Statistics

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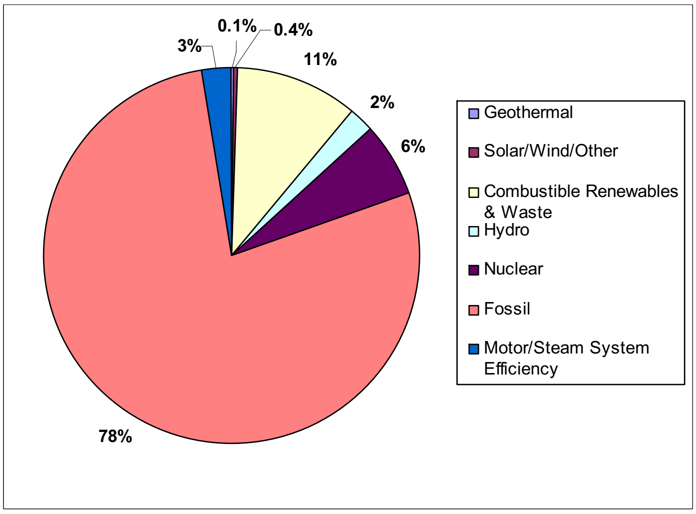
Potential Impact of System Optimization



2004 Primary Energy- does not consider other factors that could affect future fuel mix

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Why is Industry Slow to Change?

- I have about 10 minutes to explain why industry has not adopted systems efficiency programs
- About 10 minutes is all service providers have to discuss energy efficiency with corporate management

Why is Industry Slow to Change?

- Industrial energy efficiency is not a product that can be bought and installed
- Industrial energy efficiency involves changing a corporate culture
- Explaining culture change takes more than 10 minutes

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Why is Industry Slow to Change?

- Most large corporations are focused on short-term goals that maximize stock value
- Factory managers follow the lead of corporate management...usually having their compensation tied to short-term results

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Why is Industry Slow to Change?

- Most service providers work with plant-level personnel like maintenance engineers and purchasing agents
- Their main concerns are reliability and lowest first cost
- They are not evaluated on energy efficiency
- Trying to convince plant personnel that they are buying the wrong equipment risks losing business

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Why is Industry Slow to Change?

- Life Cycle costs are rarely considered in purchasing decisions
- System efficiency has traditionally been difficult to quantify
- If it is not being measured, it cannot be managed

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Why aren't industrial systems more energy efficient?

1. Engineers are trained to make industrial systems reliable, not energy efficient
2. Industrial systems are not typically separately metered, so the cost of their operation is not known to management
3. Energy efficiency is not core mission for most industries
4. Even if facility engineers know how to make a system more energy efficient, production needs and operational patterns may negate their efforts

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Relevance to CDM

- Developing countries are rapidly industrializing
- Steam and motor-driven systems in these new industrial facilities aren't any better designed than existing systems
- Once installed, the next opportunity to substantially improve the energy efficiency of these systems will be during a major system renovation, in 10-20 years
- Identifying and documenting the incremental improvement between "standard practice" and "best practice" is technically achievable

Barriers to CDM

- Industrial system energy efficiency projects are relatively small- $250K or less
- Optimizing a system requires skill
- Systems are complex; while they have many characteristics in common, each application is unique
- Although techniques for system optimization are well-tested, there aren't any accepted standards for optimization

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Establishing a Baseline of Use

- System energy efficiency is identified by an energy assessment or audit– a snapshot in time
- Establishing a reliable baseline requires consideration of all major operational modes of an industrial facility
  - Seasonal, weekly, shift variations
- For existing facilities, how is this data collected in an economically feasible manner?
- For new construction, what are acceptable assumptions?

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Assuring Persistence of Energy Savings

- System energy improvement projects have a life expectancy of between 7 and 10 years, on average
  - Some major system renovations can last much longer
- Documentation is essential
  - Policies
  - Procedures
  - Work Instructions

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Assuring Persistence of Energy Savings

- If management does not adhere to documented policies and procedures, energy savings may not be realized over the useful life of the project
- Energy efficiency improvements need to become part of the *institutional* memory, and not be reliant on *individuals*

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What can be done?

- Standardize practice, by developing
  - Energy management standard
  - System assessment protocols
- Develop skills through training
  - Engineering and design community
  - Practicing facility engineers
- Document
  - Sample procedures
  - Sample work instructions
  - Training on how to integrate into existing management systems (such as ISO)

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Create interest

- Make capacity-building part of the CDM toolkit
- Encourage the adoption of energy management standards (recognition, incentives)
- Demonstrate applications of standards and techniques, especially in developing countries
- Host international workshops on optimization techniques (actual and virtual)
- Communicate the opportunity to the financial community in their language

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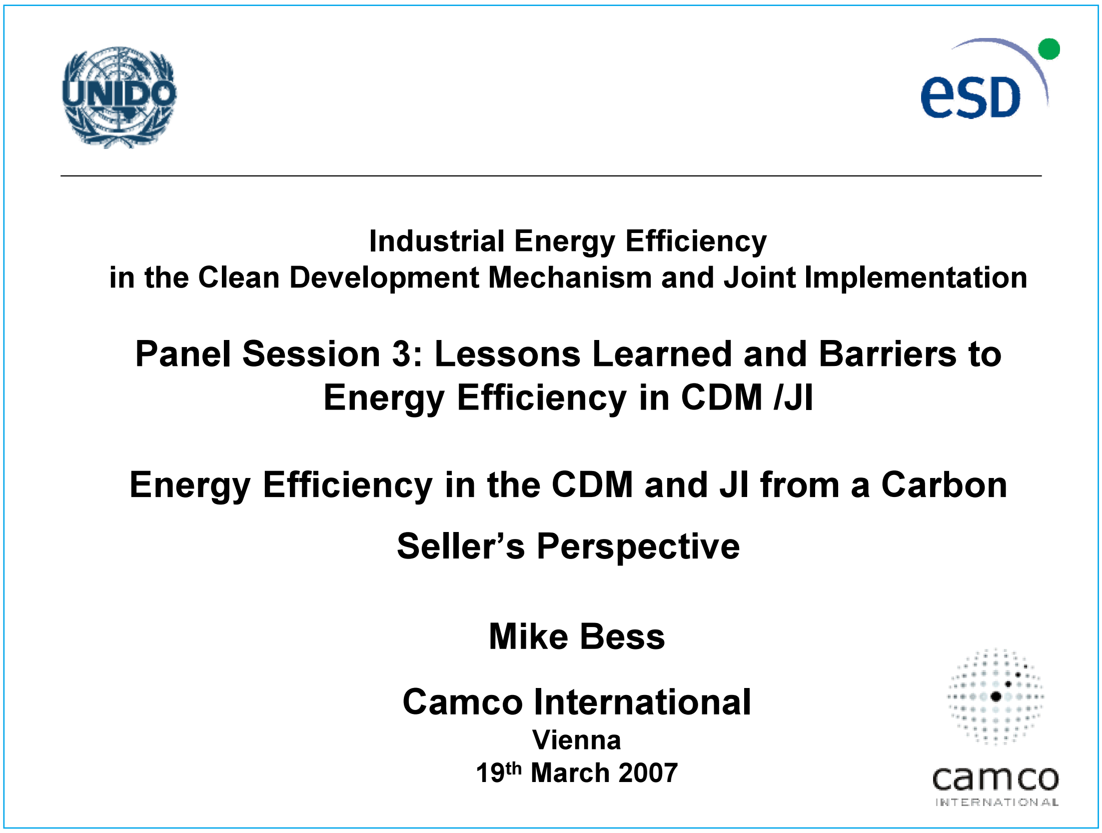
Energy efficiency in the CDM and JI from a carbon seller's perspective

Mr. Michael Bess, ESD

Mr. Mike Bess, Director, Camco International, discussed lessons learned and barriers to energy efficiency projects under the CDM and JI, and highlighted that CERs can contribute to energy efficiency being considered as part of core business within industry. He recommended the aggregation and bundling of SSC CDM projects to overcome high transaction costs.



SUMMARY

- Introduction to Camco
- Kyoto mechanisms & energy efficiency
- Energy efficiency projects in JI & the CDM
- Principles & methodologies for energy efficiency & Climate Change
- Problems with JI & CDM energy efficiency projects
- Camco's role in energy efficiency in CDM
- Prospects for energy efficiency beyond 2012

Introduction to Camco

- **Camco is a co-developer of CDM projects and our role is to help project hosts to identify opportunities to generate carbon credits and to realise and monetise those opportunities**
- **We develop all aspects of a CDM Project:**
  - Develop all CDM Documentation, including new methodologies, if required;
  - Structure the off-take contracts to maximise benefits / minimise risks;
  - Manage the approval and validation process at local and UN Level;
  - Manage monitoring and verification; and,
  - Cover the costs of developing the CDM aspects of the project.
- **We co-finance the development costs of the Project in certain cases:**
  - For example, cover costs of Feasibility Reports, Environmental Impact Assessments, Project Structuring to attract investment and reach financial close quicker.
  - We have a number of other services and co-operation models which can help project developers get their projects registered and generating credits.

Kyoto & Energy Efficiency

- Energy efficiency in reality:
  - Improved efficiency of energy use in industry, commercial, transport & ag-sectors
  - Demand side management (DSM)
  - Fuel-substitution/fuel-switching
- Energy efficiency has the greatest role in reducing greenhouse gas emission (GHG) of any field under the Kyoto Protocol

Energy Efficiency in JI & CDM

- First, and most common, energy efficiency projects under JI & CDM are fuel-substitution (mostly natural gas for coal in electricity and heat generation, or combined heat & power (CHP)
- Second most common is CHP (cogeneration), and biomass waste taking the leading share (sugar bagasse, other agricultural wastes from oil extraction, agro-industries, pulp & paper, milling, etc.)
- Next is waste heat recovery (including cement, steel, alloys, metallurgy)
- Energy efficiency in JI & the CDM has yet to realise but a tiny fraction of its potential
- Energy efficiency, when dealing with JI & CDM projects is hard to differentiate between, say, methane recovery, waste utilization, etc.

Principles & Methodologies for EE

- Energy efficiency principles are well-understood & formulated, particularly since 1970s oil crises, when North America, Japan & Europe began "decoupling" energy from industry
- EU industrial sector generates nearly three times the GDP per € as 1970 at less energy consumption per unit than 1980
- California's per capita electricity consumption today is less than 1970, yet per capita GDP has increase 2.5 times since 1970
- So, "decoupling" energy and GHG from growth is possible, and should be supported

Problems with JI & CDM EE Projects

- But, reality is, far more interest & support in renewable energy, HFCs, NOx, methane, fugitive gases & energy technologies than energy efficiency
- EE projects in JI & CDM are not very "sexy"
- Energy efficiency projects generally have higher transaction costs than supply side projects, etc.
- Returns on most energy efficiency projects are often low
- Monitoring requirements for energy efficiency projects are generally very high, and complicated
- Boundaries of energy efficiency projects tend to be more difficult to define than others
- Also, scepticism about being able to measure energy efficiency cause & effect

CDM Methodologies for EE

Methodology	EE Activity Category
AM 0014	Cogen
AM0029, AM0036, AM0047, ACM0003, AM0006	Fuel Sub
AM0027	Fuel Sub, Cogen
AM0031,AM0033, AM0038,AM0040,AM0044,AM0045, AM0046,ACM0005,ACM0007	Optimization
AM0009	Recovery
AM0017,AM0018,AM0020,AM0022, AM0023,AM0024,AM0032,AM0027, AM0041,AM043,ACM0004	Recovery, Optimization

Principles & Methodologies for EE

- AM 0007: Analysis of the least-cost fuel option for seasonally-operating biomass cogeneration plants
- AM 0009: Recovery and utilization of gas from oil wells that would otherwise be flared
- AM 0014: Natural gas-based package cogeneration
- AM 0017: Steam system efficiency improvements by replacing steam traps and returning condensate
- AM 0018: Steam optimizing systems
- AM 0020: Baseline methodology for water pumping efficiency improvements
- AM 0022: Avoided Wastewater and On-site Energy Use Emissions in the Industrial Sector
- AM 0023: Leak reduction from natural gas pipeline compressors or gate stations
- AM 0024: Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants
- AM 0029: Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas
- AM 0031: Baseline Methodology for Bus Rapid Transit Projects
- AM 0032: Baseline methodology for waste gas or waste heat based cogeneration system
- AM 0033: Use of non-carbonated calcium sources in the raw mix for cement processing
- AM 0036: Fuel switch from fossil fuels to biomass residues in boilers for heat generation
- AM 0037: Flare reduction and gas utilization at oil and gas processing facilities
- AM 0038: Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn
- AM 0040: Baseline and monitoring methodology for project activities using alternative raw materials that contain carbonates in clinker manufacturing in cement kilns
- AM 0041: Mitigation of Methane Emissions in the Wood Carbonization Activity for Charcoal Production
- AM 0043: Leak reduction from a natural gas distribution grid by replacing old cast iron pipes with polyethylene pipes
- AM 0044: Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors
- AM 0045: Grid connection of isolated electricity systems
- AM 0046: Distribution of efficient light bulbs to households
- AM 0047: Production of waste cooking oil-based biodiesel for use as fuel
- ACM 0003: Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture
- ACM 0004: Consolidated baseline methodology for waste gas and/or heat and/or pressure for power Generation
- ACM 0005: Consolidated Baseline Methodology for Increasing the Blend in Cement Production
- ACM 0006: Consolidated methodology for grid-connected electricity generation from biomass residues
- ACM 0007: Baseline methodology for conversion from single cycle to combined cycle power generation
- ACM 0009: Consolidated baseline methodology for fuel switching from coal or petroleum fuel to natural gas

Principles & Methodologies for EE

- AM 0007: Analysis of the least-cost fuel option for seasonally-operating biomass cogeneration plants
- AM 0009: Recovery and utilization of gas from oil wells that would otherwise be flared
- AM 0014: Natural gas-based package cogeneration
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- AM 0024: Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants

Principles & Methodologies for EE

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Principles & Methodologies for EE

- AM 0044: Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and
- district heating sectors
- AM 0045: Grid connection of isolated electricity systems
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- ACM 0009: Consolidated baseline methodology for fuel switching from coal or petroleum fuel to natural gas

Camco's Contribution to EE Projects under CDM

- **Authors of AM0024**
  Methodology for GHG reductions through waste heat recovery and utilization for power generation at cement plants
- **Based on** Taishan Cement Works Waste Heat Recovery for Power Generation Project
- 676,000 CERs
  Application of ACM0004 in various industrial contexts and sectors

Challenges Facing EE Projects under CDM

- **Structural**
  - Non-core business activity, limited attention/ representation at enterprise Board level
  - Requires cultural changes in organizational planning and operations
  - Investments in new, replacement technologies sometimes seen as more strategic than tactical (i.e. short time horizon of JI & CDM)
  - Benefits not seen as large as other projects (e.g., methane, HFCs, NOx), etc.

Challenges Facing EE Projects under CDM

- **Methodological**
  - Require intimate knowledge in specific industrial processes - combined industry & CDM expertise
  - Potential other uses of "waste resource" – real emissions reductions ?
  - Small-scale vs Large-scale: small-scale often not seen "worth it"
  - Most buyers not interested in small number of credits, so, bundling, focus on programmatic CDM required
  - High returns on paper don't fit easily with prevailing CDM Methodological Approaches to baseline & additionality determination;
  - Reluctance of regulators to give credence to barrier analysis approaches

Recommendations to Accelerate EE Projects under CDM

- Less reliance on pure economic analysis
- Gathering of national data to facilitate use of industry benchmarking approaches
- More open methodologies – e.g., Meth Panel recommendation to restrict applicability of ACM0004 would hold back the sector even further
- Reduce transaction costs – particularly monitoring requirements & costs
- Make small-scale methodologies easier
- Increasingly an area of national strategic importance in booming economies of China & India
- Programmatic CDM itself is an opportunity to accelerate EE Projects under CDM (see Annex 15 - Guidance on the registration of a programme of activities as a single project activity, http://cdm.unfccc.int/EB/028/eb28_repan15.pdf)

esd

camco INTERNATIONAL

Prospects for EE beyond 2012

- If the past year is any example, energy efficiency will come even more into its own in the coming years
- We need to emphasise programmatic & bundling, & reducing transaction costs for really bringing in lots of energy efficiency in
- Energy efficiency is front & centre on the JI & CDM project stage
- Finally, recognition of true potential

For energy efficiency in combating climate change

UNFCCC

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camco INTERNATIONAL

Thank you!

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Technological breakthroughs for 3E: Japanese industry and NEDO's activities on JI

Prof. Morihiro Kurushima, CTI

Mr. Morihiro Kurushima, Programme Manager, CTI, discussed projects where Japan has made contributions and investments, and a "win-win" project involving technology transfer to Mexico. He highlighted Japan's high level of energy efficiency and stressed industry's role in sustainable development.

NEDO Offices are waiting for you.

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Ⅰ.F/S by NEDO on CDM/JI Projects in Mexico etc. *- Hop/Step/Business -*

1. Feasibility Study / Basic Survey

Ex: NEDO → Entrust → Private Sector → FS

in Mexico

in Thailand

2

2. Project Formulation

In Mexico

Mitsubishi Electric Corp. → Japan EXIM Bank → Mexico BANOBRAS

Finance

Priv. Bank

In Thailand

Japan AMA → Thai AIA/ OCMRT, MOSTE

Consultation

3

3. Project Implement.

In Mexico & Thailand

Mitsubishi Electric Corp. → Mexico STE

Export (200 vehicles)

Japan AMA → Traffic Improvement Project in Bangkok

Monitoring, Construct. etc.

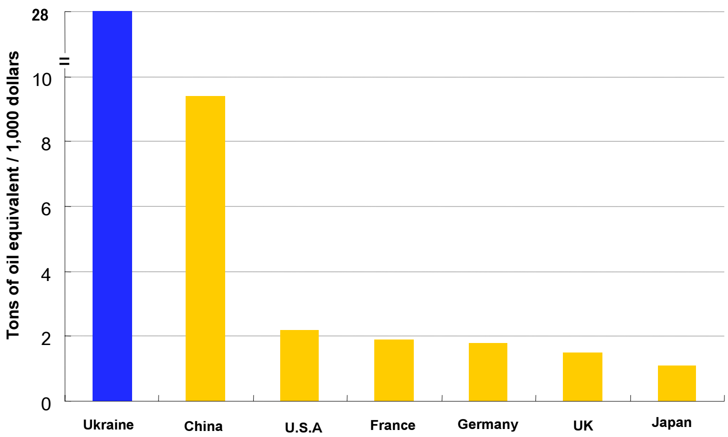
4

Ⅱ. Possibility

Ⅱ – 1: Comparison of Primary Energy Supply per GDP

Since Ukraine uses 28 times more energy per GDP dollar than Japan, there is a significant opportunity for energy conservation technology.

Primary energy supply per GDP in different countries



Source: IEA "Key World Energy Statistics 2006"

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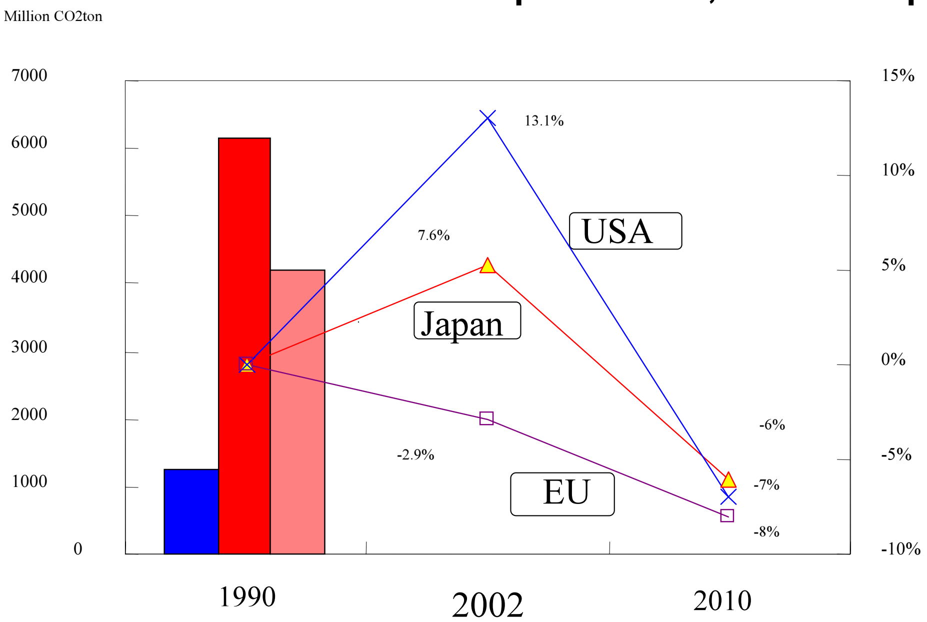
Ⅱ – 2 : GHG Emissions Comparison US, EU and Japan



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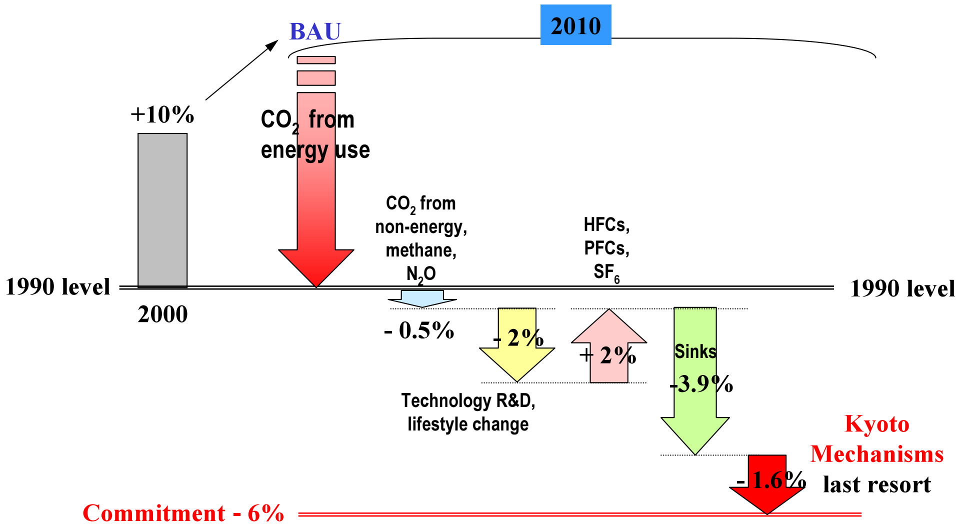
Ⅱ – 3 : Japan's Strategies for the Kyoto Target :

6% GHG Reduction!



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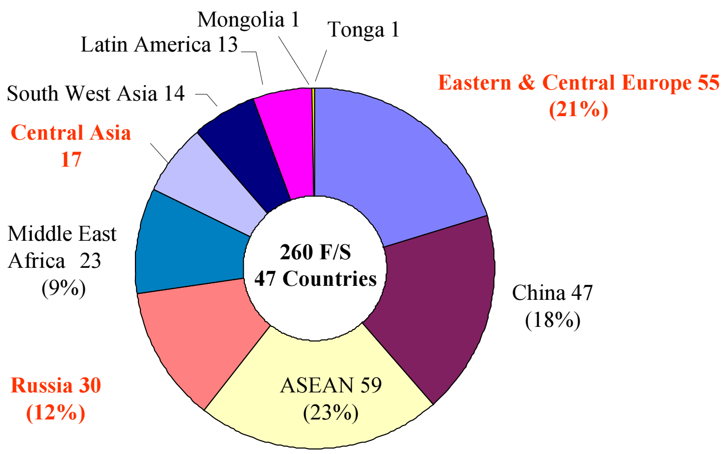
Ⅱ – 4 : Implementing F/S on CDM/JI

260 F/S in 47 countries!



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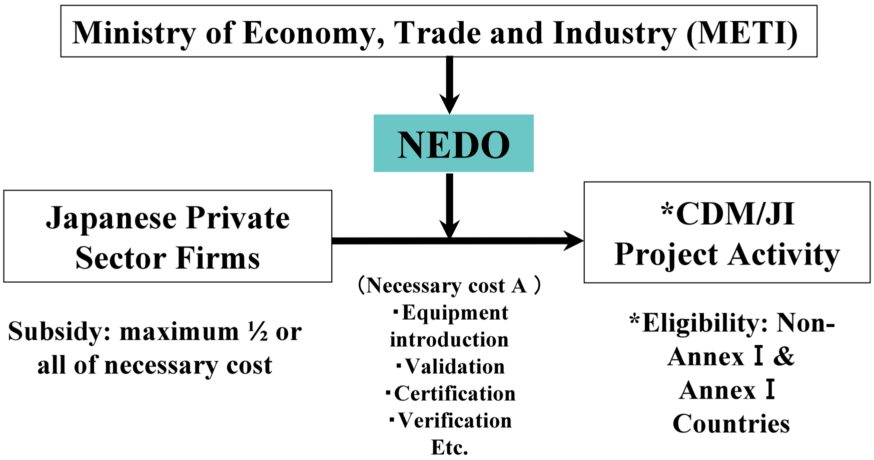
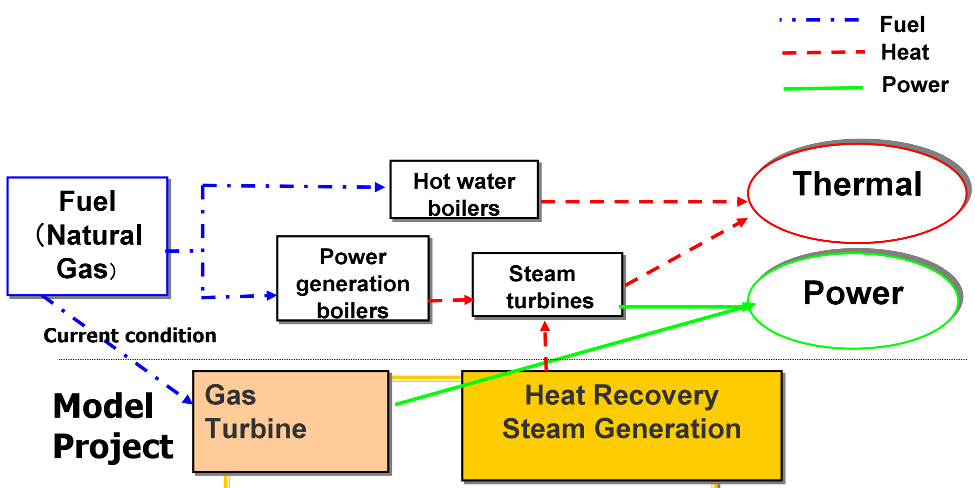
II – 5 : Subsidy for CDM/JI by NEDO

F/S: 10/10, Projects: 5/10



III – 1 : Project with Tohoku Electric Power in Kazakhstan

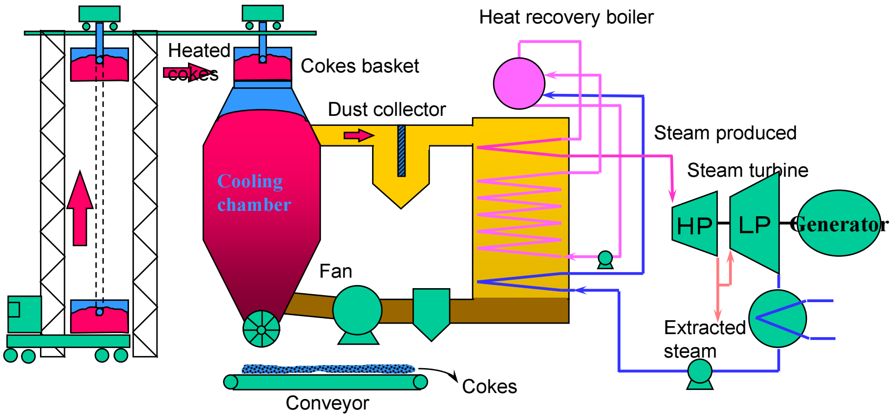


Annual CO_2 emissions in baseline case 192,000 t-CO_2 /y

Annual CO_2 emissions in project case 130,000 t-CO_2 /y

Annual Emissions Reduction 62,000t-CO_2/y

III – 2 : Project with Nippon Steel in China & India



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6.2 Discussions

Participants noted that a broader definition for projects that included training and skills could increase the benefit of the CDM to developing countries. Some participants questioned the lack of CDM projects in Africa. One participant stressed that the development of CDM projects could be improved by addressing methodology issues and that direct communication between project participants, the CDM EB and the UNFCCC Secretariat would help in the processing of projects.

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7. Panel session IV: New approaches to CDM/JI

Mr. Patrick Matschoss, Economist, German Advisory Council on the Environment, introduced the panelists and said the session would focus on bundling projects and Programme of Activities (PoAs) under the CDM, which is a mechanism to define a series of projects under a single implementing agency that use the same methodology and technology.

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Industrial Energy Efficiency Projects in the CDM and JI

Panel Session 4: New approaches to CDM/JI

Patrick Matschoss

20 March 2007

Vienna International Centre

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Energy Efficiency CDM: Barriers

- Fewer CER than e.g. waste gas project
- Transaction cost partly fix
- Savings dispersed, many stakeholders
- Methodological difficulties

New Approaches I: Bundling

- Originates from Small-Scale CDM
- Number of *individual* Projects, each with
  => pre-defined baselines, reductions…
  => operator as CDM-participant
- Processed together
  => coordinated action
  => some scope for dispersion

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New Approaches II: Programme of Activities (PoA)

„…project activities under a programme of activities can be registered as a single clean development mechanism project…“ (4/CMP.1)

„volountary coordinated action by…entity wich coordinates and implements…“ (CDM-EB-28)

- PoA as CDM-participant
- CDM Project Activity (CPA) *within* PoA
  - *Not* CDM-participant
  - may start any time within PoA-period

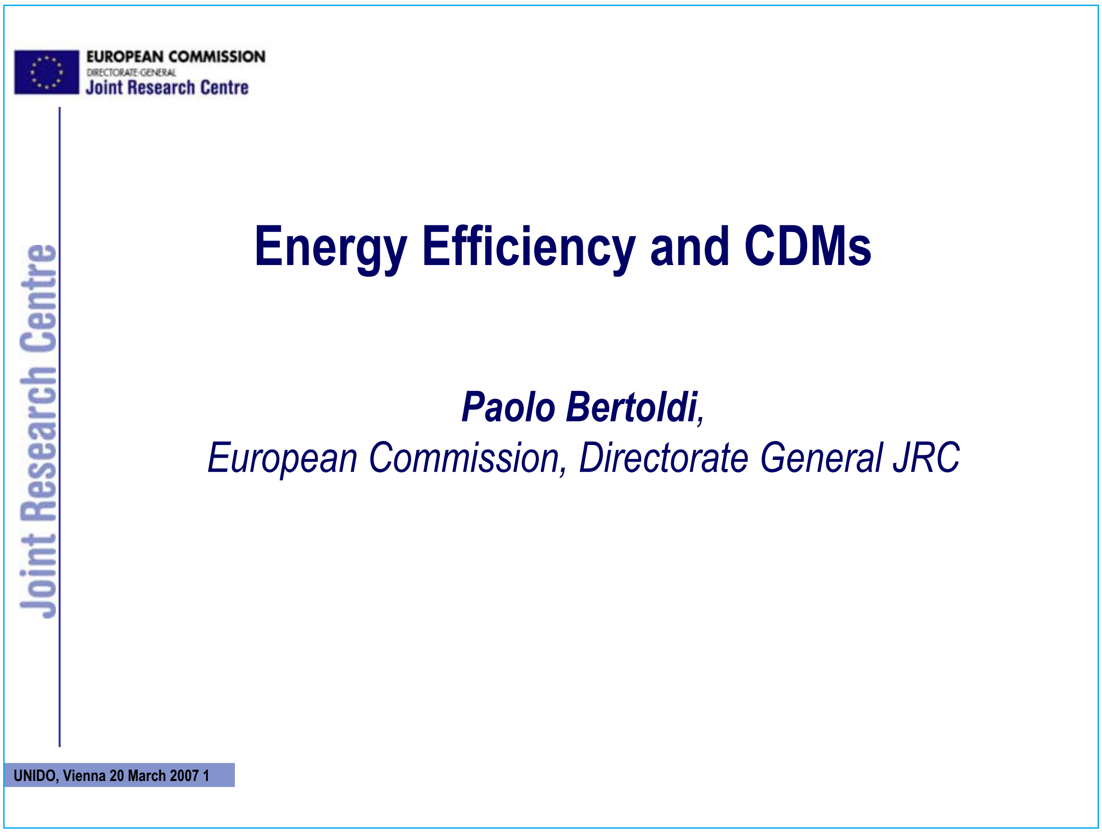
=> More suitable for very dispersed micro activities???

7.1 Presentations

Energy efficiency and CDMs

Mr. Paolo Bertoldi, EU-JRC

Mr. Paolo Bertoldi, EC Joint Research Centre, described actions for increasing energy efficiency CDM projects, including financial instruments such as direct subsidies, tax incentives, loans or partial guarantee funds, and carbon financing. He suggested the Green Investment Scheme could encourage energy efficiency projects under JI, and noted the need to develop monitoring and verification protocols to account for energy savings, as well as methodologies for assessing the market penetration of efficient technologies.



EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Issues

Joint Research Centre

- Energy efficiency one of the key area of action for climate change mitigations;
- Energy Efficiency solutions and projects are dispersed in different sectors (residential buildings, commercial buildings, industry, transport), and use technologies (boilers, air-conditioners, lighting, motors, etc.);
- Energy Efficiency even if its know to be very cost-effective does not take place as economic theory would predict.
- There is a large number of well know institutional, regulatory, and financial barriers (split incentives, high risk associated with efficiency);
- Hence policy support is needed to promote energy efficiency;
- Policy support is not enough, financial instruments are needed to further promote efficiency.

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Financial instruments to support EE

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- Direct subsidies (e.g. utilities programmes, white certificates, state programmes);
- Tax incentives;
- Loans or partial guarantee funds;
- ESCOs (including EPC and TPF);
- Carbon financing;

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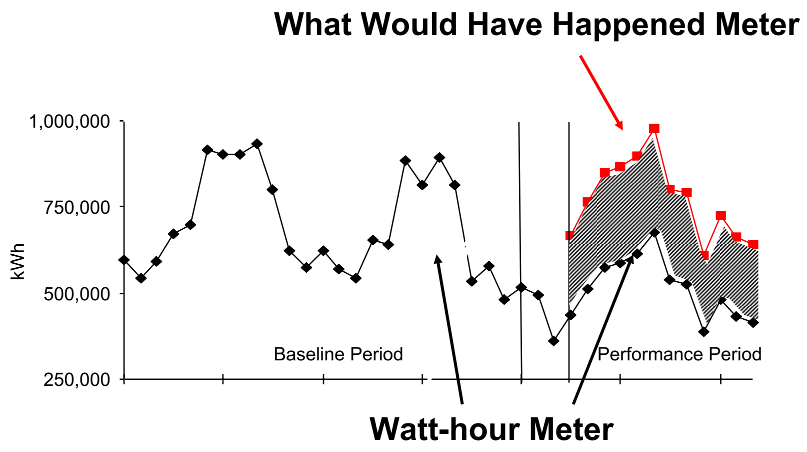
Carbon Financing

- Not easy, and in addition only representing a small share of investment in EE (especially at the very low cost of CO_2 allowances), still very important;
- Very difficult to include end-use EE projects (e.g. electricity efficiency projects) in the EU ETS, as these is based on the the direct (upstream) approach (based on the physical source ('the pipe')) ;
- Great hopes on CDMs and JIs, and more recently in GISs (perhaps the right solution for EE under JIs);
- However additional problems in the methodologies

Watt-hour (Wh) meters & What Would Have Happened (WWHH) meters



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Measuring Energy Savings

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Common issue in programme evaluation (e.g. DSM programme) and white certificates programmes (creating a real market for "energy savings";

Methodologies have been developed both for individual projects (IPMVP) and for programmes and polices (based on bottom up methods with correction for free riders and spill over effect, life of the measure and persistence of the measure, using deem values, engineering models with partial measurement, and full measurement). Benchmarking is also under development

Methodologies for the assessment of market penetration of efficient technologies (in particular following labelling/classification schemes)

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Programmatic CDMs

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- Policies and programmes such as Standards and Labels, voluntary programme, and awareness programme are need to transform the market;
- However a Policies and programmes such as Standards and Labels is not a guarantee that the market is transformed. It requires enforcement, promotion (manufacturing of advanced equipment, market surveillance).
- CDMs can provide useful and important financial assistance to market transformation programmes. CDM methodology is very similar to programme evaluation (in our view these should be similar).

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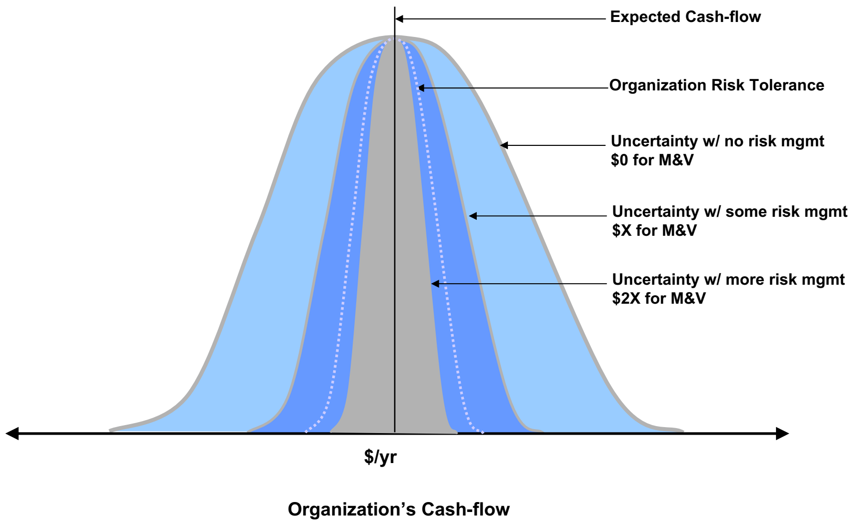
M&V Risk Management @ a reasonable cost



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Conclusions

- End-use EE is very important component in climate change mitigation, and needs to be supported as other carbon mitigations options through carbon financing mechanisms;
- Great complexity is measuring EE, however a lot of work and activities have been carried out over the pats 10 years (e.g. IPMVP, evaluation protocols, etc.). These can and shall be used by the CDM community.
- EE Policies and programmes needs to additional support of carbon financing, as well as EE policies can further promote CO2 emission reduction.

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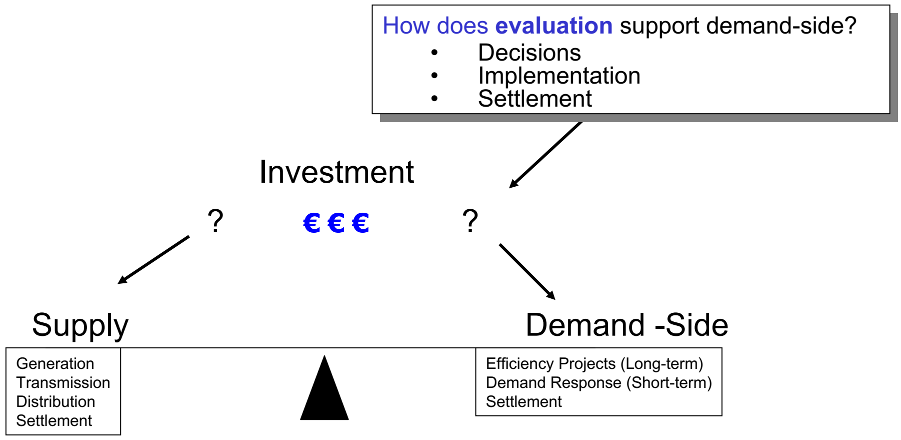
Energy Impacts
Balancing Investment in Supply and Demand



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Thank you for your attention!

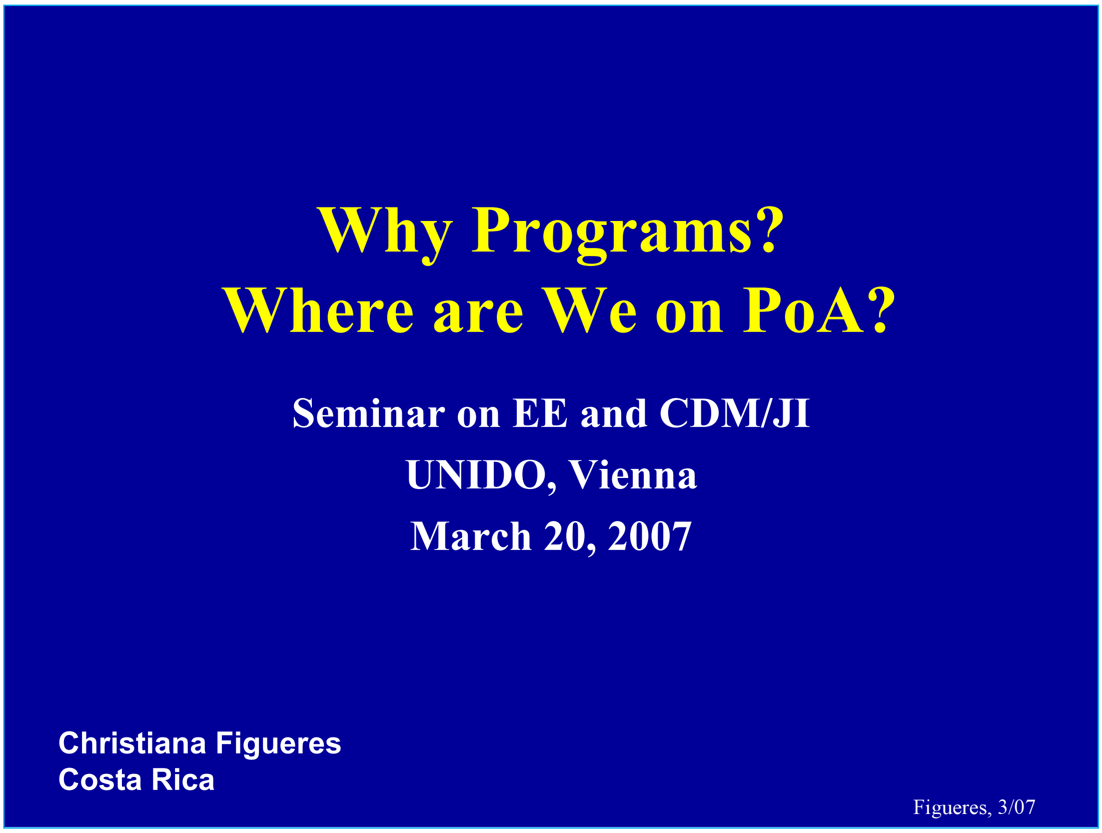
paolo.bertoldi@ec.europa.eu

http://re.jrc.ec.europa.eu/energyefficiency/

Why programs? Why are we on PoA?

Ms. Christiana Figueres, CDM Executive Board

Ms. Christiana Figueres, Member, CDM EB, discussed programmatic CDM projects, and noted that guidelines for programmatic approaches have been approved by the CDM EB and that the approval of some programmatic CDM projects has commenced. She explained that CDM PoAs allow for greater variation and flexibility in the timing and location of activities to reduce emissions. She also noted some restrictions on CDM PoAs, which may be addressed by the CDM EB, including that PoAs are limited to one technological approach and methodology.



Why CDM for EE?

- Can positively affect SOME barriers to EE:
  - CERs are additional income stream -- versatile!
  - Upfront costs
  - Split incentive
- *Could* affect policy willingness
- *Could* entice institutional strengthening
- Does NOT solve all the challenges of EE dissemination

Figueres, 3/07

Are Bundles Appropriate for end use EE?

Bundle: separate CDM projects bundled to reduce transaction costs

Reduction activities are exactly identified (location, size, etc) at registration

Discreet projects- not systems or sectoral approach

Figueres, 3/07

COP/MOP1 decision on CDM programs

- "A local/regional/national policy or standard cannot be considered as a CDM project activity,
- ....however project activities under a programme of activities can be registered as a single CDM project activity…"

Figueres, 3/07

	BUNDLE	PROGRAMME
Sites and volume of reductions	Ex ante identification of exact sites and volume of GHG reductions	Exact sites may not be known Expected types and maximum potential volume is estimated ex ante
Project participants	Each single activity is represented by a CDM project participant	The implementing entity implementing is the project participant
	Project participants are identical to entities achieving reductions	The project participant does not necessarily achieve the GHG reducing activities but rather promotes others to do so
Project activities	Each activity in the bundle is an individual CDM project activity	The PoA is a registration option for a set of project activities
	Composition does not change over time	No pre-fixed composition (uptake of an incentive could be unkown)
	All projects in a bundle must be submitted (and start) at the same time	PoA is validated and registered based on identification of intended activities that will start over a period of time. Actual reductions are not confirmed until verification

Figueres, 3/07

CDM Programs

Based on a deliberate program of emission reduction actions

- Government policy (mandatory or voluntary)
- Private initiative (voluntary)

One coordinating agent

– Private or public
– Provides incentives or obligations
– The "project participant"
– Does not necessarily implement all actions but does promote others to do so

Figueres, 3/07

CDM Programs

Implement multiple dispersed actions

- Actions may be implemented by many entities/owners
- Can occur over a period of time
- Size and timing may not be known at registration
- Actual reductions are confirmed through verification

Figueres, 3/07

Chronology

- Dec '05 COP/MOP1 → Decision to allow
- June '06 MP 21 → Issues paper
- Sept '06 MP 22 → Options for definition paper
- Sept '06 EB 26 → no decision
- Oct '06 EB 27 → no decision
- Nov '06 COP/MOP2 → "finalize guidance"
- Dec '06 EB 28 → Guidance
- Feb '07 EB 29 → Forms, not discussed
- March '07 EB 30 → Review guidance and forms

Figueres, 3/07

Achievements

- PoA coordinates or implements a policy or measure
  - If mandatory, not enforced or PoA goes beyond
  - Allows sectoral approach
- Boundary of PoA can extend beyond a country
- Duration of PoA 30 years
  - Crediting period of CPA: 2x7 or 10 years
- Project activities can be added to PoA during crediting period
- Small scale PoAs (60 GWh) offer many opportunities for end-use EE

Figueres, 3/07

Challenges Ahead

- Restriction to one methodology
- Restriction to one technology

- Attribution, particularly in market transformation
- Guidance on generic issues of EE

- Methodologies developed and approved!!!!
  – Start with best EE measurement protocols
  – Add what is necessary for CDM requirements
  – CDM implies additional layer of stringency

Figueres, 3/07

Gracias!

“ Let There be Light in the CDM“ paper
with Martina Bosi, WB

www.figueresonline.com

Figueres, 3/07

Chillers between Montreal and Kyoto

Mr. Thomas Grammig, GTZ

Mr. Thomas Grammig, Project Manager, GTZ, discussed the issue of centrifugal chillers that use chlorofluorocarbons (CFCs). He explained that a large stock of chillers exists, including over 600 in Africa, that were not addressed under the Montreal Protocol. Grammig said GTZ's approach to phasing out chillers is to bundle them and to pursue CDM registration under technological additionality. He also described the CDM India Accelerated Chiller Replacement Programme, implemented by the ICICI Bank, and said that additionality was demonstrated for each owner using a financial model to illustrate fiscal barriers.ethodology under programmatic CDM.

Chillers between Montreal and Kyoto

AFROC **technological add. , 6 African countries**

Additionality **Financial**
Technological
Prevailing practice (regulation or policy)

India **programme with fixed financial incentives**
ICICI **CERs are ex-ante estimated and performance does not affect the grant terms**

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Chillers between Montreal and Kyoto

AFROC

African Fund for Replacement of Chillers project created through decision 48/25 of the Exec. Committee of the Multilateral Fund.

Its purpose is to fund strategic projects for the conversion of CFC chillers in:

Cameroon, Egypt, Namibia, Nigeria, Sudan and Senegal

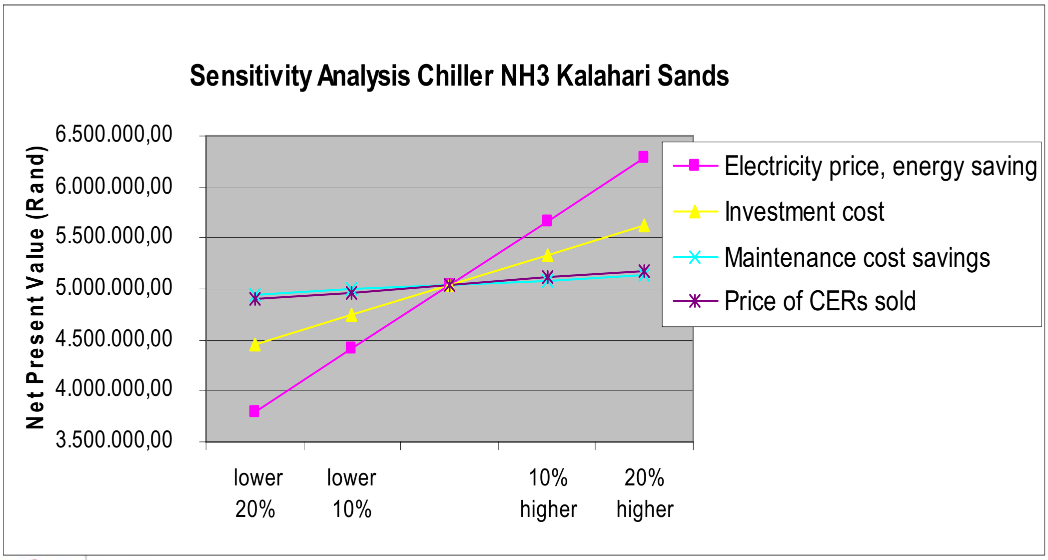
19 chillers to be replaced in the first round, Lead Agency UNIDO

CDM approach: bundle investor types, public sector, hotels etc.
small scale methodology,
technological additionality

Chillers between Montreal and Kyoto

Key financial parameters	
1,470 kW	total cooling capacity
0,445 N$ / kWh	current price used for electricity bills in Windhoek
8 % price increase p.a.	according to the contract Eskom and Nampower
R2.38 mio.	price for NH_3 chiller, quote from Grasso International
R61,600	maintenance cost savings estimated by GTZ-Proklima
1,362 MWh saving p.a.	calculated by GTZ Proklima based on industry statistics for split-system units and data provided
R76 / t CO_2	current low price range, applying in Namibian conditions
37.4 %	Internal rate of return
	System change by replacing multi-splits

Chillers between Montreal and Kyoto



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Chillers between Montreal and Kyoto

For chillers

even at South African EF, CER incentive like maintenance

seek systems changes to create other incentives

that allow more

technological additionality, in small countries in Africa

but that makes it a specific solution each site

bundle with a methodology for each site

problem to find a bundle owner, Montreal Protocol habits

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Additionality in SSC submitted

Steam turbine India	Invest. Barrier	increase of IRR
Compressed air Malaysia	„	payback < 3 years
Solar heating South Africa	“	each techn. excessive discount rate
Biomass Moldova	“	negative NPV without CER
Manufact plant Malaysia	“	< 2 yrs payback of past investments
PV lights India	Techn. Barrier Invest. Barrier	PV support services unavailable capital cost in rural areas
Glass furnace India	Techn. Barrier Invest. Barrier	furnace control techn. new in country IRR below past investment, uncertainty

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continued Additionality in SSC

Caustic soda India	Invest. Barrier Prev. Practice	electrolysis cell cost fuel switch from NG to H2
Automobile plant India	Techn. Barrier Prev. Practice	performance uncertainty sector is new for technology package
Elec arc furnace India	Techn. Barrier Prev. Practice	different system components untested supplier’s training for operators
Air preheater India	Techn. Barrier Prev. Practice	flue gas temperature too low retrofit not common
Beer wasteheat Laos	Techn. Barrier	no operating experience
Plate heat exch India	Techn. Barrier	heat exchange manufacturing

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continued Additionality in SSC

most cases investment analysis alone

technology barriers and prevailing practice

but fewer with investment and technology barriers

perhaps only seen as difficult combination, easier for chillers

Chillers between Montreal and Kyoto

often chillers represent neglected business management, operating conditions are so suboptimal that financial critera do not show additionality

better argument for owner future cost threats, as bigger incentive than CER income

Chillers between Montreal and Kyoto

India – Accelerated Chiller Replacement Program

531 chillers, 100 % measurement, baseline function

additionality for each owner with a financial model

ICICI exchanges all CERs against loan to each owner

Major new programme CDM initiative after NM0159

Sector averages - reduce financial risks

- create a credible set of conditions

- separate financial from technological parameters

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Chillers between Montreal and Kyoto

Programme CDM based on financial additionality

lock in Montreal shortcomings in the form of

HCFC-22, HFC-134a and HCFC-123

overcome finance infrastructure barriers

Programme CDM on chiller based on technology cannot be additional

Single chiller or small bundles target technological additionality,

when financial merit already doesn‘t convince owners and technological additionality creation doesn‘t reduce financial, esp natural refrigerants

Montreal / Kyoto overlap for chillers either

large scale smaller innovation benefit

small scale innovation but no influence for investor

gains from having both in parallel

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Financial Parameters

CER sales from CDM are directly proportional to energy savings

$$\frac{\text{Gain from investment with CDM}}{\text{Gain from investment without CDM}} = \frac{\text{Emission factor x CER price}}{\text{Electricity price}}$$

Egypt: $\frac{0.525 \text{ CER / MWh x } 12 \text{ € / CER}}{0.027 \text{ € / kWh}}$ = 23 % higher NPV with CDM

Nigeria: 0.540 CER/MWh, 0.067 €/kWh = 9.6 %

Cameroon: 0.880 CER/MWh, 0.09 €/kWh = 11.7 %

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Bundling basics

Bundles have been submitted from Indonesia, South Africa, Moldova, Morocco, Nepal, Sri Lanka, India

Bundling organization: private company, NGO, trade or industrial organization, manufacturer, distributor, contractor

all bundle parts must have the same crediting period

the composition of bundles shall not change over time, i.e. all activities must be submitted at the same time

one DOE validates, registers and certifies the whole bundle

maximum size 60 GWh / year + 60 CO2Ee HFC, when exceeded during "any verified period" CER limited to maximum

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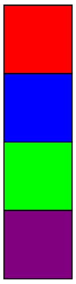
Chillers between Montreal and Kyoto

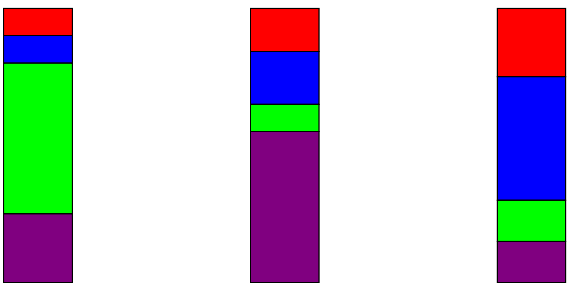
Institutional factors are path-dependent because of organisatioal learning within the companies involved

origin	100%	usable skills:
Engineering		master technology
PDD, NM		prove emission reductions
Investment		financing
CER sale		brokerage



Chillers between Montreal and Kyoto

Brazil:	**India:**	**China:**
CDM de jure investor owned	**operator-owned**	**government owned**



Methodology

Small-scale simplified PDD, baseline, methodology
most importantly simplified additionality: 1 barrier sufficient

< 60 GWh / yr = 60,000 CER / yr = 500 - 900,000 / yr

900 kWh/yr = max 100.000 refrigerators

Small-scale and large scale allow to propose a new methodology

Approved small-scale methodologies:	AMS II.C	8 registered
	AMS II.D	32 registered
	AMS II.E	3 registered
Pending:	AMS III.-	fluorinated gas emissions

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Bundling and Methodology

Bundle with same technologies: one monitoring plan

Bundle with different technologies: separate monitoring and reports

Different chiller types can be in the same bundle and use either
AMS II.C or AMS II.D

Common baseline for all chillers on the grid,
separate common baseline for all chillers on generators with differentiated emission factor for the load factor

even so types, systems are different all chillers in Senegal, Cameroon, Sudan or all public chillers in Egypt can be one bundle
Bundle challenge: which company can assure technical quality, establish contracts with the chillers owners, with DOE and sale CER ?

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De-Bundling

Appendix C1 of the Simplified Modalities and Procedures for Small-Scale CDM

DETERMINING THE OCCURRENCE OF DEBUNDLING

1. Debundling is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. The full project activity or any component of the full project activity shall follow the regular CDM modalities and procedures.
2. A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

Ineligible when All 4 apply

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is **within 1 km of the project boundary** of the proposed small-scale activity at the closest point.

3. If a proposed small-scale project activity is deemed to be a debundled component in accordance with paragraph 2 above, but total size of such an activity combined with the previous registered small-scale CDM project activity does not exceed the limits for small-scale CDM project activities as set in paragraph 6 (c) of the decision 17/CP.7, the project activity can qualify to use simplified modalities and procedures for small-scale CDM project activities.

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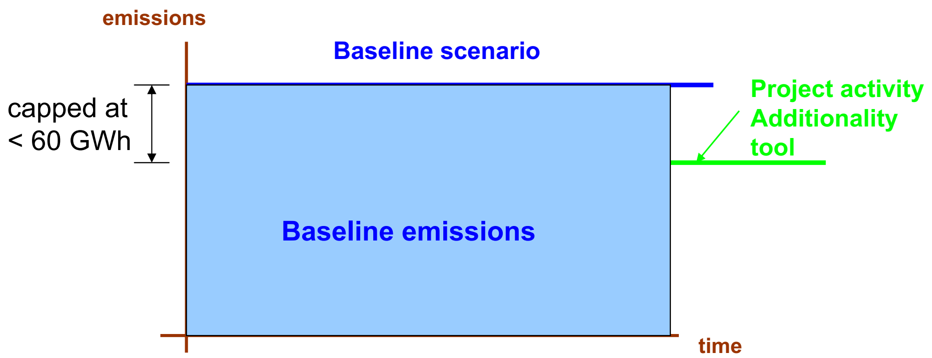
Additionality



each project shall meet the threshold criterion of each type, i.e. total energy saving (plus fluorinated gas emissions 60 ktCO_2e)

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Additionality

Version 06: 30 September 2005 Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM

1. Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to **at least one** of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

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Policy Bundle Programme

CDM – Meth Panel 22nd Meeting Report Annex 13 13 Sept. 2006
Draft proposal on definitions to distinguish between a bundle, a program and a policy as well as alternative definitions of a program

By reducing transaction costs, CDM programmes could help reduce one of the barriers to CDM project development.

Option 3: Each individual project activity in a ”programme of activities” has a direct, real and measurable impact on emission reductions and should be traceable, e.g. identified and localized at either the validation or verification stage of the ”programme”.

comes from Kyoto

A requirement that each underlying activity generates measurable reductions would not mean that each underlying activity has to be measured in practice: just that it could be measured if necessary. This will exclude ”soft” actions.

Each ”programme of activities” can involve only one [*option 4:* or more] project type, and is put in place by a coordinator/managing entity [*option 5*: that is neither part of the government, nor a government agency. decided as ‘anyone’option

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AMS II.C. Formula for groups of devices

Baseline

3. If the energy displaced is a fossil fuel, the energy baseline is the existing fuel consumption or the amount of fuel that would be used by the technology that would have been implemented otherwise. The emissions baseline is the energy baseline multiplied by an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used.

4. If the energy displaced is electricity, the energy baseline is calculated as follows:

$$EB = \Sigma_i (n_i \cdot p_i \cdot o_i)$$ where:

EB annual energy baseline in kWh per year

$\boldsymbol{\Sigma_i}$ the sum over the group of "i" devices replaced (e.g. 40W incandescent bulb, 5hp motor), for which the replacement is operating during the year, implemented as part of the project.

$\boldsymbol{n_i}$ the number of devices of the group of "i" devices replaced (e.g. 40W incandescent bulb, 5hp motor) for which the replacement is operating during the year.

$\boldsymbol{p_i}$ the power of the devices of the group of "i" devices replaced (e.g. 40W, 5hp). In the case of a retrofit programme, "power" is the weighted average of the devices replaced. In the case of new installations, "power" is the weighted average of devices on the market.

$\boldsymbol{o_i}$ the average annual operating hours of the devices of the group of "i" devices replaced.

5. The energy baseline is multiplied by an emission coefficient (measured in kg CO_2equ/kWh) for the electricity displaced calculated in accordance with provisions under category I.D.

AMS II.C. page 2

Monitoring

7. If the devices installed replace existing devices, the number and "power" of the replaced devices shall be recorded and monitored.1

8. Monitoring shall consist of monitoring either the "power" and "operating hours" or the "energy use" of the devices installed using an appropriate methodology. Possible methodologies include:

(a) Recording the "power" of the device installed (e.g., lamp or refrigerator) using nameplate data or bench tests of a sample of the units installed and metering a sample of the units installed for their operating hours using run time meters.

OR

(b) Metering the "energy use" of an appropriate sample of the devices installed. For technologies that represent fixed loads while operating, such as lamps, the sample can be small while for technologies that involve variable loads, such as air conditioners, **the sample may need to be relatively large.**

9. In either case, monitoring shall include annual checks of a sample of non-metered systems to ensure that they are still operating (other evidence of continuing operation, such as on-going rental/lease payments could be a substitute).

UNFCCC CDM – Executive Board EB 21 Report Annex 21

D. Principles applying to bundling of small-scale project activities of the same type, same category and technology/measure:

6. The following principles shall apply to bundling of small-scale project activities of the same type, same category and technology/measure:

(a) Project activities may use the same baseline under some conditions (details on these conditions will be further elaborated);

(b) One DOE can validate this bundle;

(c) A common monitoring plan can be utilized for the bundle with the submission of one monitoring report, under conditions to be specified (e.g. conditions for sampling);

(d) All CDM project activities within the bundle should have same crediting period, i.e. the same length and same starting date of the crediting period;

(e) One verification report is adequate, one issuance will be made at the same time for the same period, and a single serial number will be issued for all the project;

(f) The sum of the size (capacity for type I, energy saving for type II and direct emissions of project activity for type III) of the technology or measure utilized in the bundle should not exceed the limits for small-scale CDM project activities as set in paragraph 6 (c) of the decision 17/CP.7; and

(g) Each small-scale CDM project in the bundle should comply with the simplified modalities and procedures for small-scale CDM project activities and use an approved simplified baseline and monitoring methodology included in Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

E. Principles applying to bundling of small-scale project activities of (a) the same type, same category and different technology/measure; (b) same type, different categories and technologies/measures and; (c) different types

7. The following principles shall apply to bundling of small-scale project activities of (a) the same type, same category and different technology/measure; (b) same type, different categories and technologies/measures and; and (c) different types:

(a) Project activities may use the same baseline under some conditions (details on these conditions will be further elaborated);

(b) One DOE can validate this bundle;

(c) Different monitoring plans will be required for the bundle and separate monitoring reports must be prepared;

(d) All small-scale CDM project activities within the bundle should have same crediting period, i.e. the same length and same starting date of the crediting period;

(e) One verification report will be adequate, one issuance will be made at the same time for the same period, and a single serial number will be issued for all the project;

(f) The sum of the size (capacity for type I, energy saving for type II and direct emissions of project activity for type III) of the technology or measure utilized in the bundle should not exceed the limits for small-scale CDM project activities as set in paragraph 6 (c) of the decision 17/CP.7; and

(g) Each small-scale CDM project in the bundle should comply with the simplified modalities and procedures for small-scale CDM project activities and use an approved simplified baseline and monitoring methodology included in Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Landing programmatic CDM at a Peruvian airport

Mr. Luis Ugarelli, BCI

Mr. Luis Ugarelli, Managing Partner, Market Facilitators, discussed the proposal for a fuel switching project in Peru as a programmatic CDM project. He detailed that retrofitting boilers to be fuelled by natural gas instead of coal or oil is expected to generate between 500,000 and 3 million CERs. He also noted the challenges of being limited to one methodology under programmatic CDM.

Hedging climate change risk through regulatory, financial and technological solutions

I. ABOUT A2G

A2G, a global consulting firm, integrates a full range of consulting capabilities to hedge non financial risk through regulatory, commercial and technological solutions.

Our staff, business and technology savvy, is able to manage current emerging issues such as climate change, state reform, regulatory change, mergers and acquisitions and business development to enter new markets.

For more information visit www.atwog.com or contact us at info@atwog.com

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I. ABOUT MARKET FACILITATORS

Market Facilitators is an independent consulting firm with the mission of supporting companies, governments and other participants in the market to strengthen the areas of investments and competitiveness through the study and the implementation of strategies in key variables.

Its areas of work include environment and sustainable development.

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Hedging climate change risk through regulatory, financial and technological solutions

II. WHAT´S THE ITINERARY?...

Promote a GHG reducing practice through a feasible concept

↓

Get the concept registered as PoA

↓

Use the registered PoA as an incentive to enroll CPAs

↓

Manage the PoA and distribute its benefits

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III. WHO´S THE PILOT? THE PoA MANAGER PROFILE

The PoA Manager should be :

- Business and technology savvy on the sector targeted by the PoA.
- Fully conversant on CDM Meths.
- Experienced developing CDM projects.
- Competent on the monitoring and management of simultaneous projects.
- Highly credible to safeguard full compliance with CDM rules of the enrolled CPAs.

Hedging climate change risk through regulatory, financial and technological solutions

IV. CHECKING NAVIGATION CONDITIONS: CURRENT RULES

According to the “**guidance on the registration of project activities under a programme of activities as a single CDM project activity”** passed by the CDM Executive Board on its 28th meeting, each CDM Program can use only one approved baseline methodology and one technology.

What are the the pros and cons of this restriction?

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Hedging climate change risk through regulatory, financial and technological solutions

PROGRAM CONCEPT based on:	PRO´s	CON´s
One Baseline methodology and a single technology	Homogenous universe makes sampling easier for monitoring and verification.	This "one fits all" approach is divorced from reality, even in a single project activity (e.g. LANDFILL) one can find several meth and technologies included **This means that a PoA seeking to promote, for instance, landfill gas capture to supply electricity to the grid would not be allowed since they need to use two baseline & monitoring methodologies and utilize more than one type of technology.**
Several meth and several tech	Allows the structuring of "real programs" addressed to tackle specific business sector activities.	Its heterogeneous universe adds complexity to the sampling process. **However, sampling can be unnecessary if the PoA Manager standardizes information and monitoring protocols to ease verification activities.**

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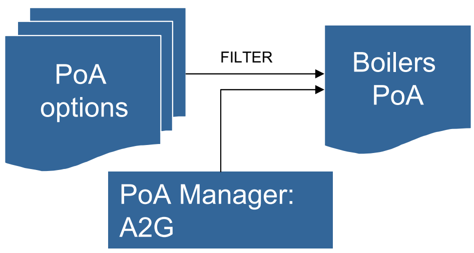
V. TAKING OFF: STARTING THE PoA



- 500+ Peruvian boilers: Fuel switching from residual fuel oil to natural gas
- Partnership established with equipment vendors and Natural Gas Distributor
- CERs can be accepted as a colateral by NG distributor to take the pipeline beyond the feasible limit
- CERs can be seen as incentive to switch to NG even if it involves capital expenditure
- Meth used: ACM0009

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ABOUT THE PoA

These will be implemented by a multitude of boilers (+500) owners/users in response to the PoA. According to ACM0009, the following conditions apply:

- •Prior to the implementation of the CPA, only coal or petroleum fuel (but not natural gas) have been used at the boilers;
- •Regulations/programs do not constrain boilers from using the fossil fuels prior to fuel switching;
- •Regulations do not require the use of natural gas or any other fuel at boilers;
- •The CPAs do not increase the capacity of thermal output or lifetime of the element processes during the crediting period nor is there any thermal capacity expansion for each boiler planned during the crediting period;
- •The proposed PoA does not result in integrated process changes;

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ABOUT THE CPA´s

A typical CPA will consist on fuel switching at a small or medium size boiler and the CPA activities would consist of:

- Contract to extend natural gas pipeline
- Purchase and installation of internal natural gas tubing within the industrial facility
- Purchase and installation of natural gas meters and natural gas burners
- Natural Gas Supply contract & Fuel switch from coal or oil to natural gas

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VI. FLYING BY THE DASHBOARD: MONITORING BASICS

Since the PoA will use the consolidated methodology ACM0009, A2G plans to monitor the PoA according to the following indicators:

•The annual natural gas consumption for each CPA will be measured on a continuous basis. This is to be reported on a monthly basis to A2G, the Program Manager.

•The energy efficiency of each CPA, the net calorific value (NCVNG,y) and the CO2 emission factor of natural gas (EFNG,CO2) will be monitored monthly, based on national or international standards. Based on the monthly measurements, annual averages will be calculated and used in the equations presented in the baseline methodology.

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VII. LANDING AT PERU: DELIVERING GHG REDUCTIONS

This PoA expect to deliver:

•GHG reduction in the range of 500,000 – 3´000,000 CERs for the period 2008-2012
•Total Capital Expenditure of 6´000,000 – 21´000,000 US$
•Total Operative Expenditure of 500,000 - 750,000 US$
•On average the impact of CERs revenues on each CPA will be 1.5 - 3%

The impact of the PoA will be to boost NG consumption beyond the feasible pipeline and he feasible migrations to NG.

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THANKS

FEEL FREE TO CONTACT US TO REQUEST FURTHER INFORMATION

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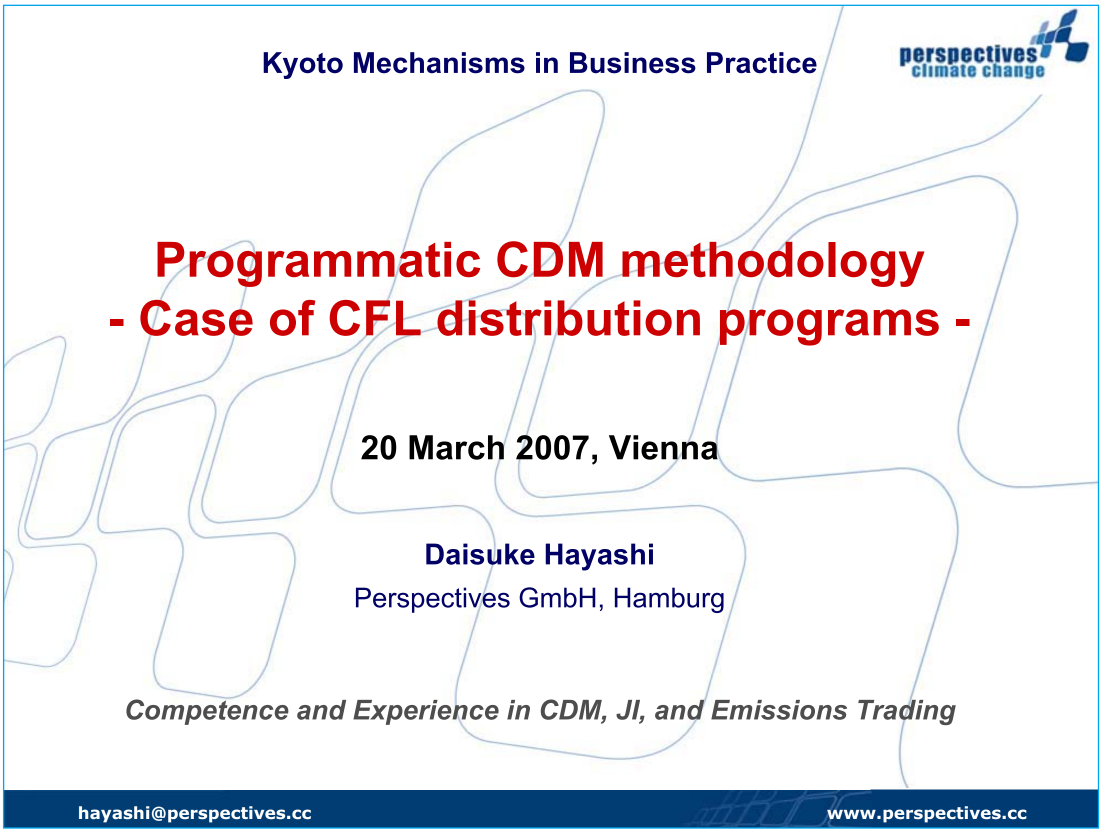
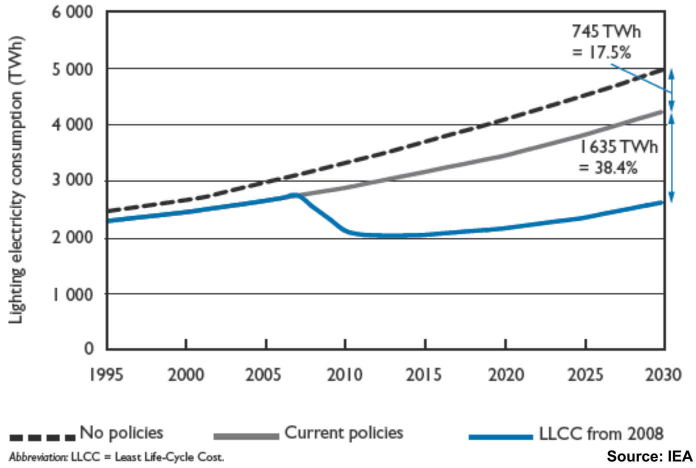
Programmatic CDM methodology: Case of CFL distribution programmes

Mr. Daisuke Hayashi, Perspective GmbH

Mr. Daisuke Hayashi, Consultant, Perspectives, outlined the methodology for a compact fluorescent lamp (CFL) distribution project under the CDM. He outlined barriers to the take-up of CFL in the residential sector, such as higher initial costs, lack of information, inadequate regulatory guidance, and a lack of incentives for lighting installers. Hayashi described the methodology and random sampling method used in calculating emission reductions. He stressed the trade-off between sample size and the volume of CERs, and the need to consider optimal sample size to maximize CER volume to reduce transaction costs.



Lighting: Cost-effective savings



Source: IEA (2006) Light's labour's lost: Policies for energy-efficient lighting

- Global lighting cost could be reduced by US$ 2.6 trillion and 16 $GtCO_2$ could be saved (2008-2030)
- These savings are realized by making good use of today's routinely available efficient-lighting technologies

Compact fluorescent lamps (CFLs): Energy-efficient light bulbs

- Technology commercialized in early 1980s
- Available in two types:
  - Lamps with ballast integrated
    - Intended as direct substitutes for incandescent lamps
  - Lamps without ballast integrated
    - Oriented more at commercial building retrofits and new-build as alternatives to incandescent lamps
- Much longer lifetimes (5,000-25,000 hours) compared to incandescent lamps (1,000 hours)
- Consume 1/4th to 1/5th of the energy used by incandescent lamps

Figure: CFLs with ballast integrated

Source: OECD (2006) Barriers to technology diffusion: The case of CFLs

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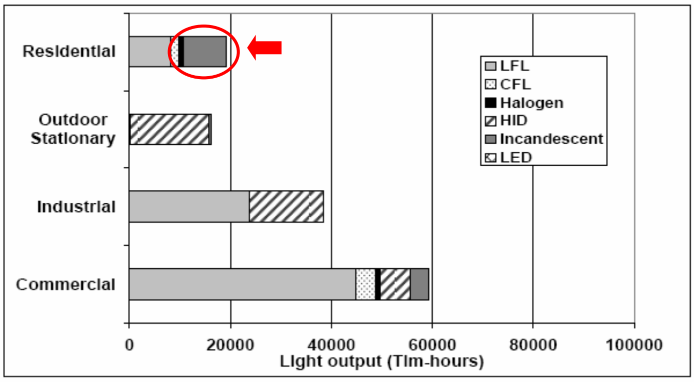
The economics of CFLs compared to incandescent lamps

	Incandescent lamp	CFL
Initial cost of bulb (USD)	0.50	10
Light output (lm)	900	900
Lamp power (W)	75	15
Efficacy (lm/W)	12	60
Lifespan of bulb (h)	1000	10 000
Calculation over a 10 000h operating period, assuming an electricity tariff of USD 0.1/KWh		
Electricity consumption (kWh)	750	150
Cost of electricity (USD)	75	15
Cost of lamps (USD)	5	10
Total cost of lamp and electricity (USD)	80	25
Total savings for CFL (USD)		55

Source: IEA (2006) Light's labour's lost: Policies for energy-efficient lighting

- **Economics of CFLs:**
  - **Significantly higher initial costs (20 times more expensive than incandescent lamps)**
  - **Lower life-cycle costs (less than 1/3rd of incandescent lamps)**

Estimated light production by user sector and lamp type in 2005



Note: LFL = Linear Fluorescent Lamps; HID = High-Intensity Discharge Lamps; LED = Light-Emitting Diodes.

Source: IEA (2006) Light's labour's lost: Policies for energy-efficient lighting

- **Incandescent lamps prevalent in the residential sector due to:**
  - **Lack of information on energy efficiency levels for end-users;**
  - **Lack of incentives for lighting equipment installer (e.g. landlord) to minimize energy bills of end-users (e.g. tenant); and**
  - **Lack of regulatory guidance on residential lighting energy efficiency, etc.**

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CDM methodology for CFL distribution programs

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Brief program description

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- Program of activities is sales, at a reduced price, or donation of CFLs to households within a distinct geographical area
- A distributed light bulb must have:
  - i) higher efficiency and
  - ii) the same (or lower) lumen output than a replaced light bulb
- The households purchase or receive CFLs upon return of currently used and functioning light bulbs
- The returned light bulbs must be destroyed
- Distribution and collection of CFLs must be conducted:
  - i) directly at each household; and/or
  - ii) at dedicated distribution/collection points upon presentation of an invitation to participate in the program

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Project activity area(s) under the program

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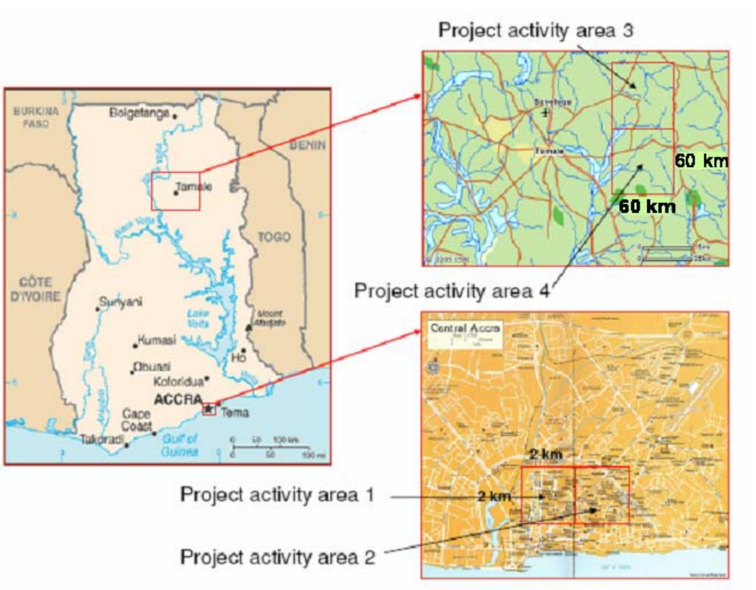

- Applicable to single- or multi-site programs
- Each site is restricted to the area of:
  - 4 km^2 (2 km x 2 km) for urban areas; and
  - 3,600 km^2 (60 km x 60 km) for rural areas

Emission reductions calculation: Random experimentation method

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Project area i

Population group

l

l = 2 km (urban area); 60 km (rural area)

Random sampling

Sample group

Use of randomization to establish "equivalence" between baseline sample group (BSG) and project sample group (PSG)

$$\text{Sample size in project area i} = \frac{\text{\# of CFLs to be distributed in project area i}}{\text{Total \# of CFLs to be distributed under the program}} \times \text{Total sample size under the program (min. 200)}$$

Coin toss

Allocation of households to BSG and PSG

- BSG: Households do not receive the program intervention, but are free to purchase CFLs autonomously
- PSG: Households participate in the program

Monitoring every three to six months (or at least annually)

Main monitoring items:

i) Electricity consumption or utilization hours with power ratings,
ii) Existence of lighting appliances, and
iii) Functionality of measurement equipment

Emission reductions calculation

Difference in emissions from lighting-related electricity consumption in BSG and PSG represents the program impact (i.e. emission reductions)

Issues in emission reductions calculation

- Statistical treatment is indispensable because it is cost-prohibitive to monitor every single project activity
  - Need to consider "perfect" vs. "good enough" program impact assessments
  - It remains to be seen if alternatives to a random experimentation method can pass the CDM scrutiny
- Emission reductions are adjusted by:
  - Conservative sides of 95% confidence intervals for baseline and project emissions calculation
  - Note that a smaller sample size leads to a higher margin of error (although it reduces transaction costs)
- Hence, a trade-off exists between:
  - Sample size (i.e. transaction costs), and
  - CER volume

Conclusions

- The first approved programmatic CDM methodology has set rigorous precedence
- Monitoring requirement is heavy and associated costs are likely to be high
  - Rule of thumb: At least 2,000,000 CFLs should be distributed to make a CFL program attractive under the CDM (~ min. 500,000 households required)
- A trade-off exists between sample size and CER volume
  - Need to contemplate the optimal sample size to maximize CER volume under the transaction costs constraint
- Intermediaries play a pivotal role
  - If monitoring is not conducted properly, the program will get problems at the verification stage

Countries of particular interest for CFL distribution programs

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- Countries with higher grid emission factors (gCO_2/kWh)
  - India: 750 – 1,040
  - China: 700 – 1,000
  - Southeastern Europe: Macedonia, Moldowa, Serbia: ~ 750
  - Near East: Israel, Qatar, Oman, UAE: ~ 800
  - Africa: Morocco, Senegal, South Africa: ~ 800
  - Island states:
    - Caribbean: Jamaica: 835, Cuba: ~ 800, Trinidad: ~ 700
    - Mediterranean: Malta: ~ 900, Cyprus: ~ 760

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Thank you for your attention!

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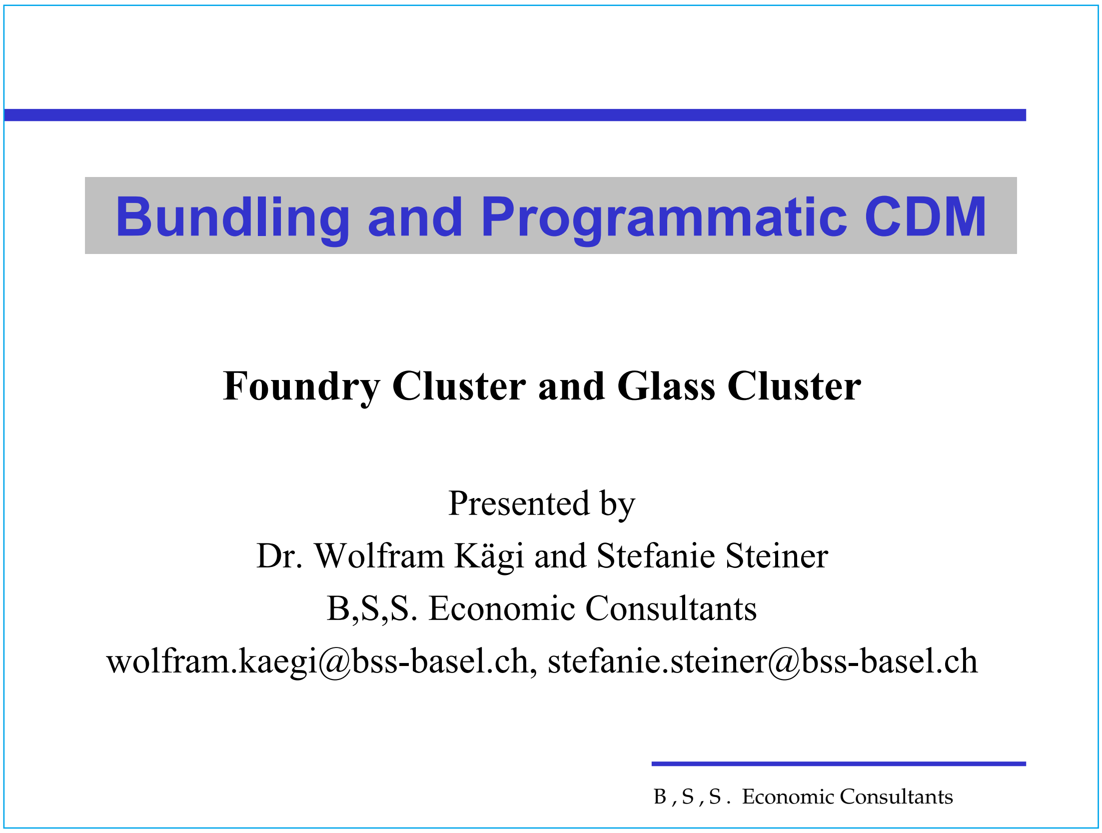
Bundling and programmatic CDM: Foundry cluster and glass cluster

Ms. Stefanie Steiner, BSS

Ms. Stefanie Steiner, Researcher, BSS, discussed a foundry project in Belguam, India, designed to increase the energy efficiency of 100 foundries by improving the design of the cupolas, which are used to melt iron. Wolfram Kägi, Chief Executive Officer, BSS, described a glass project in Firozabad, India, where numerous efficiency improvements could be made in local glass manufacturing, resulting in savings of up to 100,000 tonnes of carbon dioxide per year. He suggested the Belgaum project could form part of a bundled CDM project, and that ideally the Firozabad project would be programmatic.



The Foundry Cluster Project

- Located in Belgaum
- About 100 foundry units
- Produce high-precision castings used by industries to manufacture electric motors, pumps, valves, etc.

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Technology

Processes

1. Charging
2. Melting
3. Pouring
4. Moulding

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Energy-intensive Stage

- Melting is the most energy-intensive stage
- -> The melting stage is the most important process regarding the reduction potential of greenhouse gas emissions

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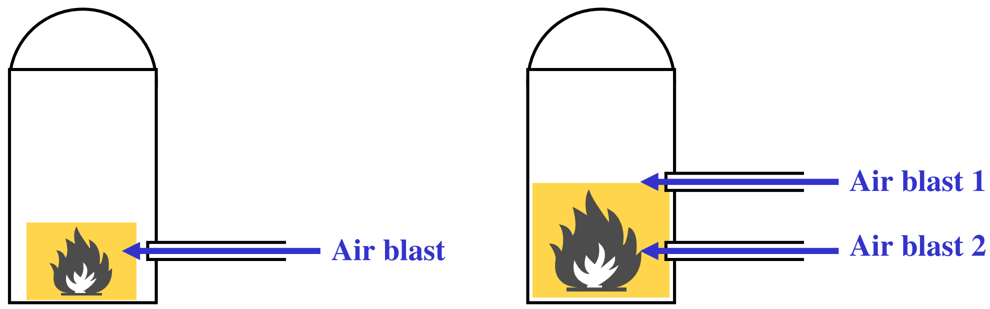
Improvement of the design of the cupola

Common practice: conventional cupola

One air blast -> not enough oxygen in the upper zone of the cupola -> reduces the core temperature and lowers the furnace efficiency

Project idea: divided-blast cupola (DBC):

Two air blasts to improve the oxygen supply



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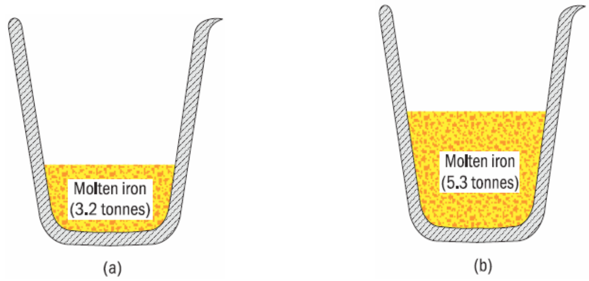
Energy saving due to DBC

Conventional cupola:
1 t coal -> 3.2 t iron

divided-blast cupola:
1 t coal -> 5.3 t iron



➔Reduction of coal consumption in Belgaum foundry Cluster: ~ **3500 tons/a**

➔emission reduction: ~ **9000 tons CO_2/a**

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Costs and Benefits of a DBC

- Installation of a new divided-blast cupola: ~ **USD 20‘000 per unit**
- Conversion of a conventional cupola: ~ **USD 4‘500 per unit**
- Energy bill of a typical unit can be reduced by ~ **USD 10‘000 per year and unit**
- CERs: **90 tCO_2 per year and unit**

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Belgaum as Bundling Project

Proposed Project Organization

Belgaum Foundry Cluster (established in 2004)

- Promotion of the project
- Enrol micro enterprises under the project
- Provide logistical support
- Undertake the carbon transaction as an intermediary

TERI (The Energy and Resource Institute)

- Provide technology know how
- Write the PDD

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- Support of PDD development

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The Glass Cluster Project

- About 300 glass units are located in Firozabad
- Produce a variety of glass items (ranging from simple glass ware to high value added products)

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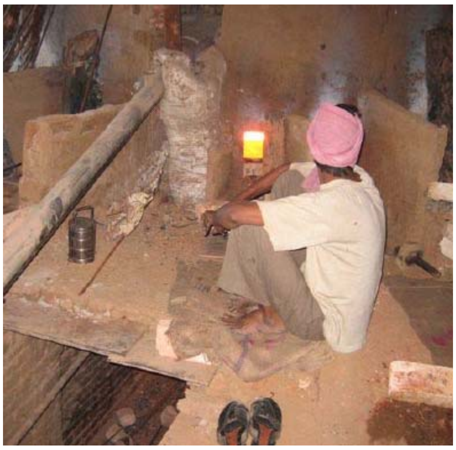
Characteristics of Glass Cluster Firozabad

- Income for **half a million** people
- Very primitive and **inefficient** technology



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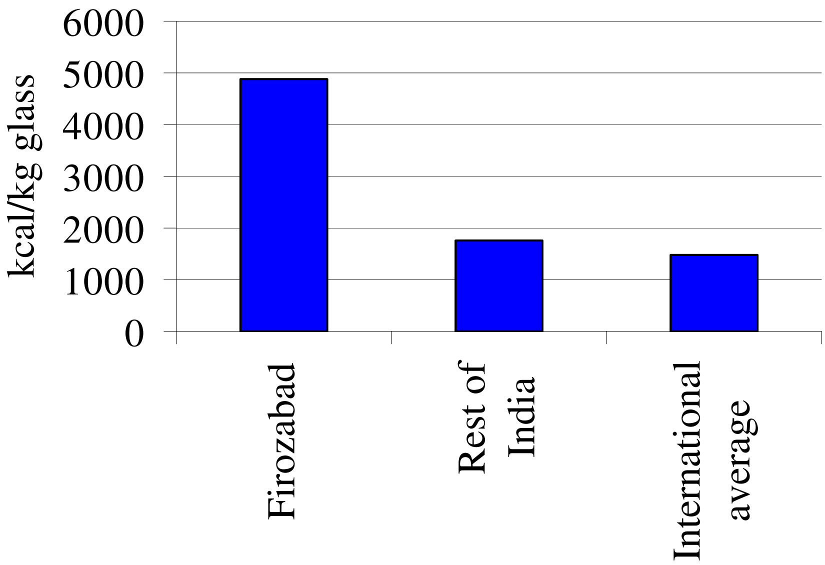
Energy Efficiency of Glass Cluster



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Energy Efficiency of Glass Cluster

- Energy consumption of furnace accounts for 70-85% of whole process
- Industry of Firozabad is obligated to switch from coal to gas (60% of the units allready use natural gas, 40% use coal)
- Baseline emissions (2002): about 1'000'000 tons CO2 per year.
- Energy consumption about 4000 GWh per year

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Possible Energy Efficiency Measures

- Improvement of furnace design
- Improvement of burner efficiency
- Introduction of temperature control
- Introduction of gas usage control
- Introduction of pressure control
- Heat recovery

→ Estimation of reduction potential:

→ about 10% of actual CO_2 emission

→ 100'000 tCO_2 per year totally

→ 333 tCO_2 per year and unit

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Glass Cluster as Programmatic CDM

Proposed Project Organization

Organisation to be selected

- Promotion of program
- Provide technology know how
- Provide logistical support

NPC (National Productivity Council of India)

- Provide technology know how
- Write the PDD

Indian Government

- Introduce the program (USD 3 Mio. are available for the program)

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- Development of the program
- Establishment of new methodology

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Methodological Approach

- Is the proposed approach appropriate for the two projects? Bundling or programmatic CDM?

➔ *"A programmatic project activity is a CDM project activity where the emission reductions are achieved by* ***multiple actions executed over time*** *as a result of a government measure or a private sector initiative. " (Christiana Figueres, 2005)*

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Comparison of Projects regarding Methodological Approach

	Foundry Belgaum	Glass Firozabad
Number of companies	~ 100	~ 300
Investor	Single units	Indian Government
Energy efficiency activities	1 activity (Introduction of divided-blast cupola)	Various activities (improvement of furnace design and efficiency, introduction of monitoring instruments)
Emission reduction	9'000 tons CO_2 per year	about 100'000 tons CO_2 per year
Scale and category	Small scale, category II.D.	Large scale
Proposed Approach:	**Bundling**	**Programmatic**

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Thank you for your attention!

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7.2 Discussions

Participants focused on CFLs, with some highlighting the high transaction costs of CFL substitution in households as opposed to at the point of purchase. Hayashi said the methodology is rigorous and resulted from discussions with the Methodology Panel. He also noted that the optimal sample size for monitoring is 300 households.

8. Panel session V: Methodologies for electric motor-driven systems

Ms. Anne Arquit Niederberger, Director, A+B International, moderated the session and introduced the panelists.

8.1 Presentations

India: Accelerated chiller replacement programme (NM0197) — overview and issues

Ms. Martina Bosi, World Bank (NM0197 chillers)

Ms. Martina Bosi, Methodology Specialist, Carbon Finance Unit, World Bank, discussed the India Accelerated Chiller Replacement Programme, where under the PoAs, CFC-based centrifugal chiller systems would be replaced with hydrofluorocarbon (HFC) chillers by offering replacement costs. She noted this programme could reduce emissions by up to 2.3 Mt of carbon dioxide by 2012 as a result of energy efficiency gains, and that this excluded the secondary benefits of using HFC-based, instead of CFC-based, chillers. She highlighted the synergies between the Global Environment Facility (GEF), the Multilateral Fund for the Implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol), and the CDM. After participants inquired about the disposal of the refrigerants, Bosi confirmed that these would not be destroyed under the project, but that CFCs may be recovered. Other participants shared information on Indian companies that recover CFCs commercially.

India – Accelerated Chiller Replacement Program (NM0197)– Overview and Issues

Martina Bosi and Klaus Oppermann
Carbon Finance Unit, The World Bank

March 20, 2006
Presentation to the
UNIDO/CTI/UK Trade and Investment Seminar on Energy Efficiency Under CDM and JI
Vienna, Austria

India Chiller replacement program: Overview

- Accelerated replacement of building cooling systems
  - Accelerated replacement of old, large-size (>100 tons refrigeration) CFC chillers by more efficient HFC chillers
  - Established technology but significant barriers
  - Without project, chillers could remain in operation for 30 years or more.
  - Location: all states (i.e. 20) or territories (i.e. 15)
- Contribution to India's sustainable development
- Estimated impact:
  - Expected number of chiller replacements 2007-10: > 500
  - Improvements of ~40%-50% in energy consumption
  - Expected CO_2 reductions up to 2012: > 2.3 Mt CO_2
    - Only CO_2 emission reductions from power savings are claimed

India Chiller replacement program: Building on Synergies between Agendas

- GEF:
  - Interest in addressing environmental and economic externalities – provide new and additional resources for incremental costs of measures to achieve global environmental benefits
- Multilateral Fund (MLF) of the Montreal Protocol:
  - Interest in eliminating consumption* of CFCs by 2010

  (*defined as production, less feedstock use, plus imports, less exports, less destruction)
- Kyoto Protocol:
  - Reduction of GHG emissions and contribution to host country's sustainable development

India Chiller replacement program: How it works

- To compensate chiller owners for cost of earlier replacement
  - Carbon credits, together with grant funding from GEF and Multilateral Fund of Montreal Protocol are critical
    - ➢ Average grant amount (incl. carbon credits): ~ 10% of new chiller cost (and accelerates replacement by estimated 10.1 years)
    - ➢ Carbon credits represent ~ 60% of incentive amount (average)
- Financing
  - ICICI Bank offers grants to chiller owners refinanced out of GEF, MLF of the Montreal Protocol, Carbon finance
  - GEF, MLF as seed funding for first chiller generation; then self-financing out of CER revenues

India Chiller replacement program: Roles and Responsibilities

- Core legal undertaking of chiller owners in program:
  - Sign over their carbon credit rights in exchange for upfront incentive for replacement of chillers
  - Chiller onwers responsible for replacement activities (e.g. appraisal, installation, operation…)
- Program implemented by ICICI Bank (*program implementing entity*); its role is:
  - Market program to eligible owners;
  - Develop legal & financial instruments for chiller owners;
  - Monitor implementation of chiller replacement activities

Meth: Power Saving through accelerated replacement of non-system integrated electrical equipment with variable output (NM0197)

- Baseline power consumption:
  - BAU remaining lifetime of old chillers (manufacturers).
  - Power consumption of old chillers under operational conditions of new chillers (power consumption function for old chillers through measurement procedure).
  - Applies up to capacity of old chillers.
- Project power consumption: measured (as well as operating conditions: output delivered).
- Baseline for both (i) program implementing entity; and (ii) individual equipment owners participating in program
- Scrapping of old chillers in order to avoid leakage.
- No refrigerant leakage due to exclusion of shifts to refrigerants with higher GWP
- Status: Received Preliminary recommendations from Panel (15-19 January, 2007); resubmitted to Meth Panel; expect rating at EB31

Preliminary Feedback from Meth Panel – Key Issues (1)

1. Recovery & destruction of refrigerants
   - Panel recommends recovery & destruction of refrigerants contained in existing equipment
   - However, destruction is environmentally dangerous→ done in a couple of incineration plants in US & EU →difficult & costly
   - NM 0197 based on normal practice accepted Montreal Protocol
   - Project is good practice and is supported by Multilateral Fund of the Montreal Protocol
   - If Panel insists on recovery and destruction of refrigerants →project stopper

Preliminary Feedback from Meth Panel – Key Issues (2)

2. Output Capacity
   – NM 0197 allows replacing small with larger chillers (but increased energy efficiency in small chillers should limit this)
   – Meth already conservative as based on actual sizes:

   Example:
   baseline: size: 100 TR with EF 1→100tCO2
   project: size: 200 TR with EF 0.5→100tCO2
   } No emission reductions

   – Panel comment suggest misunderstanding of equations: *« capacity of new equipment should not be larger than existing equipment »*
   – In meth revisions, we are clarifying the approach

Preliminary Feedback from Meth Panel – Key Issues (3)

3. Applicability Conditions

- Applicability of original Meth very broad: all variable output equipment
- Panel arguing that it is too broad; Panel asking for complete guidance on how to use the Meth for each type of equipment.
- Result:
  - we are narrowing down the applicability to chillers, pumpsets and refrigerators
  - → but unsure if this will be accepted; in the end, may need to restrict to chillers.

General interest of the Chiller program

- Incentive scheme with contractual relationships with owners of individual activities (allows integration of monitoring requirements)
- Self-financing vehicle out of CDM revenues with help of seed funding (transforms emission reduction payments on delivery in upfront payment for next generation of activities)
- Combining agenda of Montreal Protocol with agenda of Kyoto Protocol; combining CDM and GEF
- Development of new CDM methodology for programmes of activities

For more information

Contacts:
Martina Bosi (mbosi@worldbank.org)
Klaus Oppermann (koppermann@worldbank.org

World Bank Carbon Finance website:
www.carbonfinance.org

UNFCCC CDM website (NM0197)
http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html

Insights from energy efficiency projects on motor-driven systems outside CDM

Mr. Ian Lane, Energy Cybernetics

Mr. Ian Lane, Director, Energy Cybernetics, provided insights from the South African experience with energy efficiency projects for motor driven-systems outside the CDM. He noted that there are few energy efficiency CDM projects in South Africa and explained that this may be because the national energy regulator's demand-side management fund pays US$45 per tonne of carbon dioxide-equivalent to protect supply side security. He said projects funded under this scheme typically take system approaches and would not qualify for the CDM as they would not demonstrate additionality.

Insights from energy efficiency projects on motor driven systems outside CDM

UNIDO,CTI, UK Trade and Investment SEMINAR

Industrial Energy Efficiency Projects in the Clean Development Mechanism and Joint Implementation

Vienna International Centre

19-20 March 2007

PRESENTED BY DR. I.E. LANE (South Africa)

Energy Cybernetics

OVERVIEW

- CDM IN SOUTH AFRICA
- ENERGY EFFICIENCY IN CDM IN SA
- ENERGY EFFICIENCY OUTSIDE CDM IN SA
- CONCLUSION ON MOTOR ENERGY EFFICIENCY PROJECTS IN SA
- MEASUREMENT AND VERIFICATION OF MOTOR ENERGY EFFICIENCY PROJECTS IN SA
- CLASSES OF MOTOR ENERGY EFFICIENCY PROJECTS

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CDM IN SOUTH AFRICA

- 43 PROJECTS ACKNOWLEDGED BY DNA
- 26 AT PIN STAGE
- 17 AT PDD STAGE
- 6 REGISTERED BY CDM EXECUTIVE BOARD
- 2 REQUESTING REGISTRATION
- 9 AT VALIDATION STAGE
- 121950 KILOTONS CO_2 EQUIVALENT

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ENERGY EFFICIENCY IN CDM
IN SOUTH AFRICA

- 5 (OUT OF 43) PROJECTS ACKNOWLEDGED BY DNA
- 4 AT PIN STAGE
- 1 REGISTERED BY CDM EXECUTIVE BOARD
- 302 KILOTONS CO_2 EQUIVALENT (0.25 % OF TOTAL)
- NONE OF THE ENERGY EFFICIENCY PROJECTS ARE FOR MOTOR DRIVEN SYSTEMS

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ENERGY EFFICIENCY OUTSIDE CDM
IN SOUTH AFRICA

- NATIONAL DEMAND-SIDE MANAGEMENT (DSM) PROJECT APPROVED BY NATIONAL ENERGY REGULATOR
- DSM PROGRAM CURRENTLY RUN BY ESKOM (MAJOR GENERATOR IN SA)
- MOTOR ENERGY EFFICIENCY PROJECTS RANGE FROM 4 TO 30 KILOTONS CO_2 EQUIVALENT
- DSM FUND PAYS 45 US$ PER TON CO_2 EQUIVALENT, OR
- DSM FUND PAYS 90 US$ PER TON CO_2 EQUIVALENT, PROVIDED 50% OF THIS AMOUNT IS PAID BACK OUT OF SAVINGS
- ESKOM TARGET FOR MOTOR ENERGY EFFICIENCY PROJECTS IS 7500 KILOTONS CO_2 EQUIVALENT , OR 6% OF CDM PROJECTS IN PIPELINE

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CONCLUSION ON MOTOR ENERGY EFFICIENCY PROJECTS
IN SOUTH AFRICA

THE HIGH VALUE ATTACHED TO DSM BY THE GOVERNMENT IN SOUTH AFRICA MAKES IT DIFFICULT FOR CDM TO GENERATE ENERGY EFFICIENCY PROJECTS ON MOTOR DRIVEN SYSTEMS IN SOUTH AFRICA

HOWEVER, THE TARGET FOR TONS CO_2 EQUIVALENT EMISSIONS REDUCTION DUE TO MOTOR ENERGY EFFICIENCY PROJECTS OUTSIDE THE CDM IN SA REPRESENTS A SIGNIFICANT PERCENTAGE OF THE TOTAL FORESEEN BY THE DNA

Energy Cybernetics

MEASUREMENT AND VERIFICATION OF MOTOR ENERGY EFFICIENCY PROJECTS
IN SOUTH AFRICA (OUTSIDE CDM)

- ESKOM APPOINTS UNIVERSITIES TO CREATE BASELINE METHODOLOGIES, TO VERIFY SAVINGS AND TO PRODUCE M&V REPORTS
- M&V FUNDED SEPARATELY OUT OF DSM FUND
- M&V PROTOCOLS DOCUMENT INSPIRED BY IPMVP, BUT ADAPTED TO ALSO PROVIDE FOR
  - WHEN ENERGY IS USED (TO M&V LOAD MANAGEMENT, LOAD CURTAILMENT)
  - HOW ENERGY IS STORED
  - WHAT LEVEL OF SERVICE IS ACTUALLY REQUIRES
  - IDENTIFICATION OF FACORS THAT DRIVE ENERGY CONSUMPTION
- SA PROTOCOLS RESULTED IN
  - LOWER TRANSACTION COSTS
  - MORE CREDIBLE AND ACCURATE REPORTS ON SAVINGS
- NEW METHODOLOGIES APPROVED BY M&V STEERING COMMITTEE

Energy Cybernetics

CLASSES OF MOTOR ENERGY EFFICIENCY PROJECTS

TYPICAL PROJECTS THAT DO QUALIFY FOR DSM FUNDING

(NOTE DSM PROJECTS NEED NOT BE ADDITIONAL)

- MONITORING, TARGETING AND ON-LINE CONTROL OF ENERGY CONSUMPTION
- OPTIMIZATION OF CONTROLS TO REDUCE SPECIFIC ENERGY
  - SWITCH OFF UNNECESSARY EQUIPMENT (e.g. IDLING MACHINES)
  - AVOID OPERATING OUT OF BEST EFFICIENCY ZONE
  - OPTIMIZE SET-POINTS IN PROCESSES
- TAKE ADVANTAGE OF PROCESS MEDIA STORAGE TO AVOID THROTTLING FLOW
- REPLACE WITH MORE EFFICIENT MOTOR SYSTEMS (INCLUDING VSD'S)
- SPECIFY MORE EFFICIENT SYSTEMS FOR NEW CONSTRUCTION

Energy Cybernetics

CLASSES OF MOTOR ENERGY EFFICIENCY PROJECTS

TYPICAL PROJECTS THAT DO NOT QUALIFY FOR DSM FUNDING

(THESE PROJECTS MAY BE ADDITIONAL, AND COULD BE CDM COMPATIBLE)

- REPLACING SYSTEMS WITH VSD'S WHEN THERE ARE HIGH RETROFIT COSTS, e.g. CIVIL WORKS
- REPLACING MOTOR DRIVEN SYSTEMS PREMATURELY
- PLANT OR PROCESS MODIFICATIONS TO INCREASE CAPACITY OR DE-BOTTLENECK
- VSD'S AND SPECIAL CONTROLS TO LIMIT FRICTION ENERGY CONSUMPTION ON CONVEYORS

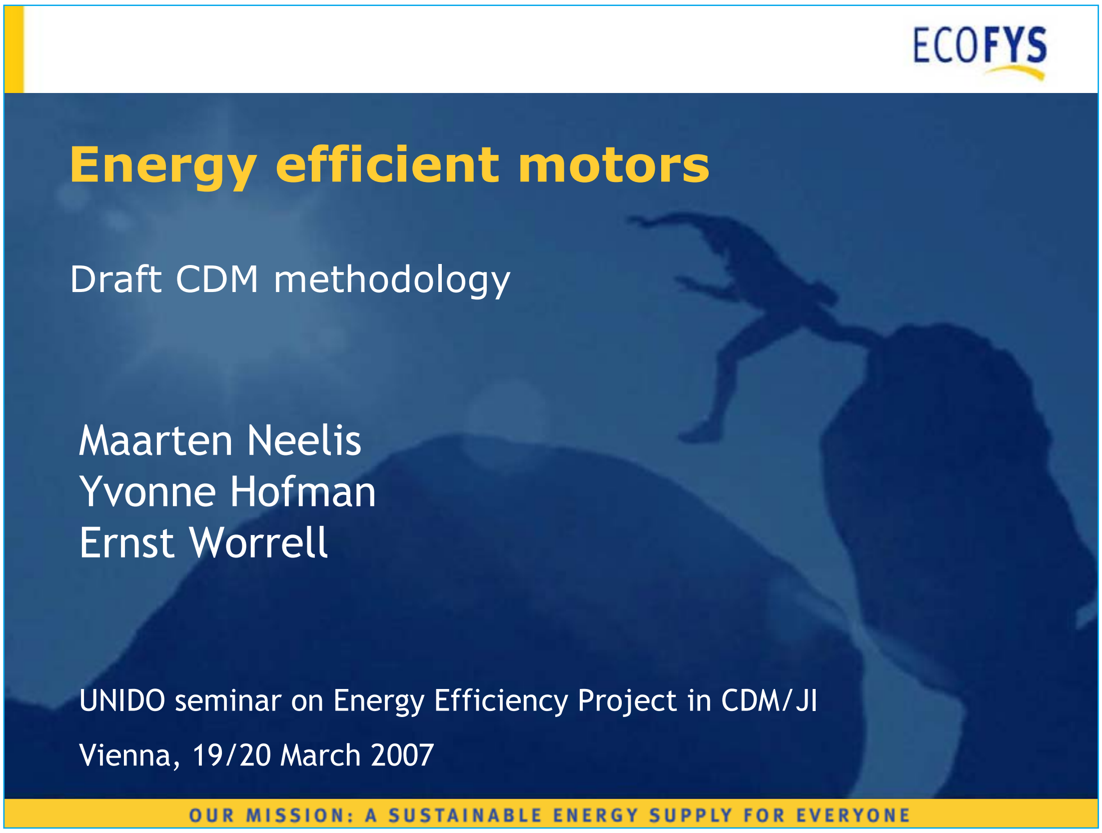
Energy Cybernetics

QUESTIONS?

Energy efficient motors: Draft CDM methodology

Mr. Maarten Neelis, Ecofys (motors)

Mr. Maarten Neelis, Consultant, Ecofys, outlined a methodology developed by Ecofys and funded by the Ministry of Economics, Trade and Industry of Japan for induction motors. He explained that the methodology was not developed for a specific project and had therefore not been submitted to the Methodology Panel. Neelis said the methodology involved determining a representative sample, and monitoring periods and using load-efficiency curves to assess minimum differences between efficiencies. He emphasized that the methodology would suit projects with many small motors functioning in the same way.



ECOFYS

Background and status

- Draft methodology prepared as part of project: “future CDM”, funded by METI, Japan
- Principles of baseline and monitoring methodology checked with motor experts
- Methodology not yet submitted to CDM-EB

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ECOFYS

Other ‘motor’ methodologies

- NM 0100: Electric motor replacement program in Mexico – Rejected (variable load issue)
- NM0159: activities to increase market penetration of EE appliances – Rejected (improper definition of system output)
- NM 0197: Accelerated replacement of electrical equipment – comparable approach, but how to determine “output” in non-chiller cases?

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Applicability 1/2

- Only AC induction motors
- Not for the introduction of Adjustable Speed Drive
- No fuel switching of electricity supply within project boundary
- Applicable to individual projects as well as programmatic CDM
- Only motor efficiency – no system improvements

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Applicability 2/2

No motor system improvements:

- Avoids difficulties in specifying the 'output' of the motor system (compare rejection NM 0159)
- Avoids difficulties in determining project boundary (other causes for system changes)
- But, the largest potential is in the motor systems!

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Baseline approach

- Approach 48b (economically attractive course of action) as this addresses that the most likely BAU motor procurement
- 48a: actual emissions do not apply as the motor in the baseline situation (in the case of end-of-life replacement) will not be implemented
- 48c:too complicated to assess 'similar' project activities

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Baseline methodology

- Distinction between end-of-life replacement and early replacement.
- Assessment of remaining lifetime of existing motor
- Division of motors into categories by size and purpose: baseline for each category
- Possible scenario's:
  - Project without CDM
  - Continuation of current situation including BAU
- Barrier and investment analysis
- Common practice analysis:
  - Individual projects & Programmatic projects

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Possible barriers

- Risks due to new technology
- Lack of skills of employees
- Fail of motors needs quick solutions: repair or BAU new motor
- Company motor specification reduce options

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Emission reductions

1. Determine representative sample
2. Determine reasonable monitoring periods (depending on load characteristics)
3. Monitor electricity use and determine load using **load-efficiency curve**
4. Use **load-efficiency curve** of BL motor to estimate electricity use of BL motor at this load and calculate emission reductions
5. Extrapolate to total motor population

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Emission reductions (motors with ASD)

- Load-efficiency curve does not apply due to ASD
- Our approach: use curves to assess minimum difference between efficiencies of baseline and project motor
- Very conservative approach

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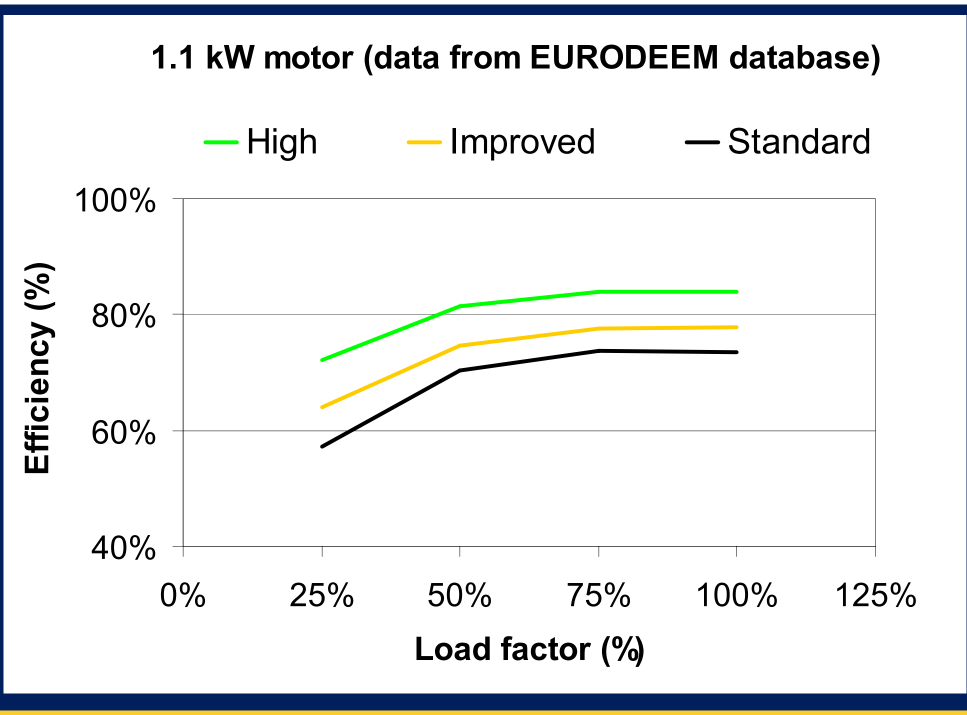

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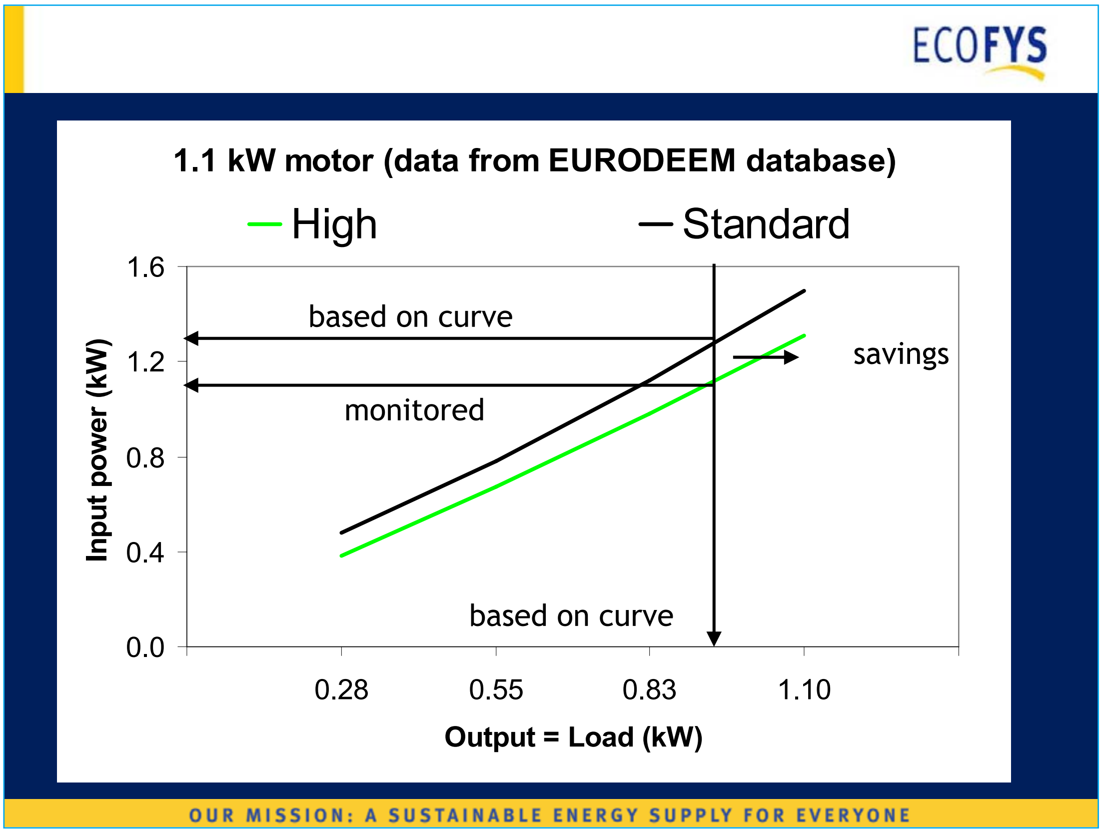

ECOFYS

Required monitoring

- Variables to be monitored:
  - T_motor: operating hours per monitoring period
  - EC_motor: electricity consumption during monitoring periods (data logging equipment)

- Variables not monitored:
  - NPC: nameplate capacity of motor
  - Efficiency project motor (determined based on curve)
  - Efficiency baseline motor (determined based on curve)

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ECOFYS

Methodological challenges 1/2

1. Will the use of load-efficiency curves be accepted (accuracy)
2. Actual design of the sampling method
3. How to determine suitable amount of monitoring periods (comments NM0197)
4. Determining normal replacement practice (rejection NM0159)
5. Limited potential per motor – Required project size

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ECOFYS

Methodological challenges 2/2

Replacing 400 motors (75 kW) results in annual savings of 26 GWh and reductions of 30 kton CO_2 assuming:

- Full load operation
- Indian grid electricity (900 ton / GWh)
- 10% savings for each motor

Preferred projects (also in view of monitoring):

- Projects with relatively few large motors
- Projects with many small motors doing the same thing

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Energy efficient motors

Draft CDM methodology

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Energy efficient motors: Key considerations in their application

Prof. Anibal T. de Almeida, University of Coimbra

Mr. Aníbal De Almeida, Professor, Coimbra University, discussed the application of energy efficient motors. He pointed out that improvements in efficiencies in electric motor systems could save up to 1.25 megatons (Mt) of carbon dioxide per year, with medium and large scale motors com prising the majority. He noted the importance of, inter alia, harmonization of electric motor efficiency standards; technology transfer; correct motor sizing; and full analysis of the systems in which electric motors are installed.

Energy Efficient Motors –

Key considerations in their application

UNIDO, Vienna, March19-20,2007

Anibal de Almeida
University of Coimbra

Global electricity consumption for industrial motors

	Unit	Value
Electricity production global (2006)	TWh/a	19.000
Electricity for industrial motors (40% of total consumption)	TWh/a	7.400
Capacity for electric motors (peak)	TWe	1.6 to 2.3
Motor electricity, greenhouse gas emissions	Mt CO2/a	4.300
Motor system energy efficiency improvement potential (average within life cycle 10..20 years)	Range 20-30%	25%
Electricity savings potential	TWh/a	1.850
Greenhouse gas emission reductions potential	M t CO2/a	1.250
Electricity cost savings potential (industrial end-users)	Billion Euro/a	100

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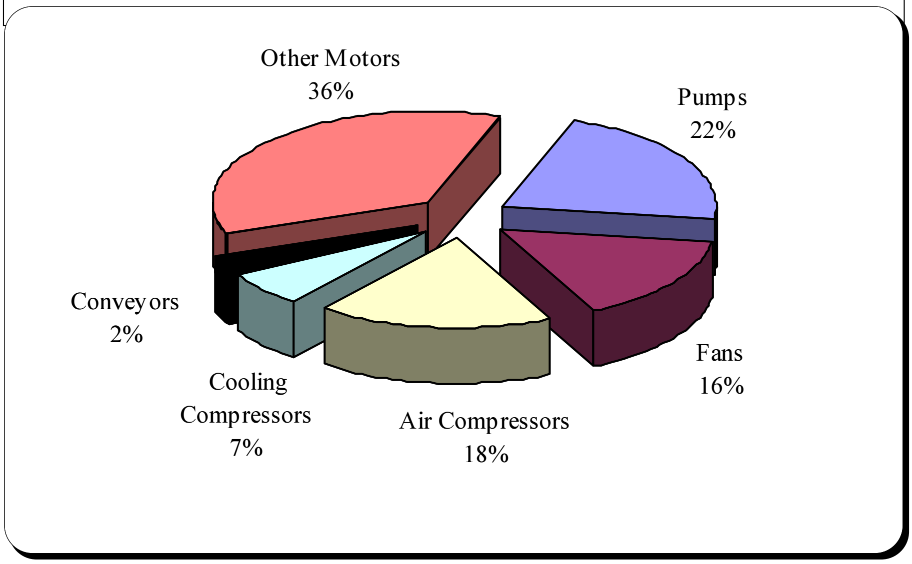
Disaggregation of motor electricity consumption by end-use, in the Industrial sector



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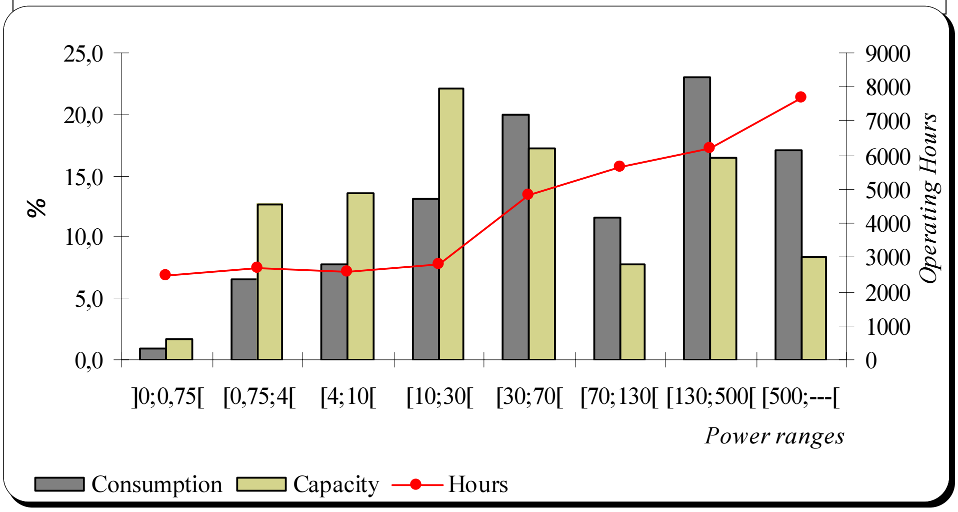
Motor Electricity Consumption by power range in the industrial sector



Electric Motor System – Key Factors:

-Power quality;
-Motor selection;
-Motor controller (VSDs);
-Transmission ;
-End-use device (e.g. Pump, fan, etc)
-System and design
-Type of process
-Maintenance practices

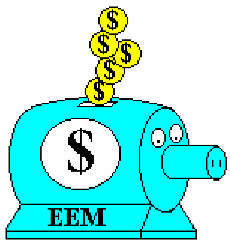
INDUCTION MOTORS - Lifecycle Cost

-In Industry, an induction motor can consume per year an energy quantity equivalent to 5-10 times its initial cost, along all its lifetime of about 12-20 years, representing 60-200 times its initial cost.

-This fact justifies a life-cycle cost (LCC) analysis including the repair/maintenance.

ENERGY EFFICIENT MOTORS

- HIGHER EFFICIENCY (2-8% MORE);
- THEY CAN REDUCE ENERGY BILLS AS WELL AS THE MAINTENANCE COSTS;
- MORE MATERIAL OF HIGHER QUALITY – MORE EXPENSIVE (25-30%);
- LONGER LIFETIME (LOWER OPERATING TEMPERATURE);
- TYPICALLY, LOWER STARTING TORQUE (DEPENDS ON THE ROTOR SLOT SHAPE);
- HIGHER STARTING CURRENT (DEPEND ON STARTING TORQUE);
- LOWER SLIP- MAY REDUCE SAVINGS;
- HIGHER ROTOR INERTIA.



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Barriers to application of energy efficient motors

- Market structure (OEM market)
- Efficiency of low importance
- Ambiguous definition of motor efficiency

  Efficiency Testing and Classification
- Motors not interesting
- Split budgets
- Stocks of old motors
- Company motor specifications
- Repair of failed motors
- Economical factors (e.g. capital)

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Efficiency testing standards

- **IEEE 112-B (2004)**

  -North America and Latin America.

- **IEC 60034-2 (1996)**

  -Europe and part of Asia

- **JEC 37**

  -Japan

- **AS 1359.102**

  -Australian Std.

- **IEC 60034-2 (CDV Ed.4/2, 2006).**

  -Allows three different test methods to obtain the motor efficiency:

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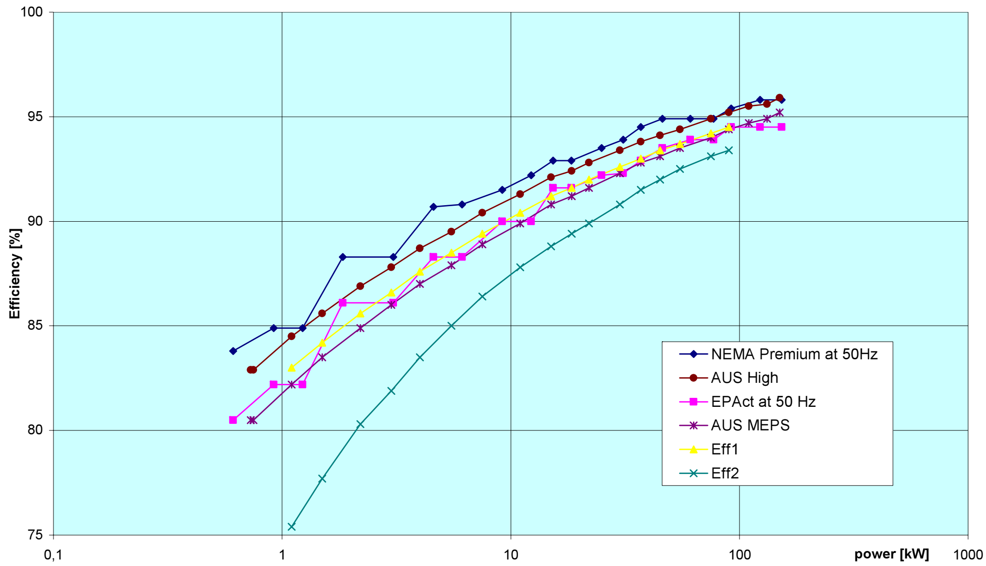
Comparison of Minimum Efficiency Requirements in Different Parts of the World



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Harmonization of efficiency classification standards in the World

IEC is now developing a classification standard trying to harmonize different requirements for induction motors efficiency levels.
Efficiency and losses shall be tested in accordance with revised IEC60034-2.

IEC 60034-30 Energy Efficiency Classes
Four efficiency classes are being proposed:
- Class ***: Premium efficiency (16-20% lower losses than class B)
- Class **: High efficiency (existing Eff1, EPAct)
- Class *: Improved efficiency (existing Eff2)
- Class : Standard efficiency (existing Eff3)

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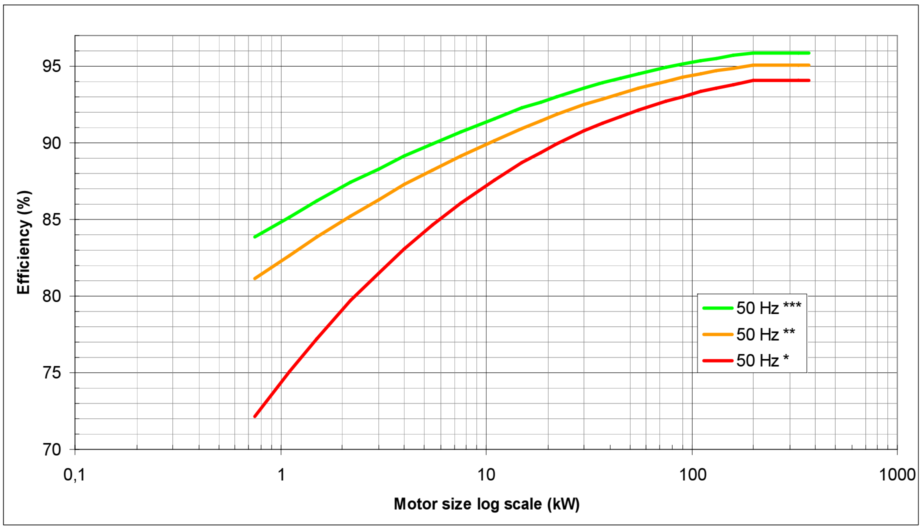
Proposed new IEC 60034-30 Energy Efficiency Classes 0.75 kW - 370 kW (4-poles, 50Hz)



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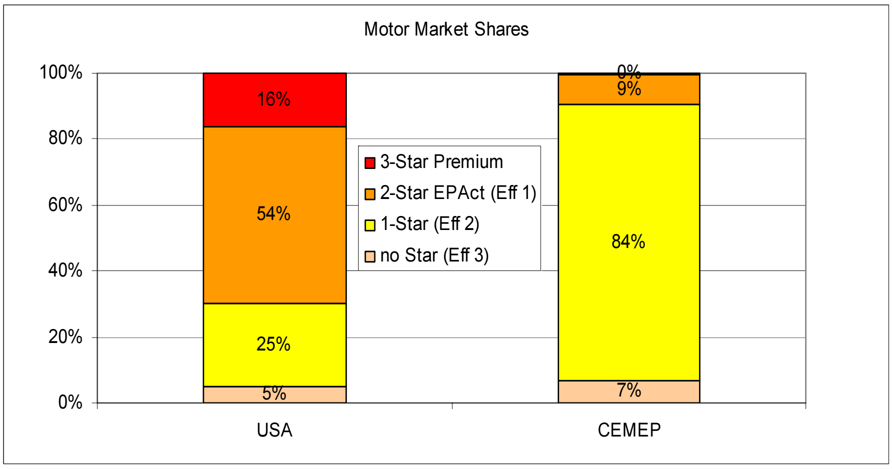
Motor Markets in USA and Europe: New motors sold with energy efficiency classes (2005)



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SEEEM (Standards for Energy Efficiency of Electric Motor Systems)

- Market transformation strategy to promote efficient industrial electric motor systems worldwide;
- Harmonize energy efficiency testing procedures, efficiency classes and marking schemes for motors;
- Introduce a timeline for mandatory minimum energy performance requirements for motors and harmonize them at a high efficiency level;
- Promote best practice and coordinate measures to achieve efficient motor systems.

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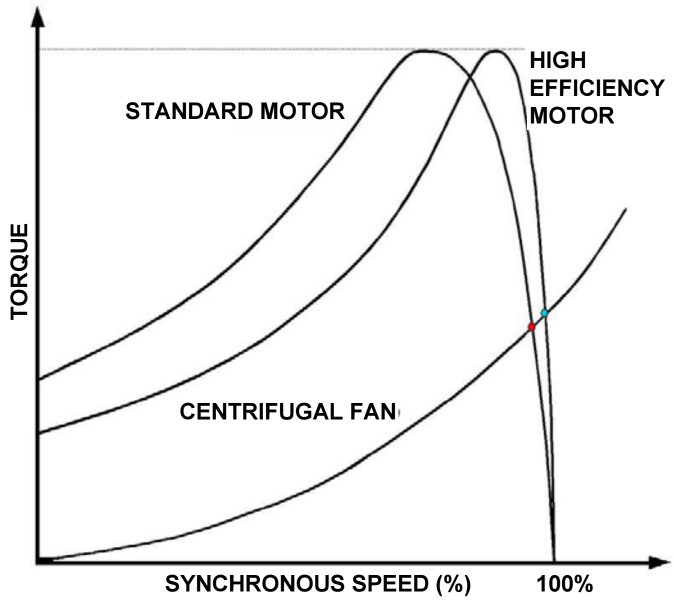
Upgrading to an EEM may not bring the expected benefits – May even lead to higher consumption!



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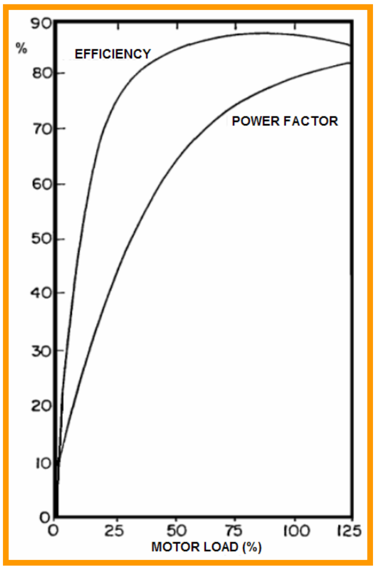
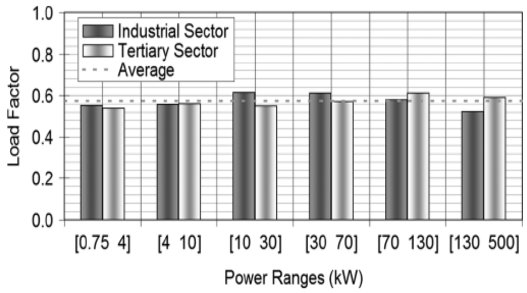
MOTOR OVERSIZING



DESADVANTAGES:

- HIGHER CAPITAL COST (MOTOR AND COMMAND AND PROTECTION EQUIPMENT);
- LOWER MOTOR EFFICIENCY AND POWER FACTOR;



AVERAGE LOAD FACTOR BY POWER RANGE, IN NDUSTRY AND TERTIARY SECTOR, EUROPEAN UNION, 2000.

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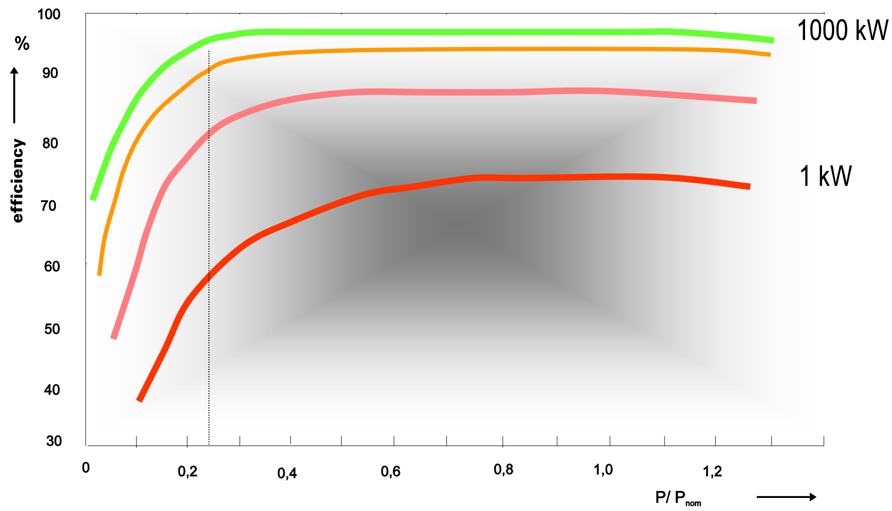
Efficiency of AC induction motors



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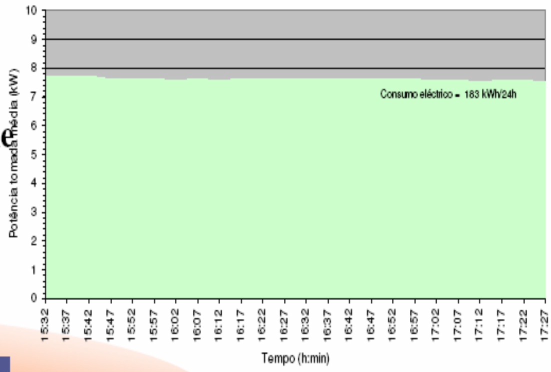
Inventory of some analysed motors of flyer machines for twisting

Machine No.	Power rate (kW_m)	Average power demand (kW_e)	Average power factor	Operation hours (h/year)	Transmission type	Load factor (%)	Duty
TORCEDORES							
3	36,7	22,1	0,65	7896	Flat belt	55,4	Two phases twisting
15	30	26,4	0,79	7896	Flat belt	80,1	Twisting
16	30	7,7	0,44	7896	Flat belt	23,4	Twisting
17	30	6	0,35	7896	Flat belt	18,2	Twisting

Electric consumption profile of flyer machine no. 16



Supported by Intelligent Energy Europe

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Power Quality Factors

- Voltage magnitude
- Voltage unbalance
- Harmonic distortion

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Economical Product Life

Average motor life (including repairs)

Power range	Average life – years
1.0 – 7.5 kW	12
7.5 – 75 kW	15
75 – 250 kW	20

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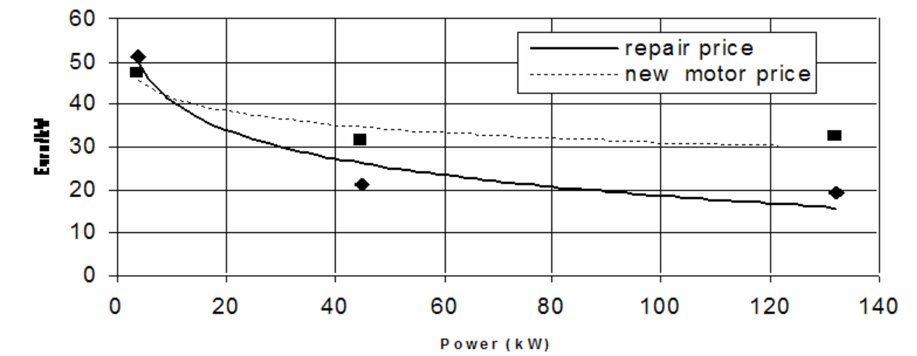
Repair and maintenance costs

Motor larger than 5 kW are normally repaired when they fail. For small motors it is not in general economical to repair them.

A motor is normally repaired at least 2 times during its lifetime but this can happen up to 4 times.

Comparison between repair prices and new motor prices



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Motor Repair/Maintenance

-In the EU Motors are repaired 2-3 times, more times in Developing Countries
-Similar market size (€) to new motors
-Motor repair practices may reduce motor efficiency typically between 0.5 and 1%, and sometimes up to 4%.
-Issue particularly relevant in Developing Countries

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INDUCTION MOTORS - REPAIR/MAINTENANCE

What happens during repair ?
-Extraction of old windings
-Uncorrect rewinding

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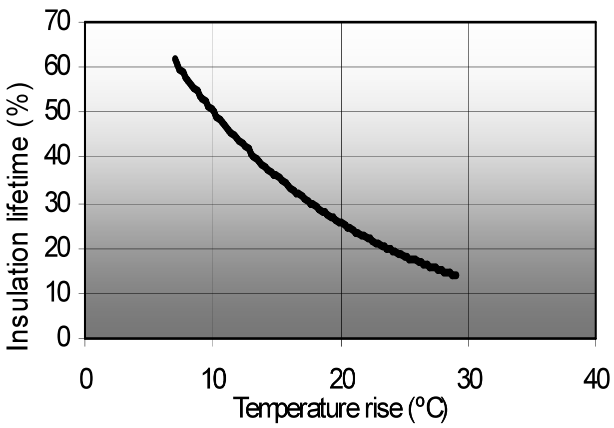
INDUCTION MOTORS - REPAIR/MAINTENANCE

Impact of repair in motor Lifetime and operating cost



Lifetime versus temperature rise above the maximum permissible temperature of the material used.

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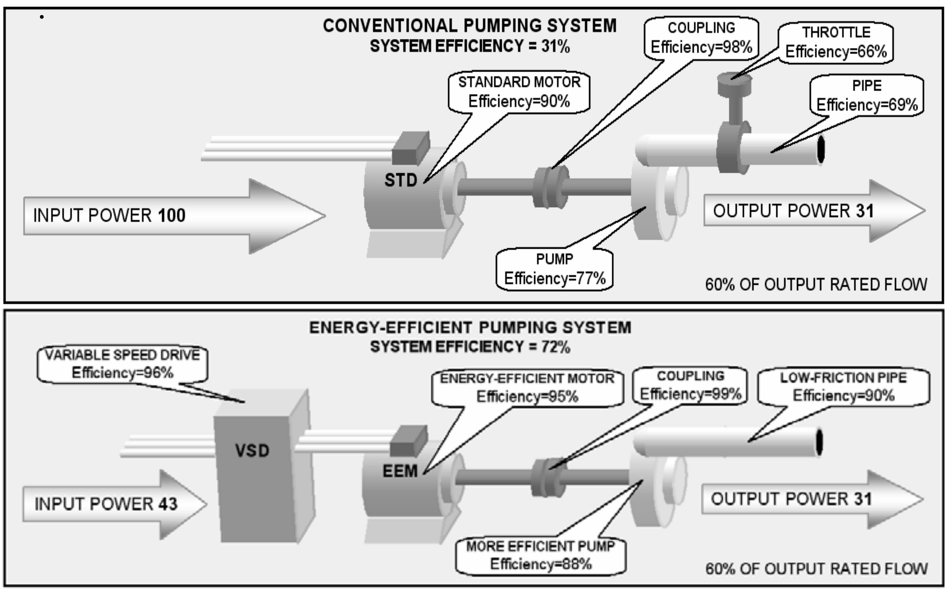
Pumping installation – Looking at whole system



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EUROPEAN GUIDE TO PUMP EFFICIENCY FOR SINGLE STAGE CENTRIFUGAL PUMPS

http://energyefficiency.jrc.cec.eu.int

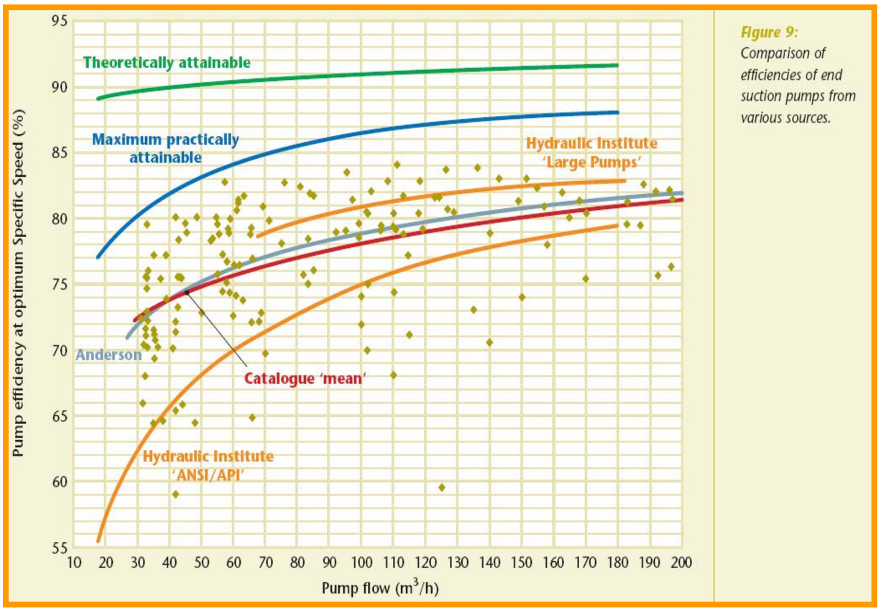

Figure 9: Comparison of efficiencies of end suction pumps from various sources.

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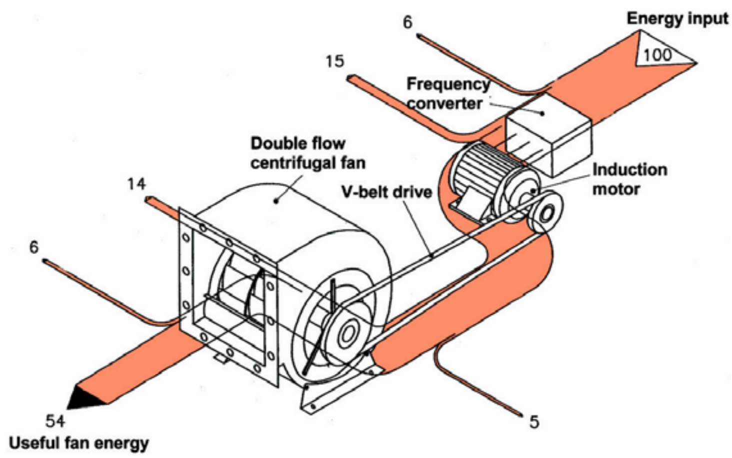
Fans systems are more than a fan

-Fan Saving Potential is about 5 to 10 %;
-Fan System Saving Potential is about 17.5 %;



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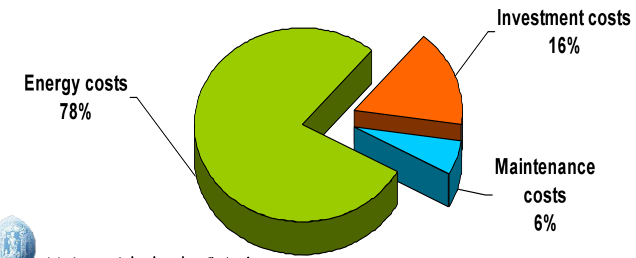
Compressed Air Systems (CAS)

- More than 321 000 Compressed Air Systems (CAS) are commonly used in the industrial and service sectors,
- Compressed air accounts for 10% of industrial consumption of electricity
- Compressed air systems often have poor energy efficiency: possible energy savings are in the range from 5% to 50%
- Potential average savings 25%



Assumptions

Power 110 kW
Equipment life 15 years
Operating hours 4000 h/year
Electricity price 5 c€/kWh

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8.2 Discussions

Ms. Anne Arquit Niederberger observed that there are clear barriers to energy efficiency CDM projects and said top-down guidance is required from the CDM EB on the specific information it requires for demonstrating the barriers to energy efficiency. She cautioned that methodologies appear to be being developed to fit the demands of the Methodology Panel and that a systems approach is not being taken.

9. Discussion Groups

Participants divided into five groups to consider the following topics: PoAs and energy efficiency projects (Group 1); energy efficiency projects and methodology issues (Group 2); combined heat and power (CHP) projects and the CDM (Group 3); linking chiller demonstration projects under the Montreal and Kyoto Protocols (Group 4); and linking energy efficiency projects to the CDM and JI (Group 5). Late Tuesday afternoon, representatives from each group reported back to all seminar participants.

9.1 Group 1: Programmes of activities and energy efficiency

Mr. Patrick Matschoss outlined three issues the group had identified for PoAs: that allowances are necessary for economic and technical frameworks within which proposed PoAs take place, for example, energy tariffs and grid emission factors; the need for further guidance from the CDM EB as to the restriction of a single technology to PoA projects; and the need for support to obtain assistance for appliance labelling as an energy efficiency programme.

Mr. Chia-Chin Cheng, with the UNEP Risø Center on Energy, Climate and Sustainable Development, submitted the following presentation.

Energy Efficiency Potentials in End-Use Consumptions in China

UNIDO Industrial Energy Efficiency Projects in the CDM and JI

Chia-Chin Cheng

UNEP Risø Center on Energy, Climate and Sustainable Development

UNEP RISØ CENTRE

UNEP RISØ 1

UNEP RISØ

Energy Efficiency Potentials in Electricity End-Use in China

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Why Electricity End-Use

- Electricity sector is the largest carbon emitter
- Electricity demand has been growing at 10 % per year
- 98% electrification rate,
  -- links to almost all aspects of economic activities & human livelihood
  – includes main and dispersed consumptions

	1971	2000	2010	2030	Average annual growth 2000-2030 (%)
Coal	192	659	854	1,278	2.2
Oil	43	236	336	578	3.0
Gas	3	30	57	151	5.5
Nuclear	0	4	23	63	9.3
Hydro	3	19	29	54	3.5
Other renewables	0	1	4	9	6.8
Total primary energy demand	241	950	1,302	2,133	2.7

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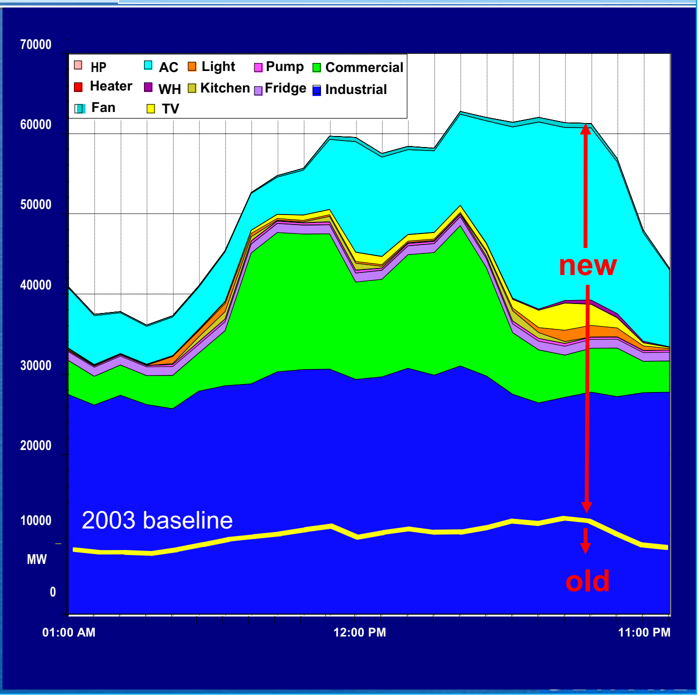
UNEP RISØ

What constitutes the future demand

- **Electricity demand is quadrupled by 2024**
- **Annual CO2 emissions reaches 300 MT, 70% from new demand**
- **Industrial sector demand is still a big portion**
- **Household and services sector demand will constitute nearly half; largest portion is from AC/Heating demand**



Summary of Electric Energy Saving Potentials

Source: Wu, 2003, Shanto Power Plant, Shanxi

		Cumulative Total GWh Saving till 2024	Peak Load Saving at 2024	600 MW Power Units Saved	Carbon Saving Potential Shandong	Carbon Saving Potential China
EE Options	Categories	%	%	#	MT CO2	MT CO2
Household	Appliances	1%	1-2%	2	50	700
	Buildings	1%	2-4%	5	50	700
	App. +Buildings	2%	4-5%	6	85	1200
	Behavior Change	add 3-6%	add 2-5%	8-11	100-230	1400-3200
Industrial	Motor Driven Equip	5%	3-5%	5	220	3000
Commercial	AC/HP+Buildings	1-2%	7-9%	13	90	1200
combined	Total	12-15%	14-15%	38-41	580	8000

Priorities of Energy Efficiency Improvement

- Regulating new installation first
- Improving building technology
- Aggressive industrial energy efficiency measures & industrial structural change
- Designing behavioral and operational measures along with technological improvement
- Combining with urbanization policies
- Improving appliances efficiency

RISØ

Chinese Energy Efficiency Policies

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China's National Energy Efficiency Plan

- The 11th Five-year Plan (2006-2010): reducing the energy intensity per GDP by 20%;
- *2020 Energy Conservation Plan*: China plans to double its energy consumption as its economy quadruples by 2020 on the 2002 level.
- 40% reduction in the CO_2 emission intensity per GDP by 2020, 80% drop by 2050 (both on 2000 basis)

10 Priority Areas of Chinese EE policy – Electricity & Others

- Motor engine system energy saving program;
- Building energy-saving program;
- Green lighting program;
- Regional heat and electricity co-generation program;
- Energy system optimization program;
- The coal-fired industrial boiler renovation program;
- Waste heat and waste pressure capture and using program;
- Oil saving and replacement program;
- The program of energy-saving in governmental agencies
- The program of energy-saving monitoring and technical service system establishment

Industrial sector EE policy --Targeting big players and outdated technologies

- 1000-enterprise action- targeting big players
  - Identified 1008 industrial enterprises in 9 energy-intensive industries, e.g. iron and steel, metallurgical, coal, electricity, oil and petrochemical, chemicals, building material, textile, and paper.
  - These 1008 industrial enterprises' total energy consumption in 2004 was 670 million toc, account for 33% of China's energy consumption and 47% of the energy consumption by the industrial sector.
- Mandatory early elimination of low efficiency and out-dated production capacity
  - in 13 energy-intensive industries (iron & steel, aluminium, cement)

UNEP RISØ

Realizing Energy Efficiency Potentials through CDM

UNEP RISØ CENTRE

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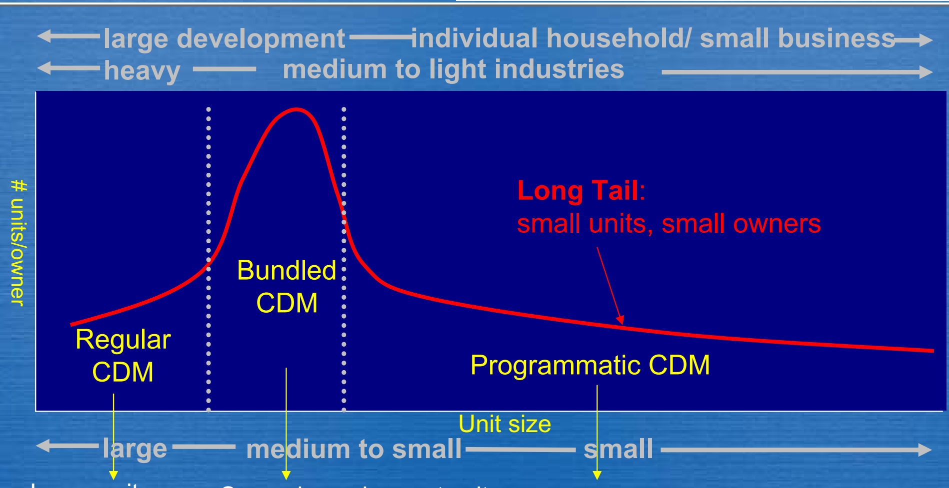
Harnessing the full potentials of energy efficiency- various CDM schemes



- Large units
- Large site
- Single owner

- Several conglomerate sites
- Temporally concentrated
- Limited # of owners
- Known committed owners
- Combine EE measures

- Small to medium-size units
- Geographically dispersed
- Temporally dispersed
- Large quantity of owners
- Unknown committed owners
- Combine EE measures

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Further discussion to realize EE potentials in CDM framework

- Interplay between standards and regulations v.s P-CDM
  - Important for new installations for perspective into the future
  - Non-compliances from the tail
  - New rules allow P-CDM if local policies not enforced
  - Mandatory v.s. voluntary
  - Proving additionality– source of struggle
  - Affecting regulation of government- incentive & implementation
  - Can P-CDM & government climate policies facilitate each other?
- Combine methodologies
  - Reduced trouble for small owners
  - Reduced costs
- Include soft measures
  - Technology based
  - Devil is in detail, in day-to-day operation

Energy Efficiency through P-CDM in China

- URC is actively exploring new ideas of EE projects under P-CDM framework, one recent activity is through a project in China
- Project: TA sponsored by DANIDA, implemented by URC and local partners in China
- Time-frame: March. – Feb. 2007, so far MOU signed between DANIDA and Chinese government, detailed working plans are under drafting, kick-off meeting planned in early March.
- Contents: the potential and feasibility of P-CDM implementation in China, focusing on 3 case studies: one is about industrial EE. URC's role is keeping track of P-CDM rule changes, implementation progress, and international research about P-CDM to help with CDM policy making and local capacity building.

UNEP

RISØ

Thank You

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Report on discussion group

Mr. Patrick Matschoss

The discussion group considered the very new approach of programmes of activities (PoAs) in the CDM. The Group exchanged their views on a number of issues in a fruitful discussion.

The implementation of CDM activities under a programme of activities (PoA) may reduce some barriers to energy efficiency but not all. Energy efficiency requires a conducive economic environment. This environment relates to (*a*) electricity tariffs and related subsidies, (*b*) the size of the emission factors and (*c*) the capacity to recover cost. Electricity tariffs need to be sufficiently high in order to create an economic incentive for energy efficiency. Subsidies on electricity may make energy efficiency projects unviable. High emission factors (through low grid efficiency and/or high shares of fossil fuel in the fuel mix) result in higher generation of CER per unit of end-use energy saved and therefore make efficiency projects more viable. The last issue relates to illegal access to the grid. If electricity users do not pay for the electricity in the first place, there is no incentive to invest in energy efficiency measures. Therefore, cost recovery is essential. These conditions for successful energy efficiency project activities apply to "normal" CDM projects as well as to PoAs. That is, PoAs too work only under certain circumstances that relate to the general economic framework. PoAs may be particularly useful if they lead to enhanced cost recovery.

The restriction to one technology in PoAs is perceived as a barrier. Increasing end-use energy efficiency often relates to dispersed micro-activities (light bulbs, refrigerators, air conditioning, insulation etc.). Currently, distinct baseline and monitoring methodologies are required for each technology in order to be able to prove the additionality of the respective technology or measure. Furthermore, there is no definition of the term "technology". An alternative would be the implementation of several technologies as a package. A standardized package of technologies as a "typical" project activity under a PoA would enable emission reductions to be attributed to this package. This would reduce transaction costs and increase the financial viability of PoAs. Among the participants of the discussion group there was a perceived need for further guidance from the CDM Executive Board on this issue. Metering was regarded as prerequisite in order to measure electricity savings. At the same time it was also considered as an obstacle as metering is not widespread in many developing countries.

Policies as a PoA have been ruled non-eligible by COP/MOP as actions where considered non-additional in the event of binding legislation. However, legislation is often not enforced. Therefore, participants of the discussion group generally welcomed the specification of the CDM Executive Board that the actual implementation of an otherwise not enforced legislation is additional and may be therefore eligible.

Labelling under the CDM. Labelling refers to the provision of information on energy use of, for instance, appliances. Among the participants, labelling was felt to be a vital measure to increase the uptake of energy efficient equipment. However, there has been a very recent rejection of a methodology that introduces the labelling of air conditioners as a CDM activity. Participants in the discussion group attributed this to the problem of being unable to prove cause-and-effect relationships when submitting CDM methodologies. It was felt that the ability to do so is vital when submitting

CDM methodologies. However, the ability to show these cause-and-effect relationships is particularly difficult in the labelling of energy-using appliances since it relates to measuring behavioural change.

Taken together, many participants in the group felt that PoAs may make an important contribution to the increased uptake of energy efficiency in the CDM. However, the instrument is still new. In addition, there are still some clarifications necessary in order to unfold the full potential of PoAs.

9.2 Group 2: Energy efficiency methodology issues and tools

Mr. Robert Novak, UNIDO, explained the Computer Model for Feasibility Analysis and Reporting (COMFAR) tool developed by UNIDO, which assesses the feasibility of projects based on cash flows and which can be used in additionality assessments.

COMFAR *III Software*

Computer Model for Feasibility Analysis and Reporting

UNIDO's methodology for project preparation and appraisal

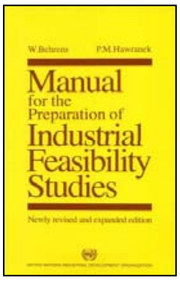
COMFAR Team, PTC/ITP/IPU
2007

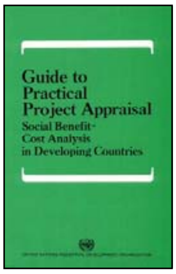
COMFAR *III* – what it is

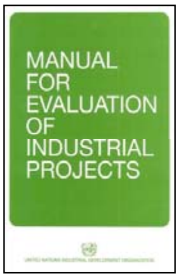
COMFAR *III Software* is cash-flow oriented computer model to facilitate the financial and economic appraisal of investment projects.

COMFAR *III* – Common features

- Manual for the Preparation of Industrial Feasibility Studies;
- Guide to Practical Project Appraisal;
- Manual for Evaluation of Industrial Projects.







COMFAR *III* – Common features

- COMFAR *III Expert* is a comprehensive and flexible software, based on more than 20 years of experience;
- Through continuous development COMFAR *III* has been expanded to cover not only industrial, but also agro-industrial, infrastructure, tourism, mining projects, as well as projects complying with the Kyoto Protocol (CDM/JI);
- It can be applied to 'New projects', 'Existing projects' (Expansion, Rehabilitation) as well as 'Joint-ventures';
- Available in Arabic, Chinese, Croatian, Czech, English, Farsi, French, German, Indonesian Bahasa, Italian, Japanese, Korean, Polish, Portuguese, Russian, Serbian, Slovak, Spanish;
- Three products to serve different needs:

  COMFAR *III* Expert

  COMFAR *III* Business Planner

  COMFAR *III* Mini Expert
- world-wide more than 5,000 users.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

COMFAR *III Expert* – what it is

- COMFAR *III Expert* enables the detailed financial and economic appraisal of investment projects;
- COMFAR *III Expert* may be adjusted to the special characteristics of the project to be analyzed, by expanding its standardized basic structure to the needs of the analyst;
- COMFAR *III Expert* produces detailed and standardized financial and economic statements;
- COMFAR *III Expert* supports the analyst through a powerful *Sensitivity analysis module*.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

COMFAR *III Expert* – main features

Flexibility is ensured through:

- Variable planning horizon (up to 60 years);
- Variable time structure for construction & start up phase;
- Up to 20 main products may be distinguished;
- Data may be entered in up to 20 currencies;
- Up to 20 joint-venture partners may be defined;
- Price escalation and/or inflation option may be applied;
- User-defined breakdowns for investment, operating and marketing costs, as well as for sources of finance (loans, equity shares and grants) may be defined;
- Economic analysis option is available.

COMFAR *III Expert* – CDM/JI Module

For the support of financial analysis of investment projects additional features have been incorporated into COMFAR *III*:

- Investment Ranking Test;
  - Up to 5 projects (alternatives) may be ranked according to relevant indicators (e.g.: IRR, NPV, Benefit-Cost Ratio, Unit costs)
- Carbon credit definitions:
  - Product definitions;
  - Definition of CDM related investment cost (transaction costs);
  - Definition of CDM related operating costs (monitoring costs);
  - Definition of the Sales programme for emission reductions;
- Incremental analysis;

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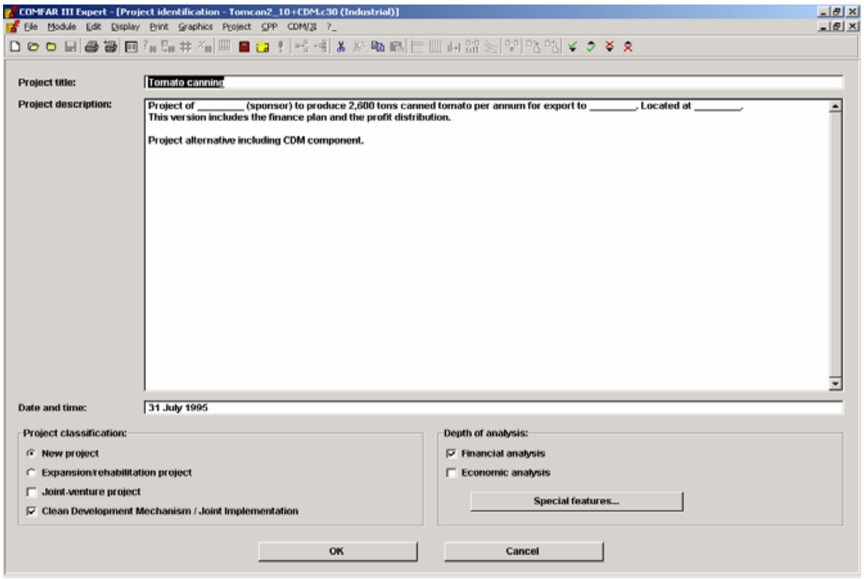
COMFAR *III Expert* – CDM/JI Module



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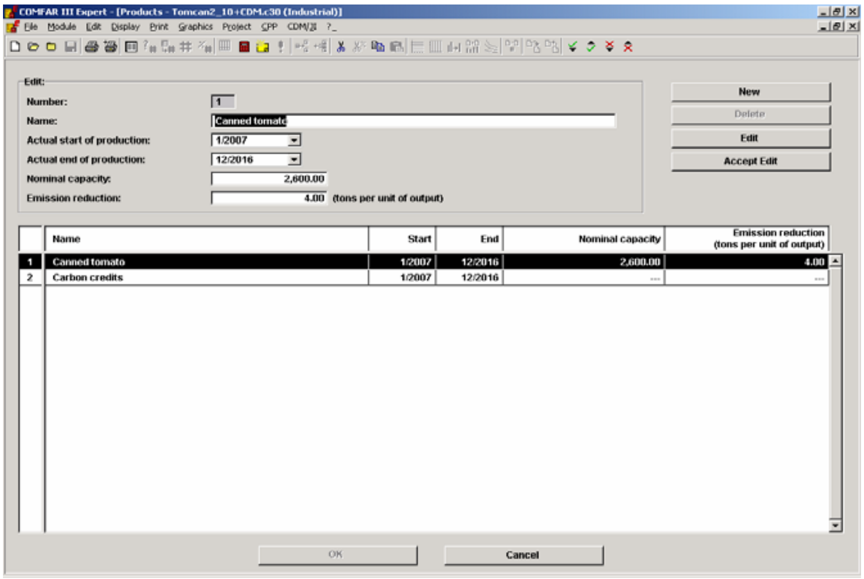
COMFAR *III Expert* – CDM/JI Module



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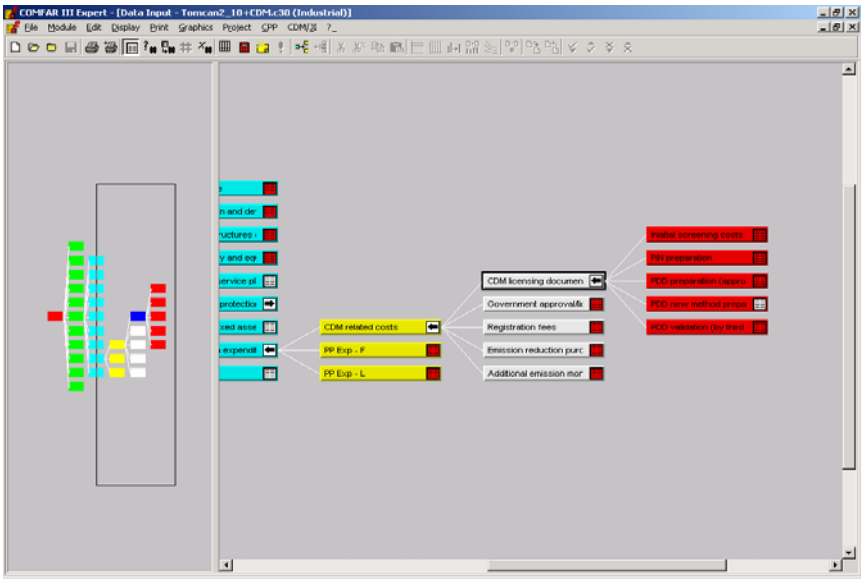
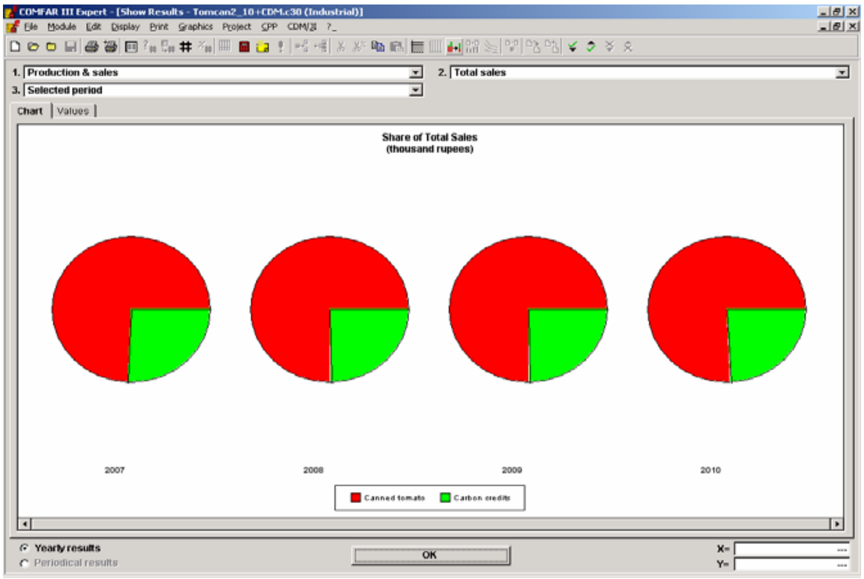
COMFAR *III Expert* – CDM/JI Module



COMFAR *III Expert* – CDM/JI Module



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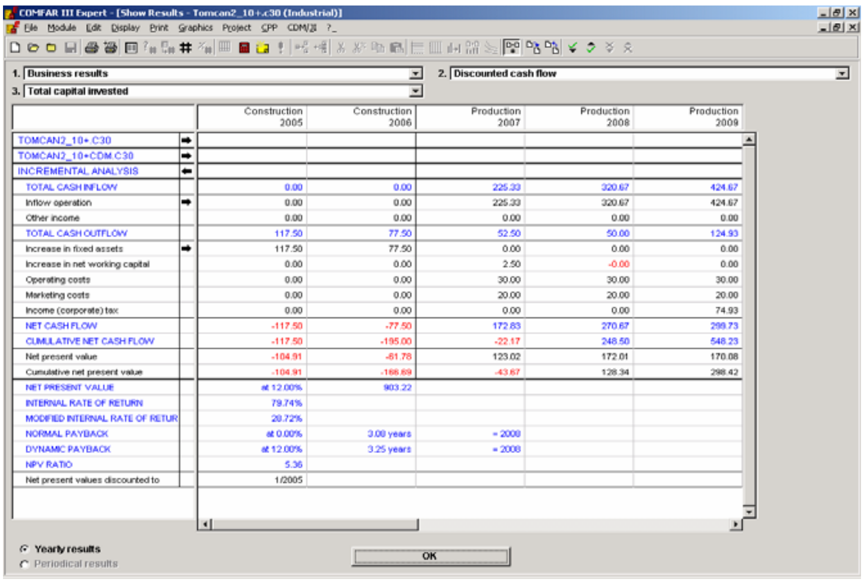
COMFAR *III Expert* – CDM/JI Module



	Construction 2005	Construction 2006	Production 2007	Production 2008	Production 2009
TOMCAN2_10+.C30					
TOMCAN2_10+CDM.C30					
INCREMENTAL ANALYSIS					
TOTAL CASH INFLOW	0.00	0.00	225.33	320.67	424.67
Inflow operation	0.00	0.00	225.33	320.67	424.67
Other income	0.00	0.00	0.00	0.00	0.00
TOTAL CASH OUTFLOW	117.50	77.50	52.50	50.00	124.93
Increase in fixed assets	117.50	77.50	0.00	0.00	0.00
Increase in net working capital	0.00	0.00	2.50	-0.00	0.00
Operating costs	0.00	0.00	30.00	30.00	30.00
Marketing costs	0.00	0.00	20.00	20.00	20.00
Income (corporate) tax	0.00	0.00	0.00	0.00	74.93
NET CASH FLOW	-117.50	-77.50	172.83	270.67	299.73
CUMULATIVE NET CASH FLOW	-117.50	-195.00	-22.17	248.50	548.23
Net present value	-104.91	-61.78	123.02	172.01	170.08
Cumulative net present value	-104.91	-166.69	-43.67	128.34	298.42
NET PRESENT VALUE	at 12.00%	903.22			
INTERNAL RATE OF RETURN	79.74%				
MODIFIED INTERNAL RATE OF RETUR	28.72%				
NORMAL PAYBACK	at 0.00%	3.00 years	= 2008		
DYNAMIC PAYBACK	at 12.00%	3.25 years	= 2008		
NPV RATIO	5.36				
Net present values discounted to	1/2005				

COMFAR *III Expert* – Training

- Training workshops (Basic and Advanced levels) are conducted twice a year at UNIDO Headquarters in Vienna. The next workshops are scheduled for:

  Basic level: 16 – 20 April 2007

  Advanced level: 23 – 27 April 2007

- On request, workshops on COMFAR *III* can be organized at the premises of the customer.

COMFAR *III Expert* – Testing

The COMFAR *III Software* may be tested by:

- downloading *Demonstration versions* free of charge from UNIDO's Homepage:

www.unido.org/comfar

www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

COMFAR *III Expert* – Contact

- Further information about the COMFAR *III Software* may be obtained through:

Web:	www.unido.org/comfar	
Email:	comfar@unido.org	
Tel:	(+43 1) 26026;	Ext: 3877, 4066 (administrative matters)
		Ext: 3840, 3855 (technical matters)
Fax:	(+43 1) 26026;	Ext: 6807

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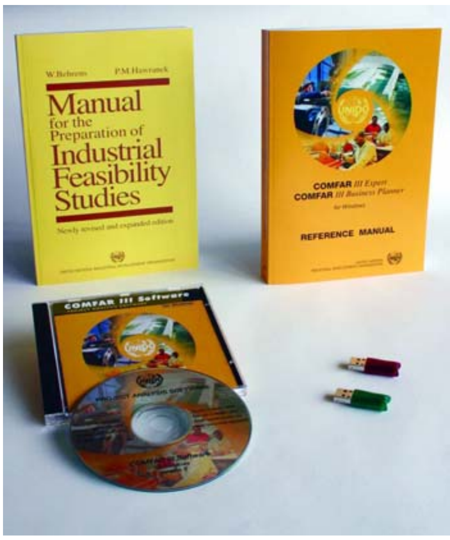
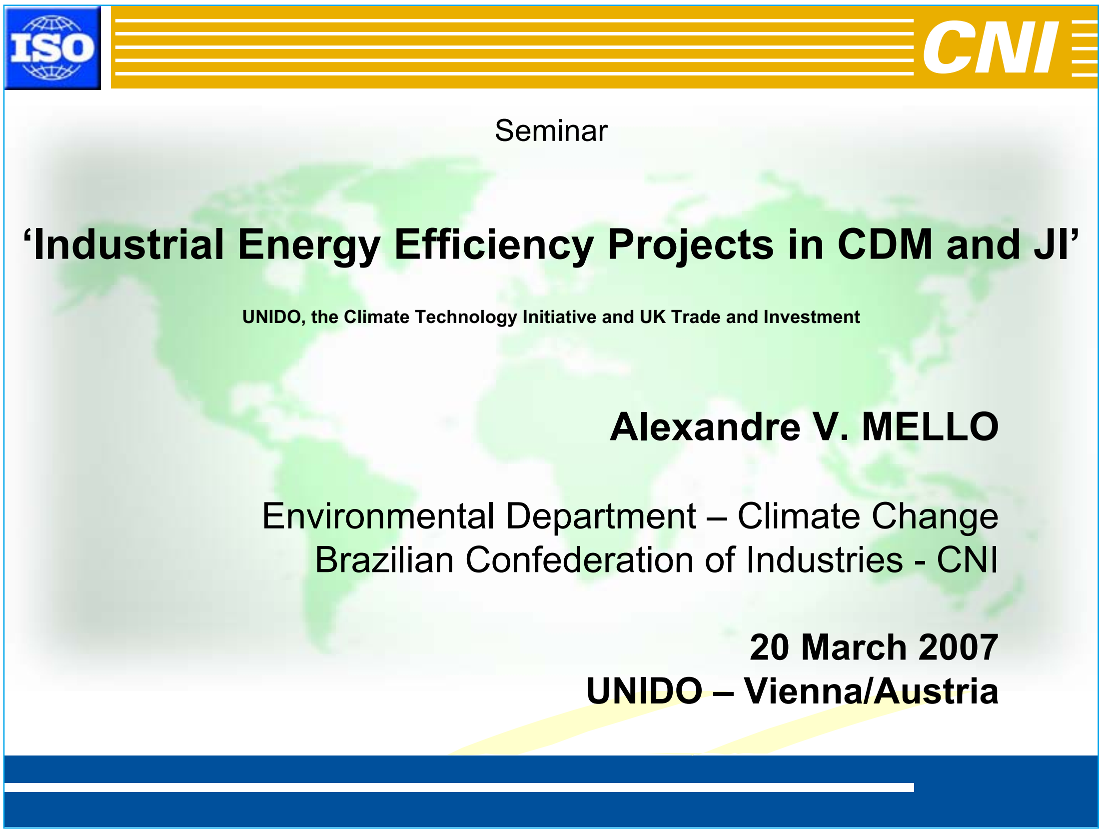
COMFAR *III Software*



THANK YOU

Report on discussion group

Mr. Alexandre V. Mello, Brazilian Confederation of Industries – CNI, explained the International Standards Organization (ISO) 14064 Standard for greenhouse gas accounting and project monitoring.



ISO 14064 Standards for greenhouse gas accounting and verification

ISO 14064

New International Standards for Greenhouse Gas Management

Origins, concepts and challenges

Topics

- Why an ISO standard?
- Source Material
- Key issues
- The standards

Why an ISO standard?

- Climate Change Task Force (CCTF) published initial papers 1998
- Climate change events
- Carbon market pressure
- Different CO_2 schemes and other voluntary standards
- Discussion with relevant ISO committees

Existing ISO work

TCs most strategically placed or active vis-à-vis climate change	Other TCs of direct relevance
	22 Road Vehicles
59 Building Construction	27 Solid Mineral Fuels
146 Air Quality	70 Internal Combustion Engines
180 Solar Quality	86 Refrigeration and Air Conditioning
190 Soil Quality	160 Glass in Building
197 Hydrogen Technologies	163 Thermal Insulation
203 Technical Energy Systems	192 Gas Turbines
205 Building Environment Design	193 Natural Gas
207 Environmental Management	208 Thermal Turbines

ISO CNI

Source materials

- UK ETS
- UNEP GHG Indicator Report
- WBCSD/WRI GHG Protocol
- Canadian CC Voluntary Challenge & Register
- Standards Australia – Carbon Accounting Standard
- Sundry US state CC protocols

ISO CNI

Guiding Principles

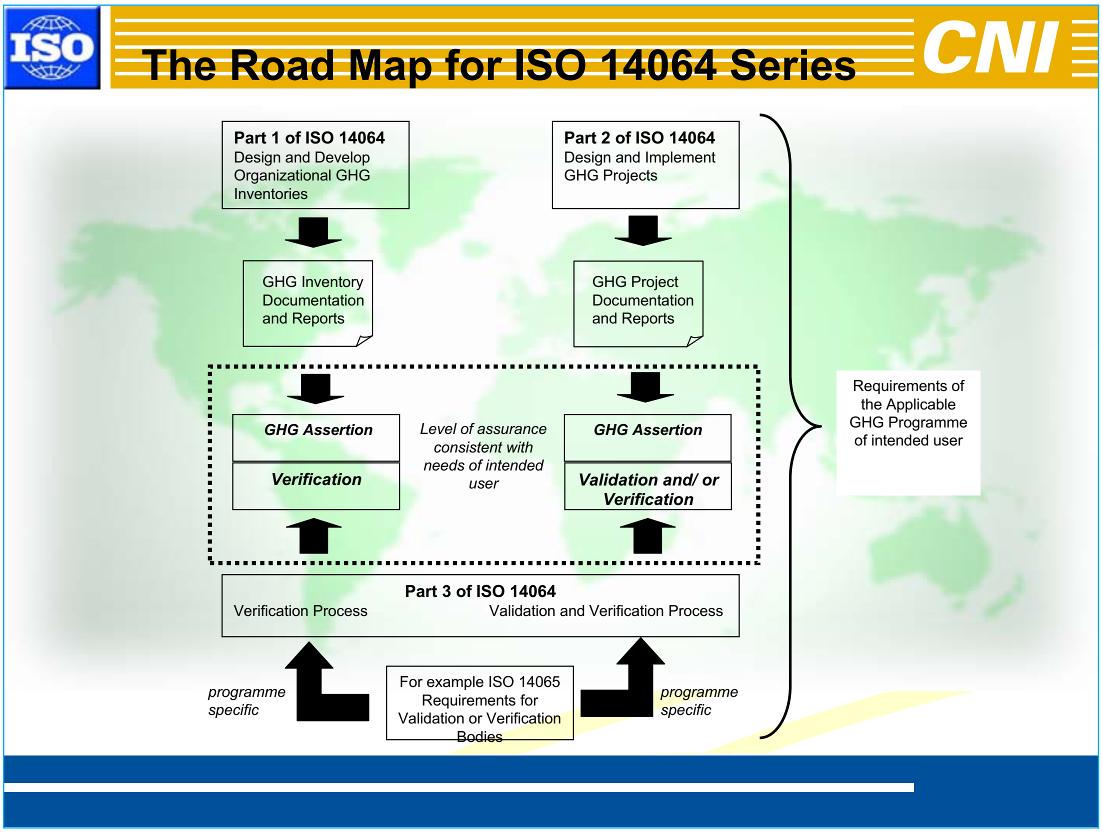
- Technical rigour
- Speed to market
- Extensive participation
- Policy/regime neutral
- Compatibility/consistency:
  - WBCSD / WRI GHG Protocol;
  - Kyoto Mechanisms

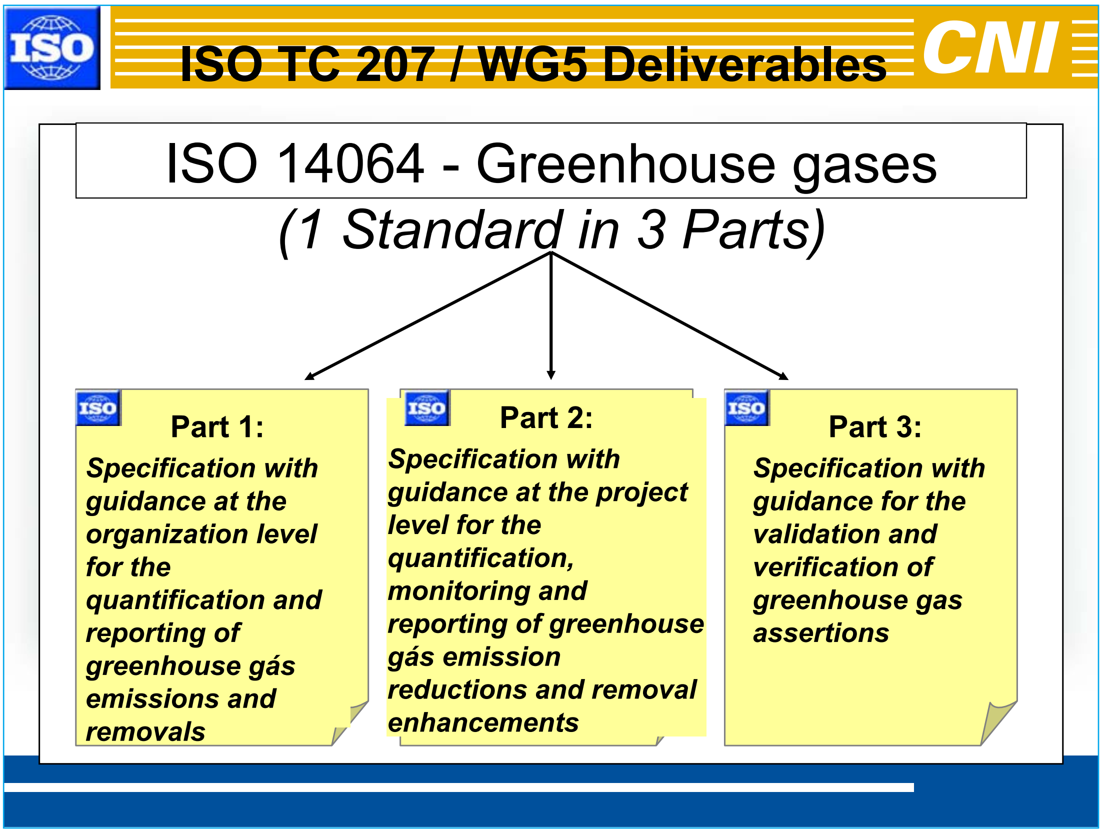
ISO 14064 - Benefits:

- Support the environmental integrity of GHG assertions;
- Promote and harmonize best practice;
- Assist organizations to manage GHG – related risks;
- Promote investor confidence and facilitate trade;
- Flexible, regime-neutral tools for use in voluntary or regulatory GHG schemes.

Other benefits of using ISO 14064

- Internal:
  - Providing technical guidance
  - Ensuring consistency of a GHG management scheme
- External:
  - Enhancing credibility of a GHG management approach (e.g. in communications with stakeholders)
  - Enhancing compatibility with external requirements


The Road Map for ISO 14064 Series
CNI
Part 1 of ISO 14064
Design and Develop Organizational GHG Inventories
Part 2 of ISO 14064
Design and Implement GHG Projects
GHG Inventory Documentation and Reports
GHG Project Documentation and Reports
GHG Assertion
Verification
Level of assurance consistent with needs of intended user
GHG Assertion
Validation and/ or Verification
Requirements of the Applicable GHG Programme of intended user
Part 3 of ISO 14064
Verification Process
Validation and Verification Process
programme specific
For example ISO 14065 Requirements for Validation or Verification Bodies
programme specific


ISO TC 207 / WG5 Deliverables
CNI
ISO 14064 - Greenhouse gases
(1 Standard in 3 Parts)
Part 1:
Specification with guidance at the organization level for the quantification and reporting of greenhouse gás emissions and removals
Part 2:
Specification with guidance at the project level for the quantification, monitoring and reporting of greenhouse gás emission reductions and removal enhancements
Part 3:
Specification with guidance for the validation and verification of greenhouse gas assertions

ISO CNI

ISO 14064 – Greenhouse Gases (Part 1)

- **Direct GHG emissions and removals; energy indirect GHG emissions; indirect GHG emissions**
- **Quantification methodology**
- **Uncertainly – parameter associated with the result of quantification which characterizes the dispersion of the values that could be reasonably attributed to the quantified amount**
- **Requirement for quality management of data compilation**
- **Reporting**
- **Verification**

ISO CNI

ISO 14064 Part 2: Key Issues

- Ensuring completeness in quantification of all relevant emissions reductions and removal enhancements;
- Tracking the impacts of project-based activities and induced emissions (or leakage);
- Identifying the environmental additionality of emissions reduction or removal enhancement projects; and
- Promoting transparency and considering public access to relevant project information.

ISO 14064 – Greenhouse Gases (Part 2)

- Base line scenario
- Planning and implementation
- Project validation
- Project verification

ISO 14064 Part 2: Future Application

The standard should provide guidance on good practices for:

- project developers regardless of which emissions reduction regime they operate within;
- validators of emissions reduction or removal enhancement projects;
- administrators and regime developers; and
- investors and financiers seeking to evaluate project design documents.

ISO 14064 – Greenhouse Gases (Part 3)

- competent verifiers/validators (ISO 14065)
- Scope
- Criteria
- ..evidence collected in the assessments of controls, GHG data and information, and applicable GHG programme criteria supports the GHG assertion
- Offer a level of assurance

ISO 14065 – Greenhouse Gases

Specifications for greenhouse gas validation and verification bodies for use in accreditation and other forms of recognition

Potential Use of ISO 14064

- **Organizations**:
  - Companies with significant direct and indirect climate impacts
    - For large transnational corporations for GHG management, including internal emission trading;
    - For responsible management of their environmental impacts and preparing for the "greening of the market";
    - For identification of GHG issues in the supply chain;
    - In SMEs: quick scan of potential emissions and reductions and estimation of CDM or JI potential
  - Service companies (e.g. verifiers of inventories, brokers of GHG projects)
  - Non-business organizations, such as municipalities or international financial institutions, (e.g. World Bank)

Potential Use of ISO 14064

- **National and International Policies**:
  - Any policies that require quantification and reporting of GHG emissions;
  - Bottom-up approach to compiling UNFCCC national inventories (might be especially relevant for some transition countries);
  - Implementation of emission trading schemes
  - Development of National CDM strategies and quick-scan for CDM eligibility of projects
  - Development of "green investment funds"
  - Voluntary initiatives for GHG reporting or GHG management (e.g. Global Reporting Initiative)

QUESTIONS ?

MANY THANKS !

Alexandre V. MELLO

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+ 55 61 3317.9482

9.3 Group 3: CHP in CDM

Mr. Sytze Dijkstra, Research Executive, World Alliance for Decentralized Energy (WADE), noted that although CHP CDM projects are touted as success stories, they are presently limited geographically to India and Brazil and sectorally limited to sugar projects. He said that CHP has much larger sectoral potential, including hospitals and schools, and in the area of gas-fired CHP. He outlined barriers identified by the group, including the difficulty in ensuring project financing due to upfront capital costs; the variability of grid access; and the existence of a cultural barrier for industries not familiar with selling electricity. Dijkstra said the group recommended that UNIDO and WADE work together in an industrial context to develop broadly applicable methodologies.

Report on discussion group

Mr. Styze Dijkstra

Cogeneration projects have been successful in the Clean Development Mechanism to date: about 20 per cent of all registered projects have involved some kind of CHP application. Most projects have been in the sugar sector, but there have also been projects using industrial waste heat in the iron and cement sector. India and Brazil have been the most active countries.

The additionality of these cogeneration projects has sometimes been questioned, because many are economically viable in their own right, due to considerable efficiency improvement and fuel savings. However, industrial CHP projects in developing countries face many other barriers, including:

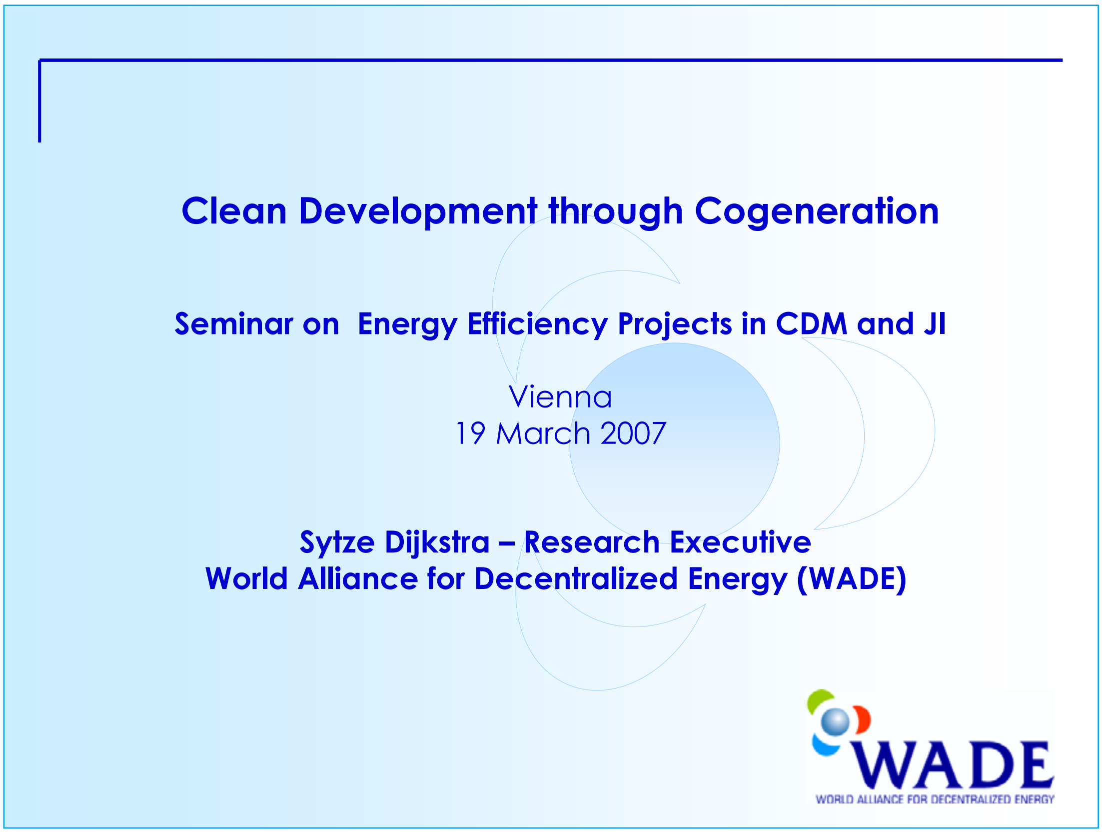
- High up-front investment costs
- Internal rate of return insufficient for commercial loans
- Lack of skills available locally, particularly for gas-turbine cogeneration
- Inadequate access to the electricity network for exporting electricity
- Unfamiliarity with the power sector

The initial success of CHP in the CDM does not show the whole picture. Cogeneration project activities have mostly been limited to a few countries, and a few sectors. Most projects use well-established technology for cogeneration in the food processing industry, using biomass wastes. For CHP projects to remain successful in the CDM, it is therefore necessary to widen the application of the types of projects to more countries and sectors. In addition, other technologies, fuel types and application sites must be developed. The most important opportunities for new industrial cogeneration projects are:

- Grid-connected gas-turbine cogeneration
- Building-integrated CCHP
- Biomass cogeneration in industries other than food processing

To enable the expansion of the applications of CHP in the CDM, a number of new baseline methodologies for the types of application listed above must be developed. At the moment most methodologies are for biomass CHP, so a particular need exists for gas-fired cogeneration methodologies. Similarly, no methodologies for building-integrated CCHP are available, despite the considerable potential of such applications in developing countries. These projects face the additional barrier of being small, so that they would need to be bundled to become attractive for the CDM. It is important that experience with such bundling is developed, and disseminated.

The interest in such baseline methodologies would be considerable, and many project developers are developing such projects. However, these project developers normally prefer to use an existing methodology, rather than proposing one themselves, so they are all waiting for others to develop the methodology. This suggests a possible role for organizations such as UNIDO, WADE and other technical agencies and programmes.



About WADE

- Founded in response to UNFCCC process
- Non-profit research & promotion organisation created June 2002
- Aims to accelerate the worldwide development of high efficiency cogeneration (CHP) and decentralized renewable energy systems
- Raises awareness of the substantial economic and environmental benefits Decentralised Energy (DE) can deliver

2

WADE Mission

- WADE Research activities
  - Reports, market surveys and studies
  - WADE Economic Model
- WADE Advocacy activities
  - Policy advise for governments
  - Participation in legislative and regulatory proceedings
  - Cooperation with International Organisations, Institutions and NGOs
- WADE Promotion activities
  - WADE Conferences and events
  - WADE Newsletters

3

What is Decentralized Energy (DE)?

Electricity production *at the point of use*, irrespective of size, fuel or technology – on-grid or off-grid:

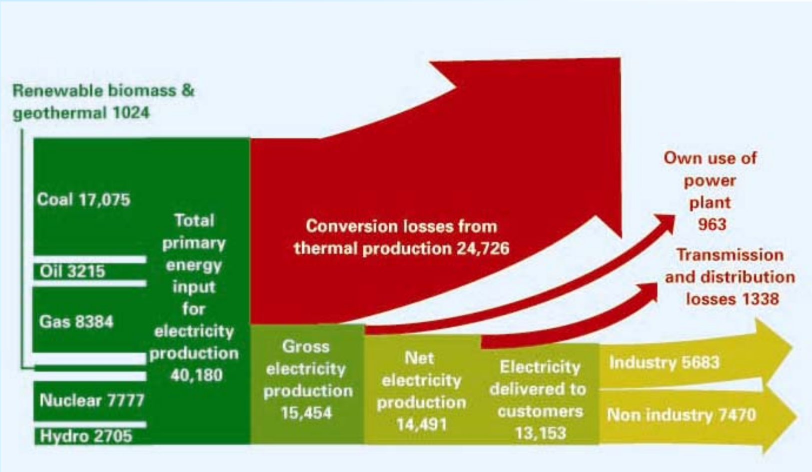
- High efficiency cogeneration (CHP)
- On-site renewable energy
- Industrial energy recycling and On-site power

- Otherwise known as:
  - Distributed Generation, Captive Power, Embedded Generation

WADE
WORLD ALLIANCE FOR DECENTRALIZED ENERGY

Why Decentralised Energy?

Electricity Generation Worldwide (TWh)



(Source: International energy Agency 2002)

WADE
WORLD ALLIANCE FOR DECENTRALIZED ENERGY

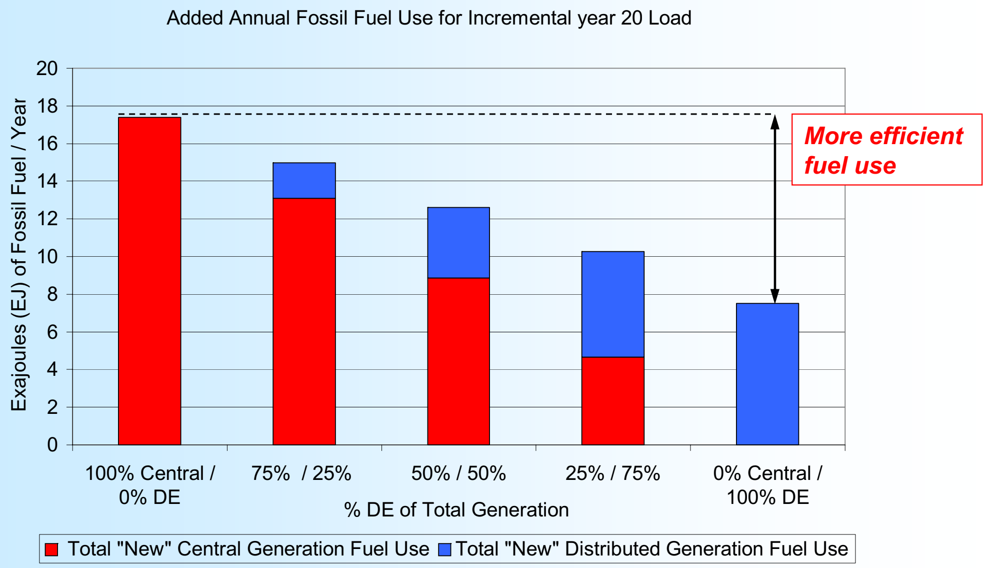
DE Benefits – Environmental

Fossil Fuel Emissions by Technology

- CO2 emissions, kg per MWh
  - Heavy Fuel 844
  - Coal (FBC) 815
  - Gas oil (diesel) 815
  - OCT (open cycle) 582
  - CCGT (combined cycle) 354
  - CHP (combined Heat & Power) 269
  - Biomass 0
  - Renewables (wind, solar etc.) 0

Source : IEA + DIDEME

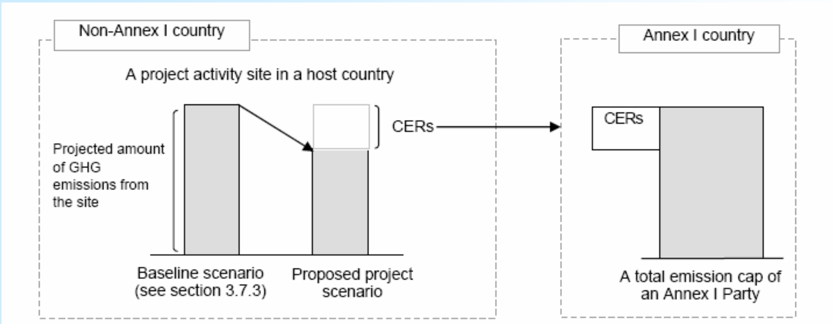
WADE Economic Model – Combined Heat and Power



Clean Development Mechanism – General Principles

CDM Global Principles

- Participation of the project partners is voluntary.
- The project results in real, measurable and long term benefits related to the mitigation of climate change.
- Additionality Principle: The reduction of emissions through the CDM project must be additional to reductions that would occur without the CDM project.



Project Types and CHP

Type I – Renewable Energy Projects

- *I-A Electricity generation by the user*
- *I-B Mechanical energy for the user*
- *I-C Thermal energy for the user*
- *I-D Renewable generation for a grid*

Type II – Energy Efficiency Projects

- *Supply-side*
- *Demand-side and fuel switching*

Type III – Other Projects

- *Methane recovery*
- *Transport, agriculture, land use*

CHP Projects

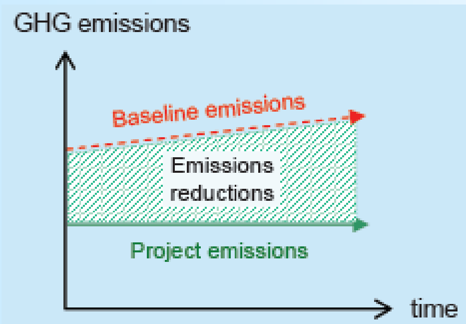
Project Cycle for CHP Projects

Project Stage	Party	Output
1. Screening and Planning CDM Project	PP	
2. Preparing the Project Design Document (PDD)	PP	Project Design Document
3. National Approval of Involved Parties	DNA PP	Letter of Approval
4. Validation and Registration	DOE 1	Validation Report
5. CDM Project Activity and Monitoring	PP	Monitoring Report
6. Verification and Certification	DOE 2	Verification and Certification Reports
7. Issuance of CERs	CDM-EB	CERs

Project Design Document

- *Additionality assessment*
- *Baseline methodology*
- *Monitoring requirements*
- *Emission reduction calculation*

Baseline Methodologies for CHP Projects



Baseline Methodology

- *Project specific*
- *Cover all emissions within project boundary*
- *Adjusted for leakage*
- *Reflect local policies and regulation*
- *Use transparent data and methodology*

Additionality

- *Investment Analysis*
- *Barrier Analysis*
- *Common Practice Analysis*

Considerations for CHP

- *Up-front capital required*
- *Internal rate of return for commercial loans*
- *Not the cheapest option locally (AM0007)*

Emission Reductions from CHP

Baseline emissions

- *Electricity and heat generated*
- *Alternative generation processes*
- *Other emissions*

—

Project emissions

- *Fuel input*
- *On-site emissions from storage, processing etc*
- *Leakage*

=

Emission Saving

↓

Certified Emission Reductions

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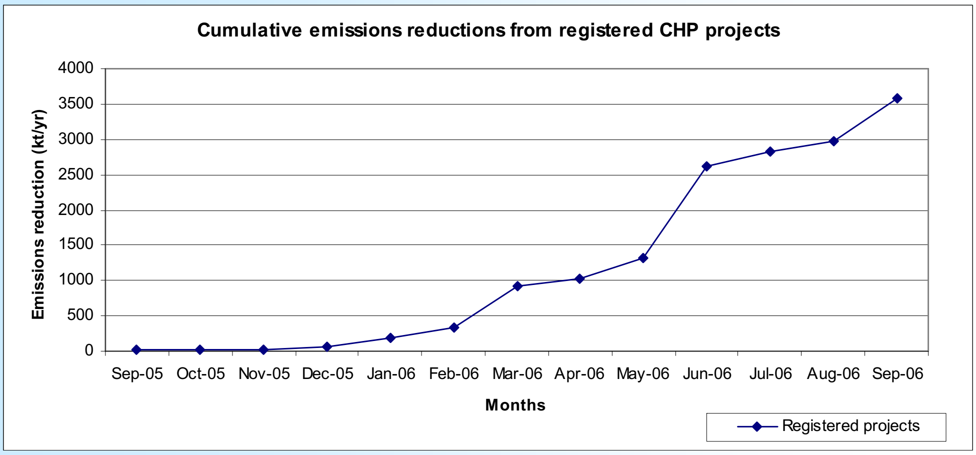
Current Status of CHP Projects



Registered cogeneration projects (October 2006)

- *66 projects registered (20%)*
- *Annual emission reductions of 3.6 Mt CO_2-eq*
- *Main countries: India (37%), Malaysia (29%), Brazil (14%)*

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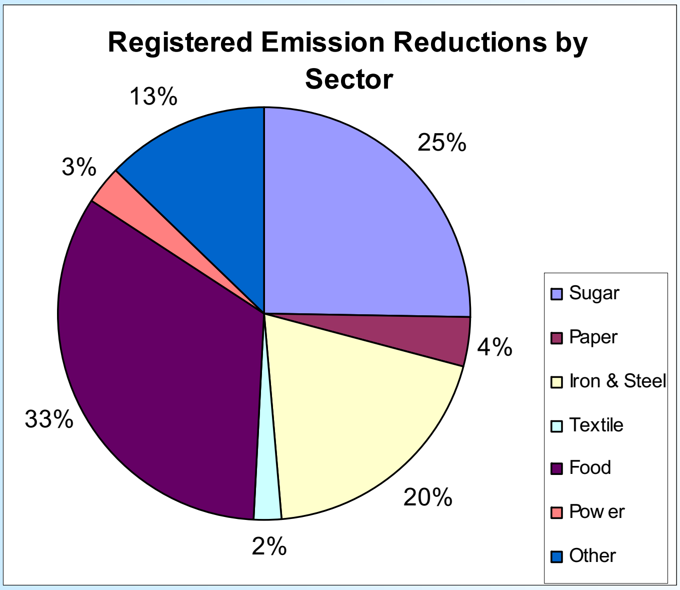
Current Status – Industrial sectors



Examples:

Sugar: Bagasse CHP

Paper:

Iron and Steel: Waste-heat recycling

Food: Fruit bunches for CHP

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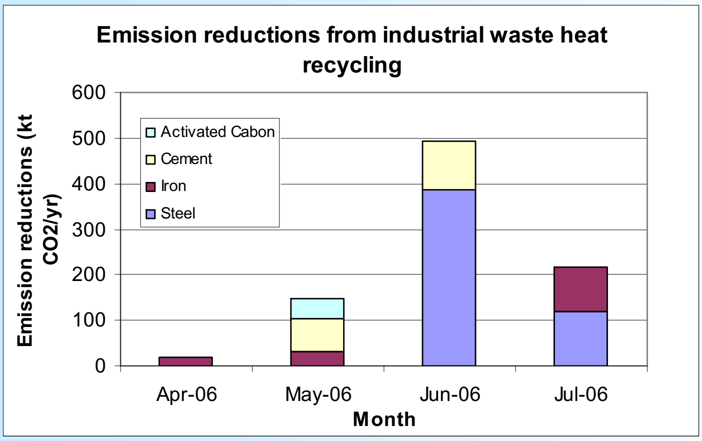
Current status – Industrial Waste-heat recycling



CDM projects using Industrial Waste-heat recycling:

- *Large projects (average emission reduction 875,000 tCO_2/yr)*
- *Main sectors: Steel, Iron and Cement*
- *Cost-effective emission reductions*
- *Issue of additionality*

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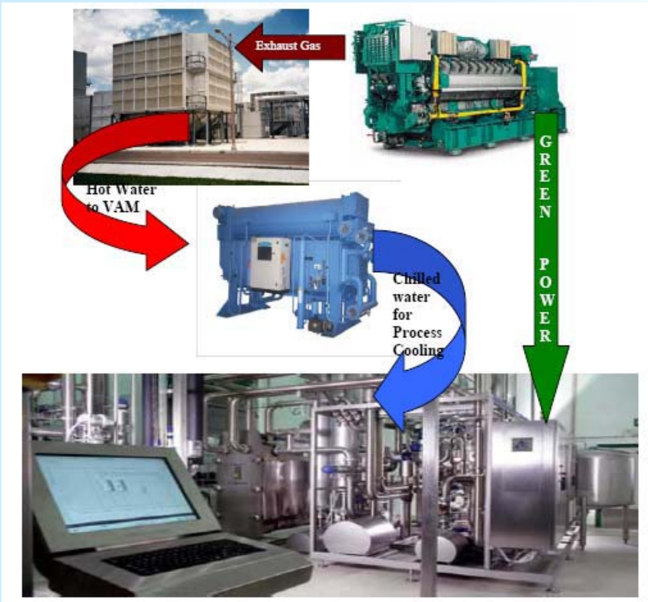
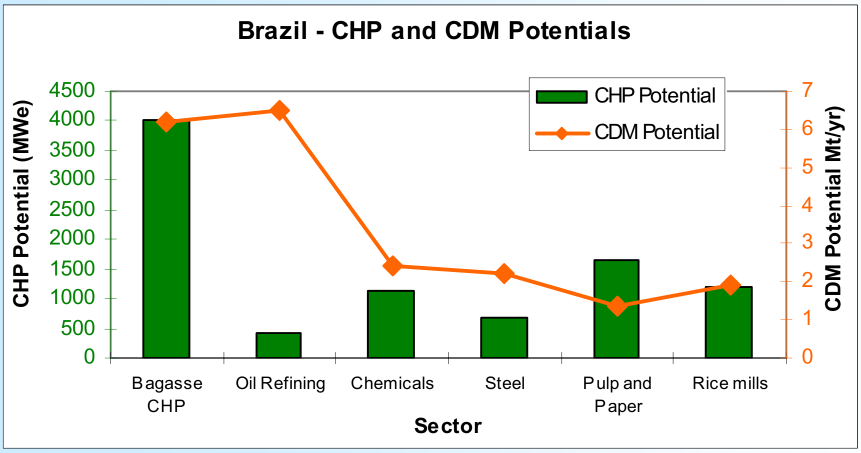
Industrial CCHP Project – Tetra Pak, Pune, India



Description

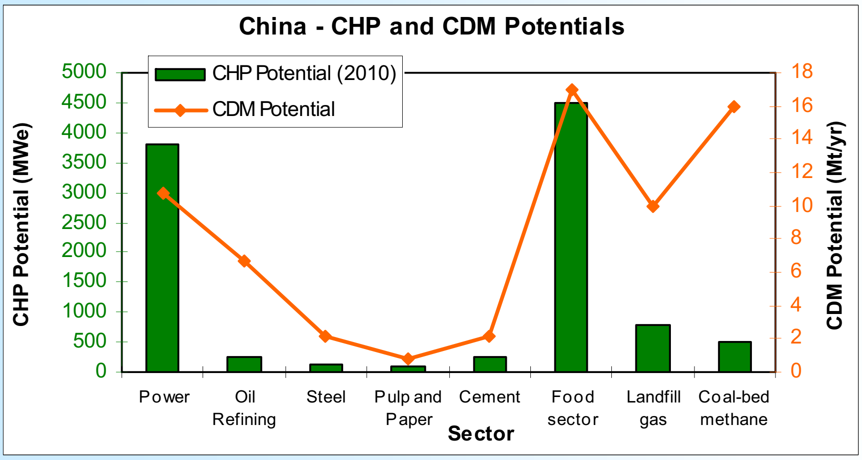
- *Food packaging factory*
- *Project developer: Thermax India*
- *Existing 2.0 MW and 1.25 MW Cummins engines*
- *342 TR Absorption Chiller replacing electric cooling*
- *Cooling for production process (14ºC/7ºC)*
- *Electricity saving: 298.8 kWh/h*
- *Payback: 0.8 years*

CHP in the CDM - Brazil



- ***DNA***: *Interministerial Commission on Global Change (CIMGC)*
- ***Sustainability criteria***: *Contribution to local economy*
- ***Status of CHP***: *26 out of 71 projects, mostly bagasse CHP*
- ***Opportunities***: *Bagasse, oil refining, industrial energy recycling*

CHP in the CDM - China



- ***DNA***: *National Development and Reform Commission (NDRC)*
- ***Sustainability criteria***: *energy efficiency, renewable energy methane capture*
- ***Status of CHP***: *1 out of 20 projects*
- ***Opportunities***: *Power sector, large industry*

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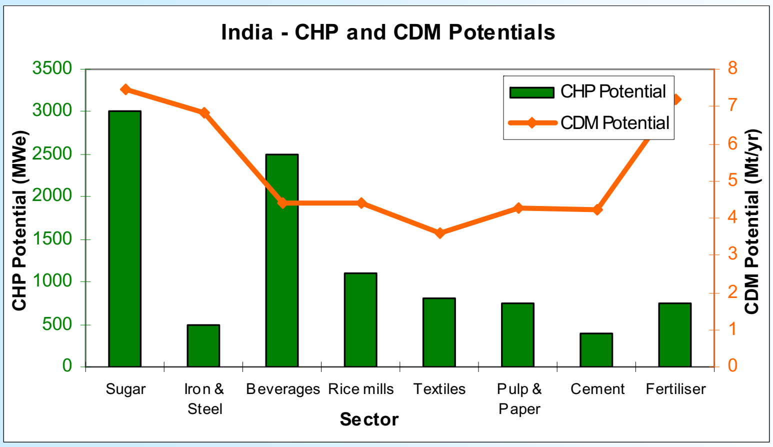
CHP in the CDM - India



- ***DNA***:*National Clean Development Mechanism Authority (NCA)*
- ***Sustainability criteria***: *Societal benefits and poverty reduction*
- ***Status of CHP***: *23 out of 104 projects*
- ***Opportunities***: *Food processing, Iron and Steel, Chemicals*

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CHP in the CDM – Future

Neglected opportunities for cogeneration in the CDM:

- *Building-Integrated CHP and CCHP*
- *Avoided network losses through on-site generation*
- *CHP replacing CCGT*

Outstanding issues for the CDM:

- *CDM creates additional emissions allowances*
- *Additionality difficult to prove*
- *Political uncertainty – Post-Kyoto arrangements*
- *Financial uncertainty – Carbon markets and carbon prices*

Industrial cogeneration projects are likely to play an increasingly important role in the CDM and other GHG-reduction mechanisms

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Clean Development through Cogeneration

Questions?

World Alliance for Decentralised Energy (WADE)

www.localpower.org

Info@localpower.org

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DE Project Examples – Mittal Steel Energy Recovery

- ***Conventional power generation discards 2/3 of energy output***
- ***Most discarded energy can be profitably recycled on-site***
- ***Efficient energy recycling requires decentralised generation***

Mittal Steel – Chicago, IL

Industrial Energy Recycling

- ***Streamlines production process***
- ***Supplies on-site energy demand***
  - ***Mittal Steel: 20%***
- ***Cost effective***
- ***Reduces Emissions***
  - ***CO_2: 490,000 t/yr***
  - ***NO_x: 1,300 t/yr***
  - ***SO_x: 1,500 t/yr***

Source: Primary Energy, 2006

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WADE Research

DE Market data

Future Studies:

Onsite Power in the Cement Industry, August 2006

Cogeneration and the CDM, September 2006

Onsite Power and Security, ?

Sector Specific DE Research

Research on Specific Challenges facing DE

WADE Economic Model

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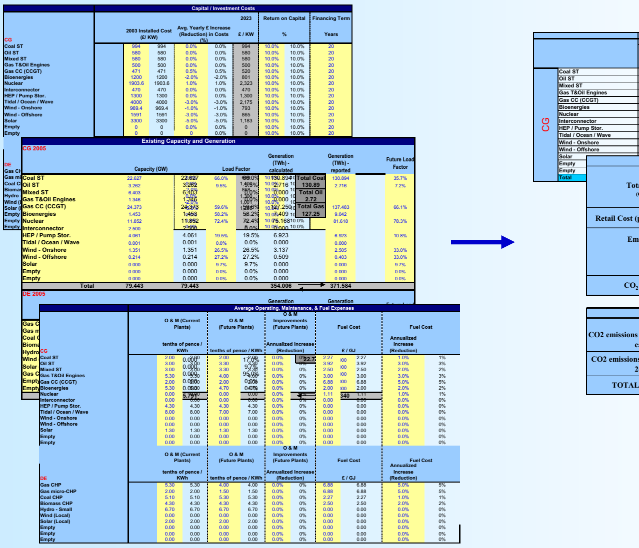
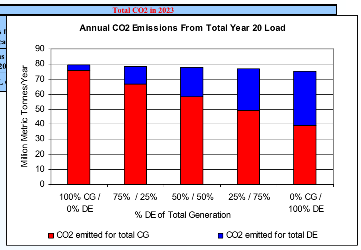
WADE Economic Model





Compares DE with centralised generation on the basis of costs, emissions and fuel use

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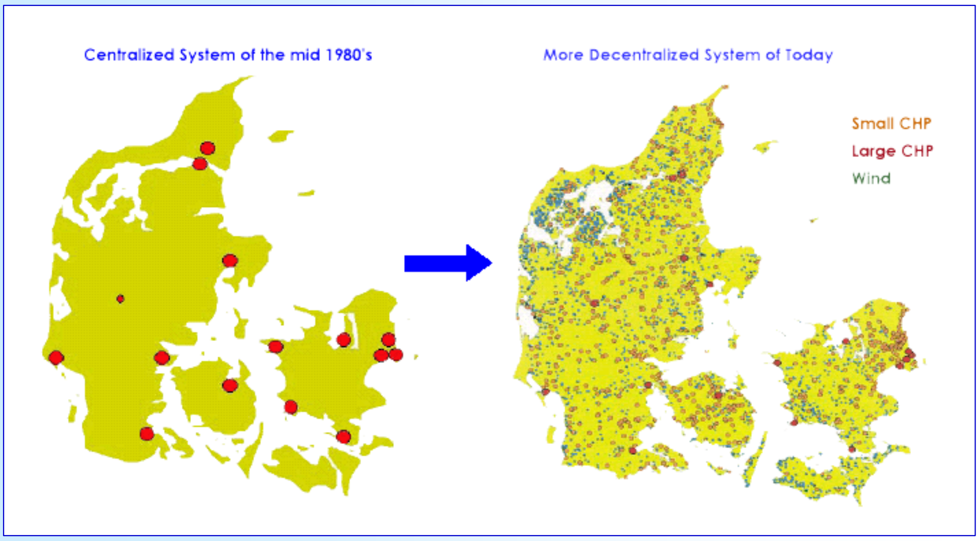
Decentralised Energy Systems



Source: Danish Energy Center

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9.4 Group 4: Linking Montreal and Kyoto: Chiller demonstration projects and CDM

Mr. Stefan Kessler, Senior Project Manager, Infras, noted the availability of seed funding from the Montreal Protocol's Multilateral Fund and the GEF for chiller demonstration projects. He said the group suggested the establishment of national level carbon funds fed from different CDM projects to carry projects beyond the demonstration stage. He also reported that the group discussed monitoring approaches and highlighted the need for in-built direct incentives, through revenue streams from CERs, to ensure owners operate replacement technologies efficiently. The group concluded that the methodology developed by the World Bank, known as NM0197, will be useful for other chiller projects, and agreed that the destruction of recovered CFCs should not be included as a requirement in methodologies.

Barriers

- The discussion group members perceived the missing trust of owners in the reliability of the new equipment and it's maintenance requirements as the main barrier for chiller replacement projects.
- Financial viability of chiller replacement is one of the barriers but in many cases can be overcome with commercial financing arrangement, involvement of Energy Saving Companies (ESCO), etc. depending on the project area.
- Co-financing by Multilateral Fund under Montreal Protocol and GEF to complement CDM revenues provides a limited window of opportunity for implementing demonstration projects. At the end of this limited period CDM methodologies and financing models must be available which reach the entire chiller market incl. the units in smaller countries .

Monitoring

- The monitoring concept has to be developed in view of how the revenues from CERs will be assigned to the the project stakeholders. In contrast to large scale chiller projects where a strong implementing entity may take a major responsibility in ensuring efficient operation of the new chillers, small scale projects may need to provide a direct revenue stream to owners as an incentive to operate the units efficiently
- Detailed metering during project implementation will also provide relevant information for developing energy efficiency policies.
- The stringent monitoring requirements as foreseen under NM0197 will not suit the requirements of projects implemented in small countries. Approaches applicable for addressing chiller replacement in small countries also need to be developed.

Baseline and project emissions

- If methodology NM0197 will be approved, the set out baseline procedures will very likely be useful also for other projects and methodologies incl. other chiller projects.
- In NM0197 the aspect of future change (increas/decrease) in cooling load may need to be addressed in more detail. The basic provisions for including including load variations however are included in NM0197. Over the project implementation period, changes in load will be the standard case and the methodology should not restrict improvements in the overall building systems.

Application of chiller methodologies to other technologies

- CDM approaches would be beneficial to address other relevant technologies in relation to Montreal Protocol compliance such as Air-Conditioners, domestic and commercial refrigerators, etc.
- Existing chiller methodologies will not suit the requirements for addressing a large numbers of small appliances as e.g. monitoring requirements are too stringent for application to large volumes of appliances.

Financing options

- Co-financing by Multilateral Fund under Montreal Protocol and GEF to complement CDM revenues provides a limited window of opportunity for implementing demonstration projects. At the end of this limited period CDM methodologies and financing models must be available which reach the entire chiller market incl. the units in smaller countries .
- GEF supports approaches which look at the entire building system in an integral way. While chiller related CDM activities will need to focus on the chiller units, GEF co-financing may be used for enlarging the project scope to an integrated system aproach.
- Suggestion was made to develop e.g. on a national level CDM based Carbon Funds which can be used as revolving funds for multiplication of projects. However, no specific suggestions could be arrived at from the discussion.

Restrictions on use of refrigerant from discarded systems

- Under the Montreal Protocol it is good practice to recover refrigerants from old installations. This should be mandatory for all project activities under CDM involving refrigerant handling.
- A requirement to immediately destruct recovered CFCs should NOT be included in methodologies. The established procedures under the Montreal Protocol and specific national legislations will allow for:
  - Direct reuse of the refrigerant in other installations (e.g. in older ones which can not be retrofitted on a commercially viable basis)
  - Reclaim refrigerant to virgin standard and use as recycled refrigerant.
  - Destruct refrigerant in specialised incineration installations.

9.5 Group 5: Linking the EE and CDM/JI expert communities: CDM EE network

Mr. Maarten Neelis said the involvement of energy efficiency experts is key to improving CDM project design. He identified calls for public input and methodologies as issues on which energy efficiency experts can contribute and said the group proposed a CDM energy efficiency expert group. He said that vast amounts of energy efficiency knowledge from a network of energy efficiency experts could be communicated to the CDM world, and highlighted existing protocols and standards of practice that would be beneficial to CDM activities, such as the International Performance Measurement and Verification Protocol (IPMVP) and energy management standards.

Report on discussion group

Ms. Anne Arquit Niederberger and Mr. Maarten Neelis

Who are we?

Following a quick round of introductions, a survey of the 11 participants showed that 6 regarded themselves primarily as energy efficiency (EE) experts, 2 as climate change (CC) experts and 3 as hybrid EE/CC experts. This was a good mix to address the issue of better linking the two communities.

Goal of linking

Better cross-fertilization between EE and climate/CDM experts to leverage carbon markets for energy efficiency

Entry points for EE expertise into CDM

The group identified four primary pathways that the expertise of the energy efficiency expert community can flow to the CDM community:

1. Response to public calls for input from the CDM bodies
2. Submission of new methodologies/projects to the CDM-EB for approval
3. Direct participation in CDM bodies (e.g., Meth Panel, RIT, Meth Expert for Desk Reviews)
4. Unsolicited inputs to CDM bodies or Parties to the Kyoto Protocol.

It was agreed that none of these pathways had been effective, and that there was a need for:

- Top-down consideration of methodological issues related to energy efficiency under the CDM and
- Institutional arrangements that would ensure informed decisions on EE CDM by the CDM EB and Meth Panel, based on authoritative energy efficiency expertise.

The group suggested the creation of an international energy efficiency expert network that can give unsolicited inputs, also directly to the countries involved in Kyoto (e.g. to the intermediary meetings annually in May in preparation of the COP). Participants stressed that such a network should not be limited to CDM issues, since issues of quantification of energy savings and greenhouse gas emission reductions face other types of policies and measures (e.g., white certificate trading, domestic utility demand-side management), and considering the full breadth of energy efficiency promotion programmes would contribute to greater fungibility among programmes.

What can the energy efficiency community deliver?

An Energy Efficiency Expert Network could bring existing expertise into the CDM/JI world. These inputs could be classified into the following areas (not strictly separated):

- Clear framework for methodologies (i.e., terminology; specification of which issues should be treated in the baseline itself vs. addressed via monitoring and baseline adjustments vs. in the context of gross-to-net adjustments)
- Inputs into the gross-to-net adjustment discussion: Within the EE community (e.g., utilities, ESCOs, government EE programme managers), there is quite some knowledge about rebound effects and free-rider/spillover effects. This knowledge could be used to develop generic top-down tools/guidance on this issue.
- Tools/guidance on demonstrating barriers and additionality: Investment analysis as a demonstration of additionality is in many cases not relevant in the context of EE CDM projects (which are often highly profitable, once barriers to implementation can be overcome). Barrier analysis is therefore crucial to the demonstration of additionality for EE projects/programmes. However, current tools and guidance do not reflect the main barriers that EE programmes typically face, and the Meth Panel has demonstrated scepticism of barrier analysis for profitable projects. It was proposed that the EE Expert Network could compile information on generic and project-type specific barriers to EE initiatives that could then be used by individual project developers to demonstrate additionality. It was regarded as wasteful and ineffective to require each individual energy efficiency programme/project to document barriers, when there is ample evidence or real, prevalent and persistent barriers to EE globally, many of which are systemic in nature. Specifically, it was proposed that the Network could provide documentation (based on the published literature) of:

    Generic barriers that prevent the adoption of EE technologies/practices

    Barriers to specific technologies/practices (e.g., industrial electric motor systems) and programme types (e.g., provision of financial incentives for high-efficiency equipment) that can yield large climate benefits. One output could be a list of energy efficiency technologies and/or programme types that are judged by the CDM EB ex ante to be additional, which could be periodically reviewed.

It was also suggested that the EE experts could draft a tool or provide guidance for project developers that would specify documentation requirements for barrier analysis of additionality that could be met with the types of existing information typically available in the developing country context. Requiring data that do not exist will prevent energy efficiency projects/programmes from going forward. Participants stressed the urgency of removing barriers to EE, given that huge amounts of capital equipment/infrastructure will be built in the developing world over the next decade.

- Recommendation of appropriate Key Performance Indicators for specific technologies/systems for approval by the CDM EB, which would make it much easier for methodology developers to prepare new methodologies and for the Meth Panel to evaluate them.

- Development of methodologies (based on current good practice and taking into account the developing country context for CDM) for top-down approval by the CDM EB (as has been done for SSC and A/R projects): Within the context of energy efficiency programmes, numerous standards and EE programme methodology guidance documents have already been developed, and could serve as a basis for the Expert Network to develop good practice methodology guidance for the CDM. Special attention should be given to system approaches and design issues (e.g. compressed air, steam systems). At present, methodology developers are focusing on discrete technologies, even though they know that a system approach is needed, because of the difficulty of getting EB approval of methodologies that address systems that are viable in the field.

More information on the methodological challenges facing EE projects/programmes and the types of methodological inputs that the energy efficiency expert community could contribute is included in the Seminar Issue Paper and other seminar documentation (papers, PowerPoint presentations), which can be accessed at www.unido.org.

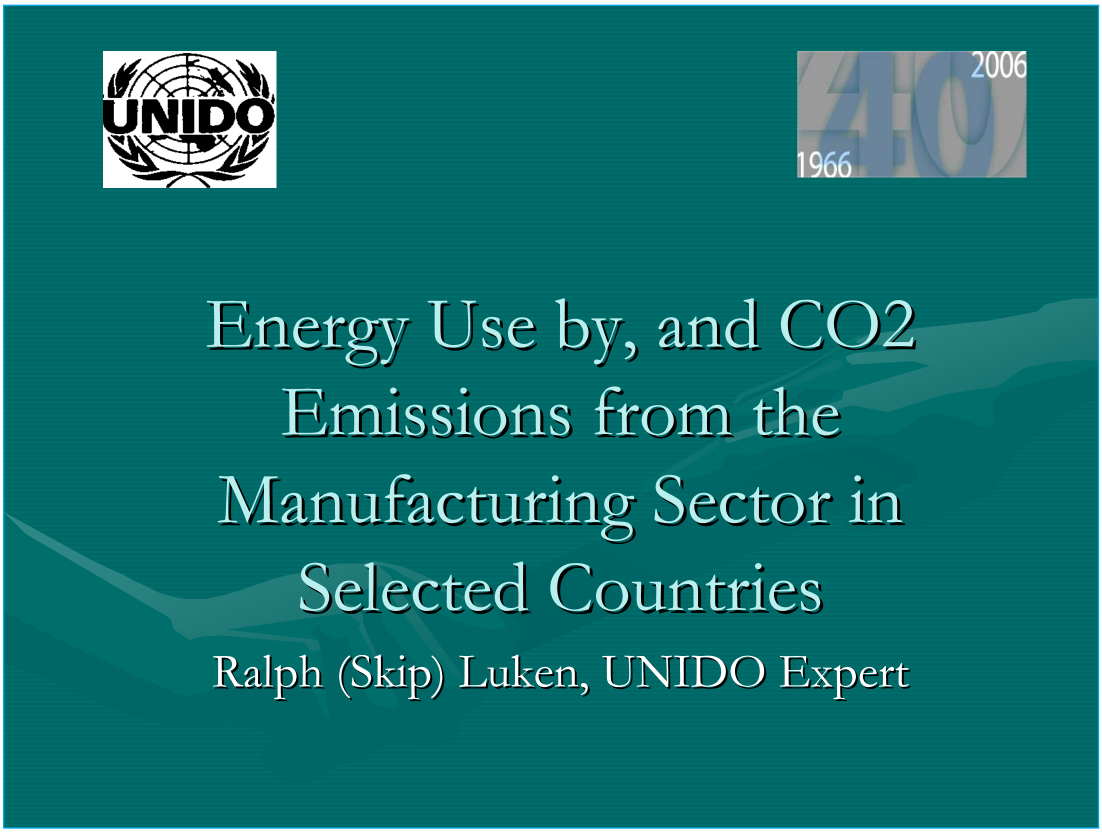
10. Panel session VI: Transforming markets for energy efficiency

Paolo Bertoldi, EC Joint Research Centre, introduced the discussion and the panelists.

10.1 Presentations

Energy use by, and CO2 emissions from the manufacturing sector in selected countries

Mr. Ralph Luken, UNIDO Consultant



Introduction

- The industrial (manufacturing) sector accounted for 26% of global energy use and emitted 18.5% of CO_2 emissions in 2004 (IEA).
- Global and selected country trends in energy use from industrial growth between 1990 and 2004.
- Comparison: energy-use and associated CO2 emission intensities at country level and selected subsectors.

The Decoupling Concept and Data Availability

- Relative growth rates of environmental pressure and the economic activity with which it is causally linked.
- Decoupling occurs when the growth rate of an environmentally relevant variable, energy use in this case, is less than the growth rate of the economically relevant variable, industrial output in this case, over the same period of time.

GLOBAL AND SELECTED COUNRY TRENDS IN DECOUPLING

Country Group (number of countries/total number in group	% Total MVA	% CO_2 Emissions	Energy use (2004)	
			Relative	Absolute
Developed Countries (24/24)	74	63	-17	5
Transition Economies (6/29)	1.3	3	-66	-47
Developing Countries (54/70)	24	33	-26	69
Least Developed Countries (8/15)	0.05	0.1	NA	87

Country-level energy-use intensities

	Energy Use	Energy Use intensity				
	Average Annual Growth (%)	"Energy use intensity (toe/1000US$)"		Average Annual Growth (%)	Average energy use in industry as a share of total energy use	
Country Group		1990	2004		1990	2004
Developed Market Economies (23/23/23)*	0.4	0.23	0.19	-1.2	27	24
Transition Economies (9/7/9)	-2.7	1.35	0.55	-4.2	37	27
Newly Industrialized Countries (7/7/7)	7.8	0.23	0.21	-0.8	25	23
China (1/1/1)	4.6	2.08	0.72	-4.6	50	39
Other Developing Countries (59/52/59)	3.5	0.72	0.78	0.6	27	24
Least Developed Countries (13/12/13)	19.6	0.66	2.16	16.3	18	11

SUB-SECTOR ENERGY-USE INTENSITY

- Energy-use data for selected manufacturing sub-sector in some countries (IEA).
- MVA data for most manufacturing sub-sectors and most countries (UNIDO).
- Same sector analysis avoids complexity of structural differences in economies for energy efficiency comparisons.

Chemical and petrochemical

Country Group	Chemical and Petrochemical				
	Energy use (000's Ktoe)	VA (1995 US$)	Energy-use Int. (10^{-5}) (toe / 1000 US$)	CO_2 -emissions (Mt)	CO_2 – use Int.
Developed (23/24 and 22/24)	156	$5.5*10^8$	26.2	297.6	$4.2*10^{-7}$
Transition (9/29 and 9/29)	72	$0.1*10^8$	188.1	81	$3.1*10^{-6}$
Developing (20/70 and 14/70)	217	$1.2*10^8$	134.8	312.7	$43.3*10^{-7}$

40% 78% 5%

- The per cent reduction in energy use in the chemical and petrochemical sub-sector, if developing countries were to meet developed countries' average energy-use intensity, was estimated to be 38 per cent less energy use

Pulp and paper sub-sector

Country Group	Paper, Pulp and Printing				
	Energy use (000's Ktoe)	VA (1995 US$)	Energy -use int. (toe / 1000 US$)	CO_2 emissions (Mt)	CO_2 Emission - int.
Developed (22/24 and19/24)	116	$44.7*10^{7}$	$2.5*10^{-4}$	121.6	$2.0*10^{-7}$
Transition (9/24 and 7/24)	5	$1.3*10^{7}$	$4.3*10^{-4}$	6.8	$5.3*10^{-7}$
Developing (12/70 and 9/70)	49	$3.6*10^{7}$	$2.9*10^{-4}$	65.8	$4.3*10^{-7}$
	135%	91%		85%	

- The per cent reduction in energy use in the pulp and paper sub-sector, if developing countries met developed countries' average energy-use intensity, was estimated to be approximately 77 per cent less energy use in the sub-sector.

Food and tobacco

Country Group	Food and Tobacco				
	Energy use (000's Ktoe)	VA (1995 US$)	Energy -use Int. (toe / 1000US$)	CO_2 emissions (Mt)	CO_2 Int.
Developed (21 and 20)	66	$5.1*10^{8}$	$1.2*10^{-4}$	121.5	$1.9*10^{-7}$
Transition (9 and 8)	26	$0.3*10^{8}$	$3.5*10^{-4}$	26.5	$6.0*10^{-7}$
Developing Countries (13 and10)	79	$1.1*10^{8}$	$2.0*10^{-4}$	100.4	$4.5*10^{-7}$
	20%	80%		21%	

- The reduction in energy use in the food and tobacco sub-sector, if developing countries were to meet developed countries average energy-use intensity, was estimated to be about 58 per cent less energy use.

Textile and leather

Country Group	Textile and Leather: Energy use (Ktoe)	VA (1995 US$)	Energy-use Int. (toe/1000 US$)	CO_2 emissions (Mt)	CO_2 Int.
Developed (20/24 and 18/24)	14	$15.8*10^7$	$1.01*10^{-4}$	22.17	$1.72*10^{-7}$
Transition (9/29 and 8/29)	5	$0.93*10^7$	$2.32*10^{-4}$	3.44	$2.89*10^{-7}$
Developing (13/70 and 8/70)	56	$6.66*10^7$	$1.11*10^{-4}$	66.75	$2.53*10^{-7}$
	300%	58%		200%	

- The reduction in energy use in the textiles and leather sub-sector, if developing countries were to meet developed countries average energy -use intensity, was estimated to be 75 per cent less energy use.

SUMMARY/CONCLUSIONS

- The comparison of energy-use intensities supports the proposition that there still remains significant potential to reduce energy-use intensity and the associated CO2 emissions.

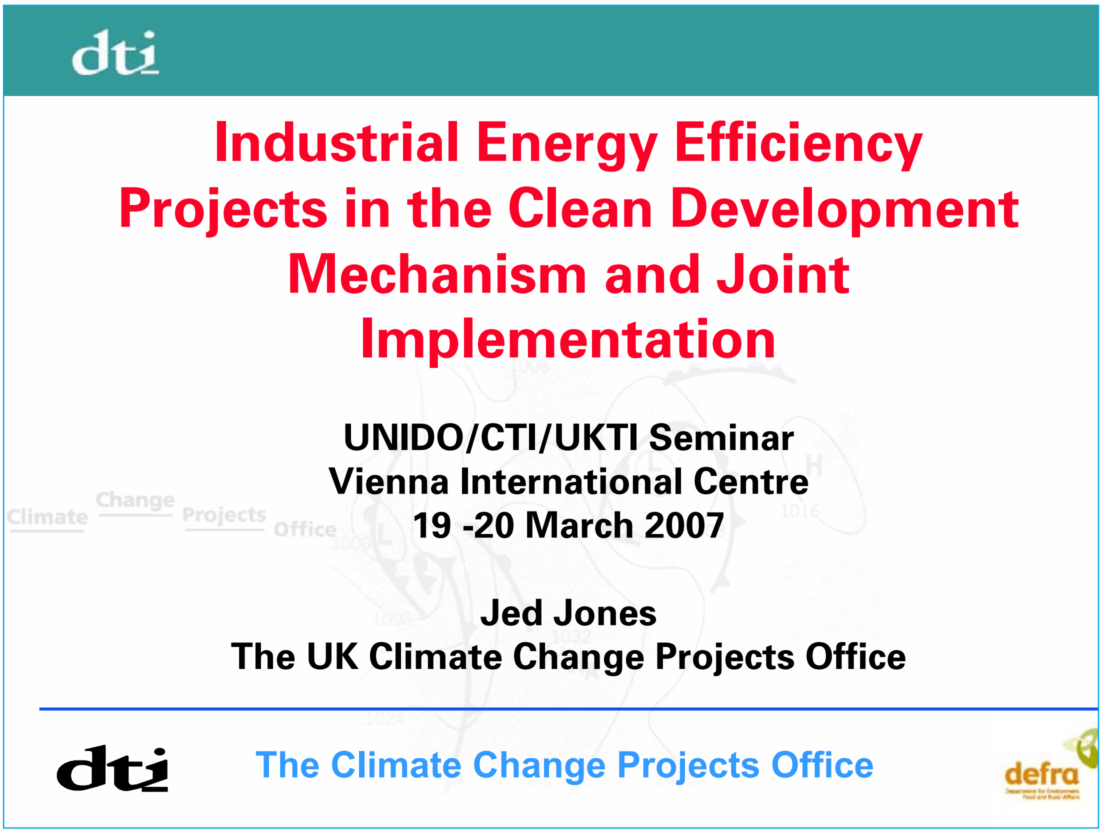
- 2 'what if ' scenarios, all developing countries meeting the average energy-use intensity of developing countries and all developing countries meeting the average energy-use intensity of developed countries, found that there could be the potential to reduce energy use by 40 and 70 per cent respectively.

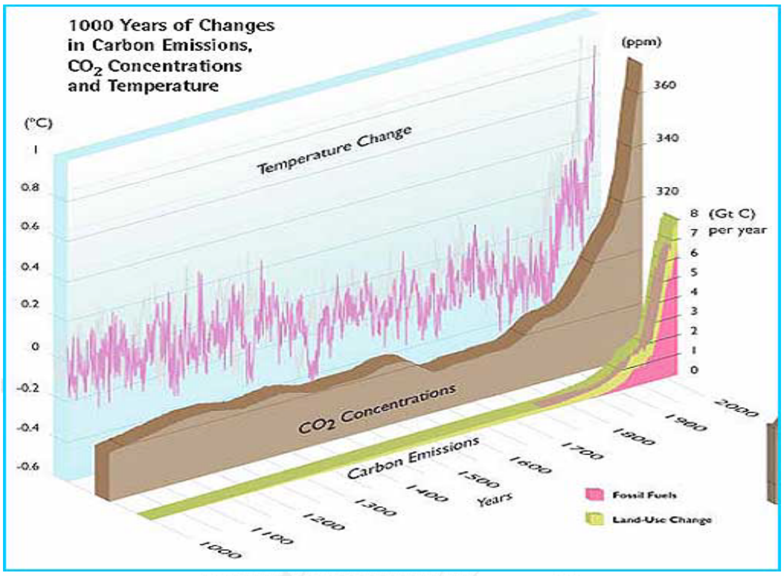
- The sub-sector analysis of energy-use intensity for four sub-sectors, chemicals and petroleum, pulp and paper, food and tobacco and textiles and leather, supports the findings of the country level analysis that there is potential for improving energy-use efficiency

Industrial energy efficiency projects in the Clean Development Mechanism and Joint Implementation

Mr. Jed Jones, DTI CCPO

Mr. Jed Jones, Principal Projects Advisor, Department of Trade and Industry Climate Change Project Office, UK, explained that poor energy efficiency is widespread, on both the supply and demand sides, and said the central question around energy efficiency CDM projects is additionality. He stressed the need to demonstrate additionality and suggested regional, sectoral and technological benchmarks were necessary to do this. He said supply-side energy efficiency projects fit well with the CDM and JI, but that demand-side projects require lateral thinking, and he questioned if the CDM is the most appropriate vehicle for demand-side energy efficiency projects or if a more appropriate alternative could be developed.





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The Problem

The problem of low energy efficiency is widespread. It is not limited to non-Annex I countries or the EITs.

- **Supply side**
  - Poor energy utilisation
  - Inadequate management practices
- **Demand side**
  - Poor training
  - Lack of maintenance
  - Neglect

The Climate Change Projects Office

The perception of the Kyoto mechanisms

We must respect the objectives of the CDM/JI, particularly

- Sustainable development
- Integrity and credibility

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Additionality

Additionality is not going to go away

- Many registered CDM projects are considered not to be additional
- These projects will survive their crediting period
- Do not repeat mistakes of the past

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How do we assure additionality

- Do not reward bad practices or neglect
- Set appropriate baselines for demand side projects
    - Regional
    - Sectoral
    - Technological

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How do we move forward

- Do not reward bad practices or neglect
- Set appropriate baselines for demand side projects
    - Regional
    - Sectoral
    - Technological

BENCHMARKS

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Does Energy Efficiency have a future in the CDM and JI

- There should be a future for energy efficiency in the mechanisms, particularly on the supply side
- Demand side projects need innovative lateral thinking. Is the CDM the best vehicle to undertake these projects?
- Could demand side projects be financed through a different vehicle, e.g. through a re-structured adaptation fund?

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The UK Climate Change Projects Office

Thank you and good luck!

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Barriers to improving energy efficiency

Ms. Marianne Moscoso-Osterkorn, REEEP

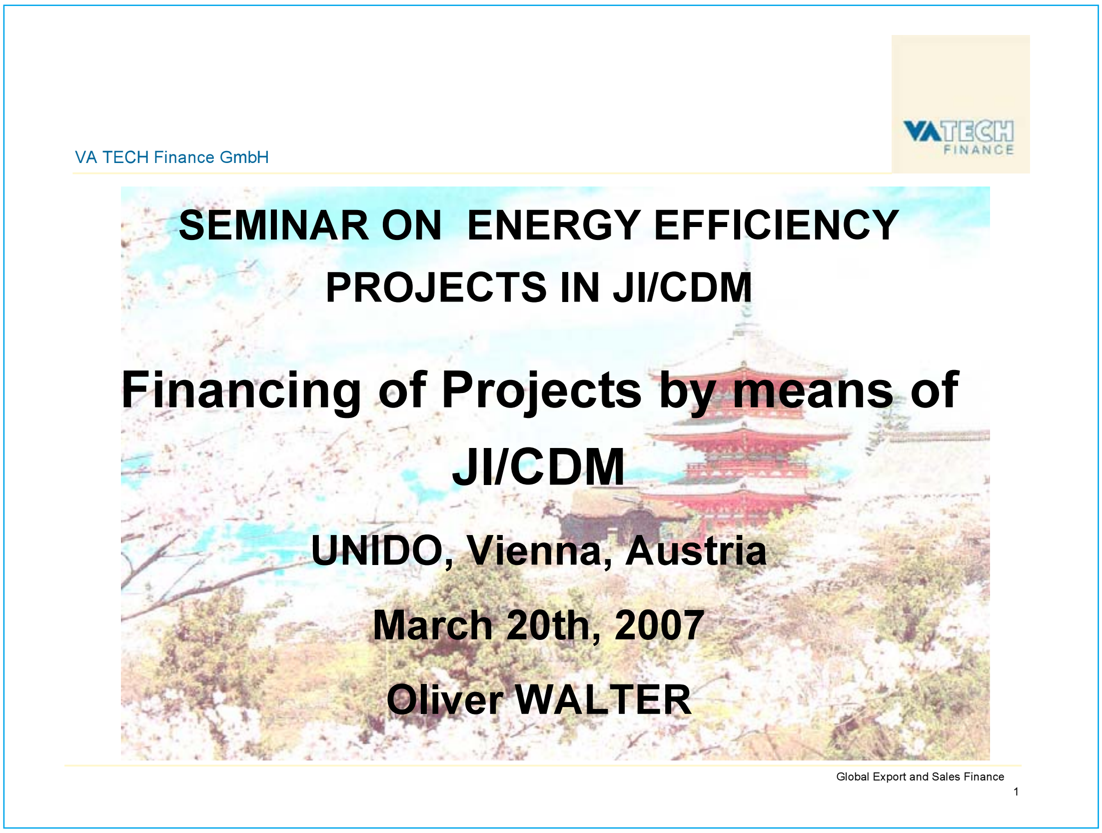
Ms. Marianne Moscoso-Osterkorn, International Director, REEEP, discussed barriers to improving energy efficiency, highlighting lack of institutional support for energy efficiency measures and subsidies for fossil fuels. She stressed the need to increase support for improving energy efficiency from the financial sector, and suggested that perceptions of energy efficiency activities might need improving. She suggested the CDM's present structure is not appropriate for typical energy efficiency projects, citing examples of top-down methodologies for industry and building energy efficiency, which have been created but are not being used.

The slides for Ms. Moscoso-Osterkorn's presentation are unavailable.

Financing of projects by means of JI/CDM

Mr. Oliver Walters, VA Tech Finance GmbH

Mr. Oliver Walters, Vice President, VA TECH Finance, discussed the financing of CDM and JI projects. He presented a case study of the Hydro Electric Power Plant Tsankov Kamak in Bulgaria, which involved the financing of an 80 Megawatt (MW) hydro power plant. He highlighted the success of the intersectoral synergies required to implement this project. He also noted the benefits to Austria, which secured its first JI deal, and to Bulgaria, which reduced carbon dioxide emissions equivalent to the fossil fuel required to generate 200 GWh per year.



Financing in the Project Development Process

VA TECH Finance GmbH

Financing is a most decisive step in the entire project development process, it is not a bolt-on element, which can be set up at the end of a process, but must be secured and embedded early in the process!

→ Finance Dept./Institutions shall be involved at an early stage of a project!

→ a good and bankable project must be identified at the beginning!

→ lack of realistic and viable projects!

→ convincing approach towards potential lenders (also bankers have to be trained!)

Financing, the greatest barrier?

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- Third party financing of - in particular large scale - projects is a challenge and has to be structured well.
- Kyoto related financing is not yet widely known and adopted and often companies have to finance their investments themselves!
- Funds are available but it is often difficult for host countries to make use of them (collateral, required min. equity, involvement of local banks,..).

Sources of Financing / Risk Insurance

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Sources for Kyoto related financing might be:

- **Funds/donors:**

  Out of various energy efficiency, carbon or private funds f.ex. the *Global Environment Facility* (GEF, www.gefweb.org) has given since 1995 over USD 1 bio in grants to climate change activities in developing countries.

  The *Special Climate Change Fund* finances projects relating to technology transfer

(http://unfccc.int/cooperation_and_support/financial_mechanism/special_climate_change_fund/items/3657.php).

- **Export Credit Agencies:** so far, only limited experience
- **International Financial Institutions (EIB, EBRD, NIB,..)**

  public sector financial institutions usually require tendering.
- **commercial banks:** required tenors, amounts,..?

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4

ECA financing vs. local financing

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Involvement of ECAs ensures:

- longer credit periods (construction period plus generally up to 10 or 12y repayment)
- lower interest rates (CIRR or even below)
- lower risk premiums, due to national export promotion schemes

Local capital markets/banks are in most cases:

- only active in rather short term transactions
- lower volumes and
- characterized by liquidity problems

→ off-shore escrow accounts might be door-opener for set-up of comprehensive bankable financing structure!

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(Financial) environments

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Establishing the necessary enabling environments, including removing of **barriers** remains an essential element not only in relation to financing but also to the overall process of technology transfer.

→ important aspect for prove of financial additionality in Baseline Study!

→ take into account trade, investment and environmental policies!

→ sustainable development objectives have to be made palatable to financial institutions/ ECAs (generally, MoF is behind National Carbon Fund and ECA, one budget pot! - national measures vs. flexible instruments.)

→ innovative legislation linked with incentives

→ a good understanding and cooperation between involved government institutions is a precondition, often a MoU is of great value!

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Collateral Structure

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- focus on creditworthiness of Borrower/Guarantor and country risk often requires challenging security packages
- more and more, traditional securities do not suffice anymore in particular for high volume projects (pledge, mortgage, corporate guarantees, prom. notes,…)

→ cash payments for ERUs/CERs by a purchasing fund/national JI/CDM program are considered as bankable security from a lender's point of view!

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ERPA as collateral – escrow account

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- Emission Reduction Purchase Agreements are concluded between the owner of the ERUs/CERs in the host country and the buyer of the Certificates. Upon Commercial Operation of a plant (= start of repayment period) and successful Monitoring, ERUs/CERs will be generated, issued and thereafter transferred from the national register of the host country to the fund's country.
- So far, only PPAs were accepted as security by banks, nowadays ERPAs become more commonly accepted by Lenders as bankable and reliable collateral.
- it is favourized to have ERU/CER-payments by the buyer to be effected on an off-shore escrow account, serving as partial repayment of the loan.

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Key factors for success

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- collect info and build up detailed knowledge of JI/CDM regulations
- select good, JI/CDM-eligible project
- company's in-house common understanding and convince Management for JI/CDM as useful instrument and benefit
- bankable security structure for set-up financing
- have a clear picture on additional JI/CDM related cost → PIN at early stage to potential buyer for 1st cross check might save stranded cost
- together with client early positioning towards involved (non-) govt. institutions (Ministries, Consultants, Banks, Embassies, IE/OE,…)
- close co-operation between related government entities

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Carbon Financing Structure

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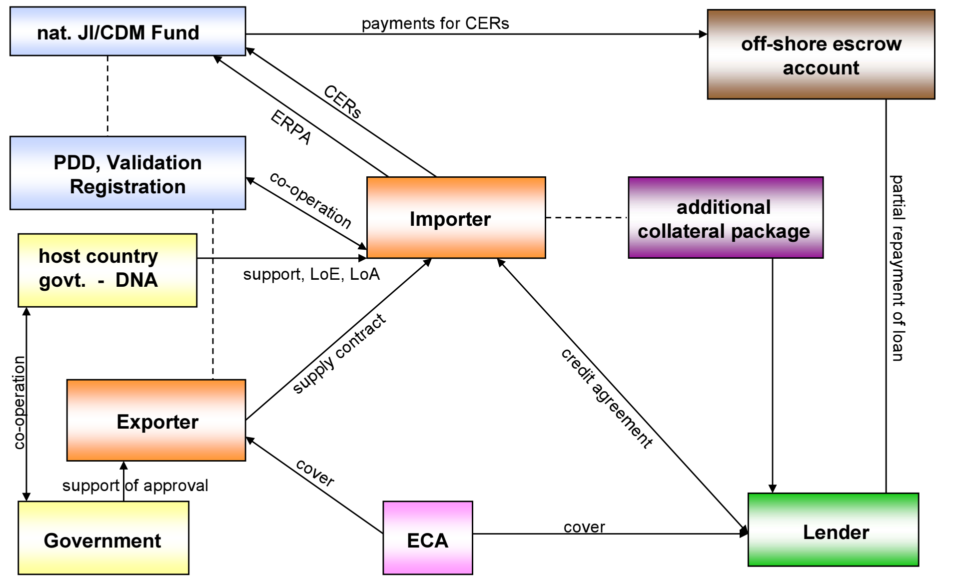

Simplified CER revenue calculation

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Project:	Hydro Power Plant, EUR 100 mio
Installed Capacity:	2 x 45 MW
Annual Output:	220.000 MWh
Carbon Factor acc. to BLS:	~ 1 ton of CO_{2e}/MWh
Tons of CO_2 avoidance:	approx. 220.000 tons of CO_{2e} per annum
CERs:	approx. 220.000 CERs shall be issued/annum
Commercial operation:	1/2008
Kyoto Period:	2008-2012
Price per CER:	EUR 5,-
Revenues:	EUR 5.500.000,- during 1st Kyoto Comm.Period

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Case Study:

Financing of a JI-Pilot Project

under the Kyoto Protocol

'HEPP Tsankov Kamak' - Bulgaria

Project Data

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Hydro Power Plant Tsankov Kamak (2x40 MW)

- **Total Project Cost: approx. EUR 200 Mio.**
- **Client: NEK, Natsionalna Elektricheska Kompania (investor, owner, operator & borrower)**
- **Exporters: - VA TECH HYDRO
- ALPINE MAYREDER
- Verbundplan**

Starting Point in 2001

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Approach of IFIs and ECAs (OeKB) for Financing:

<u>Project Cost</u>:

MEUR 200 versus MEUR 5 max. OeKB cover for BG

<u>Security</u>:

NEK corporate risk versus request for State Guarantee

<u>Tenor</u>:

16 y versus cover of up to 5 y repayment period

<u>Client</u>:

100% state owned versus cover only for private clients

Development

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- <u>Kyoto Protocol approach:</u>
  Tsankov Kamak to be realized as Joint Implementation (JI)-Project based on the Kyoto Protocol
- <u>Memorandum of Understanding</u>: Sept. 2nd, 2002
  Ministry of Environment, Austria – Bulgaria
- <u>Pilot Project</u>: November 2002
  Tsankov Kamak declared as Pilot Project between Austria & Bulgaria
- <u>Supply Contracts</u>: signed Oct. 1st, 2003
- <u>Credit Agreements</u>: signed Nov. 14th, 2003, Financial Closing 4/2004

2003 **Deal of the Year, awarded by Euromoney/Trade Finance Magazine**

Financing

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EXPORT CREDIT AGREEMENT

- EUR 100 mio. loan
- 5 commercial banks
- Tenor: 16 years
- ECA: Cover of 5 Export Credit Agencies (A, CZ, D, F, S)

COMMERCIAL CREDIT AGREEMENTS

- 4 loans, totaling to EUR 120 mio.
- 1 commercial bank
- Tenor: 7 years

Collateral structure

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a mixture of structured security package consisting of, inter alia, Bulgarian government involvement, various escrow accounts, pledge of assets, mortgage of the site, promissory notes,…

KYOTO PROTOCOL ASPECTS

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BASELINE STUDY: elaborated by Austrian Consultant
- international Validation
- official recognition as JI-project

EMISSION REDUCTION PURCHASE AGREEMENT:

concluded between NEK and Kommunalkredit for transfer of ERUs → revenues serve as collateral!

EMISSION REDUCTION UNITS (ERUs):

Upon commercial operation (2008), ERUs will be generated and purchased by the Republic of Austria (approx. 200.000 ERUs/year).

(KYOTO-) FINANCING STRUCTURE

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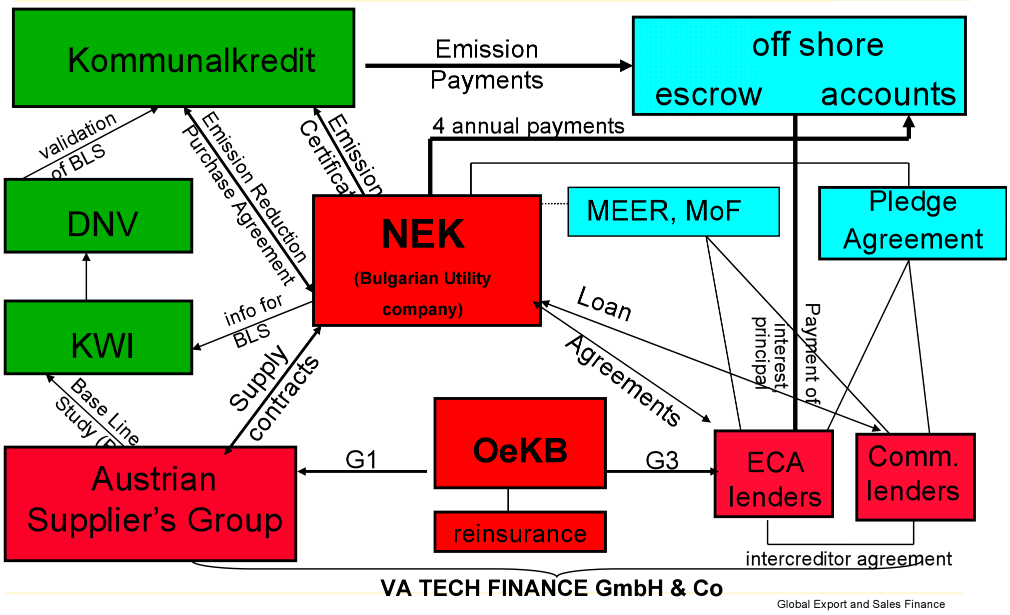

JI/CDM is a win-win situation for both parties!

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AUSTRIA

- 1st JI/CDM project
- export increase
- tax income
- job creation
- higher OeKB cover

  MEUR 5 → MEUR 80!!!

BULGARIA

- green, clear energy
- reduction of CO_2-Emissions
- job creation
- know-how transfer
- overcome barriers
- WWTP Devin

Excellent cooperation between both countries:
Ministries, Embassies, Trade Commissions, Banks,…..

Global Export and Sales Finance
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VA TECH Finance GmbH

CONTACT DETAILS:

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UNDP approach to transforming markets for energy efficiency

Mr. Vladimir Litvak, UNDP

Mr. Vladimir Litvak, Regional Team Leader, Energy and Environment, UNDP, discussed UNDP's efforts to transform markets for energy efficiency, involvement in CDM projects and its activities as an implementing agency for GEF. He highlighted CDM activities that contribute to UNDP's wider development goals to address climate change and increase sustainable development, such as its activities in capacity building in developing countries, establishing designated national authorities, and developing CDM strategies, pipelines and new projects.

Global Environment Facility, period 2006-2010 : US$1 Billion for Climate Change Mitigation in Developing Countries & Economies in Transition

- The GEF is the Financial Mechanism of the UNFCCC Convention
- GEF projects focus on policy, legal and institutional reforms (environmental fiscal reform, resource pricing, access to information, property and land tenure rights, etc.) in order to remove barriers and transform markets.
- UNDP is one of GEF implementing agencies

GEF Mitigation Mission

To develop and transform the markets for energy and mobility in developing countries and economies in transition so that over the long term, they will be able to grow and operate efficiently toward a less carbon-intensive path.

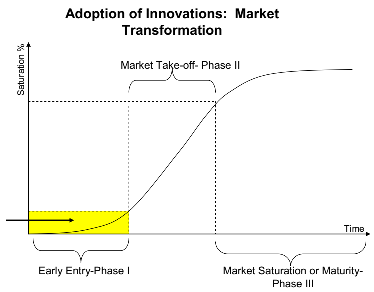
GEF Approach to MT

barriers that require attention generally relate to five market characteristics: policy; finance; business skills; information; and technology. The GEF's approach to market transformation focuses on removing barriers related to these five pillars or dimensions of the markets being addressed.

GEF role in stimulating MT

GEF – Phase I

Carbon Finance – Phase II



GEF EE Programming

- Energy Efficient Buildings

Scope: This program area covers the entire spectrum of the building sector, including the building envelope and the energy-consuming systems and appliances used in buildings for heating, cooling, lighting, as well as household appliances and office equipment.

Evolution: The initial focus will continue to be on appliances, with support to lighting and refrigerators phasing out. Emphasis will shift to building efficiency over the course of GEF 4.

Carbon finance may be useful to “incentivize” replication or accelerate market dissemination.

GEF EE Programming

- Energy Efficiency in Industry

Scope: This program covers the energy systems in industrial manufacturing and processing, including combustion, steam, process heat, combined heat and power, electricity generation, and other public utilities. Adoption of an appropriate energy pricing framework is essential to ensure project effectiveness.

Evolution: this programming area is expected to evolve into focused, sector-specific, technology transfer programs focusing on GHG-intensive industries. This programming area may be also used to test potential modalities for sector-specific or technology-specific GHG mitigation programs for use in GEF-4 and beyond.

Carbon finance may be useful to create incentives for replication to accelerate market saturation.

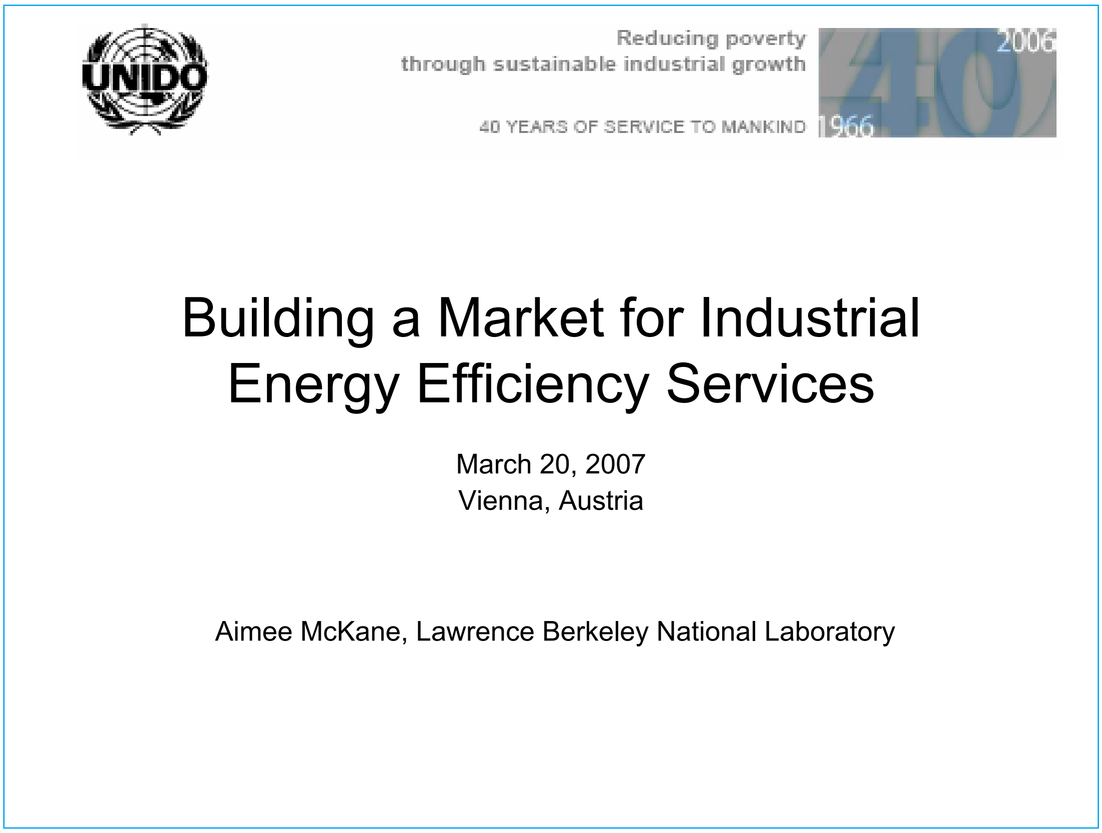
UNDP GEF to UNDP EF

- Combining and sequencing ODA, GEF and carbon finance
- Linkage to UNDP core development work
- Development co-benefits
- MDG Carbon Facility: programmatic CDM/JI?

Industrial system energy efficiency: potential and opportunity

Ms. Aimee McKane, LBNL

Ms. Aimee McKane discussed building a market for IEE services and the importance of identifying where business and public policy intersect. She highlighted the benefits of public-private partnerships and stressed that the public and private benefits of potential projects need to be identified up front.



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through sustainable industrial growth

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Why are industrial systems important?

- Steam and motor-driven systems account for approximately for more than 50% of final manufacturing energy use worldwide
- Energy savings potential from cost-effective optimization of these systems for energy efficiency is estimated at 10-12 EJ of primary energy[1]
- A global effort to cost-optimize industrial systems for energy efficiency could achieve these energy savings through
  - the application of commercially available technologies
  - in existing and new industrial facilities

1 2007 IEA Statistics

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Why aren't industrial systems more energy efficient?

1. Engineers are trained to make industrial systems reliable, not energy efficient
2. Industrial systems are not typically separately metered, so the cost of their operation is not known to management
3. Energy efficiency is not core mission for most industries
4. Even if facility engineers know how to make a system more energy efficient, production needs and operational patterns may negate their efforts

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What makes industrial energy efficiency so challenging?

- Energy use in industry is much more related to operational practices than the commercial & residential sectors
- Energy use in industry changes with variations in production volume and product mix
- Industrial energy efficiency is not a product that can be bought and installed
- Industrial energy efficiency involves changing a corporate culture

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Role of Government

- Level the playing field
  - Develop and issue standards that support a market transition to more energy efficiency industrial systems
    - Energy management standards
    - System standards/protocols
- Design program with industry
  - Work with both end use and supplier companies to build in both energy efficiency and business benefits
- Build capabilities
  - Provide training and technical assistance to develop the necessary skills
- Develop supporting policies
  - Publicity and recognition
  - Financial incentives

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Role of industry (end use)

- Management commitment to managing energy
- Establish an energy management plan
- Empower an energy team to implement the plan and comply w/standard
- Be open to changing traditional practices
- Measure and document progress
- Participate in recognition programs
- Support financial incentives that require validated energy savings

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Role of suppliers

Industrial Equipment Suppliers

- Have close relationships with their industrial customers over a long period of time
  - relied on for emergency response & maintenance
  - valued source of expert advice
- Can have an important role in encouraging plants to optimize their industrial systems
- Can discourage industrial facilities from changing traditional, inefficient practices

Partnership engages industrial suppliers by helping them to identify a business opportunity in more energy efficient practices

Role of ESCOs

Energy Service Companies (ESCOs)

- Provide customers with a range of services to develop energy efficiency projects
- Offer industrial facilities the potential to develop projects "off budget"
- Are under-represented in industrial markets
  - Typically trained in commercial/residential
  - Tend to focus on "cross-over" measures like lighting and district heating or develop a narrow area of specialty

Partnership could bring additional financial resources to system optimization projects, especially in developing countries

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Partnering as a Business Opportunity

Equipment Supplier as ESCO

- Suppliers trained in system optimization
- Offer customers a package of system services rather than components and maintenance
- Supplier advantages:
  - Existing customer relationship
  - More robust financial rating than many ESCOs
  - Detailed knowledge required to develop cost-effective contracts

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Utility Companies

- In the US, utility companies have been very effective partners
  - Since the 1980s, many states have rewarded utilities for conserving energy in lieu of new power plant construction
  - Utility restructuring has created some challenges
  - Many states have sustained or re-entered the market for energy efficiency through the levy of public benefit charges
- Utilities typically assign account representatives to service large industrial customers
  - Offer financial incentives for system assessments and energy efficiency projects
  - Sponsor system optimization training
- Frequently have deeper pockets than state government

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Structuring Effective Partnerships

- Purpose:
  - Characterize the public benefit (in this case energy efficiency, GHG emission reduction)
  - Work with companies to identify the intersecting private interests that have the potential to carry the desired actions forward
- Key Questions:
  - What is the potential contribution of each participant in the collaboration (why are they desirable partners)?
  - What is their initial motivation to join the collaboration?
  - What are their primary drivers?
  - What do they hope to gain from their participation?

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Key Questions

As a result of the proposed partnership

- What will take place to promote greater energy efficiency?
  - Is it better than business-as-usual?
  - Can the results be measured?

*If these questions cannot be answered, the **public benefit** has not been identified*

- Is industry willing to invest (time, money, staff, expertise) in the proposed activities of the partnership?
- How this activity be sustained over time with limited investment of public resources?

*If these questions cannot be answered, the **business benefit** has not been identified*

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How partnership can work

Government can:

- Develop partnerships through "organizations of interest"
  - Industrial companies with multiple facilities and supply chains
  - Trade associations- supplier and end user
  - Utilities
  - State governments
  - Energy efficiency NGOs
- Develop tailored agreements toward a common goal
  - Offer "brand affiliation"
  - Define the scope, expectations, and the period
  - Be consistent
  - Reward results

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Developing a partnership network

One to one

One organization

Government signs agreement w/ trade association

↓

One to many

Hundreds of organizations

Association invites members to become active participants and to align with the "brand"

↓

Many to many

Thousands of organizations

Active, affiliated member companies work with customers or employees

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US DOE Allied Partner Program

Peak of operation (1997-2004)

- ~ 200 Allied Partners with signed agreements
- Voluntary, no fee
- Included associations, suppliers, utilities, states, energy efficiency organizations
- Allied Partners
  - Distributed more than 10 times the amount of USDOE information annually than any other program element
  - Most frequent host for training sessions
  - Generated 2/3 of program energy savings

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Benefits

- Cost-effective outreach on a limited budget
- Leads to widespread implementation
- Built-in exit strategy

Trade-offs

- Loss of control (perceived or real)
- Potential for diluting program message
- Need to maintain contact with the partners

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For more information:

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518 782 7002
atmckane@lbl.gov

10.2 Discussions

Participants stressed that energy efficiency projects must be made more attractive to financial institutions. Noting that commercial institutions respond to changes in the market and cannot be expected to lead the market, one participant said the energy efficiency sector must present proposals to attract investment. Another participant noted the increased support for energy efficiency and carbon market projects from merchant and investment banks. Some participants said that public and institutional perceptions act as a barrier to energy efficiency projects and proposed the alternative term "energy optimization" and approaching energy efficiency projects from an energy security perspective to increase appeal.

11. Annex I: List of participants

Country	*Name*
Albania	Ms. Emira Fida Mr. Laci Hysni Ms. Mirela Kamberi Mr. Zija Kamberi
Austria	Mr. Karl Fiala Mr. Miles Fischer Mr. Hiroshi Fujiwara Mr. Michael Haslinger Mr. Peter Jenkins Mr. Peter Franz Koegler Mr. Peter Pembleton Mr. Oliver Percl Mr. Vladimir Stehlik Mr. Christian Steinreiber Mr. Oliver Walter Ms. Evelin Walzer Mr. Daniel Weisser Mr. Wolfgan Wetzre Ms. Gertraud Wollansky
Azerbaijan	Mr. Emin Teymurov
Brazil	Mr. A.Valadares Mello Mr. G. Alves Soares
Bulgaria	Ms. Daniala Stoycheva
China	Mr. Li Tienen
Croatia	Mr. Tonko Curko Ms. Vesna Kolega
Denmark	Ms. Chia-Chin Cheng Mr. Adrian Lema
Egypt	Mr. Ihab Elmassry Ms. S.Hisham Fouad Mr. Ezzat Lewis Hannalla Agaiby Mrs. Lydia Mohamed Kamel Elewa

France	Mr. Philippe Bosse Mr. Paul Waide
Georgia	Ms. Marina Shvangiradze
Germany	Mr. Martin Burian Ms. Renate Duckat Ms. Ayse Frey Mr. Thomas Grammig Mr. Stefan Guldin Mr. Daisuke Hayashi Mr. Patrick Matschoss Mr. Sudhir Sharma Mr. Sam Warburton
Iran (Islamic Rep. of)	Mr. N. Mohammadreza Omidkhah
Italy	Mr. Paolo Bertoldi Mr. Daniel Rossi
Japan	Ms. Kaori Hayashi Mr. Taiki Kuroda Prof. M. Kurushima
Kenya	Mr. James Wakaba
Macedonia	Ms. Elena Bucevska Mr. Nikolov Igor Mr. Marin Kocov
Malta	Mr. Marco Cremona
Malysia	Mr. Krishna V.S. Kannan
Moldova	Mr. Andrei Percium Mr. Vasile Scorpan
Netherlands	Mr. Stefan Bakker Mr. Sytze Dijkstra Mr. Maarten Neelis
Nigeria	Mr. Kasimu Bayero Mr. Okey Oramah
Peru	Mr. Luis Ugarelli
Philippines	Ms. Alice Herrera
Portugal	Mr. Anibal De Almeida
Republic of Korea	Mr. Kwon Yong-Seok
Senegal	Mr. Ndiaye Cheikh Sylla
Serbia	Ms. Danijela Bozanic Ms. Antonela Solujic Mr. Miroslav Spasojevic

Slovakia	Mr. Stanislav Kucirek Mr. Vladimir Litvak
South Africa	Mr. Ian Lane
Spain	Mr. José Luis Tejera
Sweden	Mr. Gunner Hovstadius
Switzerland	Mr. Edwin Aalders Dr. Wolfram Kägi Mr. Stefan Kessler Ms. Stefanie Steiener
Thailand	Mr. Tiep Nguyen
Tunisia	Mr. Amel Bida Mr. Mongi Bida
UK	Mr. Lorand Farkas Mr. Hervé Gueguen Mr. Jerald Jones Ms. Janet Kidner Mr. Tony Lamb Mr. Mario Merchan Ms. Eva Snajdrova
Ukraine	Ms. Olga Gassan-zade
USA	Ms. Anne Arquit Niederberger Ms. Melanie Ashton Ms. Ingrid Barnsley Ms. Martina Bosi Ms. Christiana Figueres Ms. Jonathan Manley Ms. Heather McGeory Ms. Aimee McKane Mr. Williams Meffert Mr. Wayne Perry

12. Annex II: List of abbreviations and acronyms

BCI	Business Continuity Institute
BMLFUW	Bundesministerium fur Land und Forstwirtschaft, Umwelt und Wasserwirtschaft
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CERU	Certified Emission Reduction Unit
CFL	Compact Fluorescent Lamp
CHP	Combined Heat Power
CO2	Carbon Dioxide
CTI	Climate Technology Institute
DTICCPO	Department of Trade and Industry Climate Change Project Office
EB	Executive Board
EE	Energy Efficiency
ERU	Emission Reduction Unit
ESCO	Energy Service Company
ESD	Energy for Sustainable Development
EU ETS	European Union Greenhouse Gas Emission Trading Scheme
EU JRC	European Union Joint Research Centre
GEF	Global Environmental Fund
GHG	Greenhouse Gas
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWh	Gigawatt hour
HFC	Hydroflourocarbon
ICICI Bank	Industrial Credit and Investment Corporation of India
IEA	Internacional Energy Agency
IEE	Industrial Energy Efficiency
IETA	International Emissions Trading Association
IPMVP	International Performance Measurement and Verification Protocol
ISO	International Standards Organization
JI	Joint Implementation
JISC	Joint Implementation Supervisory Committee
LBNL	Lawrence Berkeley National Laboratory
MF	Multi-lateral Fund
MW	Megawatt
NGO	Non-governmental Organization
PoA	Programme of Activities

PDD	Project Design Document
PTC	UNIDO Programme Development & Technical Cooperation Division
REEEP	Renewable Energy & Energy Efficiency Partnership
SSC	Small-scale
UK	United Kingdom
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development
WADE	World Alliance for Decentralized Energy

13. Annex III: Seminar on energy efficiency projects in the CDM and JI agenda

Day 1, March 19, 2007

8:30- 9:30 Registration
9:30- 10:10 Welcoming remarks/opening session

Keynote presentations/statements:

Welcoming address:
- Mr. D. Piskounov, MD, PTC, UNIDO
- H.E. John Malcom Macgregor, Ambassador Permanent Representative, UK
- Dr. Mr. Karl Fiala, CTI
- Dr. Gertraud Wollansky, BMLFUW

Keynote statement:
- Dr. Peter Jenkins, REEEP

Introduction of agenda:
- Ms. Marina Ploutakhina, UNIDO/PTC/Energy efficiency and climate change

10:45 - 11:00 Break

11:00 - 12:30 Overview of the status of energy efficiency under the CDM and JI

Panel session I: Overview of carbon markets

Themes:
- Key market characteristics (size, depth, liquidity, volatility, participants, other)
- Market demand, market differentiation and CDM and JI price
- Energy efficiency in the carbon market
- Carbon markets trends

Panel coordinator: Mr. Edwin Aalders, IETA

Panel participants:

- Mr. Herve Gueguen, EDF Trading
- Ms. Eva Snajdrova, Carbon Capital Markets
- Ms. Olga Gassan-zade, PointCarbon
- Ms. Heather McGeory, Natsource
- Mr. Paul Waide, IEA

Discussions

12:30-14:00 Lunch

14:00 - 15:30 **Panel session II: Status of energy efficiency under CDM and JI**

Themes:

- Approved methodologies and challenges
- Energy efficiency project pipeline
- Lessons learned
- Performance vs. potential
- Calls for public inputs: comments and inputs on EE in CDM

Panel coordinator: Marina Ploutakhina, UNIDO

Panel participants:

- Mr. Adrian Lema, UNEP Risoe Centre on Energy, Climate and Sustainable Development
- Mr. Sudhir Sharma, UNFCCC Secretariat
- Ms. Daniela Stoycheva, JISC
- Ms. Gertraud Wollansky, BMLFUW
- Ms. Marina Shvangiradze, Georgia, Accreditation Panel Member

Discussions

15:30-16:00 Break

16:00 - 17:30 **Panel session III: Lessons learned and barriers to energy efficiency in CDM /JI**

Themes:

- Review of barriers
- Systems approach
- Baselines: data availability and other pitfalls in development
- Tools for CDM/EE development

Panel coordinator: Mr. Bob Williams, UNIDO/PTC/ Energy efficiency and climate change

Panel participants:

- Ms. Ayse Frey, TUV Süd
- Mr. Michael Haslinger, Pöyry Energy
- Mr. Peter Koegler, Austrian JI/CDM programme
- Ms. Aimee McKane, LBNL/ Mr. Wayne Perry Kaeser Compressors
- Mr. Michael Bess, ESD
- Prof. Morihiro Kurushima, CTI

	Discussions
19:00 - 21:00	Cocktail Reception – VIC Restaurant, Mozart Room Hosted by UK Trade and Investment

Day 2, March 20, 2007

9:00 - 10:30 **Panel session IV: New approaches to CDM / JI**

Themes:

- Programmes of activities: Advantages for energy efficiency?
- Scope for aggregation under Type II SSC methodologies
- Bundling
- Methodology development for programmatic activities

Panel coordinator: Dr. Patrick Matschoss, German Advisory Council on the Environment

Panel participants:

- Mr. Paolo Bertoldi, EU-JRC
- Ms. Christiana Figueres, CDM Executive Board
- Mr. Thomas Grammig, GTZ
- Mr. Luis Ugarelli, BCI
- Mr. Daisuke Hayashi, Perspective GmbH
- Ms. Stefanie Steiner, BSS

Discussions

10:30 - 11:00 Break

11:00 - 12:30 **Panel session V: Methodologies for electric motor-driven systems**

Themes:

- Potential greenhouse gas reductions from industrial electric motor systems in buildings and industry
- Proposed methodologies
- Key methodological challenges
- Prospect under small-scale methodologies and PoA
- CDM / JI programme and project design

Panel coordinator: Dr. Anne Arquit Niederberger, A+B International (sustainable energy advisors)

Panel participants:

- Ms. Martina Bosi, World Bank (NM0197 chillers)
- Mr. Ian Lane, Energy Cybernetics
- Mr. Maarten Neelis, Ecofys (motors)
- Prof. Anibal T. de Almeida, University of Coimbra

Discussions

12:30-13:30 Lunch

13:30 -15:00 **Discussion groups**

- Group 1: Programmes of activities and energy efficiency

Facilitator: Dr. Patrick Matschoss, German Advisory Council on the Environment

- Group 2: Energy efficiency methodology issues and tools. Facilitator: Mr. Sudhir Sharma, UNFCCC Secretariat
- Group 3: CHP in CDM, Facilitator: Mr. Sytze Dijkstra, WADE
- Group 4: Linking Montreal and Kyoto: chiller demonstration projects and CDM

Facilitator: Mr. Stefan Kessler, Infras

- Group 5: Linking the EE und CDM/JI expert communities: CDM EE Network

Facilitator: Dr. Anne Arquit Niederberger, A+B International (sustainable energy advisors)

15:00-15:30 Break

15:30 - 16:30 **Reports from the discussion groups**
10-minute summaries from each group

16:30 - 17:00 Break

What to look out for after 2012

17:00 - 18:00 **Panel session VI: Transforming markets for energy efficiency**

Themes:
- Scenarios of role of energy efficiency in realizing mitigation potential
- Key ingredients to a market transformation strategy
- Future prospects for EE in CDM/JI
- Interplay of environmental markets & energy efficiency
- Financing energy efficiency
- Other

Panel coordinator: Mr. Paolo Bertoldi, EU-JRC Panel Participants

Panel participants:
- Mr. Ralf Luken, UNIDO Consultant
- Mr. Jed Jones, DTI CCPO
- Dr. Marianne Moscoso-Osterkorn, REEEP
- Mr. Oliver Walters, VA Tech Finance GmbH
- Mr. Vladimr Litvak, UNDP
- Ms. Aimee McKane, LBNL

18:00 - 18:30 Concluding session

14. Annex IV: Papers

Energy efficiency in CDM - Ms. Anne Arquit Niederberger - Policy Solutions

Way forward for CDM energy efficiency projects - Mr. Patrick Matschoss - German Advisory Council on the Environment

Clean development though cogeneration - Ms. Sytze Dijkstra – WADE

Lessons from submission and approval process of methodologies - Mr. Daisuke Hayashi - Perspectives Climate Change GmbH

Energy efficient lighting projects in the CDM - Carbon Finance Unit - World Bank

Energy efficiency in CDM - Ms. Anne Arquit Niederberger - Policy Solutions

22 March 2007

UNIDO/CTI/UK Trade & Investment Seminar
Energy Efficiency Projects in CDM and JI
19-20 March 2007, Vienna

Seminar Issue Paper

Prepared for UNIDO by Anne Arquit Niederberger, Policy Solutions (policy@optonline.net)

Introduction

UNIDO, in cooperation with the Climate Technology Initiative (CTI) and UK Trade and Investment, will hold a seminar on "Energy Efficiency Projects in CDM and JI" in Vienna, Austria, on 19 and 20 March, 2007. The objective of the seminar is to provide a forum for business and industry to advance their understanding of the methodological issues surrounding energy efficiency projects/programmes under the flexibility mechanisms of the Kyoto Protocol, namely the Clean Development Mechanism (CDM) and Joint Implementation (JI).

This paper is prepared to facilitate discussion and knowledge sharing among experts It is stuctured around a set of nine theses, which can be explored during the workshop panel and discussion sessions.

Thesis 1

End-use energy efficiency is crucial for climate mitigation and Parties expect the CDM to promote it

It has become abundantly clear that the current trend in greenhouse gas emissions is unsustainable (the IEA (2006) anticipates more than a doubling of energy-related CO_2 emissions from 1990 to 2030 under its Reference Scenario). Equally troubling is that most of the emissions growth over the next decades is expected to take place in the developing world.

Recent energy scenarios (e.g., IEA, IPCC, WBCSD) converge in demonstrating that demand-side energy efficiency will have to carry most of the weight in climate mitigation in the next decades, if we are to limit emissions sufficiently to stabilize atmospheric concentrations. In the latest IEA Alternative Policy Scenario, which assumes the use of existing technologies, implemented only through additional policies currently planned or under discussion in each country, end-use efficiency accounts for 65% of energy-related CO_2 abatement in 2030 (IEA, 2006). This means that if we do not succeed in overcoming market failures and breaking down barriers to introducing energy efficient technologies and practices in industry and transforming global markets for high-efficiency equipment, products and services, the price of climate mitigation will be much higher.

Investment in end-use energy efficiency is not only crucial from the perspective of climate protection; it can make an important contribution to economic and social development in all countries (Arquit Niederberger et al., 2007). A more energy and resource efficient economy can improve the competitiveness of domestic enterprises, lower the cost of doing business in a given country and moderate the rise in commodity and consumer prices (e.g., as a result of reducing oil imports). For developing countries facing the challenge of providing adequate energy services to growing populations and economies, investments in energy efficiency improvements have the added benefit of creating jobs and being much quicker and cheaper to implement than building new supply capacity (Spalding Fecher and Roy, 2004).

Creating framework conditions that put cost-effective investments in energy efficiency improvements on an equal footing with investment in energy supply as one option to meet the energy needs of end-users, can offer them a number of advantages, including:

- Improved access to and reliability of energy services;
- Lower and less volatile energy bills;
- Improved private sector competitiveness as a result of improved overall productivity / process efficiency;
- Avoidance of pollutant and greenhouse gas emissions that are damaging to humans, infrastructure and ecosystems.

However, significant, well-documented barriers to investment in high-efficiency equipment and practices are widespread, even in the most advanced economies, and these can be particularly pronounced in the developing country context: knowledge of energy-saving potential in industry and other sectors is lacking; access to capital can be a challenge in cases where capital markets are not well developed to support the efficiency market; the motivations and decision criteria of those who make investment / procurement decisions (i.e., up-front capital cost of equipment) and those who pay energy bills are often conflicting; retrofits may incur additional planning expense, can require factories to be shut down and may not function flawlessly from the outset; a strong policy, regulatory and enforcement regime and incentives to make energy conservation efforts profitable are lacking.

The challenge of ensuring that billions of energy end-users, mostly in poor countries, make additional up-front investments in energy efficient technologies is daunting (despite the attractiveness of such investments on a least lifecycle cost basis), but there is a range of regulations, market mechanisms and other policies and measures to promote the necessary market transformation. The Kyoto Protocol's flexibility mechanisms, the Clean Development Mechanism (CDM) and Joint Implementation (JI), can address primarily financial barriers. A number of countries – for example, China – have made energy efficiency a CDM priority.

Yet the CDM has only managed to catalyze approximately two dozen demand-side efficiency projects across all sectors, which collectively will reduce greenhouse gas emissions by about 300 kt CO_2e per year (of the order of 3 Mt CO_2e cumulatively through 2015). This is an insignificant amount, compared with the vast potential for cost-effective energy efficiency improvement. With energy efficiency currently at the top of the political agenda around the globe, there is a desire to make the carbon markets work for energy efficiency, recognizing that CDM/JI are only one part of the necessary market transformation process.

Thesis 2
The Kyoto Mechanisms have largely failed to stimulate industrial end-use efficiency

The sustainable development benefits of improved energy efficiency are widely acknowledged, yet the Clean Development Mechanism has failed so far to live up to its potential to promote more efficient technologies (Arquit Niederberger & Spalding-Fecher, 2006; Hayashi & Michaelowa, 2007). Among the 563 CDM projects approved up to 22 March 2007[1], captive industrial cogeneration projects (i.e., power plants built to generate electricity primarily for the facility's own use) and use of waste heat or gas to deliver heat/power (which are sometimes classified as energy efficiency projects) are well-represented, but only five large-scale[2] and six small-scale projects – out of a total number of

[1] http://cdm.unfccc.int/Projects/projsearch.html

[2] Simplified modalities and procedures have been adopted for small-scale project activities. For an energy efficiency project or program to qualify as small-scale, it must result in less than 60 GWh of

277 and 286, respectively – are aimed at improving the efficiency of energy end-use (this is referred to as "Sectoral Scope 3", energy demand[3]).

The approved energy efficiency projects in the industrial sector are listed in Table 1. These 19 projects – representing only 3% of the total number of registered CDM projects – are estimated to reduce greenhouse gas emissions by < 300 kt CO_2e per year, a miniscule share of global energy efficiency potential. This is reflected by their limited geographical distribution (all but two projects in India), range of applied technologies and tendency to be small-scale.

Table 1. Registered Industrial End-Use Efficiency Projects

Project ID	Title	Host Party	Sector	Methodology
Full-Size CDM Projects				
CDM0123	Energy efficiency through installation of modified CO2 removal system in Ammonia Plant	India	Chemicals	AM0018
CDM0261	Energy efficiency through steam optimization projects at RIL, Hazira	India	Petrochemicals	AM0018
CDM0340	Reduction in steam consumption in stripper reboilers through process modifications	India	Petrochemicals	AM0018
CDM0677	Optimization of steam consumption by applying retrofit measures in blow heat recovery system	India	Paper	AM0018
CDM0679	Optimization of steam consumption at the evaporator	India	Paper	AM0018
Small-Scale CDM Projects				
CDM0255	Demand-side energy efficiency programme in the 'Humidification Towers' of Jaya Shree Textiles	India	Textiles	AMS-II.C
CDM0262	Energy efficiency projects - Steam system upgradation at the manufacturing unit of Birla Tyres	India	Petrochemicals	AMS-II.D.
CDM0445	Demand side energy conservation & reduction measures at IPCL – Gandhar Complex	India	Petrochemicals	AMS-II.D.
CDM0568	GHG Emission Reductions through Energy Efficiency Improvements	India	Cement	AMS-II.D.
CDM0582	India - Vertical Shaft Brick Kiln Cluster Project	India	Building materials	AMS-II.D.
CDM0701	Energy efficiency project in the Ramla Cement Plant in Israel through instalment of new grinding technology	India	Cement	AMS-II.D.
CDM0745	Demand side energy conservation and reduction measures at ITC Tribeni Unit	India	Paper	AMS-II.D.
CDM0757	Factory energy-efficiency improvement project in Malaysia (MAPREC, PRDM, PSCDDM, PAVCJM, PCM)	Malaysia	Manufacturing	AMS-II.D. (bundle)
CDM0759	Factory energy-efficiency improvement project in Malaysia (PHAAM, PCOM (PJ), PCOM (SA), PEDMA, MEDEM)	Malaysia	Manufacturing	AMS-II.D. (bundle)
CDM0777	Energy Efficiency Improvement in Electric Arc Furnace at Indian Seamless Metal Tube Limited (ISMT), Jejuri, Maharashtra	India	Iron & steel	AMS-II.D.
CDM0806	Demand side energy efficiency programmes for specific technologies at ITC Bhadrachalam pulp and paper making facility in India	India	Paper	AMS-II.D.
CDM0850	Installation of Plate Type Heat Exchanger for preheating combustion air of primary reformer and reducing heat loss to atmosphere through flue gases at Indo Gulf Fertilisers (A Unit of Aditya Birla Group), Jagdishpur	India	Chemicals	AMS-II.D.

energy savings annually. All other activities are classified as large-scale. For more on small-scale CDM, refer to Thesis 4.

[3] Annex 1 lists the Sectoral Scopes defined under the CDM.

CDM0858	Grasim Cement: Energy efficiency by up-gradation of clinker cooler in cement manufacturing	India	Cement	AMS-II.D.
CDM0932	Energy Efficiency Measures At Paper Production Plant	India	Paper	AMS-II.D.

(Source: http://cdm.unfccc.int/Projects/projsearch.html, categories: Energy Demand, Manufacturing Industries – end-use energy efficiency)

The pipeline for energy efficiency projects, however, is expanding rapidly. The UNEP Risoe Centre on Energy, Climate and Sustainable Development (URC) periodically publishes a compilation of projects at each stage of the CDM pipeline, including projects that have been:

- registered by the CDM Executive Board (see previous section);
- validated by a Designated Operational Entity (DOE) and requested registration by the CDM Executive Board;
- submitted to a DOE for validation.

In the most recent compilation from 15 March 2007 (URC, 2007), energy efficiency projects[4] represent roughly 12% (196) of the total of 1571 projects in the CDM project pipeline (at least submitted to a DOE for validation). In terms of cumulative CERs that would be delivered by the projects in the pipeline, however, the share of energy efficiency projects is only 7% (about 120 Mt $CO2_e$). The majority of these proposed projects are hosted by Indian entities and over 80% (162 projects) are in the industrial sector.

Over half of the projects in the pipleline attributed to the industrial energy efficiency category involve recovery and use of waste heat/gas, and the vast majority of these use the consolidated methodology ACM0004. Just over one-third of the industrial energy efficiency projects are small-scale (<60 GWh of savings per year).[5] It is clear that the CDM is only making a very small contribution to promotion of energy efficiency, despite significant potential for improvement in developing countries worldwide.

Thesis 3

A lack of viable, broadly-applicable approved methodologies is a barrier to energy efficiency CDM

One of the barriers that energy efficiency projects face under the CDM is a lack of suitable approved baseline and monitoring methodologies for large-scale projects. The approval of CDM methodologies generally takes a "case law" approach: Once a methodology has been approved by the CDM Executive Board, it is valid for use by any project developer to prepare new CDM Project Design Documents for official CDM project registration. It is therefore important to get a critical mass of methodologies approved rapidly that can serve as a basis for energy demand CDM project development across key sectors and applications.

Table 2 provides an overview of CDM Executive Board decisions on proposed new methodologies for industrial energy efficiency projects. Only three full-scale methodologies for demand-side industrial energy efficiency (Sectoral Scope 3) have made the cut[6]:

[4] Note that this figure is much lower when the selection is limited to projects that use Sectoral Scope 3 (demand-side efficiency) methodologies. The classification used in the UNEP-URC compilation includes both supply and end-use efficiency under the groupings "EE Supply side", "Energy distribution", EE Service", "EE Industry", "EE Households", and "Transport".

[5] For a more detailed pipeline analysis, refer to Hayashi and Michaelowa (2007).

[6] The designation of Sectoral Scope is taken from the UNFCCC web site for approved projects and from the information provided by the developer of the rejected and "B"-case (revisions required) methodologies. Note that there is some inconsistency in these designations, but for full-scale methodologies, cogeneration and waste heat/gas utilization methodologies are generally excluded from

- AM0017 (steam system efficiency at refineries)
- AM0018 (steam system optimization)
- AM0038 (energy efficiency of electric arc furnaces)

Table 2. Overview of CDM Methodology Approval and Rejection for Demand-Side Energy Efficiency Projects/Programs applicable to Industry

Methodology Type	Approved	Rejected	Under Consideration
Consolidated	none	n/a	n/a
Large-Scale	• AM0017 (steam system efficiency at refineries) • AM0018 (steam system optimization) • AM0038 (energy efficiency of electric arc furnaces)	• NM0086 (petrochemical industry) • NM0092-rev (smelter upgrade) • NM0099 / NM0101 / NM0137 / NM0154 (cement) • NM0100 (unitary equipment replacement) • NM0118-rev (brewery optimization) • NM0119 (process energy integration) • NM0169 (efficient utilization of energy in the form of fuel, power and steam) • NM0182 (advanced SCADA control systems & enegy management)	• NM0197 (replacement of electrical equipment with variable load) • NM0195 (steam turbine replacement)
Small-Scale	• AMSII-C (specific technologies) • AMSII-D (industrial facilities) • AMSII-E (buildings)	n/a	n/a

Source: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html and http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html

Unfortunately, it is difficult to distill the key ingredients shared by these approved methodologies (beyond their focus on the discretionary retrofit market and application of a baseline approach that determines the emissions baseline from existing actual or historical emissions). There is a lack of top-down guidance, consistency and predictablility that discourages methodology development. Over all, the energy efficiency category has suffered the highest rejection rate by the Executive Board (Hayashi & Michaelowa, 2007).

To be sure, the quality of new methodology proposals has varied widely; some proposed new methodologies were simply not prepared well enough to meet the demands of the CDM. Yet there were also many thoughtful and professional attempts to draft credible methodologies that were rejected, which appears to have discouraged the development of new methodologies (in the last four new methodology submission rounds combined, only two Sectoral Scope 3 methodologies were proposed).

The CDM Executive Board has given a number of common reasons for the rejection of new methodologies for energy efficiency projects. These can be summarized[7] as a failure to:

- Select an appropriate project scope or specify how methodology can be applied in different sectors
- Provide a procedure to select baseline scenario (even though retrofit projects often apply the historical emissions approach to setting the baseline)

this category. AM0038 has been included here, even though it is in Sectoral Scope 4 (Manufacturing Industries), due to the nature of the methodology.

[7] Refer to Arquit Niederberger and Spalding-Fecher (2006) for details.

- Clearly define the project boundary, (e.g., geographical boundary, greenhouse gas sources included/excluded, ownership).
- Specify data/assumptions and explain how to determine if these are adequate, reliable and conservative
- Consider autonomous energy efficiency improvements, account for planned replacement and address free riders
- Take into account factors unrelated to energy efficiency measures that can affect future emissions
- Distinguish between energy efficiency markets (i.e., discretionary retrofit; planned replacement ("lost opportunity"); new equipment markets)
- Give full consideration to the potential for leakage
- Provide adequate guidance on developing a monitoring plan
- Provide level of methodological specificity sufficient to allow DOE to verify reductions

In addition, there have been a plethora of unique issues with individual proposed new methodologies, such as failure to: implement changes requested by the Methodology Panel; justify the need for a complex methodology (when simpler, more robust and/or readily verifiable methods are available); limit use of small-scale operating margin methodology for determining grid electricity factors to projects that do not exceed the small-scale energy saving limit; address planned industrial process changes; provide a methodology to handle variable load applications; treat plants or buildings individually; differentiate electricity emission factors, based on distribution of end-use equipment within project boundary (i.e., use regional rather than national grid emission factors); adequately evaluate uncertainties; account for rebound effects; demonstrate that efficiency gains are significant relative to uncertainty (signal-to-noise ratio).

Due to the "case law" approach to full-scale methodologies, as opposed to small-scale methodologies (which have been prepared by the Small-Scale Working Group and approved by the CDM Executive Board), the onus of developing methodologies has fallen on individual project developers. As a result, the sectoral scope of approved methodologies reflects the market niches of larger developers (e.g., landfill methane and renewable power) and/or the investment criteria of buyers, in particular, low risk, large volume and low cost CERs (which drove HFC-22 destruction projects).

There has been little incentive for developers to invest in methodologies for energy efficiency (Sectoral Scope 3), not the least because private investors expect higher returns from non-CO_2 greenhouse gas projects, but also because of the lack of guidance on how end-use efficiency methodologies must be designed to receive approval, which creates great uncertainty. There is no common understanding of what constitutes a good or best practice energy efficiency CDM methodology, and large inconsistency in the decision-making process, particularly with gross-to-net adjustments (refer to Thesis 6 for an in-depth discussion).

As a result of the challenges faced by energy efficiency methodologies, widely applicable methodologies for sectors, program types and technologies with large greenhouse gas emissions from energy end-use, such as energy-intensive industry or industrial motors[8] are lacking. Two proposed new industrial energy efficiency methodologies have received preliminary recommendations from the CDM Meth Panel and are currently under revision (see Table 2). If NM0197 is ultimately approved, it could open the door for industrial energy efficiency improvements to at least those electric motor systems that are easily monitored.

[8] Electric motor systems are responsible for 70% of industrial electricity demand and have an average cost-effective efficiency improvement potential of 25-30% (SEEEM, 2006).

A gaping hole in the coverage of the approved industrial energy efficiency methodologies for full-size projects is that all of the methodologies approved to date only apply to the retrofit market (and apply the baseline approach that relies on "existing actual or historical emissions"). Given the double-digit growth rates in many industrial sectors, particularly in emerging economies, the lack of methodologies applicable to new installations means that we are missing an important opportunity to leverage CDM to ensure adoption of state-of-the-art energy management practices and systems that will have a significant operating lifetime.

Another observation is that even though a methodology might ultimately have received EB approval, it is not necessarily viable in practice. AM0018 is the only one of the approved industrial Sectoral Scope 3 methodologies that has actually led to projects being registered (5 projects, with two more currently reqesting registration).

Thesis 4

Most industrial efficiency projects could be conducted under the new 60 GWh limit for small-scale CDM (SSC)

The CDM Executive Board has provided a suite of small-scale CDM (SSC) energy efficiency methodologies (that apply to "Type II project activities"; Table 2 lists the SSC methodologies relevant to the industry sector). To qualify as a Type II small-scale project, a CDM activity must result in less than 60 GWh of energy savings annually. In addition to being eligible to apply pre-approved, simplified methodologies, SSC project activities can follow simplified modalities and procedures – which include a simplified PDD and provisions for environmental impact analysis, as well as lower registration fees and other special arrangements – with a view to reducing the transaction costs associated with preparing and implementing CDM projects.

While a large number of small-scale projects have been registered in other project categories, industrial energy demand projects account for only 13 registered small-scale CDM projects (less than 5% of the total), all but one of which use methodology AMS II-D (see Table 2).

The decision by the Parties to the Kyoto Protocol in November 2006 to raise the limit for small-scale energy efficiency activities from 15 GWh to 60 GWh has a significant impact on the scope of industrial energy efficiency activities that fall under the SSC rules and, hence, the transaction costs for industrial energy effiency CDM projects. In the industry sector, an individual factory might have an electricity consumption of the order of between 1 and 100 GWh annually. This means that three large factories (or 300 small factories) could be bundled together in a single small-scale project or program to improve the efficiency of energy use by 20%.

Taking the example of industrial electric motor systems (Arquit Niederberger & Brunner, in press), the 60 GWh electricity savings can come from a combination of efficiency measures that might affect the coefficient of performance of the motor, operating conditions (e.g., hours per year) or the load split across the range of motor size. A motor system of any size (between 1 kW and 20 MW) running 3000 hours per year and delivering 30% efficiency gains would qualify as a small-scale CDM project (equivalent of < 60 GWh energy savings).

The resulting total load of motors to be improved is between 2000 and 6000 kWe. The load can then be attributed to individual motor systems within the same project boundary. Given the distribution of motor size, CDM projects will likely target the most common standard motor sizes between 5 kW and 500 kW. A CDM motor project that resulted in 30% efficiency gains for 100 large (500 kW) or 10 000 smaller pieces of equipment (5 kW) operating 4000 hours annually would still qualify under the SSC rules (Arquit Niederberger & Brunner, in press). This calculation illustrates the significance of the new SSC limits for motor and other industrial system efficiency initiatives under the CDM.

Given the relatively small scale of the vast majority of motor systems, even under the SSC rules, transaction costs associated with PDD preparation and determining project emissions remain a key consideration in CDM project viability. Fortunately, the small-scale methodologies allow for energy efficiency programs to be implemented under a single Project Design Document (PDD):

- under AMS II.D., a single PDD is applicable to "any energy efficiency and fuel switching measure implemented at a single industrial facility";
- AMS II.E. only requires a single PDD applicable to "any energy efficiency and fuel switching measure implemented at a single building…or group of similar buildings" and
- AMS II.C. allows "programs that encourage the adoption of energy-efficient equipment…at many sites" to be submitted under a single PDD.

Thesis 5

Barriers to SSC industrial energy efficiency projects/programs remain

Given that SSC methodologies applicable to the industry sector have been approved, why aren't we seeing more projects being developed, with the exception of India (which is the only country with registered industrial energy efficiency projects)? There are a number of possible explanations, for example:

- Lack of awareness of energy efficiency opportunities in host country industrial sector
- Unfamiliarity with CDM and scope for SSC CDM
- Challenge of structuring deals, so that the CDM revenue stream can help address the important up-front capital (and sunk) cost barriers
- Simplified methodologies put the burden of documentation and PDD preparation on the individual enterprise, without much guidance, and demands human resources that might not be readily available, particularly in SMEs
- CER income may not cover the true transaction, business interruption and sunk costs involved, and is often less than the cost savings from reduced energy demand, which can be substantial (Arquit Niederberger & Brunner, in press); there is a sense that CDM is "not worth the effort".

In addition to addressing methodological issues, awareness-raising is a key challenge. Relevant institutions (e.g., UNIDO, World Bank, UNDP, GEF, in partnership with local industry associations) should establish programs to assist industry in taking advantage of the CDM, preferably piggy-backing onto existing programs to provide energy audits, training and other market transformation activities. There is also a need for funds (e.g., dedicated energy efficiency lending facilities, revolving funds or ESCO structures) and programmatic approaches to ease the administrative burden on individual enterprises and make funds available to cover up-front capital costs. The energy efficiency financing facilities established by the IFC in several countries could be a model.

Finally, the potential to leverage CDM funds in support of energy efficiency incentive programs, typically run by governments and utilities, remains to be explored. There is a pervasive lack of awareness of the Kyoto Mechanisms among agencies responsible for energy efficiency, utility regulation and demand-side management in many countries and little cross-fertilization between the energy efficiency expert community and the climate change / CDM world[9].

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[9] This issue is also raised in Thesis 7 and Thesis 8.

Thesis 6

The nature of dispersed energy efficiency projects / programs raises particular methodological challenges

Energy efficiency projects/programs have many characteristics that differentiate them from those in other sectoral scopes. At a fundamental level, energy savings from energy efficiency projects cannot be measured as they can for energy supply projects, such as renewable energy projects. The savings are equal to baseline energy consumption less the consumption associated with the new project, with the understanding that baseline consumption is a hypothetical value that cannot be directly measured. It is essential to acknowledge this fact and to recognize that that energy savings and greenhouse gas mitigation impacts of energy efficiency projects therefore represent "negotiated" values, as baselines must be stated, inferred, calculated, or simulated. The UNIDO workshop can explore how to deal with the following unique methodological challenges that have been encountered by end-use efficiency efforts:

Non-financial barriers, additionality and CDM

To qualify for CDM registration, a project/program of activities must demonstrate additionality, that is, it must reduce anthropogenic emissions of greenhouse gases by sources below those that would have occurred in the absence of the registered CDM project activity. In considering project additionality, the three major energy efficiency markets should be treated separately (see Table 3). There are generally greater barriers to discretionary retrofits of existing, well-functioning systems than there are to planned equipment replacements or new installations[10] (see the following section for a discussion). In the field of energy efficiency projects, the targeted efficiency market thus has implications for the selection of an appropriate baseline approach, which, in turn, determines the significance of barrier analysis for baseline scenario selection and additionality determination.

Table 3. Energy Efficiency Markets

Market	**Definition**
Discretionary **retrofit**	Decision to prematurely replace existing technology with high-efficiency equipment for the primary purpose of improving energy efficiency
Planned **replacement**	Decision to replace existing technology at the end of its useful lifetime (e.g., failure, replacement schedule) with high-efficiency equipment
New installations	Decision to select high-efficiency equipment over other alternatives at the time of new installations

For discretionary retrofits, baseline approach 48a[11] is the obvious choice, since these projects are replacing existing, functioning equipment before the end of its useful lifetime. For discretionary energy efficiency retrofits, the key to demonstrating additionality is for project proponents to provide convincing evidence that the retrofit was indeed discretionary and not a planned replacement, i.e., the project/program of activities was undertaken with the primary aim of reducing greenhouse gas emissions.

[10] The small-scale methodologies are applicable to all three efficiency markets.

[11] The baseline approaches defined in sub-paragraphs 48 (a) to (c) of the CDM modalities and procedures are: existing actual or historical emissions, as applicable (48a); emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment (48b); the average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category (48c).

The planned replacement and new installations efficiency markets pose other issues for additionality assessment, since these generally involve new investment decisions[12]. The fact that investment in high-efficiency industrial equipment, consumer appliances or lighting is cost-effective by some measure (such as least lifecycle cost) should not be taken to mean that end-use efficiency projects are non-additional. On the contrary, the fact that such investments are not being made, despite their cost-effectiveness and often short payback periods, is evidence of significant barriers in the marketplace. Under its "Save Energy Now" program, energy assessments of 200 industrial facilities in the United States in 2006 uncovered 52 trillion Btu in annual natural gas savings potential[13] (equivalent to 3.3 million tons CO_2 per year) – over 80% of which represented activities with payback periods of less than two years (40% with payback periods of less than 9 months). Decisions taken by the CDM Executive Board and Meth Panel do not reflect this reality; even though investment analysis is not mandated by the approved additionality tool, application of both the barrier and investment analysis has been recommended to those trying to devise new energy efficiency methodologies (Hayashi & Michaelowa, 2007).

Furthermore, both the additionality tool and the combined tool to identify the baseline scenario and demonstrate additionality[14] give examples of barriers that could prevent alternative scenarios in the absence of CDM, namely investment barriers, technological barriers and barriers due to prevailing practice. However, these do not include the major barriers facing energy efficiency projects. It would be helpful to highlight examples of typical barriers to energy efficiency projects/programs, such as those mentioned above, as well as for the CDM Executive Board to provide tools and guidance on documentation requirements to demonstrate barriers. It should not be necessary for each project developer to provide individual documentation of prevalent barriers to demand-side efficiency, when these have been well documented by energy efficiency experts and reliable institutions, such as the International Energy Agency and governments.

As defined, the combined tool explicitly is not applicable "where one or more baseline alternatives are not available options to project participants", which is generally the case under energy efficiency programs. According to the tool, a program to disseminate or encourage the use of energy efficient appliances by multiple end-users could not use the combined tool, because a credible and plausible alternative to the project activity could be that the end-users (i.e. third parties) continue to use existing appliances and/or start using more efficient appliances – which are not available options to the project participants. Existing protocols to quantify energy savings from end-use efficiency improvements typically distinguish between gross energy (emission) savings at the site level (i.e., the difference between the baseline and project emissions) and net savings that actually occur at the electricity generating unit. Factors commonly considered in determining net savings include increased savings due to lower T&D losses, decreased savings due to non-additional free riders, increased savings due to spillover effects, and secondary effects (e.g., leakage, rebound effect, activity shifting)[15]. It would be highly recommended to try to address these issues systematically and comparably – rather than at the point of baseline definition. A number of these factors have caused problems in methodology approval and are discussed in detail below. Clear guidance on what needs to be taken into account to determine net energy savings and emission reductions and the methods to do so should be provided.

Quantification protocols also provide for baseline adjustments for changes in independent variables – both routine adjustments such as for weather in the case of space heating/cooling

[12] This is not always the case, for example, when replacement equipment has been purchased in advance.
[13] See http://www.eere.energy.gov/industry/saveenergynow/partners/results.cfm
[14] Tools available at http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
[15] Steve Schiller, personal communication (March 2007).

projects or for changes in the level of industrial production, which can be monitored and should therefore be included in monitoring plans, and non-routine adjustments such as a change in product line. The latter are typically addressed only as they occur. Adopting this terminology and these practices could add a great deal of transparency to the whole CDM methodology process and make it consistent with existing energy efficiency programs, especially those that might also link to carbon markets, such as white certificate schemes. Issues related to baseline adjustment have also been the cause of methodology rejection and are described below.

Another issue related to additionality testing for energy efficiency projects is the difficulty of performing the common practice test in Step 4 of the tool for assessment and demonstration of additionality. This step requires project participants to identify similar projects in the same region/country and to explain why they are different from the proposed CDM project activity. For a single project site or technology, this analysis is relatively straightforward; but for a project or program with a large number of sites, pieces of equipment or even different technologies, as is common in the end-use energy efficiency sector, this is problematic (Sathaye, 2006).

Baseline data availability, monitoring and transaction costs

One of the biggest barriers to energy efficiency CDM – and to assessing the impacts of all demand-side management programs – is the difficulty of ensuring credibility while keeping the transaction costs associated with determining baseline and project emissions at viable levels. In contrast to emissions associated with fossil power generation, which can be calculated based on fuel use data and CO_2 emission factors, determining emissions reductions from demand-side energy efficiency projects and programs is less straightforward.

Energy efficiency projects/programs under the CDM result in reduced demand for electricity or other forms of energy with respect to the baseline to produce the same energy service. For large-scale efficiency retrofit projects, some of the necessary baseline data might already be available as a result of normal monitoring processes (e.g., fuel use), and collecting any additional baseline data required by the CDM (e.g., hours of operation, load factor) is generally neither technologically nor economically prohibitive. However, the vast majority of energy efficiency improvements in terms of numbers will be smaller rather than larger and will derive from all three efficiency markets. When considering industrial electric motors, for example, a higher percentage of efficiency gains is possible as motor size decreases, and there are more small and medium-sized motors than larger ones. In addition, as is the case for all types of CDM projects that result in a reduction in demand for grid electricity, it is often a challenge to obtain the necessary data to calculate grid emission factors accurately.

Some projects are quite simple to monitor directly, such as the retrofit of a single water pumping system, and there are few exogenous factors (independent variables) that would affect the energy demand of the system and require baseline adjustment. Other systems, however, are far more complex. One unsuccessful methodology tried to address energy efficiency improvements by a food retailer. Emission reductions were to be measured by tracking changes in electricity use recorded on electricity bills. However, the Meth Panel rejected the methodology for a number of reasons. Some of these were quite specific to the type of business and location of the project activities, for example, failure to account for any changes in the composition (e.g., a greater share of frozen/chilled food in supermarkets as opposed to other types of commercial facilities) and location of shops (climatic impacts on energy demand for cooling). Clear guidance on when and how routine and non-routine baseline adjustments are required is needed, and such issues should be treated independently of baseline selection.

Monitoring costs can be a significant barrier to dispersed CDM projects in energy efficiency. One approach that has received mixed reviews from the Meth Panel is the use of system simulation models, which has been widely applied to complex building and industrial process effiency programs outside of the CDM. If a set of such tools for key applications could be pre-approved by the Meth Panel, this would be very helpful. Many such tools are in use to assist with estimating energy saving potential and could be adapted for CDM use.

Autonomous efficiency improvements

In numerous cases, proposed new baseline and monitoring methodologies for energy efficiency activities have been rejected for their failure to account for autonomous efficiency improvement trends in the baseline (i.e., rate of historical improvement in energy efficiency of equipment that is attributed to technological innovation not driven by energy efficiency policies/programs). Even more importantly, this issue has been dealt with inconsistently. Some approved methodologies do not address autonomous efficiency trends at all (e.g., AM0020), whereas numerous other proposed methodologies were criticized and rejected, in part, for their failure to take efficiency improvement trends into account (although no guidance on how to do so has been provided). More consistent decision-making and clearer guidance on this point (that differentiates baseline approaches and efficiency markets) would be extremely helpful in promoting end-use efficiency under the CDM.

Since the CDM is project-based, it can be argued that autonomous efficiency improvement need not be taken into account. In the case of discretionary retrofit projects, an owner has the option of doing nothing (leaving the existing technology in place until its planned replacement), or replacing existing equipment sooner than necessary with high-efficiency technology. If a project is a truly discretionary retrofit, then there is no trend in efficiency improvement in the baseline at the project level. This general rule could be applied to projects that use baseline approach 48a and have a non-renewable crediting period. It is misguided to require elaborate control group studies or market analyses that may not be relevant to the decision process at the level of an individual project owner.

The baseline approach 48c inherently addresses the efficiency trend issue, since it defines baseline emissions in terms of average emissions of similar project activities undertaken in the previous five years and requires that only projects whose performance is among the top 20 per cent are taken into account. Therefore there is no need for correction factors to be determined by elaborate control groups or uncertain trend analyses when approach 48c is selected. Unfortunately, as shown above, this approach is very difficult to apply to actual projects, including energy efficiency projects, because of the difficulty in determining the appropriate benchmark.

In any case, it is nearly impossible to determine with any degree of rigor what the rate of historical improvement in energy efficiency of equipment is that can be attributed to technological innovation not driven by energy efficiency policies/programs, or even how to define it in a way that is relevant at the project level. Such a complex analytical exercise certainly exceeds the capabilities of individual project developers. If there have been any major technology jumps, provisions for reassessing the baseline under methodologies that select a renewable crediting period should take this into account and would be adequate. We should always bear in mind the order of magnitude that we are talking about and consider whether addressing an issue such as "autonomous improvement" will enhance rigor or increase uncertainty.

Gross-to-net adjustments: Free riders/spillover effects & secondary effects

Under the CDM methodology approval process, concerns have also been raised about “free riders”. The concept of "free riders" and "free drivers" (spillover effects) is not mentioned in the CDM rules and procedures. A free rider is an efficiency program participant who would have implemented the program measure or practice in the absence of the program; whereas free drivers do not participate in the CDM program, but adopt efficiency measures because of it, for example, as a result of increased awareness of efficiency opportunities (Geller & Attali, 2005).

The concept of additionality does not exclude such free rider/free driver effects; it merely requires that emissions under the project activity or program of activities in the aggregate are lower than they would have been without the CDM activity (i.e., lower than the emissions in the baseline scenario). As indicated above, free riders / spillovers, secondary effects (e.g., leakage, rebound effects) and electrical transmission and distribution losses are not a project-level baseline issue, but represent factors that are generally taken into account at the level of the program when making gross-to-net adjustments.

Free rider/spillover effects are notoriously difficult to quantify, with wildly different estimates from different experts using different approaches (Geller & Attali, 2005; Gillingham, Newell & Palmer, 2004). Methods of determining free rider and spillover effects in conjunction with financial incentives include surveys/interviews with program participants and non-participants; determining whether an investment would also be profitable without financial support (where profitability is judged based on the payback period required by the investor); and research on quasi-control groups (SAVE, 2001). Some of these approaches are being tested in proposed new baseline and monitoring methodologies and have been subject to Meth Panel scrutiny, but it is too early to say whether they will be accepted by the CDM Executive Board and whether they will be viable in practice. One methodology tried to use a survey/self-declaration, but this approach was rejected (NM0157).

It is also possible to design energy efficiency promotion programs so as to minimize potential free riders (and maximize positive spillovers). Bad experiences in the USA with programs to provide direct financial incentives to purchasers of efficient industrial equipment, for example, have encouraged a shift towards programs that target equipment distributors, rather than end-users (Benkhart, 2006). Under such programs, distributors that stock and market efficient equipment above status quo levels are rewarded for their performance. In general, the fraction of free riders would probably be lower in the discretionary retrofit market than in the new or replacement markets, because the barriers to retiring equipment prematurely go beyond financial considerations.

There are numerous examples of existing energy efficiency programs that recommend only minimal or no evaluation of free rider and spillover issues, due to the general desirability of energy efficiency improvements, the tendency for both effects to occur (and therefore cancel each other out), a lack of agreement on appropriate methodologies, and the difficulty and expense of such assessments. Other programs have assigned default gross-to-net conversion factors to be used for different types of energy saving measures[16].

Similarly, most efficiency program evaluation protocols do not recommend inclusion of secondary effects in evaluation analyses, since these tend to be negligible for energy efficiency projects. In any case, gross-to-net adjustments should not be considered at the level of the project baseline and require a consistent, top-down approach applied to all eligible end-use energy projects.

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[16] See, for example, the *User's guide to the Conservation Verification Protocols* (Washington DC: US Environmental Protection Agency, April 1996).

Efficiency markets: New installations, planned replacement, discretionary (early) retrofit

With the exception of AM0017 – which has yet to be applied to a registered CDM project – the approved energy demand methodologies target energy efficiency improvements that result from discretionary retrofits by the project owner to their existing, properly functioning equipment or systems. Thus there is a huge gap in coverage, both of the planned replacement market (i.e., replacement of equipment at the end of its useful lifetime, such as when steam traps fail, which is the specific situation addressed by AM0017) and of the new installations market (e.g., expanding an existing or building a new facility/system). Particularly in developing countries with rapidly growing and industrializing economies, the new installations market represents the key opportunity for cost-effective energy efficiency improvement.

Methodology developers have not always stated clearly which efficiency market their methodology targets, and in some cases different efficiency markets were targeted implicitly, without respecting the relevant guidance from the Executive Board: The "Guidance regarding the treatment of 'existing' and 'newly built' facilities" states that, if a proposed CDM project activity seeks to retrofit or otherwise modify an existing facility, the baseline may refer to the characteristics (i.e. emissions) of the existing facility only to the extent that the project activity does not increase the output or lifetime of the existing facility. For any increase of output or lifetime of the facility which is due to the project activity, a different baseline shall apply." This text lumps discretionary retrofits and planned replacements together under "existing facilities", but as described in the previous Section, baseline approach 48a might rarely be appropriate for planned replacements.

The guidance to methodology developers could be improved by defining the three different efficiency markets – discretionary retrofit, planned replacement, new installations – and by requiring that those submitting proposed methodologies for Sectoral Scope 3 indicate which efficiency market their methodology targets. This could be incorporated into a revision of the respective form for proposed new methodologies or could be included in the "Technical Guidelines for Development of New Baseline and Monitoring Methodologies" discussed later in this paper.

In addition, the draft baseline scenario selection tool (BSST) and the additionality tool need to reflect the distinction in energy efficiency markets. All of the approved methodologies targeting the discretionary retrofit market have appropriately used baseline approach 48a, which defines the baseline as actual or historical emissions. Yet the draft baseline scenario selection tool requires analysis of alternative scenarios. To be applicable to approach 48a, the BSST should state that the list of alternatives to be determined in Step 1 may include only the status quo and the proposed project not undertaken as a CDM project, if baseline approach 48a (actual or historical situation) is used (World Bank, 2006b). The status quo under baseline approach 48a is to use the existing equipment until its planned replacement. Because this approach to baseline scenario selection is different than what would normally be considered for energy supply projects, the draft baseline scenario selection tool (see section 4.2.4) is not appropriate for methodologies in this market/sub-sector without modification.

For the discretionary retrofit market, approach 48a is a good match with the decision facing project owners on the ground: to either continue with business-as-usual, or to invest in more efficient technology, before the existing technology needs to be replaced. The methodological challenges are to provide clear guidance on excluding planned retrofits and to agree on whether and how to address autonomous efficiency improvements in the baseline and to minimize the level of free ridership in project/program design, both of which are discussed in separate sections, below.

For the planned replacement and new installations markets, more work needs to be done to explore the applicability of the three baseline approaches (48a/48b/48c). It would appear that each of these approaches could be applicable to the planned replacement market, depending on the situation. In this market, the project owner knows that equipment must be replaced; he/she may use replacement equipment already purchased or purchase any equipment available on the market. If replacement equipment has already been purchased, for example, if a chemical plant keeps an inventory of spare electric motors to prevent plant downtime when motors fail, this would represent an obvious baseline (under approach 48a), since not employing this equipment would represent a sunk cost.

If the equipment purchase decision is wide open, however – as is also the case for the new installations efficiency market – another approach is needed. The alternatives offered in sub-paragraphs 48b and 48c of the CDM modalities and procedures are difficult to apply to energy efficiency projects, which may explain the lack of approved methodologies for the planned replacement and new installations markets. Approach 48b requires that a baseline technology be defined, which represents an economically attractive course of action, taking into account barriers to investment. As stated above, however, there is great economic potential for energy efficiency improvement, but other barriers prevent the uptake of efficient technologies. The fact that there remains vast potential for fossil fuel and electricity end-use efficiency improvement in the industrial sector of OECD countries with payback periods of less than two years demonstrates the prevalence and persistence of these barriers, even when technology standards are in place and net cost savings on a life-cycle basis are substantial. Applying the draft baseline scenario selection tool could actually be helpful for this case, as the barrier analysis could make an investment analysis unnecessary. Although the 48b approach should take into account “barriers to investment” it is not at all clear how this is to be done in practice, and more guidance, targeted at energy efficiency projects is needed.

Approach 48c defines baseline emissions in terms of average emissions of similar project activities undertaken in the past (i.e., within the previous five years, in similar social, economic, environmental and technological circumstances) and whose performance is among the top 20 per cent of their category. For large, discrete pieces of end-use equipment in industry, such as a boiler in a power plant or a kiln in a cement plant, this approach could work, but many energy efficiency opportunities are associated with small, dispersed efficiency improvements for which comparable performance data are simply not available, not the least because the specific setting in which a given end-use technology is deployed can be very diverse. This is the same challenge as applying Step 4 of the additionality tool (see previous section).

Thus new baseline approaches applicable to the planned replacement and new installations markets may be required to open the door for CDM to promote energy efficiency in these important markets across end-use sectors. Benchmarking, reference to minimum efficiency performance standards and standardization of operating parameters need to be explored. New efforts to develop standards to certify the energy performance of industrial plants could assist with benchmarking and should flow directly into the CDM methodological toolbox.

For each of the three efficiency markets, it would be helpful to develop generic methodological approaches that could result in better methodological guidance for demand-side energy efficiency projects/programs or “methodology modules”.

Discrete equipment vs. systems approach

Whereas the energy efficiency of some types of equipment is relatively independent, more often than not, taking a more systematic approach can uncover greater energy-saving potential – and ensure that any technological fixes result in sustained savings. In the case of industrial electric motor systems, the difference is striking. Based on Motor Challenge programs in

North America and Europe, it is widely agreed that upgrading the efficiency of the motor alone captures only roughly 10% of the energy-saving potential (with the rest attributed to proper dimensioning of the motor; use of adjustable-speed drives, where appropriate; efficient end-use equipment, such as fans, pumps, compressors, or traction systems; and optimization of pipes, ducts, belts, and gears).

Although methodologies have been approved that take both a systems (AM0018, AM0020) and a discrete equipment approach (AM0017), methodologies for some complex types of systems have been rejected (e.g., building efficiency, cement plant efficiency). One reason is that it is difficult to demonstrate that the energy savings achieved are attributable to the CDM activity alone, rather than to other factors (e.g., NM0120, NM0137). Due to a lack of approved methodologies, other project developers have chosen to focus on the retrofit of discrete equipment to avoid methodological difficulties of addressing complete systems (NM0100), even though much greater energy savings would be possible by taking a systems approach (and also addressing the new equipment market, where it is much easier to consider complete systems). Furthermore, taking a systems approach – particularly when implemented in the context of a comprehensive energy management system – promises greater permanence of energy savings and greenhouse gas emission reductions than one-time equipment replacement (McKane, 2007).

There is no easy fix to this dilemma. It will be important to develop a consensus on international best practice for the determination of energy savings from different types of energy efficiency projects and programs that could lead to the adoption by the CDM Executive Board of consolidated methodologies for important systems. Industrial electric motor systems in industry and the tertiary sector (buildings, municipal infrastructure), for example, account for at least 40% of electricity demand worldwide (SEEEM, 2006), yet no approved methodology exists to support high-efficiency motor systems. We will discuss several new proposals for motor methodologies at the UNIDO Seminar.

Thesis 7

Energy efficiency experts should play a much greater role in the CDM

Linked to the previous thesis, it is crucial to build on the large body of existing knowledge on international protocols/best practice that has been built since the 1973 oil crisis. This requires engaging government regulators and industry energy efficiency experts (incl. utilities, ESCOs, technology providers, end-users) with experience in the implementation and evaluation of public and private energy efficiency regulatory, incentive, contracting, training, and audit programs. Ideally, a "community of practice" on energy efficiency CDM would be built.

There is an urgent need for top-down guidance on key energy efficiency design issues, including:

- Emission reduction quantification methodologies: Most energy efficiency programs/protocols offer a menu of approved options that can be selected by the project proponents, typically including (i) use of default abatement factors ("deemed savings" approach), (ii) calculated (engineering) methods for discrete equipment/systems, sometimes in conjunction default efficiencies and other parameters, (iii) before/after metering/modeling, typically applied to more complex systems, such as buildings and (iv) sometimes, reliance on energy monitoring plans audited by third parties (this is the approach followed under JI Track 2).
- Baseline adjustment requirements/techniques for routine and non-routine factors
- Decisions on whether it is necessary and, if so, how to treat "gross-to-net" energy saving issues (including leakage, rebound effects, free riders, spillovers)

- Definition of related default abatement factors, efficiencies and other parameters to enhance transparency, consistency and certainty.

Such issues are not new to CDM, and regulators have made decisions in the context of existing regulatory programs about how to handle them. This experience could be synthsized to come up with common methodologies, tools and default factors for Sectoral Scope 3 CDM. The previous practice under the CDM – with the exception of small-scale and sink-related methodologies – has been to derive guidance and tools based on bottom-up submissions. However, since there are so few approved Sectoral Scope 3 methodologies to draw from, and the approval process has been inconsistent, a top-down approach that draws on methodologies for demand efficiency projects already available outside of the CDM world is urgently needed.

A great deal of work has been done internationally, by national governments, energy agencies, utilities and other private actors, and by NGOs to devise measurement and verification protocols for energy efficiency activities, and these have been used in a range of regulatory programs, including cap and trade programs (see Table 4 for some examples, including programs in Canada, Italy, UK, USA). All of these stakeholders need to be brought together in a rapid process to propose good practice monitoring and verification approaches for key sectors and technologies under the CDM.

Table 4. Ongoing Monitoring, Evaluation, Reporting, Verification and Certification (MERVC) Activities for Energy Efficiency

Convening Organization(s)	**Title of Initiative**	**Objective**	**Focus**	**Key Deliverables**
STANDARDS / GUIDANCE				
ASHRAE	Guideline 14-2002	Provide guidelines for reliably measuring the energy and demand savings due to building energy management projects (using pre-retrofit/post-retrofit data)	Energy demand reductions in residential, commercial and industrial buildings	Guideline 14-2002 "Measurement of Energy and Demand Savings"
Efficiency Valuation Organization	International Performance Measurement & Verification Protocol	To develop and promote the use of standardized protocols, methods and tools to quantify and manage the performance risk and benefits associated with end-use energy efficiency, renewable energy and water efficiency business transactions	Development of monitoring & verification protocols	IPMVP Volume I provides general guidance for energy efficiency M&V for buildings and industry. Volume III addresses new construction
International Energy Agency	IEA Demand-Side Management Program	To develop, test, and promote an evaluation guidebook for governmental and non-governmental Energy Efficiency Programmes and also for (utility) DSM programmes targeted towards energy end-users and focussed on GHG reductions to meet Kyoto's targets	Guidance on evaluation of DSM programs	Evaluation Guidebook on DSM and EE Programs related to Kyoto targets
International Standards Organization	ISO 14064-2 International Standard for Greenhouse Gas Accounting*	Develop international standard for quantification, monitoring and accounting for GHG reduction projects	Project-based emission reductions from all sectors	International Standard for quantification, monitoring and accounting for GHG reduction projects
EU SAVE	Specific Actions for Vigorous Energy Efficiency Program	To disseminate evaluation theory and thus indirectly help reduce the overall CO2 emissions and improve energy efficiency	Demand-side management programs and the energy service provider industry	European Ex-Post Evaluation Guidebook for DSM and EE Service Programmes
WRI/WBCSD	GHG Protocol for Project Accounting	Develop project accounting framework that is program-neutral and compatible with the CDM as well as other programs	Project-based emission reductions from all sectors	GHG Protocol for Project Accounting
WBCSD	CO_2 Accounting and Reporting Standard for the Cement Industry	To provide a harmonized methodology for calculating CO_2 emissions, with a view to reporting	Emission inventories & reporting for the cement sector	Cement CO_2 Protocol
REGULATORY PROGRAMS / PROTOCOLS				
California Climate Action Registry	CCAR Emission Reduction Protocols	Develop protocols for quantifying emission reductions from projects (drawing on WRI protocol effort)	Performance standards approaches	Protocols for quantifying emission reductions from projects (in prepara-tion)

Italy	Tradable Energy Efficiency (White Certificate) Scheme	Provide guidelines for demand-side efficiency project eligibility and quantification	Interventions or projects to reduce consumption of primary energy via reducing final electricity or gas consumption or other measures.	Linee guida per la preparazione, esecuzione e valutazione dei progetti di cui all'articolo 5, comma 1, dei decreti ministeriali 24 aprile 2001 e per la definizione dei criteri e delle modalità per il rilascio dei titoli di efficienza energetica
Japan METI	Future CDM Project	Development of CDM methodologies in previously underrepresented areas	Methodologies for: (i) energy efficiency and (ii) transportation sector CDM	Methodologies submitted to CDM EB for approval
NSW / ACT (Australia)	NSW Greenhouse Gas Abatement Scheme (also applies to parallel ACT scheme)	Rules for creation and methods for calculation of NSW Greenhouse Abatement Certificates	Greenhouse gas emission reductions from various activities, including increased efficiency of electricity consumption and reduction in electricity consumption where there is no negative effect on production or service levels	Greenhouse Gas Benchmark Rule (Demand Side Abatement) No. 3 of 2003
Ontario Provincial Government	Ontario SO2 and NOx Trading Program	Emission Reduction Credit creation, recording and transfer rules, rules for renewable energy projects and conservation projects, and rules for the operation of the Ontario Emissions Trading Registry	Project-based direct SO2/NOx reductions or displacement of coal-fired grid electricity by EE/RE projects	Ontario Emissions Trading Code (detailed rules, including Standard Method for "Emission Reductions from Energy Conservation through Process Efficiencies" and for "Displacement of Electricity from Conservation Projects")
UK	Energy Efficiency Commitment 2005 – 2008	Provide guidance on quantifying energy efficiency improvement and best practice guidelines for each type of action under EEC2	Utility DSM programs to improve energy efficiency in domestic properties (insulation, lighting, heating and appliances, Combined Heat and Power, fuel switching)	Energy Efficiency Commitment 2005-2008: Technical Guidance Manual Issue 1 (stipulated values / calculation spreadsheet)
US EPA	National Energy Efficiency Action Plan	Create a Model Guide to provide basic process and technical guidance on evaluation issues and requirements, which can be used by individual jurisdictions to establish their own evaluation requirements	Energy savings & avoided emissions associated with energy efficiency programs implemented by states, cities, utilities, private companies, etc.	Model Energy Efficiency Program Evaluation Guide
US EPA	NOx SIP Call Guidance on EE/RE Set-Aside	Guidance to NOx SIP Call stakeholders	EE projects and programs that reduce electricity generation	Guide on evaluation, measurement and verification of electricity savings for determining emission reductions from EE/RE actions

US States	Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program	Model rule for participating States to use in establishing their State CO2 Budget Trading Program, which is designed to stabilize and then reduce anthropogenic emissions of CO2 in an economically efficient manner	Five broad offset categories, including reduction or avoidance of CO2 emissions from natural gas, oil, or propane enduse combustion due to enduse energy efficiency in buildings	Regional Greenhouse Gas Initiative Model Rule, including rules on CO2 offset allowances

Thesis 8

Modalities for CDM Programs of Activities should reflect the nature of programs that target energy efficiency

Programmatic CDM is a new concept, derived from the decision of the Parties to the Kyoto Protocol in December 2005 that:

> *"a local/regional/national policy or standard cannot be considered as a clean development mechanism project activity, but that project activities under a programme of activities can be registered as a single clean development mechanism project activity"*

provided that CDM methodological requirements are met. In other words, the adoption of a policy or standard in and of itself cannot be submitted as a CDM project, but the activities that constitute the actual implementation of that policy or standard – such as an incentive program for equipment that meets a voluntary high-efficiency level – can be submitted as a single CDM project activity in the form of a program.

For the industry sector, this could mean, for example, that companies participate in voluntary programs, such as rebate or tax credit programs or challenge programs that motivate enterprises to voluntarily adopt and implement energy management standards or energy intensity targets.

A typical approach that has been used to quantify the energy savings from financial incentive programs is to specify these *ex ante*, based on a hypothetical comparison between the energy efficient technology and a technology baseline (e.g., a legally mandated energy performance standard). This approach has been used in the United States, for example, to promote high-efficiency motors (NEMA Premium), with the benchmark assumed to be the Energy Policy Act minimum standard for the given motor size, assuming hours of operation that reflect industry sector practice. The Database for Energy Efficient Resources (DEER) – compiled by the California Public Utilities Commission and the California Energy Commission, with support and input from utilities and other interested stakeholders – provides estimates of the energy-savings potential for selected energy-efficient technologies and measures in residential and nonresidential applications (http://eega.cpuc.ca.gov/deer). The database contains information on typical measures – those commonly installed in the marketplace – and data on the costs and benefits of more energy-efficient measures.

Other countries, including Italy (Pavan, 2006), the United Kingdom (Defra, 2007) and a range of US States (Nadel, 2006) are using deemed values in the context of utility efficiency requirements and/or white certificate programs. Australian governments (New South Wales (NSW, 2003) and Australian Capital Territory) offer a similar default abatement factor method, as well as default efficiency improvement values that can be used to calculate emission reductions for a discrete equipment, process, or system. All of these programs include industrial motors among the equipment that can use stipulated values. It is conceivable to envision CDM-supported programs to provide incentives for utilities to implement demand-side management programs. A decision by the Parties to the Kyoto Protocol to allow the use of stipulated abatement factors or default efficiency values could pave the way for many types of energy efficiency CDM projects.

Voluntary challenge programs are typically comprehensive, treating a sector or enterprise as a black box and relying on self-reporting at the level of the enterprise, based on guidelines. More attention needs to be devoted to appropriate methodologies for such programs, which are also being established increasingly in developing countries. The 1000-enterprise program in China is an example. An increasing number of countries (including China, Denmark, Ireland, Sweden, and the USA) are developing energy management standards for industrial energy management systems, and the USA is also developing standardized assessment protocols for major industrial systems (incl. pumping, compressed air, steam, process heating), which can support quantification of energy savings and plant certification programs (McKane, 2007). Such methodological tools could be used in the CDM context to address complex industrial systems, where the greatest potential for sustained energy savings and greenhouse gas emission reductions lies.

Other types of highly-effective demand-side efficiency programs for which appropriate methodologies have yet to be approved include programs that facilitate compliance with mandatory or voluntary standards or codes. NM0159-rev was unfortunately rejected, mainly because the Meth Panel and Executive Board did not accept that emission reductions can be attributed to the implementation of an efficiency testing, consumer labelling and quality assurance program, based on the case of air conditioners in Ghana. A review of this decision by an energy efficiency "community of practice" (Thesis 7) could determine whether the proposed methodology reflects measurement and quantification good practice, or whether there is any practical alternative approach that would better address the concerns of the CDM bodies. If not, either the Executive Board itself or the Parties to the Kyoto Protocol might want to overturn the original decision. Governments around the world are using taxpayer money to implement standard/code and label programs and have documented their effectiveness; best practices adopted for such assessments should be adequate under the CDM.

Thesis 9

Rigor must be balanced against results

Uncertainty is inherent to energy efficiency projects under CDM/JI. A key question that needs to be answered by policymakers is the acceptable level of rigor that should apply to end-use energy efficiency projects and how to achieve it. Rigor is a term used to encompass the issues of uncertainty and error for monitoring & verification activities and is defined as the level of expected reliability of energy, and thus emission, reductions (EPA, forthcoming). The responsible CDM bodies are requiring great effort to address non-routine baseline adjustments up-front, as well as gross-to-net adjustments, without providing top-down guidance. It is not at all clear that this approach is making results more accurate and precise, given the lack of guidance and the limited capacity of individual project developers to address such complex issues.

Yet one thing is certain: Methodologies for end-use energy efficiency projects and programs are having a very difficult time receiving approval, preventing meaningful volumes of greenhouse gas reductions being generated from end-use efficiency projects/programs under the CDM.

If this is not the intent of the Parties to the Protocol, then appropriate means to ensure an acceptable level of rigor – that can maintain the environmental integrity of the Kyoto Protocol overall, while encouraging energy efficiency – must be defined top down. In doing so, we should start from current good practice, as reflected in existing regulations and protocols that govern requirements to monitor energy efficiency activities, and be realistic about the level of accuracy that can be achieved and still be viable. Utility DSM programs, incentive programs for energy efficient products, equipment and services and white certificate schemes all must quantify emissions reductions. The programs in place in OECD and other countries, and the methodologies that they employ (such as those listed in Table 4), should be the starting point. These protocols provide useful top-down guidance on difficult issues that have often been treated unsystematically and inconsistently under the CDM, such as baseline selection, routine and non-routine baseline adjustment for independent variables and gross-to-net adjustments (incl. free riders, spillovers, leakage, rebound effects).

In this discussion, it is important to keep in mind that allowances to Annex I Parties and compliance with commitments are based on national greenhouse gas inventories. These inventories are improving, but still contain significant room for error. Nonetheless JI employs much less cumbersome procedures than the CDM. For Track 1 JI, there is no third-party scrutiny at all, since Parties involved in the transaction have emission caps, which is assumed to guarantee a zero-sum outcome for the climate system. Track 2 JI is similar conceptually to CDM, as it must be applied when the host Party does not meet the eligibility requirements for Track 1, including having a national system for tracking greenhouse gas emissions and a national registry to track transaction that comply with guidelines. In other words, if the inventory or tracking systems are not rigorous/in place and therefore cannot guarantee a zero-sum outcome for the climate system from JI transactions (which is analagous to the situation under the CDM), then the Track 2 verification procedure must be followed.

JI verification merely requires determination by an independent entity of whether a project and the ensuing reductions of anthropogenic emissions by sources or enhancements of anthropogenic removals by sinks meet the relevant requirements (i.e., approved by the Parties involved; additional; appropriate baseline and monitoring plan; documentation on environmental impacts, and, if impacts are considered significant, environmental impact assessment undertaken in accordance with procedures as required by the host Party). This determination is based on a Project Design Document that outlines how the baseline is determined and the emissions reductions calculated. While CDM methodologies can be used, there is no requirement to use specific methodologies approved *ex ante*. Determinations are final and projects are automatically approved after 45 days, unless a review is requested. This basic procedure is similar to that adopted under a number of other regulatory programs listed in Table 4.

Adopting pragmatic, good practice procedures for Sectoral Scope 3 and related end-use efficiency CDM activities – similar to those applied under Track 2 JI and other existing regulatory programs around the world – might mean that some CERs are issued for business-as-usual activities, thus meaning that the overall emission mitigation achieved on a global basis is slightly less than projected. But it is doubtful whether the current practice offers greater rigor and certainty, and, with rapidly growing emissions in developing countries and an ongoing process to continuously strengthen Parties' emission reduction obligations over time, less complexity with respect to gross-to-net adjustments might be justified to spur the massive investment in energy efficiency that is needed urgently in developing countries. Investments in outdated equipment are being made every day and will dictate high energy demand for decades. This seems an unnecessary price to pay to fool ourselves into thinking that we can guarantee certainty in quantifying energy efficiency project impacts under the CDM.

After all, barriers to energy efficiency investment are real and prevalent, even in OECD countries.

22 March 2007

ANNEX 1
CDM Sectoral Scopes

This list of sectoral scopes is based on the list of sectors and sources contained in Annex A of the Kyoto Protocol. For some of these scopes, there is partial overlap.

Designation	Sectoral Scope
Industrial Sectors	
1	Energy industries (renewable - / non-renewable sources)
2	Energy distribution
3	Energy demand
4	Manufacturing industries
5	Chemical industry
6	Construction
7	Transport
8	Mining/Mineral production
9	Metal production
Sources	
10	Fugitive emissions from fuels (solid, oil and gas)
11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride
12	Solvents use
13	Waste handling and disposal
14	Afforestation and reforestation
15	Agriculture

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Way forward for CDM energy efficiency projects - Mr. Patrick Matschoss - German Advisory Council on the Environment

UNIDO Issue Paper

Way forward for CDM Energy Efficiency Projects: A review of programmatic, sectoral and bundling approaches to CDM as ways for development of CDM projects

CTI-Workshop on Energy Efficiency in the CDM
19-20 March 2007
UNIDO, Vienna

Prepared by
Patrick Matschoss

1. Introduction

The CDM has a dual objective of reducing GHG on the one hand and contributing to the host countries' sustainable development on the other. End-use energy efficiency projects create high sustainable development benefits as they reduce energy poverty. Furthermore, energy efficiency often generates emission reductions at low costs. Despite these facts, they are also particularly under-represented in the portfolio of current or proposed CDM-projects. The majority of CER stem from projects that generate high volumes of CER that produce only little sustainable development benefits such as emission reductions from landfills.

2. Barriers to energy efficiency in the CDM

The under-representation of energy efficiency projects in the CDM is due to a number of reasons. First of all the investor is financially rewarded only for the emission reductions but not for the contribution to sustainable development. (Ellis et al. 2007).

Despite their large potential energy efficiency projects often generate fewer CER per project than, e. g., (non CO_2-) emission reductions from landfill projects. This is due to the fact that savings from end-use efficiency are often dispersed and therefore small at a single project site. Transaction costs on the other hand are partly fix as they related to the registration, verification and certification procedure. This means a relatively higher burden for energy efficiency CDM projects.

Boosting transaction costs even further, especially energy efficiency projects face a number of additional methodological difficulties. The market(s) for energy efficiency is multi faceted making energy efficiency CDM projects particularly complicated. Niederberger et al. (2006) distinguish three markets for energy efficiency, namely (i) disretionary retrofit, (ii) planned replacement and (iii) new installations (p. 56). Discretionary retrofit relates to the decision to prematurely replace existing technology in order to raise end-use energy efficiency. Planned replacement relates to replacements that would have taken place anyhow (failure, end of lifetime). The last category relates to the choice of equipment for new installations. For proving additionality, for instance, proponents of CDM projects need to provide evidence that in the first case the retrofit is indeed discretionary and not a planned replacement. That is, it would not have taken place in the absence of CDM. If, for the second case the planned replacement appears cost-effective, barrier analysis will have to show that the investments would not have taken place in the absence of the CDM project. This is also be true for new installations.

Additional problems occur when it comes to validating emission reductions ex ante. Consider energy savings from a household appliance labelling project. In addition to being very dispersed and involving a large number of households it is inherently unsure to estimate ex ante the household's behaviour in terms of (i) how many will buy the new appliance, (ii) when they buy it and (iii) if they do it due to the labelling activity.

The examples show that there is not only a need to lower transaction costs for CDM projects in general but for energy efficiency CDM in particular – especially in light of the above mentioned benefits of energy efficiency CDM. Therefore, the under-representation of these desired projects resulted in various efforts to reduce transaction cost. These are small-scale CDM, bundling and most recently the programmatic CDM.

3. Small-scale CDM and sectoral crediting mechanisms

As mentioned above, transaction costs for smaller projects are relatively higher. Therefore, the COP/MOP, by decisions 21/CP.8 and 4/CMP.1, issued further guidance for the CDM and allowed for "simplified modalities and procedures for small-scale CDM project activities" (SSC). A basic difference to large-scale projects is that simplified baseline and monitoring methodologies are provided by the CDM Executive Board. That is, the bottom-up approached pursued for large scale projects, where baseline methodologies are developed by the project developers themselves, is turned around. Furthermore, a simplified PDD is provided for SSC (UNFCCC 2002, pp. 18-25, 2006, pp. 43-52).

The decisions foresee three different types of activities. Type I relates to renewable energy projects, Type II to energy efficiency projects and Type II to other emission reduction projects including methane reduction/recovery and emission reduction from cars. Each Type entails a number of methods. Table 1 lists the Type II methodologies relating to energy efficiency improvement. The Appendix lists all Type-II projects that are at least in the stage of validation.

Originally, the total saving was set at maximum of 15 GWh in order to be eligible for small-scale (UNFCCC 2002, pp. 18-25, 2006, pp. 43-52). However, this boundary has been criticised for being much too low for the creation of viable projects. It has therefore been suggested to raise the limit by an order of magnitude, that is, to 150 GWh (World Bank 2006b). The CDM Executive Board at its 29th (CDM-EB-29) partly followed that recommendation by deciding to raise the limit to 60 GWh (CDM-EB-29 2006).

Table 1

Approved Methodologies for Small-Scale Energy Efficiency Projects (Type II)

AMS-II.A.	Supply side energy efficiency improvements – transmission and distribution
AMS-II.B.	Supply side energy efficiency improvements – generation
AMS-II.C.	Demand-side energy efficiency programs for specific technologies
AMS-II.D.	Efficiency and fuel switching measures for industrial facilities
AMS-II.E.	Efficiency and fuel switching measures for buildings
AMS-II.F.	Efficiency and fuel switching measures for agricultural facilities and activities

Source: UNFCCC 2007

A more recent development to lower transaction cost is the interest to extend the CDM from the pure project level towards sectoral and policy-based approaches. Bosi and Ellis (2005), for instance, analyse several variants of these crediting mechanisms, namely (i) policy-based mechanisms where the generation of credits is due to the implementation of policies, (ii) rate-based crediting (intensity-targets) where credits are generated by lowering energy intensity and (iii) fixed sectoral emission limits where credits are generated by lowering emission below agreed levels. The authors discuss national and international variants as well as several technical, economic and institutional issues. This discussion is further deepened in Baron and Ellis (2006). Ellis (2006) discusses possible variants of a programmatic CDM.

4. Programmatic CDM and Bundling

4.1 Project Activities under a Program of Activities (PoA)

By decision 4/CMP.1 the COP/MOP 1 ruled out policy-based CDM: "a local/regional/national policy or standard cannot be considered as a clean development mechanism project activity". By the same decision the COP/MOP 1 also decided "that project activities under a programme of activities can be registered as a single clean development mechanism project" (UNFCCC 2006, p. 97).

The CDM Executive Board at its 28th session issued further guidance for project activities under a program of activities (PoA). The PoA is defined as "a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal…which leads to GHG emission reductions or increase net GHG removals by sinks that are additional…" (CDM-EB-28, 2006). That is, the entity running the program is not necessarily the one implementing the project activity itself.

Concerning the policies and standards under the PoA the guidance clarifies that "PoA addressing mandatory local/regional/national policies and regulations are permissible provided it is demonstrated that these policies and regulations are not enforced as envisaged" or "if they are enforced, the effect of the PoA's increase the enforcement beyond the mandatory level required" (CDM-EB-28, 2006). This would enable an institution promoting to comply with, for instance, product performance or labelling standards. It opens the door for policy-related CDM activities that are additional in the sense that a programme would enable *implementation* of a (non-binding or poorly enforced) regulation that would not have occurred in the absence of the program.

PoA's must be registered with approved baseline and monitoring methodologies (AM) and they involve one type of technology or measure. Within the PoA's duration (max. 30 yrs) CDM project activities (CPA) – using the PoA's particular AM and technology/measure – may be added at any time as long as each CPA is unambiguously identified, defined and localized and as long as the CDM EB is informed of each new CPA within a PoA. At its submission the PoA must demonstrate what information it will require from each CPA in order to ensure that they all comply with the principles of the CDM (definition of leakage, additionality, baseline emissions etc.). The CPAs use "normal" CDM crediting periods (3x7 or 1x10 years) but they must end at the end of the PoA's duration. Furthermore, the CPA must not be registered as an individual CDM project or as another PoA's CPA. (CDM-EB-28 2006). The crediting periods for CDM projects are laid out in decision 3/CMP.1, that is in the "Modalities and procedures" for the CDM (UNFCCC 2006, pp. 6-29).

Concerning physical boundaries, the PoA may extend to more than one non-annex I host country as long as all participating countries confirm that the CPA in their country contributes to sustainable development. Furthermore, all net reductions for each CPA need to be "real and measurable" (CDM-EB-28 2006).

4.2 Distinction between project bundles and PoA

Bundling CDM projects and PoA represent the same basic idea. That is, transaction costs that are partly independent of the project size shall be distributed more widely in order to reduce the overhead costs for each single CER.

Bundling for SSC was introduced together with SSC CDM projects themselves by decisions 21/CP.8 and 4/CMP.1. Bundled projects share one project design document and one validation report, are registered and verified together (UNFCCC 2006, p. 45). That is, during the whole process of validation, verification and certification the bundle is treated as one. However, the idea of bundling is also attractive for large-scale projects. Therefore, the COP/MOP allowed for bundling by stating in decision 4/CMP.1 that it "recognizes that large-scale project activities under the clean development mechanism can be bundled if they are validated and registered as one clean development mechanism project activity" (UNFCCC 2006, p. 97).

However, there are some differences between project bundles and PoA as summarized by World Bank (2006a). A Project bundles represents a *number of individual* CDM projects with pre-defined baselines, reductions etc. submitted together for registration. In contrast, the PoA *as a framework* is registered as one CDM project for one predetermined type of activities. The number of activities and actual GHG reduction is estimated but unknown beforehand and not necessarily executed by the PoA operator itself. The *sum* of activities and related reductions of GHG – once determined afterwards at verification – constitute the single CDM project as a PoA.

4.3 PoA: the way forward?

Taken together, the idea of PoA combines several elements from SSC, sectoral crediting and bundling. The bundling component/principle that originated from SSC, distributes transaction costs more widely and therefore lowers the burden for each CER. The fact that PoA is not limited to 60 GWh as the SSC allows to distribute overhead costs even further. Due to the nature of the PoA the estimation of emission reduction is less stringent ex ante and since the overhead is carried by the PoA itself, it is easier for the individual CPA to start. The fact that CPA may start at any time within the program may significantly reduce the organizational burden, especially in the presence of many stakeholders/participants. That is, there is no need for a "concerted action" as with bundles where the whole bundle has to start at once. This makes PoA especially suitable for a high number of very dispersed micro activities with an unknown timing of the uptake of the single activity ex ante. For example, this may be the case for campaigns or promotional activities for the replacement of light bulbs for CFL or a labelling scheme for electric appliances with a view of changing the development within a whole sector.

These characteristics of PoA may give rise to much wider applications of crediting and may reap the potentials of energy efficiency that currently represent lost opportunities. However, so far there is only very limited experience with PoA and actual workability will depend to a large degree on the details of administration and implementation.

4. Review of programmatic CDM pipeline with regard to energy efficiency

4.1 Methodologies for PoA

A PoA is not a method in itself. However, the above mentioned characteristics may require taking into account the special circumstances of the PoA. Furthermore, the decisions on PoA are still quite recent. Therefore, the development of methodologies for PoA is still in its infancy. Tables 2 and 3 list recently approved or still pending methodologies for large scale energy efficiency projects that either target or appear suitable for PoA.

Table 2

Selected Newly Approved Methodologies for Energy Efficiency

Approved Method (formerly new method)	Name & Project	Approved (recomm. for approval) at
AM0046 (NM0150-rev)	Distribution of efficient light bulbs to households (Ghana efficient lighting retrofit project)	EB-29 (MP-25)
AM0044 (NM0144-rev)	Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors (Energy efficiency improvements carried out by an Energy Service Company (ESCO) in Ulaanbaatar, Mongolia	EB-28 (MP-24)
AM0038 (NM0146)	Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn (Transalloys Manganese Alloy Smelter Energy Efficiency Project in South Africa)	EB-26 (MP-22)
AM0031 (NM0105)	Bus Rapid Transit System for Bogotá, Columbia: TransMilenio Phase II to IV	EB-25 (MP-21)

Source:

CDM-EB meeting reports: http://cdm.unfccc.int/EB/index.html

MP meeting reports: http://cdm.unfccc.int/Panels/meth/index.html

Table 3

Status of Selected New Methodologies for Energy Efficiency under Consideration

Method	Name & Project	Status
NM0141-rev	Displacing grid/off-grid steam and electricity generation with less carbon intensive fuels in Aba, Nigeria	MP-25: preliminary recommendation
NM0157-rev	Open-DSM type CDM for Green Lighting in Shijiazhuang city, China	MP-25: C
NM0159-rev	Implementation of an Efficiency Testing, Consumer Labeling and Quality-Assurance Program for Air Conditioners in Ghana	MP-25: C
NM0171	Use of Hydro Heavy Fuel Oil Technology (HHFOT) to improve energy efficiency at a power plant in Pakistan	MP-25:WIP
NM0195	Rama Newsprint and Paper Limited energy efficiency project, India	MP-25: preliminary recommendation
NM0197	India – Accelerated Chiller replacement program	MP-25: preliminary recommendation
NM0200	Fuel switch project for generation of cleaner power	MP-25: preliminary recommendation
NM0202	AzDRES Power Plant Energy Efficiency and change in fuel mix	MP-25: preliminary recommendation
NM0201	Cosipar Transport Modal Shift Project	MP-25: preliminary recommendation
NM0165	Feed switchover from Naphta to Natural Gas (NG) at Phulpur plant of IFFCO	EB-26: B

EB: A = approval; B = possible reconsideration; C = non-approval

MP: recommended for A, B or C

Source:

CDM-EB meeting reports: http://cdm.unfccc.int/EB/index.html
MP meeting reports: http://cdm.unfccc.int/Panels/meth/index.html

So far (March 2007), there are only two approved large-scale methodologies that are specifically designed to carry out programs of activities. Approved methodology AM0046 as shown in table 2 is designed to administer a program for the replacement of "normal" light bulbs with compact fluorescent lamps (CFL). Approved methodology AM0044 (table 2) aims at retrofitting or replacing old boilers used for heating in industry or district heating. So far, none of the underlying projects has reached the validation stage.

Other methodologies aiming at programmatic types of CDM are the "Open-DSM type CDM for Green Lighting" (NM0157-rev) and "Implementation of an Efficiency Testing, Consumer Labelling and Quality-Assurance Program for Air Conditioners" (NM0159-rev). However, the Methodologies Panel recommended non-approval for both methodologies. At the time of writing no final recommendation was available on the methodology for the "Accelerated Chiller replacement program" (NM0197).

4.2 Project Examples

The underlying project of approved methodology AM0046 is the "Ghana efficient lighting retrofit project" that is not yet validated (Figueres and Bosi 2006). As laid out in Annex 2 of CDM-EB-29 (2006) the project activity is implemented by a project coordinator who is the project participant. It is foreseen that the project coordinator runs a campaign to replace inefficient light bulbs in households for more efficient CFL. The project coordinator donates or sells the CFL at a reduced price to households who have to turn in their old light bulbs in return. This may be done either directly or via designated distribution points. In accordance with the definition of a PoA above the household that is actually executing the emission reduction activity (using the more efficient CFL) is not the project participant. Instead, the coordinator running the program is. All participating households need to be connected to the electricity grid. Together with all power plant connected to that grid they determine the spatial boundary of the PoA.

Methodology AM0046 uses baseline approach 48 (a) "Existing actual or historical emissions, as applicable" of the "Modalities and procedures for the CDM" (UNFCCC 2006, pp. 6-29).

The baseline scenario is the utilization of the currently used light bulbs with a certain rate of autonomous replacement. The use of the light bulb in the absence of the project is determined by monitoring a control group (baseline sample group, BSG). Therefore, any policy and measure affecting the use of light appliances is reflected in the baseline scenario. Leakage, could occur if the freed light bulbs would be used elsewhere. That is, emissions would rise due to the project activity. Therefore the collected lamps need to be scrapped and an independent verifier needs to check whether the number of distributed CFL corresponds with the number of scrapped light bulbs.

Approved methodology AM0044 is laid out in Annex 1 of CDM-EB-28 (2006). The underlying project is “Energy efficiency improvements carried out by an Energy Service Company (ESCO) in Ulaanbaatar, Mongolia”. An Energy Service Company (ESCO) shall increase energy efficiency by retrofitting or replacing old boilers ahead of the end of their life time. The project focuses solely on energy efficiency excluding fuel switch. The methodology uses baseline methodology 48 (b) “Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment” of the “Modalities and procedures for the CDM” (UNFCCC 2006, pp. 6-29). The installed capacity of each baseline and respective boiler shall be determined using a performance test.

Concerning small-scale projects there are already some registered projects as can be seen in Appendix A. Using methodology AMS-II.B (see table 1) there is already a retrofit program for decentralized heating stations in Mongolia. The “Kuyasa low-cost urban housing energy upgrade is an efficient lighting project in Cape Town, South Africa using AMS-II.C. The “Karnataka CDM Photovoltaic Lighting Programme” is at the validation stage as well and also uses AMS-II.C but its main focus is on solar energy using AMS-I.A.

5. Conclusions

The CDM in general and energy efficiency related CDM in particular faces a number of barriers. This has led to an under-representation of CDM projects related to energy efficiency in the CDM portfolio. Since increased energy efficiency has high development benefits as it contributes to reducing energy poverty this has triggered sustained criticism leading to new models of the CDM that try to reduce transaction costs, inter alia by moving away from its project-based nature. These include bundles of small- and large-scale CDM, some ideas on sectoral crediting mechanisms and – most recently – project activities under a program of activities whereas the latter combines features of the former. PoA have been only recently established by COP/MOP1 and further specified by the CDM Executive Board in Dec 2006. So far there are only two methodologies for running a large scale CDM program of activities. A few more methods are currently being considered by the CDM Executive Board and its Methodologies Panel. However, approval is uncertain.

Therefore, the programmatic CDM still has to prove its success. If it succeeds, however, it could make a valuable contribution to broaden the crediting of greenhouse gas emission reductions. This is especially true with regards to end-use efficiency improvements that currently still represent lost opportunities in terms of lost low-cost reduction possibilities and high sustainable development benefits.

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Appendix: Excerpt from Risoe CDM Pipeline overview (updated 1 Feb 2007)
Source: http://www.uneprisoe.org/

Small-Scale projects Type II. B.

ID	Ref.	Title	Host country	Status	Type	Methodology
CDM0133	266	Thermal efficiency improvement initiatives in coal fired boiler system	India	Registered	EE supply side	AMS-II.B.
CDM0310	479	Energy Efficiency Measures at a Thermal Power Generating Station Of CESC-limited, BBGS	India	Registered	EE supply side	AMS-II.B.
CDM0333	686	Improvement in energy consumption of a Hotel	India	Registered	EE service	AMS-II.B.+AMS-II.E.
CDM0613	706	Supply side energy efficiency improvements in steam generation at CSL by Chemplast Sanmar Ltd.	India	Registered	EE supply side	AMS-II.B.
CDM0574	295	A retrofit programme for decentralised heating stations in Mongolia	Mongolia	Registered	EE supply side	AMS-II.B.
CDM0361	775	West Nile Electrification Project (WNEP)	Uganda	Reg. request	Hydro	AMS-I.D.+AMS-II.B.
CDM0214	821	Efficiency improvement of Turbine Generator to reduce fossil fuel consumption in the Coal fired boiler system	India	Reg. request	EE supply side	AMS-II.B.
CDM1480	847	Up-gradation of Gas Turbine 1 (GT 1) and Gas Turbine 2 (GT 2) at co-generation plant of Hazira Gas Processing Complex (HGPC) of Oil and Natural Gas Corporation Limited (ONGC)	India	Reg. request	EE industry	AMS-II.B.
CDM0360		Energy efficiency through reduction in auxiliary consumption at a Thermal Power Generating Station	India	At validation	EE supply side	AMS-II.B.
CDM0408		Supply side energy efficiency measures at Tata Chemicals Ltd, Mithapur	India	At validation	EE supply side	AMS-II.B.
CDM1089		Improvement in energy efficiency of steam generation and power consumption at Recron Systhetics Limited, Allahabad	India	At validation	EE supply side	AMS-II.B.+AMS-II.D.
CDM1472		Boiler efficiency improvement and fuel switch to biomass in cogeneration plants at Atul Ltd.	India	At Validation	Biomass energy	ACM6+AMS-II.B.

Excerpt from Risoe CDM Pipeline overview (contd., updated 1 Feb 2007)

Small-Scale projects Type II. C.

ID	Ref.	Title	Host country	Status	Type	Methodology
CDM0050	79	Kuyasa low-cost urban housing energy upgrade project, Khayelitsha	South Africa	Registered	EE households	AMS-I.C.+AMS-II.C.+AMS-II.E.
CDM0238	255	Demand-side energy efficiency programme in the 'Humidification Towers' of Jaya Shree Textiles	India	Registered	EE industry	AMS-II.C.
CDM0220		GHG reduction by implementing energy efficient plough share mixer technology in soap manufacturing at Hindustan Lever Limited	India	At validation	EE industry	AMS-II.C.
CDM0380		Energy efficiency and fuel switching measures in the caustic soda and sodium cyanide plant at Vadodara complex of GACL	India	At validation	EE industry	AMS-II.C.
CDM0407		Demand side energy efficiency improvement measures at Tata Chemicals Ltd, Mithapur	India	At validation	EE industry	AMS-II.C.
CDM0721		Energy efficiency measures in a sugar plant by GMR Industries Ltd (GIDL)	India	At validation	EE industry	AMS-II.C.
CDM0958		Karnataka CDM Photovoltaic Lighting Programme	India	At validation	Solar	AMS-I.A.+AMS-II.C.

Excerpt from Risoe CDM Pipeline overview (contd. updated 1 Feb 2007)

Small-Scale projects Type II. D.

ID	Ref.	Title	Host country	Status	Type	Methodology
CDM0215	262	Energy efficiency projects - Steam system upgradation at the manufacturing unit of Birla Tyres	India	Registered	EE industry	AMS-II.D.
CDM0576	389	Waste heat recovery project project based on technology upgradation at Apollo Tyres, Vadodara, India	India	Registered	EE industry	AMS-II.D.
CDM0439	445	Demand side energy conservation & reduction measures at IPCL – Gandhar Complex	India	Registered	EE industry	AMS-II.D.
CDM0302	568	GHG Emission Reductions through Energy Efficiency Improvements	India	Registered	EE industry	AMS-II.D.
CDM0359	582	India - Vertical Shaft Brick Kiln Cluster Project	India	Registered	EE industry	AMS-II.D.
CDM0333	686	Improvement in energy consumption of a Hotel	India	Registered	EE service	AMS-II.B.+AMS-II.E.
CDM0701	701	Energy efficiency project in the Ramla Cement Plant in Israel through instalment of new grinding technology	Israel	Registered	EE industry	AMS-I.D.+AMS-II.D.
CDM0428	745	Demand side energy conservation and reduction measures at ITC Tribeni Unit	India	Registered	EE industry	AMS-II.D.
CDM0440	758	Alternate arrangement for preheating fuel NG	India	Registered	EE industry	AMS-II.D.
CDM0932	777	Energy Efficiency Improvement in Electric Arc Furnace at Indian Seamless Metal Tube Limited (ISMT), Jejuri, Maharashtra	India	Registered	EE industry	AMS-II.D.
CDM0930	794	Reducing heat loss into atmosphere along with the flue gases by utilizing it for preheating of combustion air of service boiler at Indo-Gulf Fertilisers (A unit of Aditya Birla Nuvo Limited), Jagdishpur	India	Registered	EE industry	AMS-II.D.
CDM0365	500	Efficient utilization of waste heat and natural gas at the Dahej complex of GACL	India	Correction request	EE industry	AMS-II.D.
CDM0441	587	Installation of Additional Urea Trays in Urea Reactors (11/21- R01)	India	Correction request	EE industry	AMS-II.D.
CDM0619	685	Modification of Clinker Cooler for Energy Efficiency Improvement in Cement manufacturing at Binani Cements	India	Request review	EE industry	AMS-II.D.
CDM0728	707	India-FaL-G Brick and Blocks Project No.1	India	Request review	EE industry	AMS-II.D.
CDM0506	757	Factory energy-efficiency improvement project in Malaysia (MAPREC, PRDM, PSCDDM, PAVCJM, PCM)	Malaysia	Reg. request	EE industry	AMS-II.D.

Excerpt from Risoe CDM Pipeline overview (contd. updated 1 Feb 2007)

Small-Scale projects Type II. D. (contd.)

CDM0508	759	Factory energy-efficiency improvement project in Malaysia (PHAAM, PCOM (PJ), PCOM (SA), PEDMA, MEDEM)	Malaysia	Reg. request	EE industry	AMS-II.D.
CDM0429	806	Demand side energy efficiency programmes for specific technologies at ITC Bhadrachalam pulp and paper making facility	India	Reg. request	EE industry	AMS-II.D.+AMS-I.D.
CDM0855	814	Waste heat recovery from Process Gas Compressors (PGCs), Mumbai high south and using the recovered heat to heat process heating oil.	India	Reg. request	EE industry	AMS-II.D.
CDM1332		Yantai Coal-Fired Boiler Energy Efficiency Project	China	At validation	EE service	AMS-II.D.+AMS-II.E.
CDM0379		Energy efficiency measures at cement production plant	India	At validation	EE industry	AMS-II.D.
CDM0394		Energy Efficiency Measures at Cement Production Plant in Central India	India	At validation	EE industry	AMS-II.D.
CDM0445		Energy efficiency-Use of Turbine exhaust waste heat in waste heat recovery generator to produce steam at Samtel Color Ltd in Ghaziabad, Uttar Pradesh	India	At validation	EE industry	AMS-II.D.
CDM0446		Energy efficiency-Use of engine exhaust waste heat in waste heat recovery system to produce hot water at Samcor Glass Limited at Kota, Rajasthan	India	At validation	EE industry	AMS-II.D.
CDM0447		Replacement of BFW pump turbine (TP 601B) by Electric Motor	India	At validation	EE industry	AMS-II.D.
CDM0553		Energy efficiency measures at paper production plant at APPM in Andhra Pradesh	India	At validation	EE industry	AMS-II.D.
CDM0554		Low Grade Ore (LGO) beneficiation by Rajasthan State Mines & Minerals Limited	India	At validation	EE industry	AMS-II.D.
CDM0627		Fuel efficiency improvement in glass melting	India	At validation	EE industry	AMS-II.D.
CDM0704		Energy efficiency project – Tata Motors Ltd.	India	At validation	EE industry	AMS-II.D.
CDM0927		Installation of Plate Type Heat Exchanger for preheating combustion air of primary reformer and reducing heat loss to atmosphere through flue gases at Indo Gulf Fertilisers (A Unit of Aditya Birla Group), Jagdishpur.	India	At validation	EE industry	AMS-II.D.
CDM1057		Vikram Cement: Energy efficiency by up-gradation of clinker cooler in cement manufacturing	India	At validation	EE industry	AMS-II.D.
CDM1070		Condensate Recovery from Revamping of Falling Film Evaporator and Installation of New Condenser at BILT-Sewa	India	At validation	EE industry	AMS-II.D.

Excerpt from Risoe CDM Pipeline overview (contd. updated 1 Feb 2007)

Small-Scale projects Type II. D. (contd.)

CDM1072		Efficiency Improvement in the Blow Heat Recovery System at BILT-Sewa	India	At validation	EE industry	AMS-II.D.
CDM1076		Demand side energy efficiency projects at RIL-PG.	India	At validation	EE industry	AMS-II.D.
CDM1089		Improvement in energy efficiency of steam generation and power consumption at Recron Systhetics Limited, Allahabad	India	At validation	EE supply side	AMS-II.B.+AMS-II.D.
CDM1102		Grasim Cement:Energy efficiency by up-grading a clinker coolier in cement manufacturing	India	At validation	EE industry	AMS-II.D.
CDM1103		GHG emission reduction by energy efficiency improvement of clinker cooler in cement manufacturing at Rajashree Cement	India	At validation	EE industry	AMS-II.D.
CDM1138		Demand side energy efficiency project at IPCL-Vadodara Complex.	India	At validation	EE industry	AMS-II.D.
CDM1195		Energy Efficiency Improvement in Thermosetting process at Indo Rama Synthetics (India) Limited, Butibori, Maharashtra	India	At validation	EE industry	AMS-II.D.
CDM1197		Reduction in Specific Steam Consumption Of Vapour Absorption Chillers at Indo Rama Synthetics (India) Limited, Butibori, Distt – Nagpur, Maharashtra	India	At validation	EE industry	AMS-II.D.
CDM1236		Energy efficiency by purge gas recovery at Nagothane Manufacturing Complex of IPCL	India	At validation	EE industry	AMS-II.D.
CDM1298		Energy Efficiency Improvement through replacement of Recuperative Heat Exchanger by Regenerative Heat Exchanger in the Blast Furnace Section	India	At Validation	EE industry	AMS-II.D.
CDM1372		Energy efficiency measures at Fertilizer unit of Tata Chemicals Ltd. at Haldia, West Bengal	India	At Validation	EE industry	AMS-II.D.
CDM1375		India-FaL-G Brick and Blocks Project No.2	India	At Validation	EE industry	AMS-II.D.
CDM1427		Energy Efficiency Measures at Automotive Division & Farm Sector Division of Mahindra & Mahindra (M&M) Ltd.	India	At Validation	EE Industry	AMS-II.D.
CDM1432		Energy Efficiency Improvement by Installing High Efficiency Walking beam furnace at Mahindra Ugine Steel Company Limited (MUSCO), Jagdishnagar, Khopoli, Maharashtra	India	At Validation	EE Industry	AMS-II.D.
CDM1433		Installation of an Energy Efficient Electric Arc Furnace at Mahindra Ugine Steel Company Limited (MUSCO), Jagdishnagar, Khopoli, Maharashtra	India	At Validation	EE Industry	AMS-II.D.
CDM1467		Energy efficiency improvement in power generation at Sajjan India Limited, Ankhleshwar, Gujarat	India	At Validation	EE Industry	AMS-II.D.

Excerpt from Risoe CDM Pipeline overview (contd. updated 1 Feb 2007)

Small-Scale projects Type II. D. (contd.)

CDM1478		Thermal energy efficiency improvement in the steam cycle of sugar production process	India	At Validation	EE Industry	AMS-II.D.
CDM0750		Energy efficiency improvement project at a beer brewery in Lao PDR	Lao PDR	At validation	EE industry	AMS-I.C.+AMS-II.D
CDM0891		The model project for renovation to increase the efficient use of energy in brewery	Vietnam	At validation	EE industry	AMS-II.D.
CDM0507		Factory energy-efficiency improvement project in Malaysia (MTPDM)	Malaysia	Withdrawn	EE industry	AMS-II.D.
CDM0486	317	ElDorado Energy Efficiency Project	Mexico	Rejected	EE industry	AMS-II.D.
CDM0487	311	Lazaro Energy Efficiency Project	Mexico	Rejected	EE industry	AMS-II.D.

Small-Scale projects Type II. E.

ID	Ref.	Title	Host country	Status	Type	Methodology
CDM0226	159	Moldova biomass heating in rural communities project-no.1	Moldova	Registered	EE households	AMS-I.C.+AMS-II.E.+AMS-III.B.
CDM0231	160	Moldova biomass heating in rural communities project-no.2	Moldova	Registered	EE households	AMS-I.C.+AMS-II.E.+AMS-III.B.
CDM0227	173	Moldova energy conservation and GHG emission reduction	Moldova	Registered	EE service	AMS-II.E.+AMS-III.B.
CDM0838		Pão de Açúcar – Demand side electricity management – PDD 1	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0844		Pão de Açúcar – Demand side electricity management – PDD 5	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0845		Pão de Açúcar – Demand side electricity management – PDD 6	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0847		Pão de Açúcar – Demand side electricity management – PDD 2	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0848		Pão de Açúcar – Demand side electricity management – PDD 7	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0849		Pão de Açúcar – Demand side electricity management – PDD 8	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0851		Pão de Açúcar – Demand side electricity management – PDD 3	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM0853		Pão de Açúcar – Demand side electricity management – PDD 4	Brazil	At validation	EE Service	AMS-I.D.+AMS-II.E.
CDM1332		Yantai Coal-Fired Boiler Energy Efficiency Project	China	At validation	EE service	AMS-II.D.+AMS-II.E.

Small-Scale projects Type II. F.

ID	Ref.	Title	Host country	Status	Type	Methodology
CDM0951		Northeast Caeté Mills Irrigation Project (NECMIP)	Brazil	At validation	Fossil fuel switch	AMS-II.F.

Clean Development through Cogeneration

Combined Heat and Power Generation Projects in the Clean Development Mechanism

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Paper submitted to the UNIDO/CTI/UK Trade and Investment Seminar on Energy Efficiency Projects in CDM and JI
Vienna, 19-22 March 2007

About WADE

WADE is a non-profit research and advocacy organization that was established in June 20
to accelerate the worldwide deployment of decentralized energy (DE) systems. WADE is now backed by national cogeneration and DE organizations, DE companies and providers, as as a range of national governments. In total, WADE's direct and indirect membership s include over 200 organizations around the world.

WADE believes that the wider use of DE is a key solution to bringing about the cost-effective modernization and development of the world's electricity systems. WADE's goal is to the overall proportion of DE in the world's electricity generation mix. To work towards its WADE undertakes a growing range of research and other actions on behalf of its suppo and members:

- WADE carries out promotional activities and research to document all aspect DE, including policy, regulatory, economic and environmental aspects in key countries and regions.
- WADE works to extend the international network of national DE and cogenerat organizations. Current WADE network members represent Australia, Brazil, Canada, China, Europe, India and the US. We are continually working to extend this network.
- WADE provides a forum for DE companies and organizations to convene and communicate.
- WADE jointly produces an industry journal: "Cogeneration and On-Site Power" (published by Pennwell in association with WADE).

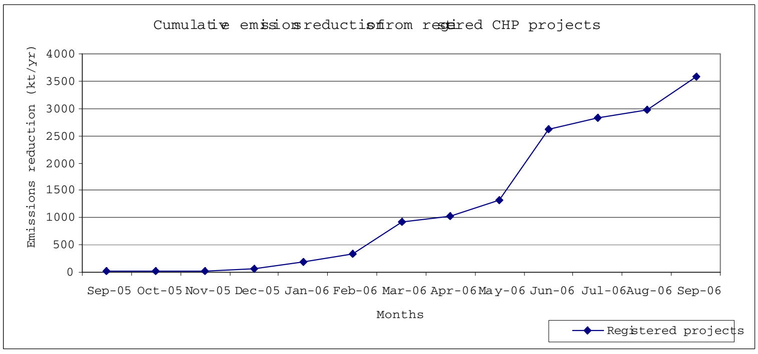
Acknowledgements

Alexander Lüchinger, Managing Partner; and Brett Orlando Director Carbon Finance, Facto Consulting+Management
Dave Schnaars, Manager Environmental Strategies, Solar Turbines
Nathaniel te Seghs, Project Origination, EcoSecurities UK

Executive Summary

Combined Heat and Power (CHP) applications provide cost-effective opportunities for reducing greenhouse gas (GHG) emissions in developing countries. This makes them hig suitable for Clean Development Mechanism (CDM) projects.

TRENDS IN REGISTRATION OF CHP PROJECTS IN THE CDM

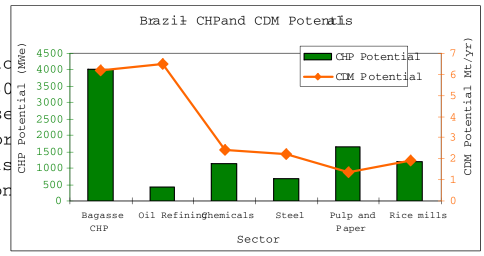


On 30 September 2006, 66 out of 326 registered CDM projects involved cogeneration (2 Emission reductions from these reached over 3.5 Mt/yr. This is rising steadily. The average size of cogeneration projects is 54,000 t/yr. Most cogeneration CDM projects are in food manufacturing and large industry in India and Brazil, but more industrial sectors and are becoming involved.

Brazil

In Brazil the CDM has been supported strongly by the government, and 26 cogeneratio projects were registered by 30 September 2006, mostly bagasse CHP. Many opportunities for pr in the sugar sector still exis potentials for CHP application refineries and industry are also considerable.

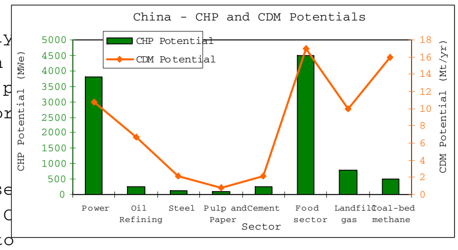
CDM potential in Brazil



China

China has been slow in implementing the CDM, and only CHP project was registered on September 2006. Industry and p generation are the main sector CHP in the CDM, with further opportunities in biomass-fired CHP. However, the strong centralise up and lack of clarity about C CDM procedures are barriers to achieving this potential.

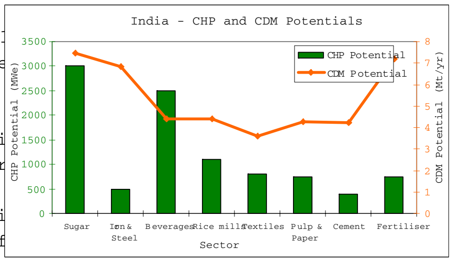
CDM potential in China



India

India represents over one third of CHP projects in the CDM. Initiall most applications were bagasse CHP, but industrial waste-heat cogeneration is becoming more significant. Sugar manufacturi likely to remain important for cogeneration projects, but in term the larger potential is in major industries, including steel, f and cement.

CDM potential in India



Present Status

The present status of CHP projects in the CDM show their suitability, but the CDM is early stage, so several opportunities have not yet been realised, and certain unresolved issues remain. Neglected opportunities for CHP projects include applications in build emission reductions from avoided network losses; and cogeneration replacing combined cycle power plants. The main outstanding issues are the creation of additional emission quota through the CDM; the difficulty of proving additionality of the CDM project; uncerta post-Kyoto arrangements; and risks associated with carbon market developments.

Potential

The overall potential for the CDM is large, though, and cogeneration can play a major part its future development. Consequently there has been much interest in participating in CDM from project developers, equipment manufacturers, governments, investors and brokers. However, many of these players do not have the time or expertise to analyse th rules and procedures of the CDM, and assess how they can benefit from the CDM.

This report aims to provide a practical guide for developing CHP projects in the CDM explains the specific procedures and considerations for cogeneration projects, describes the current status, and assesses their future potential. Country profiles for Brazil, Ch give country-specific information and projections for these important CDM mar

Clean Development through Cogeneration

Combined Heat and Power Projects in the Clean Development Mechanism

1. Introduction

Cogeneration is a cost-effective way of reducing CO_2 emissions from power generation. The combined use of the heat and power outputs of the generation process increases its efficiency, and thereby reduces the fuel input and emission output. As a decentralise (DE) technology, cogeneration also reduces transmission and distribution (T&D) losses. Cogeneration is a flexible technology, which can use various fuels, and be adapted to circumstances. The possibility of using biomass fuels or agricultural residues makes Combined Heat and Power (CHP) particularly effective in reducing CO_2 emissions. Cogeneration technologies are well established, and therefore reliable and competiti most markets. Cogeneration is therefore a prime candidate technology for carbon emis reduction projects.

The Clean Development Mechanism (CDM) is part of the Kyoto Protocol for reducing glo greenhouse gas (GHG) emissions to mitigate anthropogenic Climate Change. Opportuniti for emission reduction are generally large in developing countries, so that these can be met at lower costs than in developed countries. The CDM recognises this, and provides an opportunity for developed countries (Annex I) to meet part of their GHG emission targ through projects in developing countries (non-Annex I). This benefits Annex I countries by reducing the cost required to meet their emission targets, and benefits non-Annex I countries by facilitating investment and technology transfer and sustainable development. Overa approach aims to ensure that GHG emission targets are met quickly and cost-effectively.

CHP technologies are well suited for CDM projects, because they are generally econom attractive and technologically mature and reliable, so that they contribute directly aim of reducing GHG emissions cost-effectively. Furthermore, they are flexible and can be adapted to local circumstances. In developing countries cogeneration can easily be i in many industries, including food processing, taking advantage of the biomass residues of the production process. This has the dual benefits of lowering fuel costs and solving issue. Cogeneration projects address both energy supply and demand-side, and therefore have a wider impact than most CDM technologies. Furthermore, they provide a long-term solution, as the resulting CO_2 savings are reliable and predictable over the project's lifetime, unlike some other project types.

This report discusses the implementation of CHP projects within the CDM. It aims to practical guide for CDM project participants, outlining the CDM's organisational struct (Chapter 2), and describes the project cycle for cogeneration projects (Chapter 3). outline the present status of CHP in the CDM and country-specific information for Brazil, China and India (Chapter 4).

2. The Clean Development Mechanism

2.1 Introduction

The Clean Development Mechanism (CDM) is part of the Kyoto Protocol, adopted in 1997 the 3rd Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). The CDM itself was decided on at the 7th COP in Marrakech in 2001, as outlined in the Marrakech Accords. The Kyoto Protocol aims to stabilise GHG concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system. The target for the first commitment period (20 2012) is to reduce global GHG emissions to 5% below 1990 levels. Reduction targets differ betw parties to the conference, reflecting their 'common but differentiated responsibilities', so that Annex I countries will reduce their emissions, while no such commitments exist yet fo Annex I countries.

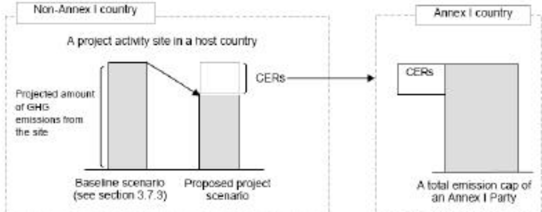
The CDM, together with Joint Implementation and International Emissions Trading, is o the three market mechanisms that enables Annex I countries to meet their targets in cost-effective way.[1] The CDM procedures were approved and adopted during the 11th COP in Montreal in 2005. Through the CDM, Annex I parties help implementing GHG emission reduction projects in non-Annex I countries, for which they will obtain emission reduction credits. These credits, Certified Emissions Reduction (CER) can then be used to cont meeting the Annex I country's target. Non-Annex I countries benefit through the investment and technology transfer that are part of the project implementation.

This chapter will give an overview of the working of the CDM. First, it describes th principles, the project types included, and how emissions are measured and verified (Section 2.2). Then it will explain the organisational structure of the CDM (Section discuss the carbon market (Section 2.4) economics of the CDM (Section 2.5).

2.2 General Principles of the Clean Development Mechanism

PRINCIPLES

FIGURE 1
GENERAL CONCEPT OF THE CDM



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[1] The Kyoto Mechanisms are Emission Trading, the Clean Development Mechanism and Joint Implementation.

The Clean Development Mechanism (CDM) allows Annex I countries of the Kyoto Protocol
meet part of their GHG emission reduction target through projects in non-Annex I countries.
By funding and implementing projects, the Annex I country reduces GHG emissions in t
non-Annex I country. The emissions saving, expressed in Certified Emission Reduction
credits, will be added to the total emission cap of the Annex I country, helping it to meets
target (figure 1). In effect, this increases the total Annex I emission allowance, b
Annex I countries do not have emissions reduction targets.

The CDM is based on three legal principles:

1. Participation of the project partners is voluntary.
2. The project results in real, measurable and long term benefits related to t mitigation of climate change.
3. The reduction of emissions through the CDM project must be additional to reductions that would occur without the CDM project (Additionality principle).

The implication of principle 2 is that the emission reductions that can reasonable b
to the project activity must be directly quantifiable, and long term. The Additionality principle
implies that the project would not be implemented in absence of CDM revenue, because
economic or other barriers, and contributes to a net reduction in emissions from a c
baseline scenario, in which the project would not happen.

PROJECT TYPES

TABLE 1
TYPES OF CDM PROJECT S

Type I. Renewable Energy Projects
♦ I-A. Electricity generation by the user
♦ I-B. Mechanical energy for the user
♦ I-C. Thermal energy for the user
♦ I-D. Renewable electricity generation for a grid
Type II. Energy Efficiency Improvement Projects
♦ Supply side, Demand side and Fuel switching
Type III. Other Projects
♦ Methane recovery, Transport, Agriculture and Land use

Any project reducing GHG emissions is eligible for the CDM, but they are classified
categories (table 1). Cogeneration projects are normally classified as Type I, category A
D, depending on the main energy output of the project. However, in specific cases
cogeneration can be considered as part of Type II or Type III projects too. For exam
industrial waste heat recovery and power generation projects (bottoming cycle CHP) could
include replacing boilers by CHP generators, and therefore be Type II. Cogeneration
can be combined with fuel switching, for instance from oil to bagasse in a sugar mill. As for
Type III projects, methane recovered from a landfill can be used as fuel for CHP gen

SMALL-SCALE CDM PROJECTS (SCC)

Small-scale CDM projects are a special category, for which the registration, validati
verification procedures have been simplified to reduce the procedural cost relative to the
project costs. For instance, a number of SCCs can be bundled in a single application
SCCs have special simplified baseline and monitoring methodologies. A project quali

SCC project if the energy output or energy efficiency gain is smaller than 15MW. For example, a microturbine application using biogas from agricultural waste, with an ins capacity of 2 MWe would qualify as a SCC.

2.3 Organisational Structure of the Clean Development Mechanism

CDM PROJECT PARTICIPANTS

Various participants are involved in the development of CDM projects (table 2).

TABLE 2
PARTIES INVOLVED IN THE CDM

Global	National	Project
♦ Conference of the Parties (COP ♦ CDM Executive Board (EB)	♦ Designated National Authority (DNA)	♦ Annex I Party ♦ Non-Annex I Party ♦ Investors (CER buyers)
Designated Operational Entity (DOE)		

The parties involved in the CDM have different motives for participating in CDM proj

- Annex I countries: cost-effective way of meeting their emission reduction commitment
- Non-Annex I countries: local sustainable development and climate change mitigation.
- Host-country participants: CER revenues
- Annex I participants: business opportunities and a corporate social respons strategy.
- Investors: investment opportunities in sustainable energy projects
- Institutional investors: investment opportunities, portfolio diversificatio socially responsible investments[2]
- Equipment manufacturers: indirect benefits from new market for renewab energy and energy efficiency equipment, application of emerging technologie and opportunities for developing special CDM packages.

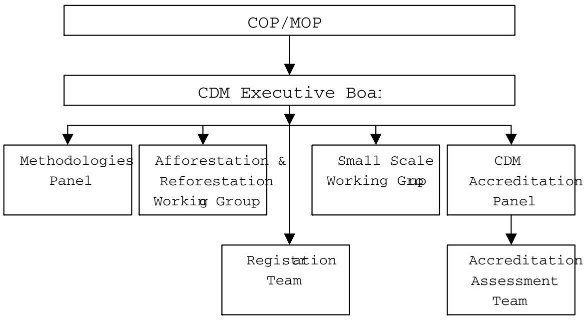
CDM EXECUTIVE BOARD (CDM-EB)

At a global level, the COP has the overall authority over the CDM, but the CDM Execu Board (EB) carries out its actual operation. The EB is responsible for the accredita Designated Operational Entities (DOE) and methodologies, keeps a project registry, publishes technical reports, and issues CERs. These tasks are delegated to two P and two Working Groups, which set procedures and offer guidance in their field of expert Accreditation Panel, responsible for accrediting methodologies, is assisted by the Accreditation Team. A separate Registration Team of the EB processes applications for

[2] Getulio Vargas, The Clean Development Mechanism – A Brazilian Implementation Guide, 2002.

project registration (figure 2).

FIGURE 2
INSTITUTIONAL STRUCTURE OF THE CDM



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DESIGNATED OPERATIONAL ENTITIES (DOE)

The CDM EB has the authority to accredit Designated Operational Entities (DOEs). These are independent organisations that validate CDM project proposals before they are submit the EB, and verify the emission reductions achieved by the project, before CERs are This facilitates the EB's work, and streamlines CDM procedures. Sixteen DOEs were accredited at the end of September 2006, but the methodologies that each is allowed validate and verify differ. A list of accredited DOEs can be found on the UNFCCC CDM website[3]

DESIGNATED NATIONAL AUTHORITY (DNA)

At a national level, the Designated National Authority is responsible for implementi CDM. DNAs are generally set up by the government, and supervised by a ministry of na resources or environment. Non-Annex I DNAs specify the procedures for CDM project activities in the country, and create the local organisational structure for the CDM report back to the CDM EB. Non-Annex I DNAs have to approve a project before it can apply for registration at the EB, and both the non-Annex I and Annex I DNAs have to give approval before credits can be issued. A list of DNAs can be found on the UNFCCC CDM website[4]

CDM projects are proposed and developed by the local and Annex I project participant the site-owner or specialised project developers. DNAs can be directly involved in project development, but generally they authorise private or public entities to oper them. These entities are responsible for the actual implementation of the project. A these participants, multilateral funds or other investors can participate to provide fun one or more DOEs are involved in validating and verifying the project.

[3] http://cdm.unfccc.int/
[4] http://cdm.unfccc.int/

2.4 The Carbon Market

WHAT IS THE CARBON MARKET?

The carbon market, which was established as part of the Kyoto Protocol, is the business of buying and selling greenhouse gas emissions. The main trading unit is one metric tonn carbon dioxide equivalent (t CO2e). Two commodities are traded in this market:

- Emissions allowances: allowances to emit GHG allocated to companies by national governments of Annex I countries. Companies that emit less than the allowances can sell these to companies emitting more than their allocation, trading companies. In the European Union Emission Trading Scheme (EU ETS) the allowances are called EU Allowances (EUAs).

- Project-based emissions reductions: emission reduction generated by project activities, which are certified by an independent auditor. Certificates are Certified Emission Reductions (CERs) or Emission Reduction Units (ERUs), depending on the origin. CDM projects generated CERs.

The carbon market covers the three Kyoto Mechanisms: the CDM, for emission reduction projects in non-Annex I countries; Joint Implementation, for emission reduction projects in Annex I countries for which the emission reductions are credited to another country t host country; and International Emission Trading, for direct trading of emission allo between Annex I countries.

SIZE OF THE CARBON MARKET

The carbon market is growing at an extraordinary pace. In 2005, about 800 Mt CO_2 eq. was transacted with a value of 9.4 billion (527 INR billion) according to Point Carbon (Carbon 2006). This is an eight-fold increase in volume and 25 times more financial value than the previous year. The CDM represented 400 Mt CO_2 eq., with a total value of 1.9 billion.

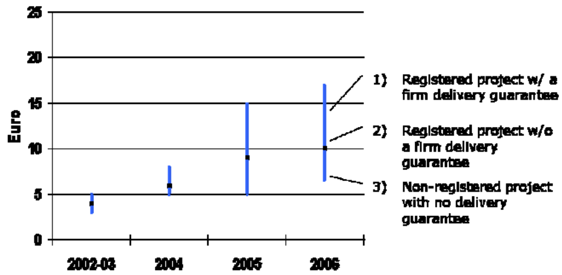
This rapid growth can be explained by accelerating government efforts to implement th Kyoto Protocol and the start of the European Union Emissions Trading Scheme (EU ETS) in particular. The EU ETS limits the emissions of 10,000 large-scale emitters in the 25 EU Member States to 2.2 billion t CO_2 eq., allowing reduce emissions internally, or trade allowances with other emitters to meet their quota. Emitters may also purchase CERs / ERUs from CDM / JI under certain conditions.

Several European financial institutions have set up procurement vehicles designed to purchase CERs / ERUs directly from project developers and sell them to emitters under the EU ETS. Similar vehicles have been set up in Japan. In addition to private sector funds, publicly funded government-led procurement programmes have been set up throughout Europe and in Japan to purchase CERs from project developers in order to support nati level compliance efforts under the Protocol. Over 3 billion in total has been raised in private and public funds in Europe and Japan to purchase CERs at the time of writing.

PRICES FOR CERS

Point Carbon, a news provider for the carbon market, estimated that the volume weighted average price for the 400 million CERs transacted in 2005 was 7 / t CO_2. This is a marked increase from 2004 and 2003, when CERs traded for around €4-5 /tCO2 as shown in Figure 3, and is driven by increased demand from Europe and Jap

FIGURE 3:
HISTORICAL CER PRICES



POINT CARBON, 2006.

The range of CER prices reflects differences in the delivery. CERs that are availabl immediate delivery are priced in the €12-15 range, whereas for future delivery are discounted at about €10-12. There are also price differences between countries. Generally, sellers in China and other countries are willing to accept lower prices than those i

2.5 Economics of the Clean Development Mechanism

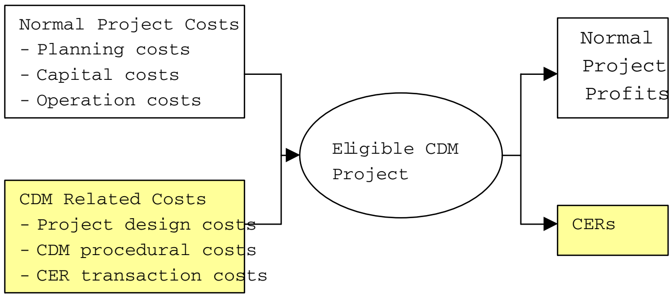
GENERAL ECONOMICS OF CDM PROJECTS

In many respects the economics of CDM projects are the same as that of other energy projects. Project planning, implementation and operation costs are similar, as are n project profits. However, CDM projects incur a range of additional costs associated w the documentation, application, registration and transaction procedures of the CDM (figu CDM projects also differ from ordinary projects because of the additionality requirem which states that the project would not be economically attractive in the absence of the CDM. The value added to the project by the CDM (i.e. the CER value) aims to bridge this gap, additional risk involved still poses barriers for obtaining funding for CDM projects

CDM RELATED COSTS

The CDM procedures add to the overall project costs in several ways. At the preparation phase there are the costs for preparing a Project Design Document (PDD) and other documentation, requiring research and administrative work. Validation, verification certification by a DOE entail costs, and the CDM EB also requires a registration fee f CDM projects. Furthermore, the purchase agreement for the CERs needs to be arranged, with associated legal and contractual costs. During project operation the monitoring requirement of the CDM adds to operational costs. The broker for the sale of CERs general also incurs a success fee of 1-5% of the total value. Finally, the CDM EB, and possibly the host DNA, takes a share of the proceeds of CDM projects. Table 3 summarises these co and their estimated values. Generally these costs constitute around 12% of total proj

FIGURE 4 :
COSTS AND OUTPUTS OF A CDM PROJECT



WADE, 2006

for small projects, and 3% for large projects.[5] Project participants normally incur these costs, but the distribution of the costs over the various partners depends on the arrangement between them.

TABLE 3:
COSTS RELATED TO THE CDM REQUIREMENTS

CDM Project Cycle	Carbon Transaction Consultant's Estimate of Costs (US$)
Up-Front Costs:	
1. Feasibility Assessment	5,000 – 20,000
2. Preparation of the PDD	25,000 – 40,000
3. Registration	10,000
4. Validation	10,000 – 15,000
5. Legal Work	20,000 – 25,000
Total Up-Front Costs	70,000 – 110,000
Operational Phase Costs	
1. Sale of CERs	Success fee of 5 – 10% of CER value
2. Risk Mitigation	1 – 3% of CER value annually
3. Monitoring and Verification	3,000 – 15,000 per year
ECOSECURITIES, 2003; QUOTED IN UNEP ENERGY AND ENVIRONMENT GROUP, THE CDM – A USER'S GUIDE, 2003.	

FINANCING STRUCTURES FOR CDM PROJECTS

Different transaction structures for the sale of CERs from CDM projects are possible depending on the type of project and project participants. The relationship between t seller and CER purchaser is vital in this. CER purchasers are generally large multinationals with extensive experience in project financing, while CER sellers are often small loc industries or community groups, with little financial expertise. It is therefore esse a reliable and fair legal agreement between the two. Figure 5 outlines popular financing mechanisms, using some price examples.

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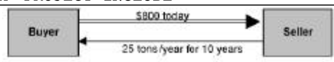
[5] UNEP Energy and Environment Group, The CDM – A User's Guide, 2003

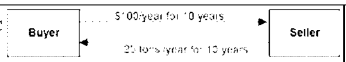
FIGURE 5:
POSSIBLE TRANSACTION STRUCTURES FOR CDM PROJECT INCLUDE

♦ Upfront payment for future stream



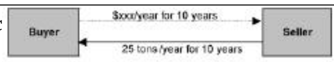
Upfront payment is attractive for small developers generally lacking funds to carry the investment. This clearly establishes additionality, directly removing a barrier to the project. Purchasers often require a share o upfront payment to mitigate the risks.

♦ Forward contract for delivery of C fixed prices



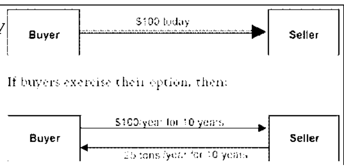
In this common structure the seller agrees to deliver a fixed number of CERs at the end of the contract, purchaser will buy on delivery at an agreed price. It reduces risks for both parties, but is complicated period is not the same as the CDM crediting period.

♦ Forward contract for delivery of C floating prices



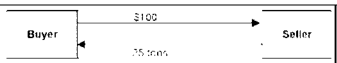
This structure is similar to the previous, but the price paid on delivery of the CERs is based on a marke than advance agreement. This is attractive for sellers who expect carbon prices to rise, but most buyers prefer f price contracts.

♦ Option payment for future delivery



For maximal flexibility buyers may prefer to buy an option on CERs purchases in the future. This requires upfront payment for the option, and a purchase of CERs at a fixed price if the option is taken. Sellers may be le sell their CERs, though, increasing risks.

♦ Future spot market trades



Sellers may choose to sell their CERs on the open market, one transaction without previous commitments. This gives both buyers and sellers much flexibility, but sellers risk not being able to find purchasers f

UNEP ENERGY AND ENVIRONMENT GROUP, THE CDM – A USER'S GUIDE, 2003.

CDM PROJECT RISKS

Investors will always evaluate a project in terms of its economic viability and risks projects this is the viability and risks of the project itself, but for CDM projects assessment must account for the CER value and associated risks too. CDM-related risks are:

- Registration risk
- Performance risk
- Counterparty risk
- Market risk

Registration Risk

Registration risk refers to the likelihood that the project will not be validated by registered by the CDM EB. There can be several reasons for this to happen:

- Non-approval of a new baseline methodology

- Unsuccessful validation of methodology of calculating emission reductions
- Non-approval by the host country
- Request for review at registration by CDM EB
- Request for review at CER issuance by CDM EB

These risks are directly related to the CDM project cycle, and will therefore be higl when this is discussed in detail below.

Performance Risk

In addition to registration risk, CDM projects pose risks similar to those faced by conventional projects, representing technological and financial uncertainties. All of these risks will in turn influence whether the project will produce the volume of emissions reductions that a estimated in the PDD. Typical risks include:

- Delays in Commissioning: Will the project start as planned?
- Unreliability of Fuel Resource Supply: Will sufficient fuel be available at price for the project throughout its lifetime?
- Breakdown in Technology: Will the technology remain reliable throughout the project lifetime?
- Unreliable Financial Flows: Will the project face problems through unreliab cash-flows?

For cogeneration projects technological risks are smaller than for other project typ is a mature technology. CHP projects using biomass residues generally also have low fuel supply risks.

Counter-party Risk

The CERs from projects are generally transacted through forward contracts in which tl Buyer agrees to pay the Seller for delivery of a specific volume of CERs on a specifi a price negotiated at the time of initial contract. Because contracts are private ag between two parties there is always a risk that a party may default on its side of tl agreement. Some of the issues relating to the likelihood of default are:

- Insolvency: Will the project proponent remain financially solvent for the du of the contract?
- Fraud / Wilful misconduct: Will the Buyer and the Seller follow through on t contract?
- Political and Regulatory Instability: Will changes in the political situation in the host-country affect the CDM project performance?

For CDM projects the risk of wilful misconduct can be higher than for other projects of the potential of dissatisfaction with the price negotiated in the forward contract sell-side the project developer commits to deliver the CERs at a negotiated price but if market changes, and CER price goes up significantly in relation to the price in the contract has a strong incentive to default on the contract at the time of delivery and transact in the open market. The same is true from the Buyer's perspective in the event that CER pri below the price negotiated in the contract.

15

Political risk of the host country is similar to non-CDM projects, but it is complicated by the issue of legal status and rights of ownership of the CERs. As a general rule the CERs arise from activities within a project, it is assumed that they belong to the owner in the absence of an agreement to the contrary. The owner of the project therefore has the right to the CERs and the right to transfer them as an exercise of the right of owne However, arrangements differ between host countries.

From the buying countries' perspective there is a risk that CERs will not be fully convertible, with other compliance units. This issue is relevant within the EU ETS which allows r emitters to purchase CERs and use them for compliance only under certain conditions. EU has stipulated, for instance, that hydro electric projects above 20MW must meet certain environmental and social criteria before the CERs from such projects can be used for compliance purposes.

Even more importantly, some Member Statues have proposed placing an upper limit on t amount of CERs that can be used by regulated emitters for compliance in the EU ETS. If limits were put in place, the attractiveness of CERs would be reduced and a Buyer may be tempted to default on its contract or renegotiate a lower price with the Seller sinc no longer equivalent with EUAs.

Market Risk

In addition to the uncertainty in financial flows faced by conventional project devel projects face an additional risk associated with the income they will receive from t CERs, based on carbon market developments.

CER prices are determined by the supply and demand in the market for emissions reduc Since market conditions change, prices fluctuate and as a result project developers certain of the additional income they will earn from CER sales. This can endanger the viability of CDM projects, if they rely heavily on the CER revenue.

3. CDM Project Cycle for Combined Heat and Power Projects

3.1 Introduction

CHP technologies can deliver GHG reductions from energy generation and are therefore eligible for the CDM. Cogeneration projects are attractive, because in many developin countries their potential is large. However, the procedures and requirements for plan developing and implementing cogeneration projects in CDM can be complicated and cumbersome, particularly for non-experts. It is therefore important that the procedures are clear and that information about these is easily available for project developers.

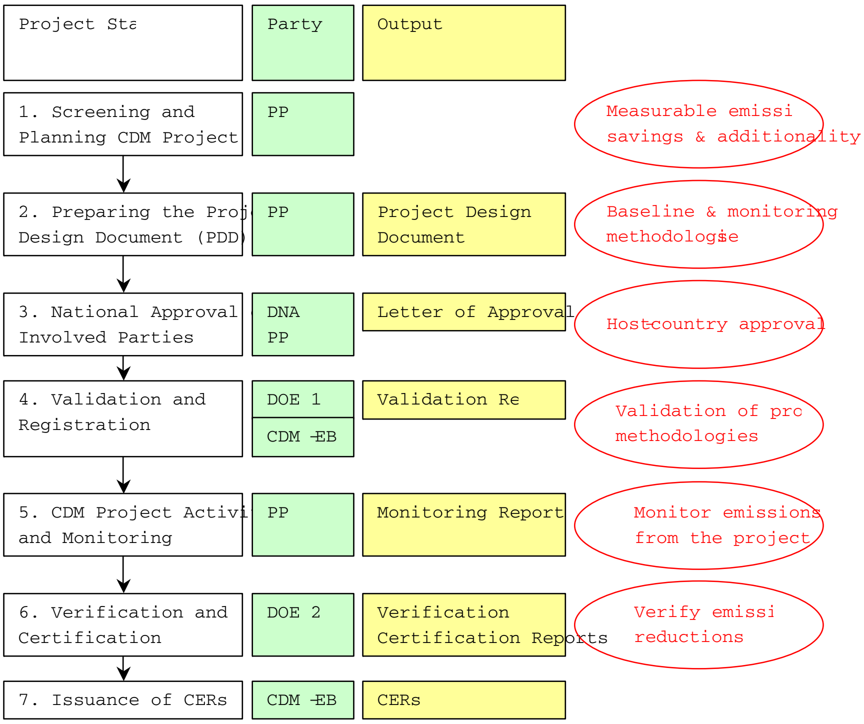
The CDM project cycle is similar for all project types, and much information is available on the standard procedures, both from the UNFCCC and from research organisations. Every proj type and technology has its own particularities, though. It is therefore important to these in detail, and to provide technology specific information for project developers. In particularly, applicable baseline methodologies, accredited DOEs and monitoring requirements for specific topic types are invaluable. This chapter discusses the issu relevant to cogeneration systems.

This chapter will first describe the general CDM project cycle (Section 3.2), and the specific issues and questions for developing CHP projects and drafting a PDD, includi baselines and additionality assessment (Section 3.3).

3.2The CDM project cycle

Figure 6 outlines the CDM project cycle, showing the seven stages, and the participa involved and documents produced at each stage.

FIGURE 6
The CDM project Cycle



WADE, 2006; BASED ON IGES, CDM IN CHARTS, 2006 AND DTI, A CLIMATE CHANGE PROJECTS OFFICE GUIDE, 2004

1. Screening and Planning a CDM Project
Developers interested in registering their project for the CDM must first check that the criteria of the CDM. The additionality of the GHG savings over the baseline is especially important for a project to be eligible.

2. Preparing the Project Design Document (PDD)
The PDD is the standardised application format for CDM projects, available from the EB. The PDD describes the project activity, the baseline methodology and additionality of the project, the monitoring methodology, and the project's contribution to sustainable development. The PDD is the central part of a CDM registration application, and will

be explained in more detail.

A CDM Project Design Document has a standard format, and consists of 7 sections (tab
It is important to follow the proscribed structure in order to apply for CDM registra
successfully. The CDM Project Design Document form outlines the structure, and is available from the UNFCCC website[6].

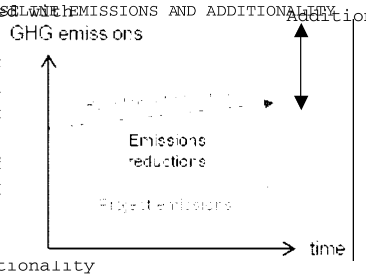
TABLE 4:
ELEMENTS OF A CDM PROJECT DESIGN DOCUMENT

A. Description of the Project Activity
B. Application of the Baseline Methodology
C. Crediting Period
D. Application of the Monitoring Methodology and P
E. Estimation of the GHG Emissions by Sources
F. Environmental Impacts
G. Stakeholder Comments
UNFCCC CDM, PROJECT DESIGN DOCUMENT FORM

A. Description of the project activity
The Project Design Document starts with a description of the project, covering its location, its aims, the local circumstances, the technology used and the type of project activity.

B. Baselines and additionality
The baseline methodology explains how the project activity will be compared with baseline scenarios "that reasonably represent the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity"[7]. The baseline methodology describes how to establish this baseline, against which the GHG emission savings of the CDM project can be measured (figure 7). This is the foundation of establishing the additionality of the CDM project, and is therefore essential for project approval.

FIGURE 7:
BASELINE EMISSIONS AND ADDITIONALITY



INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM IN CHARTS, 2006

The baseline methodology should be project specific, cover all significant emissions project boundary that are in control of the project participants and can reasonable l attributed to the project. These should be adjusted for leakage: anthropogenic emissions of GHG outside the project boundary that can be reasonable attributed to the CDM projec activity. The baseline should reflect local standards and policies, to give a reasona business-as-usual case. The methodology and data used should be transparent, and specified in the PDD.
The CDM EB has approved standard baseline methodologies for various types of project These can be used directly and applied to comparable projects. Alternatively, a proj proponent can propose a new methodology, which needs to be approved by the CDM EB.
Baseline methodologies generally take one of three approaches:

[6] http://cdm.unfccc.int/Reference/Documents/cdmpdd/English/CDM_PDD.pdf
[7] UNFCCC, CDM Modalities and Procedures, paragraph 44.

- Using actual or historical GHG emissions (i.e. extrapolation)
- Using the emissions data of a technology that represents an economically attractive course of action (e.g. Cost Benefit Analysis)
- Using the emissions data from similar projects undertaken in the previous 5 years, in similar social, economic, environmental and economic circumstances

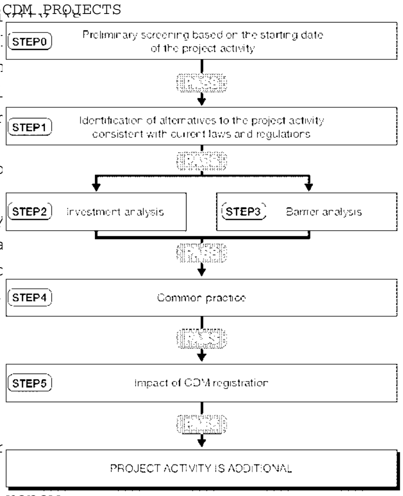
A number of baseline methodologies have been proposed for cogeneration projects, so generally it should be possible to find a methodology applicable to a new CHP project. Consolidated methodologies are general versions of project specific methodologies, so they are easy to replicate. Approved methodologies are project-specific, but this can be an advantage if used for projects with similar circumstances. Each baseline methodology outlines the criteria for its application. Table 5 outlines baseline methodologies used for cogeneration projects. Most cogeneration projects to date have use methodology AM0015, which has now been replaced by ACM0006.

TABLE 5:
CDM METHODOLOGIES FOR COGENERATION PROJECTS

Methodology	Name	Applicability to CHP projects	Emission Reduction	Comments
Consolidated Methodology				
ACM0001	Consolidated baseline methodology for landfill gas project activities	Landfill gas capture CHP projects	Methane capture and grid electricity displacement	Not used for cogeneration projects yet
ACM0004	Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation	Industrial waste heat recovery for heat and power generation	Displacement of on-site generated electricity or grid electricity	
ACM0006	Consolidated baseline methodology for grid-connected electricity generation from biomass residues	Grid-connected biomass CHP projects	Displacement of grid electricity	Replaces AM0004 and AM0015
ACM0008	Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring	CHP projects using coal-bed methane	Methane capture and grid electricity displacement	Not used for cogeneration projects yet
Specific Methodologies				
AM0007	Analysis of the least-cost fuel option for seasonally-operating biomass cogeneration plants	Refurbishment and fuel-switching for biomass CHP projects	Technological improvement and/or fuel-switching	Refurbishment only
AM0014	Natural gas-based package cogeneration	Non grid-connected natural gas fired CHP projects	CHP replacing separate heat and power generation	Cogeneration system must be owned by third party
AM0024	Baseline Methodology for GHG reductions through waste heat recovery and utilisation for power generation at cement plants	Waste heat recovery for heat and power generation in cement plants	Displacement of grid electricity	
UNFCCC, APPROVED BASELINE AND MONITORING METHODOLOGIES, 25 JULY 2006				

The additionality of CDM projects is established in comparison with the baseline scenarios. Firstly, the PDD should show that the project acti... not one of the baseline options. T... the case if the project is not th... economically attractive option, i... common practice, it is not econom... viable without CDM registration, ... other barriers. Secondly, additic... requires that the estimated GHG emissions of the project activity ... lower than any of the baseline ca... The UNFCCC has developed the 'Too... for Demonstrating Additionality', ... available on the UNFCCC CDM website.[8] Figure 8 illustrates the ... outlined by this tool.

FIGURE 8: ADDITIONALITY ASSESSMENT PROCESS FOR CDM PROJECTS



MINISTRY OF THE ENVIRONMENT JAPAN AND GLOBAL ENVIRONMENT CENTER FOUNDATION, CDM MANUAL FOR PROJECT DEVELOPERS AND POLICY MAKERS, 2005.

C. Crediting period

The crediting period for a CDM pr... during which CERs are issued, is 7 years, with the possibility to renew twice, or 10 years without the possibility of renewal.

D. Monitoring methodologies

Monitoring methodologies explain how the GHG emissions from the project activity will be measured during implementation and operation. Monitoring methodologies are part of baseline methodologies, so the choice of baseline methodology also determines the monitoring methodology. They are approved by the CDM EB in the same way as baseline methodologies are. New monitoring methodologies can also be submitted for approval.

Monitoring methodologies for energy generation projects generally require measuring ... used for electricity and heat generation from the project activity, as well as the electrici... heat output of the process. These then serve to calculate the emissions reductions f... project activities and the baseline alternatives.

E. Estimation of the GHG Emissions by Source

In the PDD the project proponent must give an initial estimate of the GHG emissions b... source for the project scenario and baseline alternatives. This enables the calculati... expected emissions reductions from the project, based on the formula described in the baseline methodology.

For energy generation GHG emissions from the project activities are normally calcula... fuel consumption basis, while baseline emissions are based on the electricity and heat ... and the alternative processes through which these would be generated.

8 http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

F. Environmental Impacts

In the PDD the project proponent must indicate the environmental impacts of the proj activity other than GHG emissions. For example, a project that includes the creation oil plantation could reduce GHG emissions, but entail the clear cutting of virgin for thereby affect biodiversity. A project using sewage waste as energy source could imp water quality by reducing the sewage effluent that is discharged. Both pos impacts should be included.

G. Stakeholder Consultation

The project proponent must consult various local stakeholders during the project dev process, and account for their involvement and feedback in the PDD. Any concerns rai stakeholders must be addressed in the project's design. Consultation takes place thr the project scooping and development stage.

3. Obtaining National Approval

Once the PDD is ready it must be approved by the host country, for which the project participants submit the PDD to the DNA. The DNA will check if the project complies w local procedures and regulation. There is therefore the possibility that the host co grant or delay host country approval such that the project cannot go forward, which is part of the registration risk of CDM projects (see Registration Risk, Section 2.5).

4. Validation and Registration

After the project is approved by the host country DNA, the PDD and letter of approval from the host country are submitted to a DOE, which will validate the PDD and the methodologies proposed. The DOE will evaluate whether the project proponent: 1) has calculated the baseline in a conservative and transparent manner and made a reasonable estimate of volume of emission reductions; and 2) convincingly demonstrated that the project is additional. There is a risk that the project is not validated if the baseline calcul inappropriate or inaccurate, or if the project is not deemed to be additional (see R Risk, Section 2.5). Once validated, the DOE will send the PDD, letter of approval an Validation Report to the CDM EB for registration.

5. Project Activity and Monitoring

The participants can now proceed with the project activity, while monitoring the emission reductions during operation for the Monitoring Report.

6. Verification and Certification

At the end of the CDM credit period the project participants submit the Monitoring r DOE for verification of the achieved emission savings. The DOE produces Verification and Certification Reports, which its sends to the CDM EB with a request for issuing the

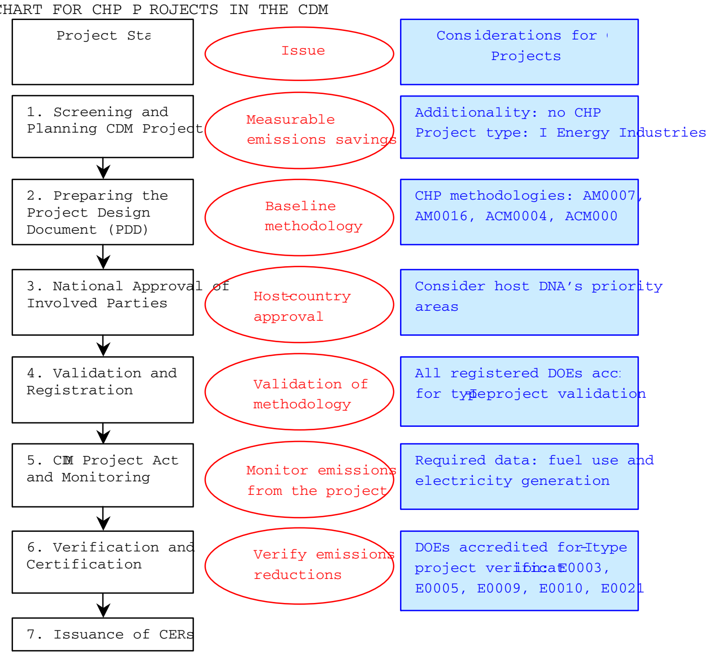
7. Issuance of CERs

The CDM EB issues the CERs to the Annex I party involved in the project.

3.3 Special Considerations for CHP projects

Figure 9 illustrates the issues addressed above, and highlights the main points relev
cogeneration projects in the flow chart of the CDM process.

FIGURE 9:
FLOW CHART FOR CHP PROJECTS IN THE CDM



WADE, 2006

The following section specifies the issues relevant for cogeneration projects in the CDM. It lists common questions that may be asked by project participants, answers these. It a highlights specifics for cogeneration, and gives examples.

1. Screening and Planning a CDM Project

Considerations for CHP: Additionality – No CHP in the baseline scenario

Is the project eligible for CDM?

A project is eligible for CDM if it satisfies the three global criteria (voluntary real and measurable emissions savings, additionality, host country's criteria for sustainable development.

Can the project benefit from CDM?

The additionality requirement means that the project cost/benefit balance of the p

activities is generally negative without CER revenue. For the project to be economically viable with CDM revenue, this must outweigh the CDM-related costs, and the net CDM benefit must exceed the negative project cost/benefit balance. Things to consider:
The size of the project (for larger projects CDM costs are relatively smaller)
The CER delivery risk (if delivery is uncertain, viability may suffer)
The CER delivery timing (inappropriate timing can lead to cash flow problems)

Is the project big enough to benefit from CDM?
For large projects the CDM-related costs represent a smaller share of the total project costs, reducing their impact on overall viability. Projects with emission savings 50,000 t CO_2 eq over the project lifetime are generally considered economically attractive. Smaller projects can be viable, but are more affected by unforeseen changes in costs and revenues. To reduce the impact of the CDM costs, small projects can register through simplified Small CDM procedures, and can be bundled together.

2. Preparing the Project Design Document (PDD)

Considerations for CHP: CHP methodologies: AM0007, AM0016, ACM0004, ACM0006

In which languages can a PDD be written?
All PDDs must be written in English for the CDM. Some countries also require a translation in the national language for national approval.

A. Description of the project activity

Should the project register as a normal CDM project or a small CDM project?
CHP projects with an installed capacity smaller than 15 MWe can register through the simplified procedures of Small CDM.

What are the project types appropriate for CHP?
CHP projects normally fall within type I: Energy Industries. For small projects, cogeneration for on-site use only is classified as I-A (Electrical energy for the user) or I-C (Thermal energy for the user), depending on whether the project is heat- or electricity-driven. CHP for export to the grid falls under I-D (Renewable electricity generation for a grid). A project can be registered in more than one category. For example, a CHP project could be I-A and I-C.

Can the project be registered without an Annex I party involved?
It is not necessary to have secured involvement of an Annex I party, who will buy CERs when registering a CDM project. However, the CER revenue is less certain if a purchasing contract has not been agreed on yet, so risks are higher.

What should the technology description include?
The technology description usually contrasts the prevalent local practice or current technology on-site with the best technology available. This helps establishing additionality of the project later on. For biomass CHP the standard technology is Rankine Cycle Steam Turbine, which can be compared to a boiler for combustion of biomass for heat only, combined with grid electricity.

B. Baselines and additonality

Is it best to use an approved baseline methodology, or propose a new methodology?
Proposing, submitting and registering a methodology is a time-consuming, work-intensive and expensive programme, so if possible, it is easier to use an existing approved

methodology. This facilitates finding a DOE approved to validate the project PDD, reduces registration risks (see Registration Risk, Section 2.5). Proposed new methodologies are not always approved, as by June 2006 the CDM had received proposals for 170 methodologies, but approved only 50, with 40 were under considerati and 65 rejected.[10] So project developers should check the available approved and consolidated methodologies to see which is applicable to their project. If no sui baseline methodology exists, a new methodology will have to be prepared and register More information on how to do this can be found in the CDM User Manual[11]

Which approved baseline methodology is most appropriate for CHP projects?

A methodology is suitable for a cogeneration project if the project satisfied the applicati criteria listed in the methodology description. In addition, methodologies that h used for comparable projects are generally very useful, as they also show how it applied. For instance, a bagasse cogeneration project for a sugar processing factory in China could use baselines of similar registered projects in Brazil.

How is the additionality of the project activity demonstrated?

The best way to demonstrate the additionality of a project is by using the UNFCCC 'Tool for Demonstrating Additionality', developed by the UNFCCC[12].

How are project alternative scenarios identified?

Alternative scenarios to be considered in the baseline include: the same project the CDM; other projects that deliver the same energy outputs and services; and continuation of the current situation.[13] For CHP projects alternatives must indicate how heat and power are normally generated. This can be the use of grid electricity or the separate generation of heat and power on-site. All alternatives must comply with existing legislation.

What existing laws and regulations should be considered for the baseline?

Four types of legislation should be considered in the baseline methodology[14]:

Type E+: Legislation that gives competitive advantages to more GHG-intensive practices

Type E-: Legislation that gives competitive advantages to less GHG-intensive practices

Type L-: Sectoral mandatory regulations that internalise environmental externalitie incidentally reduce GHG emission

Tyoe L+: Sectoral mandatory regulations that internalise environmental externalit prevent implementation of less GHG-intensive technologies

How are barriers to the project activity identified?

The CDM project activity must face barriers to meet the additionality requirement of the CDM. There are three steps in assessing these barriers[15]:

1. Investment analysis: the project is not a financially attractive option.
2. Barrier analysis: the project cannot secure investment, the local skill infrastructure base is insufficient, or the project is 'the first of its kind'.
3. Common practice analysis: similar projects are not already occurring in the are

Investment analysis provides the strongest case for additionality. For cogeneratio projects the fact that there is no previous expertise with such projects in the co sector can also be important.

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[9] Michelowa and Stronznik, 2002.
[10] Brett Orlando, Factor Consulting+Management, personal communication, 2006.
[11] Ministry of the Environment Japan and Global Environment Center Foundation, CDM Manual for Project Developers and Policy Makers, 2005.
[12] Available from the UNFCCC CDM website: www.cdm.unfccc.int
[13] UNFCCC, Tool for the demonstration and assessment of additionality (version 2), 2005.
[14] UNEP Energy and Environment Group, The CDM – A User's Guide, 2003.
[15] UNFCCC, Tool for the demonstration and assessment of additionality (version 2), 2005.

How can be shown that the project removes these barriers?

The final step in proving additionality is showing thatMthemembeefits of the CD barriers identified. The primary benefit is the CER revenue, but also the opportu attract new players able to provide funding or technical expertise, and reduced investment risks. Cogeneration projects areffectiveomakdigtionality difficult to prove. In such cases additionality assessmentfroan capisaon the up required, which is often unavailable to small manufacturers. Projects can sometim achieve the required rate of return to pay backs,commessiaCERoaevenue is included. Baseline methodology AM0007 proves additionality by showing that biomas not the cheapest available fuel for cogeneration.

How is the project boundary defined?

The project boundary is defined so that itscoversthatl can reasonably be considered direct result of the project activities. Emissions not directly result project are outside the boundary. For cogeneration projects emissions within the boundary include those from the generatiand heatesand electricity distribution.

Is there any leakage from the project?

Leakage is the net change of anthropogenic emissions by sources of GHG, which occ outside the project boundary, and which is measurable and attributable to the CDM projeactivity. Generally this means imports and exports of fuels. For cogeneratic projects, particularlyfbiredasses, the transport of biomass is normally the main type of leakage, assuming that the transport vehicles run on fossil fuel.

C. Creditinperiod

What crediting period is most appropriate for the project?

Crediting periods can be 7 years, with the option to renew twice, or fixed for a of 10 years. The crediting period can only start after the start of the project, extendbeyond its operational lifetime. The choice of crediting period depends on t project's lifetime and expected timing of delivery of emission savings. The proje developer will clearly aim to choose the crediting period that optimises the CER Fixed-term crediting periods are useful for short projects, or projects with high uncertainty. Renewal crediting periods are suitable for long projects, such as CHP, for which the local circumstances may change. At renewal, the baseline methodolog alternatives must be validated by a DOE, and can therefore be adapted to reflect changes. This also adds to the CDM costs, though.

D. Monitoring methodologies

What does monitoring require from the project developer?

Monitoring of a CDM project requires the collection and archiving of three kinds of da estimate or measurement of GHG emissions from the project activity; measurement o electricity and heat output of the project activity; calculation of emissions fro baseline; and identification of emissions outside the project boundary. All the data m be archived and kept until two years after the end of the crediting period. For C projects the project developer is responsible to measure the GHG emissions from t cogeneration system.

E. Estimation of the GHG Emissions by Source

How are the GHG emissions from CHP projects calculated?

GHG emissions from the project activity are calculated according to the formula s in the baseline methodology. For cogeneration projects generally this is done on a fuel-input basis, taking into account the efficiency and operational conditions of technology used (for instance in AM0007).

How are the GHG emissions from the baseline options calculated?

GHG emissions from the baseline are calculated according to the formula specified in t
baseline methodology. For CHP projects baseline emissions can be calculated from
heat and electricity output of the project, and the GHG emission factor of the ba
technologies used to generate these. Different baseline alternatives can therefore hav
different total GHG emissions.

What is the total GHG emission saving from the project?

The GHG emission saving of the project is the difference between the baseline emis
and the project emissions.

F. Environmental Impacts

What impacts of the project should be considered?

All impacts that are considered significant must be included in this section. To
which impacts are significant the developer can conduct an Environmental Impact
Assessment. The required procedures, and the definition of sustainable developmen
differ between host countries, so the assessment must follow local guidelines.
Assessments done for similar projects are a useful source of information. For CHP
projects possible impacts include air pollution, soil degradation, biodiversity im
socio-economic impacts such as employment or displacement.

G. Stakeholder Consultation

What are the requirements for stakeholder consultation?

Stakeholder consultations are required for CDM projects. Responses from stakeholders
must be collected, reviewed, and incorporated in the PDD. These requirements vary
between countries, so it is important to check with the DNA.

How does the consultation process usually take place?

The process normally has five stages:

1. Identify important stakeholders;
2. Devise a consultation programme;
3. Invite comments;
4. Record comments;
5. Produce a written consultation report.

At the validation of the CDM project, the DOE requests a copy of the consultation
report.

Which stakeholders should I approach for consultation?

Local stakeholders must be actively approached. Consultation meetings are an effe
way of involving them in project development. Local stakeholders that should be
approached include local residents, local authorities and community groups. Inter
stakeholders do not need to be actively approached, but can be invited to comment
correspondence.

3. Obtaining National Approval

Considerations for CHP: Consider host country's national priority areas

How do project proponents apply for host country approval?

The project proponent applies for host country approval by submitting to the DNA the
PDD, an application form, and, if necessary, additional information if requested.

How does the approval process work?

The Marrakech Accords do not offer guidance on host country approval, apart from the requirement for a written approval document, so the exact procedures and requirem vary between countries.

How long does the approval process take?

The length of the approval process depends on the country procedures and on the ty project. Generally approval takes two to three months, unless additional informat requested.

What is the best way to ensure approval for a CHP project?

To ensure a CHP project is approved by the host country it is important to thoroughly check the DNA's requirements. Host country approval assesses the project's compliance to local laws, regulations, and national sustainability criteria. Many countries have indicated priority areas for CDM projects, so if CHP is one of these, this can be emphasised. Support and involvement of local organisations also bolsters the proj proposal.

4. Validation and Registration

Considerations for CHP: All registered DOEs accredited for CHP project type validation

Which DOE is most appropriate to validate the project?

Different DOEs are approved for validating of different baseline methodologies. T choice of DOE therefore primarily depends on the methodology chosen. All DOEs registerer are accredited for CHP project type validation. Other considerations can include previous experience of the DOE in the host country, or with similar projects and the validation costs charged. Some DNAs have established their own DOEs, and require projects to be validated by a DOE based in the country itself.

What are the responsibilities of the project proponent during the validation process

The project proponent must arrange and pay for the validation process. For application for validation the PDD and written host country approval must be submitted to the DOE.

What are the responsibilities of the DOE during the validation process?

The DOE will assess the PDD, check whether it complies with the CDM requirements, and validate the baseline scenarios, additionality, and emission reductions formu the PDD. The DOE writes a validation report, which it must make available for 30 public consultation, and records comments.

How long does the validation and registration process take?

The time of the validation period depends on the DOE, but generally not less than months should be reserved for it, as the validation report must be publicly avail least 30 days. Project registration takes 8 weeks. If no objections from the CDM EB have been made within that period, the project is officially registered. For small scale projects this period is reduced to 4 weeks.

5. Project Activity and Monitoring

Considerations for CHP: Monitoring data requirements - fuel use and electricity generation

When can the project activity start?

The start date of project operation can be chosen as is convenient for the partie involved. It is not necessary to wait for project registration for the CDM. Howev projects that have not been approved yet, there is a risk of failing to meet the CI criteria, and therefore not receiving any CER revenue. The choice of start date c influenced by the desired start of the crediting period.

Can a project still register as CDM if it has already started?

Projects that have been started between 1 January 2000 and 18 November 2004 can request retroactive credits, if they have submitted a new methodology or requeste validation with a DOE before 31 December 2005, and are registered by the EB no later than 31 December 2006. Projects that have not requested for validation yet eligible for retroactive credits.

How should data be processed and stored?

All monitoring data must be stored electronically and kept until 2 years after the end of the crediting period.

What information should the monitoring report include?

The information required for the monitoring report is specified in the chosen met

6. Verification and Certification

Considerations for CHP: DOEs accredited for I-type project verification – E0003, E0005, E0009, E0010, E0021

Which DOE is most suitable for project verification?

The DOE that validated the PDD cannot verify the project emission reductions, so another DOE accredited for the chosen methodology must be selected.

What does the verification process require from the project developer?

For verification of the GHG emission reductions the project developer must submit monitoring report to the DOE, and pay for verification. The monitoring report will be made publicly available on the CDM website.

How does the DOE verify the GHG emission savings?

The DOE checks if the submitted information meets the requirements of the monitor methodology, verifies the monitoring results to check that the methodology has been applied correctly, and determines the GHG emission reductions achieved by the pro activity. If necessary, the DOE can conduct on-site visits or request additional information. It can also recommend changes to the monitoring methodology for future applications. All information is included in the verification report, which will be made publicly a

How are the emission reductions from a verified project certified?

The DOE certifies the amount of CERs based on the verification. This is made publicly available and submitted to the CDM EB. CERs are issued if no requests for review are made within 15 days.

How long does the Verification and Certification process take?

The time required for the verification and certification depends on the DOE. There are no specific guidelines or time limits.

7. Issuance of CERs

When will the CERs be issued?

CERs are issued each time GHG emissions reductions are verified and certified. Th project developer can choose when and how often to have this done. Clearly, more frequent verification increases the verification costs, but it ensures a steady i revenue from CERs. A single verification is cheaper, but also reduce the occasion are issued and can be sold. The choice depends therefore on the cash flow of the project, and on the CER purchasing agreement with the buyer.

What happens if the project is unable to deliver the emissions reductions?

29

If the project fails to deliver its emission savings, the verification report will recognise this, and no emission reductions will be certified.

Who owns the CERs?

The regulations and laws of the host country determine the ownership arrangements CERs are normally issued to the project proponents, but the national government c claim national ownership. If the project proponents receive the CERs, their legal ownership is determined by the contractual arrangements between the project propo investors, and CER buyers.

4. Status and Prospects for Combined Heat and Power Projects in the Clean Development Mechanism

4.1 Introduction

CHP projects are considered an attractive option for CDM activities, and registratio projects has been increasing. Most are in the sugar industry in India and Brazil. Th for CHP in developing countries is large, the expertise is available, and interest is r the trend is likely to continue. Cogeneration projects could therefore represent a la of the GHG emissions reductions from the CDM in the future, and facilitate significant investment in the power sector of developing countries.

The Clean Development Mechanism has only just been adopted, and the first commitment period has not yet started, so a number of outstanding issues and potential barriers projects remain. There are concerns about the reliability of measuring and verifying GH emissions savings from CDM projects, and about the long-term effectiveness of CDM measures. The paperwork and bureaucracy involved in CDM project registration is the r barrier for project developers, while investors are worried about the risks of CDM pro financing, due to uncertainties in deliverability of CERs and carbon market developme

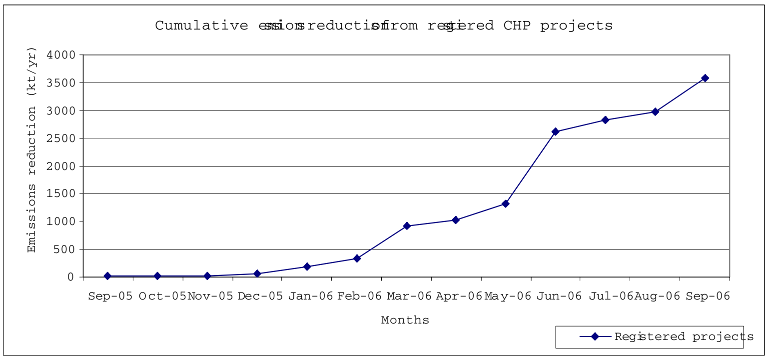
This chapter will discuss the prospects of CHP projects in the CDM, based on current trends and future projections (Sections 4.2 to 4.5). It will also discuss neglected CDM opp for cogeneration (Section 4.6) and outstanding issues (Section 4.7).

Sections 4.3 to 4.5 are country profiles for Brazil, China and India. These describe the organisational structure and procedures of the CDM in these countries, and provide th status and projections in different sectors. The CDM and CHP potentials and projectio these country profiles are based on different sources, which may have different approaches, but the data presented aim to give a consistent overview. The cogeneration potential market projections and technical potential, while the CDM potential shows the total reduction potential. In the cases where one of these was unavailable, it has been derived from the other figure. Combining the cogeneration and CDM potentials in the same gra allows the reader to assess the importance of CHP for GHG mitigation within that sec

4.2 Overall trends of CHP projects in the CDM

The total number of cogeneration projects registered for the CDM by the end of Septer 2006 was 66, out of 326 (20%). This has been increasing by about seven per month, exc in March, when the Brazilian DNA released 19 projects for registration.

FIGURE 10:
TRENDS IN REGISTRATION OF CHP PROJECTS IN THE CDM



WADE, 2006

The total registered emissions reductions from cogeneration projects are increasing l roughly 350,000 t/yr each month. Again March shows a sharp increase due to th e 19 Brazilian projects, and in June four large industrial projects raised the total emission reduct registered significantly. The total amount of registered emissions reductions from Cl end of September 2006 was 3,574,148 t/yr, out of 580 Mt/yr. The average emissions reductions per project are therefore 54,154 t/yr (figure 11).

FIGURE 11:
REGISTERED CHP PROJECTS IN THE CDM BY SIZE

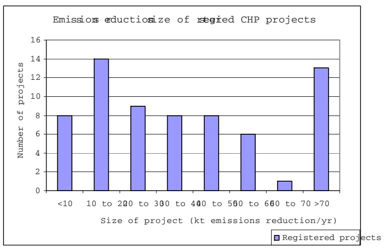
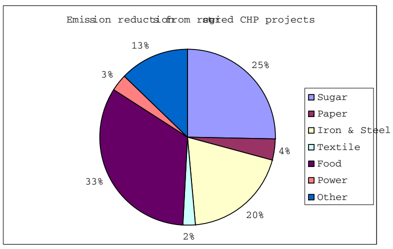


FIGURE 12:
EMISSION REDUCTIONS FROM CDM - REGISTERED CHP PROJECTS BY SECTOR



WADE, 2006

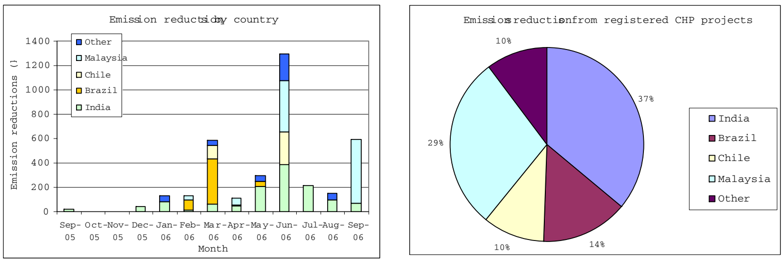
TYPES OF COGENERATION PROJECTS IN THE CDM

Initially most cogeneration projects registered were biomass fired applications in small food manufacturing. Particularly the sugar industry was strongly represented. Recently th projects registering have been diversifying, and a number of other biomass CHP projects have been registered (figure 12).

From April 2006 industrial waste heat recycling projects have been registered as well. These represent a different type of cogeneration projects, but they can deliver many of the same m benefits. All at these are in India, except the system at the Jinwen cement plant in These projects are generally larger, and located at heavy industrial sites, rather t manufacturing facilities. It has taken longer for the first of these projects to register, because they are larger and drafting the PDD can be complicated, but they represent a huge p for energy efficiency improvement in large industry, so the emission reductions obta through these is likely to overtake those from conventional biomass CHP in the near future.

PROJECT ACTIVITIES IN DIFFERENT COUNTRIES

FIGURE 13:
EMISSION REDUCTIONS FROM CDM -REGISTERED CHP PROJECTS BY COUN TRY



WADE, 2006

The CHP projects registered for the CDM are mainly located in Brazil and India, with 26 and 23 projects respectively (figure 13). Brazil represents 14% of emissions reductions, 36%. Other countries with significant project activity are Chile with 4 projects but emissions reductions and Malaysia with 7 projects and 29% of emissions reductions. This distribution of projects over different countries is likely to change, though, as In have a well-established CHP tradition in the sugar industry, and therefore took advanta the CDM early. The location of registered projects is gradually diversifying, though, countries also start to develop CHP projects for the CDM. Good examples of such coun are Malaysia, Chile and Indonesia.

The absence of China is remarkable, as China has been relatively slow in implementing and clarifying its CDM procedures, and Chinese projects only represent a small share of registered CDM projects (20 projects out of a total of 326 registered projects). The one registered CHP CDM project in China, though there is significant potential for such projects. The importance of China in the CDM is likely to increase, though, as its p for the country are clarified and structure and processes become more established.

CER MARKET DEVELOPMENTS

The size of the CER market is growing as well as the CDM project registration. The C
from CDM projects are traded in the general carbon market, which also include emissi
reduction credits from the Joint Implementation mechanism (JI) and the European Union
Emission Trading Scheme (EU ETS). Trade in CERs from CDM is still small compared to
Allowances (EUAs, the ETS's emission reduction unit). Presently there is no mechanism
place to make CERs from CDM projects compatible with EUAs for trading in the EU ETS.

Projections for the size of the CER market vary widely, from 270 Mt CO_2 eq to over 1000 Mt CO_2 eq. in 2010,[16] with Pointcarbon giving an average of 610 Mt. Estimates for the CDM component of this range from under 100 Mt CO_2 eq to over 700 Mt CO_2 eq, representing 30 – 40% of the total carbon market.[17]

The main supply of CERs comes from energy efficiency improvement projects, renewable
energy projects, and industrial projects. Cogeneration projects will represent a sig
share of these. Demand for CERs comes primarily from the EU-15, particularly the Netherlands and Spain, with Japan and Canada as the other main buyers.[18] Most analysts expect demand to exceed supply, as the total emission reductions required are genera
more than double the projected supply.

The price of CERs is subject to uncertainties. The carbon price of EUAs in the ETS wa
around 25/t C until May 2006, when the prices fell to around 16/t C. The expected prices for CERs from CDM projects are lower, though, because of added uncertainties. CER prices depend on the project type and contractual arrangements. Currently typical prices are
range of 10 – 12 per ton C, but there future projections vary. The initial estimates pr
prices of \$2/t CO_2 eq. to \$3/t CO_2 eq. (\$6.7 – \$10/t C),[19] but present price trends suggest higher prices. Projects that involve much capacity building require prices of \$3/t C
\$5/t CO_2 eq (\$10 – \$16.7/tC), so these would be viable if current developments continue.

The main threats to a stable high CER price are the absence of the US from the Kyoto agreements, and the large amount of excess emission quota from former Soviet countri
However, even at low prices the annual value of CER trade is in the range of \$2.9 mi
\$4.3 million.

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16 The Delphi Group et al., Analysis of the International Market for Certified Emissions Reductions, 2004.
17 Dhakal, S. CDM Market: Size, Barriers and Prospects. 2001; Jotzo, F. and Michaelowa, A. Estimating the CDM Market under the Bonn Agreement. 2001.
18 The Delphi Group et al., Analysis of the International Market for Certified Emissions Reductions, 2004.
19 Jotzo, F. and Michaelowa, A. Estimating the CDM Market under the Bonn Agreement. 2001.

4.3 Country Profile – Brazil

GENERAL INFORMATION

Ratification: 23 July 2002
Reason for Ratification: Brazil was one of the countries proposing the CDM, because it ca
benefit through investment and technology transfer through GHG reduction proj
Priorities:

- Renewable energy sources
- Energy efficiency/conservation
- Reforestation and establishment of new forests
- Other emission reduction projects: landfill projects and agriculture project

Total GHG emissions: 2,081 Mt CO_2eq (1994)

CDM IN BRAZIL

Organisational structure
CDM regulation in Brazil is part of its wider Climate Change Programme. The Brazilia
is the Interministerial Commission on Global Change (CIMGC), established in 1999 to coordinate the government's activities in climate change. It is chaired by the ministry of Science and Technology, and includes representatives from several other ministries (table 6).

TABLE 6:
THE NCA BODIES, MEMBERS AND TASKS

Body	Represented Parties	Responsibilities
CIMGC	Ministry of Science and Technology (president) Ministry of Environment (vice-president) Ministry of Foreign Affairs Ministry of Agriculture and Food Supply Ministry of Transport Ministry of Mines and Energy Ministry of Planning Ministry of Budgeting and Management Ministry of Development, Industry and Commerce Civil House of the Presidency of the Republic	• Set national climate change policies, including CDM • National authorisation of CDM projects • Report to the UNFCCC • Information dissemination
BFCC	CIMGC Government Private sector NGOs Academics	• Discuss climate change policy, including CDM, with a wider range of stakeholders
Getulio Vargas, The Clean Development Mechanism – A Brazilian Implementation Guide, 2002		

Other relevant organisations
The CIMGC works with representatives from government, private sector, NGOs and local communities through the Brazilian Forum on Climate Change (BFCC). The BFCC is the ma
platform for other organisations involved in the CDM in Brazil to contribute to the C
process in the country.

In 2000 the Ministry of Environment established the Integrated Studies Centre on Environment and Climate Change (Centro Clima), which supports the Brazilian climate change programme through research, information dissemination and stakeholder participation.

The Brazilian National Fund for the Environment, established in 1989, and the Brazil National Development Bank are governmental organisations involved in funding CDM projects. Ecosecurities Ltd is a private finance and trading company, which has been active in financing Brazilian CDM projects.

Sustainability Criteria

The Brazilian government has set out clear priorities for the CDM, including sustaina criteria for project eligibility. Four types of projects are ineligible for CDM: fore other than forestation and reforestation; nuclear energy projects; unsustainable bio projects; and hydropower projects larger than 30 MW. For cogeneration projects the t categories is particularly important, as it stresses that for CHP projects the source of biomass must be sustainable.

TABLE 7:
SUSTAINABILITY CRITERIA FOR CDM PROJECTS IN BRAZIL

Category	Criteria
Environmental Sustainability	Mitigation of global GHG emissions Local environmental sustainability
Economic Sustainability	Contribution to the sustainability of balance of payments Contribution to macroeconomic stability Cost effectiveness
Social Sustainability	Net employment generation Impacts on rent distribution
Technological Sustainability	Contribution to technological self-reliance
Ministry of Science and Technology Brazil, CDM Project Eligibility Criteria, 2006.	

The sustainability criteria for eligible projects are shown in table 7. In Brazil th on the economic benefits of CDM projects for the national economy. This is highlighted by three additional criteria, which have multiplying potential:

- Internalisation of the possible CER revenue in the national economy
- Possibility of regional integrity or interaction with other planned activit
- Potential of technological innovation

Country approval application process

For application for national approval for a CDM project the project proponent must su documents shown in table 8 to the CIMGC, both in electronic and paper format. The description of the project's contribution to sustainable development must directly addr environmental sustainability criteria, and be based on the PDD or other relevant wor Invitation letters must include letters addressed to the City Hall, the State, the City Coun and Municipal Environmental Agencies, the Brazilian Forum of NGOs, the Public Prosec Office, and Community Associations. The declaration of the project participants shou the organisation in charge of the project, the means of communicating with the CIMGC, and the commitment to sending the distribution document of the CERs when they are issued. Statement of DOE must prove that the DOE that will validate the project is approved b CDM -EB, and that the DOE is located in Brazil, because the CIMGC will not accept validation or verification by foreign DOEs.

TABLE 8:
REQUIRED DOCUMENTATION FOR NATIONAL APPROVAL IN BRAZIL

- PDD (English)
- Project Design Document (DCP), translated in Portugese
- Description of the project's contribution to sustainable development (Annex III)
- Invitation letters for comments from stakeholders
- Validation report (English version and Portuguese translation
- Declaration of the project participants
- Conformity with the Environmental and Labour Legislation
- Statement of DOE
- Additional documents (optional)

MINISTRY OF SCIENCE AND TECHNOLOGY BRAZIL, 2006.

The CIMGC will check the eligibility of the proposed project based on the submitted documents, and assess whether the project fulfils the global and national criteria. They also evaluate the PDD before it is submitted to the CDM-EB. There is no indication of the length of the approval process.

Government Incentives

The Brazilian government has a range of policies to promote energy efficiency and cle energy generation, some of which are directly related to cogeneration (table x). The Programme to Encourage Alternative Sources of Electricity (PROINFA) is the most signi of these, and aims to develop 3300 MWe renewable energy capacity, 1100 MWe of which biomass fired. Feed-in tariffs are guaranteed by the government to support the developmen of this capacity, and the tariff for 2005 was R$132/MWh. Other policies relate to ene efficiency and renewable, but are also relevant to cogeneration, including:

Cogeneration and Independent Power Production

- Law 10848 sets efficiency standards for electricity generation, and creates incentives for electricity buy electricity from CHP plants.
- Programme to Encourage Alternative Sources of Electricity (PROINFA) (2002)
- VAT reduction on cogeneration equipment in some states
- Independent Power Producers are legally permitted to sell electricity to licensed electricity supply c large electricity users, consumers of cogenerated electricity, and cooperatives

Energy Efficiency

- The Brazilian National Electricity Conservation Programme (PROCEL) promotes electricity savings on bot demand side and supply side.

Renewable Energy

- The Energy Reallocation Mechanism allows producers of renewable energy, including biomass cogeneration to establish central dispatching systems in order to mitigate financial risks.
- The Global Reversion Reserve, managed by Electrobras, promotes renewable energy projects.

Financial and legal arrangements

There have been proposals in Brazil to establish a national CDM financing institution would provide initial funding for CDM projects. The institution would pay project pro certain price for the emission reductions, and then keep the CER portfolio to offer to buyers abroad. This would facilitate the purchase of Brazilian CERs by foreign parties, redu

CER risk for project proponents, and allow for fast tracking of Brazilian CDM projec

POTENTIAL FOR CHP PROJECTS IN THE CDM IN BRAZIL

Cogeneration status and potential

At present only 3.3% of total electricity generation in Brazil is from cogeneration, and cogeneration facilities represent 4.4% of installed capacity[20]. However, in the sugar sector and oil and gas sector there is considerable experience with CHP projects, particularly in Sao Paulo state. These are also the sectors with the largest potential for further CHP development (table 9).

TABLE 9:
CHP POTENTIAL IN BRAZIL BY SECTOR

Sector	Potential (MWe)
Sugar	4,020
Oil and gas	4,283
Chemicals	1,581
Pulp and paper	1,740
Steel	875
Rice mills	1,200
UNIDO INVESTORS GUIDE, 2003	

CDM status and potential in Brazil

TABLE 10:
CDM STATUS IN BRAZIL

	Approved Projects	Installed Capacity (MWe)	GHG Emissions Reductions (t/yr)
All CDM projec	71	-	14,320,881
CHP projects	26	1066.1	506,962
Sugar	25	991.1	462,936
Steel	1	75	44,026
UNFCCC, 2006			

The Brazilian government has actively promoted CDM projects, and sees it as a major opportunity to develop sustainable energy resources. 71 projects have been registered; more than one third are CHP projects, mostly bagasse (table 10). This dominance of bagasse CHP reflects the technological expertise and economic attractivenes of these projects, as well as the large potential for energy efficiency improvements through cogeneration in small food processing facilities.

The potential for further cogeneration projects in the CDM in Brazil is substantial Biomass-fired projects in the food sector will remain attractive due to the large potential and existing expertise. There is further potential for CDM projects in the sugar sector, attractive projects have already been registered. In addition, rice husk based cogeneration is also attractive for CDM cogeneration projects in Brazil.

Energy efficiency measures in large industries provide a more significant and long-term potential for CDM cogeneration projects in Brazil. The most significant sector is oi where there is a considerable cost-effective potential for heat-recovery, cogeneration and methane capture and utilisation: installing CHP systems at refineries can lead to en savings of up to 30%[21]. Realising this requires on the possibility to export to the grid t cost-effective, so the marketable potential is still limited. Other sectors with larg potentials are the pulp and paper industry and the chemical industry. In the Iron an

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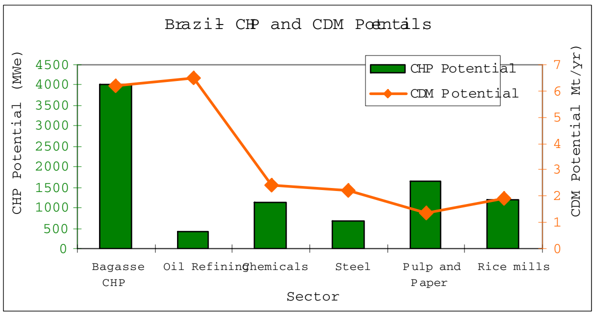
20 WADE, DE World Survey 2006.

21 Center for Clean Air Policy, Identifying Investment Opportunities for the Clean Development Mechanism in Brazil's Industrial Sector, 2001.

sector large energy efficiency savings can be made, but only a relatively small part
cost-effective.[22]

FIGURE 14:
CDM POTENTIAL IN BRAZIL



CENTER FOR CLEAN AIR POLICY, 2001; WADE, 2004; UNIDO INVESTORS GUIDE, 2003.

The potential for GHG emissions reductions in the power sector through cogeneration i
Brazil is relatively small, because most of the country's electricity is generated by hydropowe

Drivers	Barriers
• Large potential for cogeneration sugar sector and major industries • Guaranteed feed-in tariffs through PROINFA • Energy Law 10,848 sets efficiency index and creates market for cogeneration • Strong government support for CDM	• Low electricity prices not reflective of true environmental costs • Insufficient gas distribution infrastructure • Centralised governance of CDM procedures • Requirement to use Brazil-based DOE for validation and verification

Prospects

In the near future bagasse cogeneration is likely to remain the main source of CDM p
in Brazil. Opportunities in larger industries, like petrochemicals, will probably be
next, diversifying the types of CHP projects registered for the CDM. The CDM's organisational
structure in Brazil is very centralised, and the application process can be cumberso
However, as the country originally proposing the CDM in Kyoto in 1997, Brazil recogn
can benefit significantly, and will strongly stimulate the realisation of this potential.

[22] Center for Clean Air Policy, Identifying Investment Opportunities for the Clean Development Mechanism in Brazil's Industrial Sector, 2001.

4.4 Country Profile – China

GENERAL INFORMATION

Ratification: 30 August 2002
Reason for Ratification: CDM considered a major opportunity to reduce GHG emissions and increase the efficiency of China's fossil-fuel based energy sector.
Priorities:

- ♦ Energy efficiency
- ♦ Renewable energy
- ♦ Methane recovery and utilisation

Total GHG Emissions: 3650 Mt CO_2 eq (2004)

CDM IN CHINA

Organisational structure
The CDM in China is regulated through the Measures for Operation and Management of Clean Development Mechanism Projects in China, (12 October 2005), which specified the National Development and Reform Commission (NDRC) as the country's DNA, supervised by the National Coordination Committee on Climate Change (NCCC) and the National CDM Board (NCB).

TABLE 11:
THE CDM BODIES, MEMBERS AND TASKS IN CHINA

Body	Represented Parties	Responsibilities
NCCC	NDRC (chair) Ministry of Foreign Affairs (vice chair) Ministry of Science and Technology State Environmental Protection Administration China Meteorological Administration	• Review national CDM policies • Approve members of NCB • Review other relevant issues
NCB	NDRC (chair) Ministry of Foreign Affairs (vice chair) Ministry of Science and Technology State Environmental Protection Administration China Meteorological Administration Ministry of Agriculture	• Review project applications • Report overall progress of CDM activities to NCCC • Recommend interim measures
NDRC		• Assess and approve project applications • Supervise implementation of CDM projects • Establish CDM management institute
INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005		

The NDRC is central in the CDM process in China, and manages the involvement of the relevant ministries and other government organisations (table 11). It functions as a one-stop shop for project application and approval, and regulates the implementation of CDM p in China through the CDM Management Institute.

Other relevant organisations
The main parties involved in the CDM in China are state organisations, both at national and

local level. However, any foreign company doing business in China needs to work with partner company, and the applicant for CDM endorsement must be a Chinese company, so CDM projects necessary involve local industries and manufacturers as well.

Sustainability Criteria

TABLE 12:
SUSTAINABILITY CRITERIA FOR CDM PROJECTS IN CHINA

Category	Criteria
Environmental Sustainability	Reduce GHG emissions Maintain resource sustainability and avoid degradation Maintain biodiversity
Economic Sustainability	Additional investment consistent with needs of the people Funding additional to ODA
Social Sustainability	Alleviate poverty by generating employment Remove social disparities Contribute to the provision of basic amenities
Technological Sustainability	Transfer of environmentally safe and sound technologies
INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005	

The Chinese government's sustainable development strategy emphasises the harmonic development of the economy, society and the environment (table 12). Social aspects a important, but for CDM projects the focus is on the environmental criteria. Projects evaluated primarily on the basis of their impact in the three designated priority areas: energy efficiency; renewable energy; and methane recovery. The NDRC focuses on CO_2 and CH_4 rather than the other four GHG. Cogeneration projects improve energy efficiency of generation, and can use renewable fuel or recovered methane, so they are suitable for meeting these criteria.

Country approval application process

TABLE 13:
REQUIRED DOCUMENTATION FOR NATIONAL APPROVAL IN CHINA

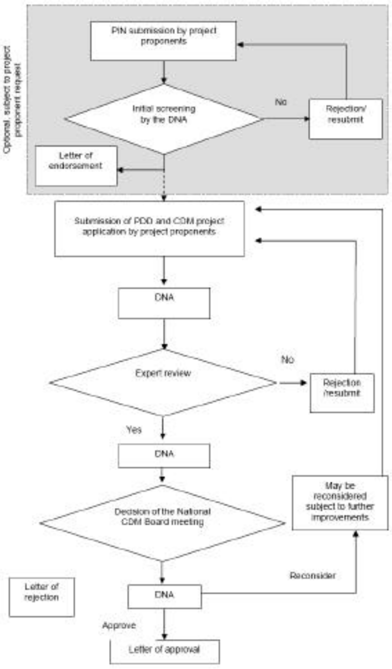
• CDM project application letter • Completed application form • PDD • General information on project construction and financing • Certificate of the applicant's enterprise status
INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005

The NDRC regulates the CER value for Chinese CDM projects, to avoid unacceptably l prices. Project developers must indicate the CER price agreed with the buyer in thei application. However, without government approval it is difficult to find a buyer. To 'catch 22', the NDRC has an initial screening process for preliminary endorsement for projects before they are officially approved.

To apply for national approval in China the project developer must submit the require documentation to the NDRC (table 13). After endorsement, the NDRC will review the PDI and consult experts to reach its decision, which is communicated to the project devel within 50 days. If further review is needed, additional information may be requested, but otherwise an approval letter is issued (Figure 15).

After registration by the EB, the CDM project developer must notify the within 10 days. During project op the developer must submit the implementation report and monitor reports to the NDRC, so that the can check that the project meets criteria set for CDM projects.

FIGURE 15:
THE CDM PROJECT APPR OVAL PROCESS IN CHINA



INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUN TRY GUIDE FOR CHINA, 2005.

Government Incentives
The Chinese government has been increasing its support for energy efficiency and renewable energy in recognition of their importance f country's development. The adopti market-based economic mechanisms also stimulates energy efficiency renewable energy has enjoyed long term government support, despite absence of a comprehensive support policy. Government incentives relevant to CDM cogeneration projects are:

Energy Efficiency
- Favourable pricing for Independent Power Producers
- 2-year tax breaks for cogenerators and energy saving generators
- Favourable rates on loans for energy efficiency projects (30% lower on average)
- Graded quotas for energy consumption in key industries

Renewable Energy
- Subsidies (overhead, R&D, capital costs, project support)
- Reduced VAT and income tax rates
- Favourable custom duties for imported biogas equipment

Financial and legal arrangements
The NDRC regulates the CER price for Chinese CDM projects to ensure that it does not below a set minimum. This aims to secure a good CER revenue for Chinese projects, bu also complicates the contractual arrangements between the project developer and the CER buyer. To guarantee the minimum set price there needs to be an advance contract, whic specifies this price before a project can apply for national approval. However, cont hard to agree without national approval, and rules out certain CER contract types, like ma price based agreements. This complicates the implementation of CDM projects in China

The Chinese banking system is traditionally centralised and state dominated, but it i gradually being restructured and Chinese banks are increasingly able to provide financ and services to foreign investors. However, for CDM financing the problem remains tha knowledge concentrated in government offices, not banks. This situation is gradual improving, and as a result of the government's encouragement of Foreign Direct Invest (FDI) different kinds of financing available from Chinese and international instituti However, the complicated international and national rules pose a major o

The Measures for Operation and Management of Clean Development Mechanism Projects in China specify that the CER revenues from CDM projects belong to the Chinese government and enterprises implementing the project. The government fixes the distribution proportions of the revenue and before the fixation, the revenue shall belong to enterprises. The CER revenue is subject to government levies (table 14), additional to normal taxes for foreign-led projects.

TABLE 14:
LEVIES ON CER REVENUE IN CHINA

GHG	Regulated base price +
HFC and PFC	65%
N_2O	30%
Other	2%
INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005.	

POTENTIAL FOR CHP PROJECTS IN THE CDM IN CHINA

Cogeneration status and potential

The present installed cogeneration capacity in China is 48.1 GWe, 10,9% of total capacity, which generates 10% of the country's electricity.[23] There is still ample potential for further cogeneration development, though, to as much as 80 GWe by 2015. Table 15 shows the potential for a number of industrial sectors.

TABLE 15:
CHP POTENTIAL IN CHINA BY SECTOR

Sector	Potential (MWe)
Power	3,800
Oil and gas	260
Chemicals	1,000
Pulp and paper	102
Steel	115
Cement	246
Biomass	5,500
Coal-bed methane	500
Landfill gas	800
WADE, 2004; KEIO, 2003; IGES, 2005.	

CDM status and potential in China

TABLE 16:
CDM STATUS IN CHINA

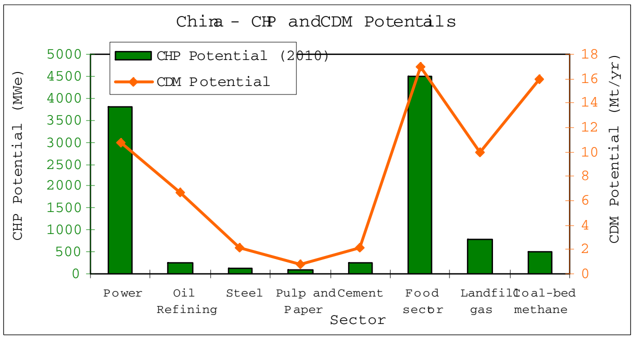
	Approved Projects	Installed Capacity (MWe)	GHG Emissions Reductions (t/yr)
All CDM projects	20	-	36,806,034
CHP projects	1	13.2	105,894
WADE, 2006			

The number of registered CDM projects in China is surprisingly small (20 out of 334), considering that the country is thought to represent half of the global CDM potential. Projects in China are generally large, though, with an average of over 1.8 Mt/yr. The one CHP project registered is a waste-heat-driven electricity generation project in a cement plant.

[23] WADE, DE World Survey 2006.

Figure 16 illustrates that the cogeneration and CDM potentials in China are large. B
availability and potential is significant, but the main sectors for CHP in China are industry and
power generation. Industrial cogeneration projects are generally large, and therefor
economically attractive, both for the project's basic profitability and the potentia
revenue. In the power sector many old power stations need to be upgraded, and new plants
are being built to meet growing electricity demand, providing opportunities for usin

FIGURE 16:
CDM potential in China



WORLD BANK, 2005; IGES, 2005; WADE, 2004; KEIO, 2003.

The large potential for CDM projects in industrial energy efficiency reflects the large ene
demand of China's industries (70% of total energy consumption) and inefficient produ
standards. Cogeneration and heat recovery can contribute significantly to increasing
efficiencies, so that they are attractive CDM projects. The main industrial sectors for
cogeneration projects are steel (14% of industrial energy use), chemicals (16% of in
energy use), pulp and paper, textiles, non-ferrous metals, and building materials (23% of
industrial energy use). The government has realised this and is promoting initiative
improve the energy efficiency of the economy.

Biomass-fired cogeneration also provides opportunities for CDM projects, particularly
areas, where wood residues, bagasse or crop stalks are available. In 2004 only 2.0 GWe
biomass-fired capacity was installed, but estimates indicate that this can increase t
in 2020.[24]

Drivers	Barriers
• Rapidly rising energy demand • Power market restructuring • Large CDM potential • Government's CDM policies prioritise energy projects • Large potential for industrial efficiency improvement through CHP	• Continued government control of power sector and slow liberalisation • Project developer must be local company • Government ownership of CER revenue • CER price regulation • Lack of financing opportunities for CDM

[24] Institute for Global Environmental Strategies, CDM Country Guide for China, 2005.

Prospects

The potential for CDM projects in China is the largest of any country in the world: a of the global CER potential. A large part of the potential can be achieved through CHP application in industrial energy efficiency and power generation projects. However, C project implementation has been remarkably slow, with only 20 approved projects so fa strong centralised control of the CDM process in China plays a major role in this, as well as lack of funding for projects due to uncertainty and risks for potential investors. C implementation in China will undoubtedly accelerate in the future, but further clari liberalisation of CDM regulation in China is important.

45

1. Introduction

Cogeneration is a cost-effective way of reducing CO_2 emissions from power generation. The combined use of the heat and power outputs of the generation process increases its efficiency, and thereby reduces the fuel input and emission output. As a decentralise (DE) technology, cogeneration also reduces transmission and distribution (T&D) losses. Cogeneration is a flexible technology, which can use various fuels, and be adapted to circumstances. The possibility of using biomass fuels or agricultural residues makes Combined Heat and Power (CHP) particularly effective in reducing CO_2 emissions. Cogeneration technologies are well established, and therefore reliable and competitiv most markets. Cogeneration is therefore a prime candidate technology for carbon emis reduction projects.

The Clean Development Mechanism (CDM) is part of the Kyoto Protocol for reducing glo greenhouse gas (GHG) emissions to mitigate anthropogenic Climate Change. Opportuniti for emission reduction are generally large in developing countries, so that these can be met at lower costs than in developed countries. The CDM recognises this, and provides an opportunity for developed countries (Annex I) to meet part of their GHG emission targ through projects in developing countries (non-Annex I). This benefits Annex I countries by reducing the cost required to meet their emission targets, and benefits non-Annex I countries by facilitating investment and technology transfer and sustainable development. Overa approach aims to ensure that GHG emission targets are met quickly and cost-effectively.

CHP technologies are well suited for CDM projects, because they are generally econom attractive and technologically mature and reliable, so that they contribute directly aim of reducing GHG emissions cost-effectively. Furthermore, they are flexible and can be adapted to local circumstances. In developing countries cogeneration can easily be i in many industries, including food processing, taking advantage of the biomass residues of the production process. This has the dual benefits of lowering fuel costs and solvin issue. Cogeneration projects address both energy supply and demand side, and therefore have a wider impact than most CDM technologies. Furthermore, they provide a long-term solution, as the resulting CO_2 savings are reliable and predictable over the project's lifetime, unlike some other project types.

This report discusses the implementation of CHP projects within the CDM. It aims to p practical guide for CDM project participants, outlining the CDM's organisational struct (Chapter 2), and describes the project cycle for cogeneration projects (Chapter 3). I outline the present status of CHP in the CDM and country-specific information for Brazil, China and India (Chapter 4).

Other relevant organizations

Currently the only India-based DOE accredited for project validation and emission reduction verification is the Indian Council for Forestry Research and Education, which only deals with afforestation projects. However, the NCA is expected to establish DOEs in other secto well to support local projects and reduce procedural costs. These would be relevant f cogeneration projects.

Most CDM projects in India are small-scale projects, which require bundling to keep CDM related costs down. Several local bundling organisations have therefore emerged, most notably the Small Industries Development Bank of India and National Bank for Agriculture and Rural Development. These banks have strong links to small food production and process and can therefore provide valuable services for CHP projects in the sugar industry a food manufacturing.

The NCA has been working closely with stakeholders through sectoral initiatives, education and training. Organisations currently involved in the CDM in India include industry bodies, NGOs, Consulting firms, ESCOs, private and public sector companies, International development organisations and International lending institutions.

Sustainability Criteria

TABLE 18:
SUSTAINABILITY CRITERIA FOR CDM PROJECTS IN INDIA

Category	Criteria
Environmental Sustainability	Environmental Impact Assessment
Economic Sustainability	Additional investment consistent with local needs
Social Sustainability	Generate employment Remove social disparities Improve quality of life
Technological Sustainability	Technology transfer
INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005	

The sustainability criteria used by the NCA to evaluate submitted CDM projects focus social benefits of the project (table 18). CDM projects are expected to have a direct effect on the lives of the local community, and promote development. This shows the importance of using local skills and resources, and working with local partners. It a suggests that CHP projects in food manufacturing using local biomass, like the sugar industry, are well-positioned for CDM approval.

The economic criterion for additional investment is also important, and implies that th related investment must be additional to normal Official Development Assistance (ODA

Country approval application process

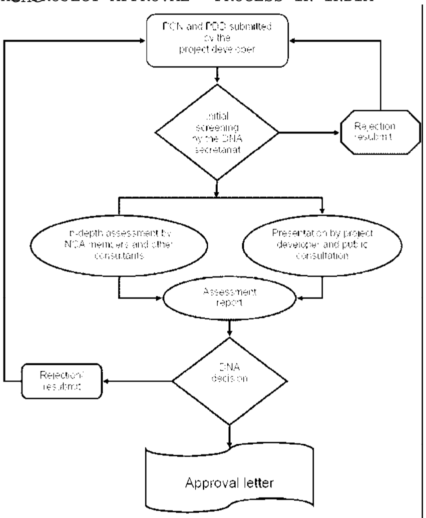
Table 19 shows the documents required for submitting a project for CDM approval in India. A Project Concept Note, as well as the PDD must be submitted, together with any support documents.

TABLE 19:
REQUIRED DOCUMENTATION FOR NATIONAL APPROVAL IN INDIA

Electronic copy of the Project Concept Note (PCN)
Electronic copy of the PDD
20 hard copies of the PCN and PDD each
Supporting documents
Two CDs containing all information
Cover letter signed by the project developers
INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005

The documents submitted are circulated among the members of the NCA for initial evaluation, and the developer is invited to present the proposal, so that NCA members can ask for clarification. Simulta[…] NCA members and experts assess the PDD in detail, producing a[…] assessment report (figure 17). [The] NCA will check that the CER re[…] is additional to ODA (i.e. not they [are] sold to an organisation using [ODA] funds). Once the NCA is satisf[ied,] Host Country Approval is grant[ed.] There is no indication of the [...] the process.

FIGURE 17:
THE PROJECT APPROVAL PROCESS IN INDIA



INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005.

Government Incentives

The Indian government consider[s] CDM as a promising opportunity [to] achieve its sustainable develop[ment] goals and attract foreign inve[stment.] It therefore offers a number o[f] incentives to promote CDM projects in the country. For CHP projects the most important of these are:

Biomass cogeneration incentives

- National Programme on Promotion of Biomas Power/Bagasse based CHP (capital grants and interest subsidies)
- 80% depreciation on cogeneration equipment may be claimed in first year
- 5-year tax holiday with 30% exemption for projects with power purchase agreement

Renewable Energy

- Customs duty for RE projects <50MW of 20% ad valorem
- Central sales tax exemption, and general sales tax exemption in certain states
- Minimum purchase rates of Rs. 2.25 per unit (all renewable energy sources)
- Encouragement of bundling to bring down transaction costs
- Incentives to promote rural energy generation and village electrification

Financial and legal arrangements

The general investment climate in India is good, which facilitates Foreign Direct In[vestment] (FDI) in CDM projects. The government promotes FDI through the Foreign Investment

Promotion Board and Foreign Investment Implementation Authority. No government approv
is needed, Indian capital markets are freely accessible, and tax incentives are avail
investment in the power sector.

A more problematic issue is the legal status of CERs in Indian law. They are defined
"intangible assets that can be traded and transferred", but their ownership is not cl
defined. Investors have avoided this uncertainty through clear contractual arra[ngements with]
the project developers about the ownership rights of the CERs. However, the taxation
CERs is still unclear too, hampering CDM investment.

POTENTIAL FOR CHP PROJECTS IN THE CDM IN INDIA

Cogeneration status and potential

In India CHP facilities represent 16% of total installed capacity (18.7 GWe), and generate 12.1% of the country's electricity[25]. Most of this is located in food manufacturing plants, particularly in the sugar sector. There is therefore already a strong tradition and expertise with bagasse cogeneration, but in other sectors cogeneration is also used. The total potential for cogeneration is estimated at 20,000 MWe, most of which is in the food processing sector (table 20).

TABLE 20:
CHP POTENTIAL IN INDIA BY SECTOR

Sector	Potential (MWe)
Sugar	3,000
Iron and Steel	1,000
Dairies, Breweries and Distilleries	2,500
Pulp and paper	800
Rice mills	1,100
Textiles	800
Cement	800
Fertiliser	1,200
MNES ANNUAL REPORT, 2004.	

CDM status and potential in India

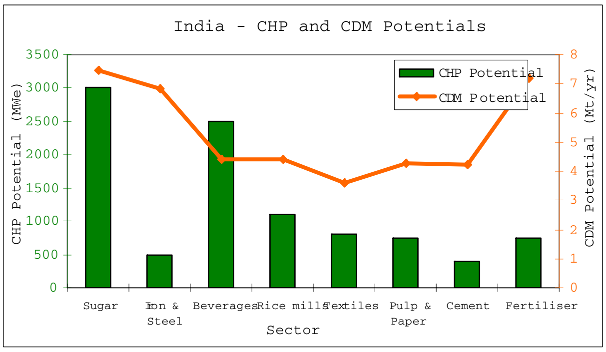
TABLE 21:
CDM STATUS IN INDIA

	Approved Projects	Installed Capacity (MWe)	GHG Emissions Reductions (t/yr)
All CDM projects	104	-	10,975,109
CHP projects	23	298.5	1,295,246
Sugar	8	91.8	340,526
Iron and Steel	7	158	653,466
Textiles	3	13.0	75,804
Pulp and Paper	1	3.0	14,744
Other	4	32.7	210,706
WADE, 2006			

India represents almost one third of all registered CDM projects, and over one third of
registered CHP projects. Initially most projects were in sugar mills, but throughout
range of projects has diversified (table 21). The sugar sector still has most registered pro
but represents only 26% of GHG emissions reductions from approved projects, as most
projects are small Since May various waste heat driven energy generation projects in industry
have been registered, lead by the iron and steel sector, which now represents over hal
registered emission reductions.

25 WADE, DE World Survey 2006.

FIGURE 18:
CDM POTENTIAL IN INDIA



INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES, CDM COUNTRY GUIDE FOR CHINA, 2005

Figure 18 shows that the CDM potential mirrors energy use in India: 65 70% of India's total energy use by 7 sectors: cement, pulp & paper, fertiliser, iron & steel, textiles, al refineries, all of which can benefit from CHP. The food sector is still significant, but the mos many large industrial energy recovery projects are attractive as well. For food processing cogeneration represents a large share of the CDM potential, while for industrial ener efficiency many more technologies and measures can deliver emission reductions, so cogeneration is a smaller segment of the total potential. However, potentials in indu generally larger, so the opportunities for CHP are still significant.

Drivers	Barriers
• Large demand for new generation capacity	• No clear time limit on approval process
• Low reliability of grid electricity	• No clarity on ownership rights of CERs
• Strong government support for CDM	• Uncertainty about the taxation of CERs
• Good investment climate	• CDM transaction costs

Prospects

The potential for cogeneration projects in the CDM in India is substantial, particularly industrial and food manufacturing applications. Furthermore, the long tradition of ba CHP makes such projects relatively low risk. However, there is no clarity yet about the legal and fiscal status of CERs, and the approval process and related costs. This needs to resolved to reduce risks and make CDM more attractive for investors.

4.6 Neglected CHP project opportunities

The number of registered cogeneration projects in the CDM has been gradually increasing, representing around 20% of all projects, including biomass-fired applications-in food processing and waste heat recycling in industry. There are many more possible applica of cogeneration in the CDM, though, which may be not as established as the current project types, but represent large future opportunities nonetheless. Below three such neglected opportunities are discussed briefly.

COGENERATION IN BUILDINGS AND CCHP APPLICATIONS

Building-integrated CHP (BCHP) is not as common as industrial cogeneration applications, but it can deliver similar benefits. The on-site generation of heat and power, rather than using heat-only boilers and grid electricity can reduce energy costs and increase supply rel residential and commercial buildings, just as it does for industrial plants. Building represent a significant portion of a country's energy consumption, so the overall po large. Furthermore, buildings are well suited for CCHP systems, because much of the energy consumed is often for cooling purposes. WADE research has indicated that the potential emission reductions from BCHP in China are 135 Mt CO_2 eq/yr in 2020, and 40 Mt CO_2 eq/yr in 2020 in India.[26]

BCHP projects can easily be made eligible for the CDM. The emission reductions compared to a baseline of continued use of grid electricity and heat-only boilers can be calculated in very much the same way as for other natural gas cogeneration projects (methodology AM0014). The case for additionality is possibly even stronger than for industrial coger projects, because BCHP and CCHP are less common, and can face more significant cost barriers and regulatory obstacles.

EMISSION REDUCTIONS FROM ON-SITE GENERATION

One of the main advantages of cogeneration and other on-site generation is the avoidance of losses in the electricity network. However, most approved methodologies for CHP proj assume that this is negligible, and no emission reductions are credited for this. It possible, though, to develop a methodology that includes the emission reductions resu from avoided network losses due to on-site generation of electricity. The calculation of emission reductions can be based on the total amount of grid electricity used, the average T&D losses of the local electricity network, and the average CO_2 emission factor of the grid electricity, as shown in the example below.

Calculating the CO_2 emission reductions from avoided T&D losses
This simplified example considers the CO_2 emission reductions from a hypothetical on-site generation project at an industrial facility in India. If we assume the facility cur GWh/yr of grid electricity, local network losses are 20% and the average emission fa the supplied electricity is 600 t CO_2/GWh, then the resulting emission reductions from on-site generation of the same amount of electricity are:
40 GWh/yr * 0.20 * 600 t CO_2/GWh = 4800 t CO_2/yr

[26] WADE, Building Integrated Cooling, Heat and Power for Cost-Effective Carbon Mitigation, 2005.

The example shows that the emission reductions from avoided T&D losses are relatively small, unless the total electricity consumption and gird losses are large. Emission r through on-site generation are therefore maybe not attractive as a stand-alone methodology, but it can form an important part of other methodologies for on-site generation projects. The incorporation of T&D losses in other methodologies would recognise one of the key ben of on-site generation, and the additional emission reductions could improve the econom viability of decentralised energy projects.

COGENERATION REPLACING CCGT

Cogeneration projects currently registered for the CDM have particularly focussed on CHP, so that fossil-fuel cogeneration has been very much neglected. There is one methodology for natural-gas based cogeneration (AM0014), but this is a very specific case, and the only relevant project in Chile has not been submitted to the EB yet. The CDM potential for emission reductions from fossil-fuel CHP projects is significant, but for the number of applications a general methodology for fossil-fuel cogeneration projects is required.

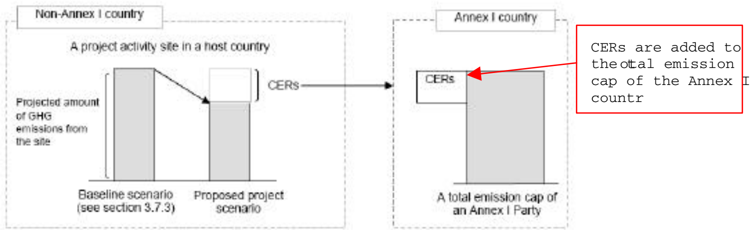
A methodology for fossil-fuel based cogeneration can be based on methodology AM0014, but it would also make sense to develop a methodology for CHP replacing CCGT, as there is already a methodology for conversions from single cycle to combined cycle power genera (ACM0007). The upgrade from CCGT to cogeneration is a similar improvement of efficien of the generation system, so that the new methodology could be based on the existing methodology.

4.7 Outstanding issues for the CDM

The CDM has only been operating for less than a year, so many of the procedures are s being developed, and the experience of implementing projects is limited. This means t there are some issues that have not been resolved fully, and need to be clarified to make CDM successful.

THE CDM CREATES ADDITIONAL EMISSION ALLOWANCES

FIGURE 19:
CERS AS ADDITIONAL EMISSION ALLOWANCES



WADE, 2006, ADAPTED FROM INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES

One problem with the CDM is that it creates additional emission allowances for Annex countries on top of the targets set by the Kyoto protocol. This results from the fact

project host countries do not have emission reduction targets, so any emission reductions
from a CDM project are effectively raising the emission target for the Annex I countr
involved, because it does not have to make those reductions at home anymore (figure 1

The response to this claim is that globally it is unimportant where the emission reductions are
made, so reductions in the emission growth from non Annex I countries are equally significant
as reductions in Annex I countries. However, the additional emission allowances creat
the CDM still undermine the reduction caps of the Kyoto Protocol, and can harm the
credibility of the mechanism and the CER market.

ADDITIONALITY OF CDM PROJECTS DIFFICULT TO PROVE

The most problematic aspect of the CDM is the additionality principle, for several re

Firstly, additionality must be proven in comparison with baseline alternatives. However, t
alternatives to the project activity will not be implemented, and are therefore hypot
scenarios. It is possible to make reasonable assumptions for these baselines, but nevertheless it
is possible that the actual scenario in the absence of the project activity would hav
different.

Secondly, the methodologies for comparing baselines with the project activity to esta
additionality entail many uncertainties. The strongest part of additionality assessment is the
economic analysis, but even here many of the input data must be based on assumptions.
instance, capital investment costs can often be estimated relatively accurately, but
costs, and particularly fuel costs are fairly unpredictable. For other additionality assess
methods, like barrier assessment, the results are more speculative. It is very diffic
that a project faces particularly barriers for implementation, and that the removal of these
particular barriers would make the project viable, and that the CDM would remove these
barriers. In reality barriers to project implementation are multidimensional, and they are
linked and influence each other. The removal of a single barrier may therefore be necessary
for project viability, but it is hard to prove that it is sufficient.

Due to these problems in establishing project additionality it is likely that some CI
are not strictly additional, particularly projects that have been operating before the CDM
became operational in 2005. The fact that these project were already implemented sugg
that they are the baseline, rather than an additional alternative.

POLITICAL UNCERTAINTY: POST-KYOTO ARRANGEMENTS

The future development of the CDM is generally thought to be promising, but a number of
uncertainties remain. On a political level it is not yet clear what kind of climate c
agreement will emerge in 2012 after the first commitment period of the Kyoto Protocol
Negotiations are still taking place, and the main questions are whether the US will be
involved, and whether developing countries will adopt emission caps. American partici
would be a huge boost for the CDM, as it would raise the expected demand for CERs, an
increase prices. The effect of emission caps for developing countries is more complica
predict, because emission reductions currently in the CDM would then also have be use
meeting targets in the host countries themselves. This would not have to mean the end of the
CDM, but it would be more like the Joint Implementation mechanism. It is therefore
conceivable that the two will merge in the future.

Whatever happens after Kyoto, any future global climate agreement is likely to inclu
international trading and project implementation mechanisms such as JI and CDM, because these are supported by all major parties in the negotiations.

FINANCIAL UNCERTAINTY: CARBON MARKETS AND CARBON PRICES

For investors the main problem with the CDM is its uncertainty. The risks related to the CDM's procedures, their costs, and the CER delivery risk still put off many finan organisations from investing in CDM projects. For project developers the availability funding is therefore limited, a problem the CDM was supposed to solve.

The future development of the carbon market is a second issue for investors. The est for the size market range widely, as do projections of carbon prices. The supply of mostly determined by the functioning of the CDM mechanisms and the carbon price, because the potential for emission reduction projects in Annex I countries is huge. The demand depends mostly on the emission caps set for Annex I countries, and the potential to these at home. Both demand and supply obviously influence the carbon price. For instance, when the US announced not to ratify the Kyoto Protocol the projections for carbon pr suddenly fell, because demand for CERs from the US would have been large. Furthermor when it became clear in May 2006 that the emission caps for industries within the EU ETS were much more generous than intended, the European carbon price fell, because suppl emission allowances was much larger than previously thought.

In the context of the uncertainties in future carbon market trends it is important to realise t the CDM is not the only source of emission reduction certificates, and must therefor with other sources. Annex I countries have various options for meeting their reducti Initially they will try to meet their commitments at home. If it is cost-effective or deemed necessary to buy emission reductions abroad they can use the CDM or the JI, but they also directly buy reduction certificates from other Annex I countries that manage to reduce emissions below their target. However, the mechanisms making emission reduction certificates from the different schemes compatible still need to be specified to crea carbon market.

There are large amounts of emission reduction certificates available from former Soviet countries, as their targets are based on their emissions before the break up of the USSR. These targets are therefore much higher than their actual projected emissions, so th have many emission reduction credits available to sell to other Annex I countries. This 'ho is a major concern for the future development of the CDM, because it not only repres competing source of emission reductions, but also undermines the credibility of the market.

Much of the current uncertainties of the CDM are the 'toothing problems' experienced new global initiative. They can be resolved as project experience increases, the CDM procedures become established, and trust in CER markets becomes stronger. To make this happen it is important that all parties involved in the CDM have the political will towards the aim of the mechanism, and to make it a success.

5. Conclusion

The CDM provides a major opportunity for cogeneration projects in developing countries. The necessary conditions for cogeneration often do exist in these places, but project implementation is hampered by lack of experience or resources. The CDM can alleviate problems by facilitating knowledge and technology transfer from Annex I countries, and giving the projects an additional source of revenue through CERs.

The CDM EB has established the general procedures for the CDM, though details still h be specified. After initial screening of the project activity, the developers compose a PDD, explaining the activity and its impacts, identifying the alternative scenarios, establishing baseline methodologies and additionality. The PDD then has to be approve the host country and validated by a DOE before it can be registered at the EB. During the project activity the developer has to monitor the emissions from the project based on methodology of the PDD, in order to calculate the achieved emission reductions. Once are verified by a DOE and certified by the CDM EB, CERs are issued, and can be sold to Annex I parties.

Currently the number of cogeneration projects in the CDM is about 20% of all registe projects, but most are smaller than the average CDM projects, so their share of emis reductions is smaller. Brazil and India are leading in implementing CHP projects, but more countries are becoming involved. Most early projects were in small food manufacturing and biomass fired, but recently a number of large industrial waste heat recycling projects have been registered too.

The potential for future cogeneration projects in the CDM is significant. Developing have both large CDM and CHP potentials, and many projects can be readily implemented The main two existing opportunities are biomass based cogeneration in the food processing sector, and industrial energy efficiency improvements through cogeneration, as shown cogeneration projects already registered. A number of different CHP project types als significant potential in the CDM, including building-integrated CHP, but these have so far been neglected. In addition to India and Brazil the main potential for cogeneration p the CDM is in China, mostly in large industry. Other countries, like Indonesia and Ch also attractive for developing cogeneration projects.

The overall prospects of the CDM in general, and cogeneration projects within it, are very positive, and the mechanism will undoubtedly continue to grow as the global carb market expands. The CDM still faces a number of issues, though, primarily relating to th reliability of the additionality assessment and the uncertainties involved in the pro These issues can be solved, though, and as the CDM matures confidence in the system w grow. The main challenge to achieve this is to get all players involved working toward overall aims of the CDM: reducing global carbon emissions and promoting sustainable development.

Glossary

Additionality Principle – The requirement for CDM projects that 'the reduction of emissions through the CDM project must be additional to reductions that would occur wi the CDM project'.

Annex I country – Country signed up to the Kyoto Protocol that has a GHG emission cap.

Baseline Methodology – Methodology for assessing the scenario and emissions for a project in absence of the CDM project activity.

Certified Emission Reduction (CER) – Tradable emission reduction certificates issued to CDM projects for GHG emission reductions achieved.

Clean Development Mechanism (CDM) – Mechanism that allows Annex I countries to meet part of their emission reductions through projects in non-Annex I countries.

CDM Executive Board (CDM EB) – International supervisory board for the CDM, operated by the UNFCCC.

Combined Heat and Power (CHP) – The combined thermal generation of heat and electricity for local use.

CO_2 equivalent (CO_2eq) – The effective global warming effect of a GHG expressed in the amount of CO_2 with equivalent warming effect.

Conference of the Parties (COP) – Annual meeting of the Parties of the Kyoto Protocol. Since ratification of the Protocol in 2005, this is combined with the Meetin Parties (MOP) of countries that have ratified the treaty.

Crediting Period – The period over which CERs are issued for a CDM project.

Decentralised Energy (DE) – Electricity generation at the point of use.

Designated National Authority (DNA) – National supervisory organisation, which regulates and manages the CDM procedures and implementation in a county.

Designated Operational Entity (DOE) – Independent organisation accredited by the CDM EB to validate the baseline methodology for CDM projects, and verify the emi reductions achieved.

EU Emissions Trading Scheme (EU ETS) – European market-based mechanism that distributes emission quota between major GHG emitting industries, and allows trade between these to meet emission caps cost-effectively.

First Commitment Period – First period during which Annex I countries must meet their emission caps (2008-2012).

Greenhouse Gas (GHG) – Chemical substance, which has a net positive global warming effect when released into the atmosphere. GHGs covered by the Kyoto Protocol are: CO_2, CH_4, N_2O, HFCs, PFCs and SF_6

'Hot air' – Excessive emission quota of former Soviet Union countries, which do not account for the sharp reduction in economic output during the collapse of communism.

Joint Implementation (JI) – Mechanism that allows Annex I countries to meet part of their emission reductions through projects in other Annex I countries

Kyoto Protocol – International agreement adopted at the 3rd COP in Kyoto in 1997, which quantifies emission reduction targets and establishes the mechanisms to redu global GHG emissions.

Leakage – 'Net change of GHG emissions which occurs outside the project boundary and which is measurable and attributable to the CDM project activity'.

Marrakech Accords – Agreements adopted during the 1st meeting of the CDM EB at COP 7 in 2001 in Marrakech, which specify the procedures and rules for the CDM.

Monitoring Methodology – Methodology for monitoring the GHG emissions from CDM

projects during project operation, including measurement of data required fo
calculating the GHGs that would have been emitted in absence of the project
activity.

Non-Annex I country – Country signed up to the Kyoto Protocol that does not have a GHG emission cap.

Project Boundary – 'All anthropogenic GHG emissions by sources under control of the project participants that are significant and reasonable attributable to the project activity',

Project Design Document (PDD) – Standard document describing the project activity, baseline methodology and emission reduction calculations for CDM projects.

Project Validation – Evaluation of the PDD of a CDM projects by a DOE, which checks its compliance with CDM procedures and requirements.

Project Verification – Evaluation of the Monitoring Report of a CDM project by a DOE, whic checks the emission reductions achieved by the project.

Small CDM project (SCC) – CDM project with a energy output or efficiency gain equivalent to 15MW.

United Nations Framework Convention on Climate Change (UNFCCC) – International convention, which aims for 'stabilisation of GHG concentrations in the atmos at a level that would prevent dangerous anthropogenic interference with the climate system'.

CDM Information, Links and Sources

Comissão Interministerial de Mudança Global do Clima (CIMGC) – Brazilian DNA, with country-specific information for Brazil.
www.mct.gov.br

CD4CDM – Online platform for CDM capacity building, established by the UN Environmen Programme and the RISO Centre. The site gives access to a large range of publications CDM procedures, baseline methodologies, economic issues and environmental impacts. Probably the most useful source for CDM project proponents.
http://cd4cdm.org

CDM Brazil – Online platform established by the Environmental Department of the German Chamber of Commerce with information about CDM in Brazil.
http://www.ahk.org.br/cdmbrazil

CDM India – Website of India's National CDM Authority, providing all information requi developing CDM projects in the country.
http://cdmindia.nic.in/

China Office of National Coordination Committee on Climate Change – The Chinese government's CDM website with information about China's CDM procedures.
http://cdm.ccchina.gov.cn/english

Institute for Global Environmental Strategies (IGES) – IGES has done extensive research on the CDM, and published a wide range of useful documents, including general guidan documents and CDM studies for Asian countries.
http://www.iges.or.jp

Kyoto Mechanims Information Platform – Online Platform hosted by the Kyoto Mechanisms Acceleration Platform of the Japanese government. Informtion includes CDM news, introductory guides, and links to other sources.
http://www.kyomecha.org

Pembina Institute for Appropriate Development – The Pembina Institute has published both general guides and country-specific documents on the CDM.
http://www.pembina.org

Point Carbon – The main source for information on the CER and carbon market, including price trends and future potentials. Much of the information is for subscribers only,
http://www.pointcarbon.com

United Nations Framework Convention on Climate Change (UNFCCC) – The UNFCCC CDM website provides guidance of all CDM procedures and regulations, an up-to-date overview of registered projects, and information about DNAs and accredited DOEs.
http://cdm.unfccc.int/

Lessons from submission and approval process of large-scale energy efficiency CDM methodologies

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January 2007
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Paper submitted to the UNIDO/CTI/UK Trade and Investment Seminar on Energy Efficiency Projects in CDM and JI
Vienna, 19 – 22 March 2007

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Lessons from submission and approval process of large-scale energy efficiency CDM methodologies

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Abstract: The Clean Development Mechanism (CDM) so far has failed to mobilize a substantial amount of energy efficiency projects. As of December 2006, less than 4% of credits come from this category. This is due to the fact that only a few methodologies for setting of baselines and monitoring project emissions have been approved by the CDM Executive Board (EB). While energy efficiency methodologies have the highest share of methodology submissions, they also suffer from the highest rejection rate. Just 27% of energy efficiency methodology submissions have been approved or consolidated. The applicability of those methodologies is typically narrow and the requirements for monitoring are heavy. Industrial efficiency improvements (e.g. waste heat recovery) are covered relatively well, whereas there are glaring gaps with regards to electricity generation and transmission as well as transport. Demand-side management in households and commercial buildings so far has not been covered either. The Methodology Panel (MP)/ EB have not been willing to accept empirical models and performance benchmarks as a basis for baseline emission determination. We see some inconsistencies in decision-making of the MP/ EB particularly with respect to the underlying baseline approach, treatment of rebound effects and endogenous energy efficiency improvement, and additionality assessment of programmatic CDM. A key challenge for energy efficiency projects is determination of additionality; attempts to focus on the barrier analysis only have been rejected by the MP/ EB. A new challenge comes up in the context of programmatic CDM which could give a boost to demand-side activities if the rules are less cumbersome than those for single projects. Here, the application of the additionality test again becomes crucial.

Key words: Clean Development Mechanism, Energy efficiency improvement, Baseline and monitoring methodology, Additionality

Acknowledgement: This paper was prepared for the "Future CDM" project, funded by Ministry of Economy, Trade, and Industry (METI), Japan.

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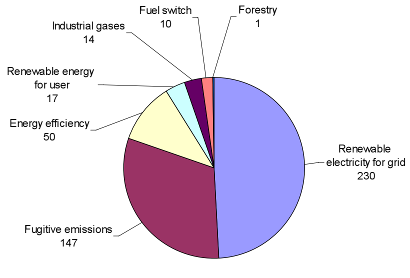
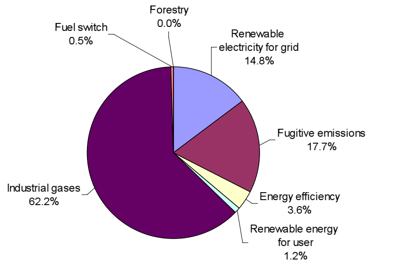
1. Introduction

The CDM has failed so far to live up to its potential for materializing the vast opportunities of energy efficiency improvement in non-Annex I countries. As of December 2006, 469 projects have been registered by the EB, only 50 of which are energy efficiency projects. Dwarfed by projects which reduce industrial gas emissions, e.g. HFC-23 and N_2O, the share of CER generation till 2012 from registered energy efficiency projects is only 3.6%, or 25 $MtCO_2eq$.



Number of registered projects, 469



CERs till 2012 from registered projects, 697 $MtCO_2eq$

Figure 1. Number of and CERs till 2012 from registered projects by project type (December 2006)
Source: UNFCCC (2006a) and authors' calculation

Energy efficiency CDM projects have faced several major challenges, notably regarding baseline and monitoring methodology development and additionality assessment. Project developers have so far focused on methodologies that do not generate problems with additionality assessment, have low costs of data collection, and restrict applicability of the methodology to a very specific project type and host country. Consequently, methodologies for complex project types with several emissions streams, several locations, indirect effects and a wide project boundary have not been submitted. Energy efficiency methodologies, especially demand-side ones, typically fall into such a complex category. This has lead to the highest rejection rate of energy efficiency methodologies among all types of methodologies submitted to the EB. Moreover, technologies which generate revenues through products that can be sold on the market, including energy efficient technologies by saving energy, have had problems in demonstrating additionality (see Michaelowa and Hayashi 2006).

This paper analyzes the submission and approval process of energy efficiency methodologies and gives recommendations regarding future methodology development and additionality assessment of energy efficiency projects.

2. Overview of small-scale energy efficiency methodologies

There are currently 21 small-scale (SSC) methodologies approved by the EB, of which six are applicable to energy efficiency projects:

1. AMS-II.A.: Supply side energy efficiency improvements for transmission and distribution;
2. AMS-II.B.: Supply side energy efficiency improvements – generation;
3. AMS-II.C.: Demand-side programmes for specific technologies;
4. AMS-II.D.: Energy efficiency and fuel switching measures for industrial facilities;
5. AMS-II.E.: Energy efficiency and fuel switching measures for buildings; and
6. AMS-II.F.: Energy efficiency and fuel switching measures for agricultural facilities and activities.

No new SSC energy efficiency methodologies have been approved since the last analysis in August 2005 (see Müller-Pelzer and Michaelowa 2005).[1] While they have repeatedly been revised, the revisions only reflect changes in the methods to calculate the electricity grid emission factor and definition of thresholds for SSC projects. Therefore, the following analysis will focus on the submission and approval process of large-scale energy efficiency methodologies.

3. Overview of large-scale energy efficiency methodologies

This chapter gives an overview of large-scale energy efficiency methodologies, first, in form of a summary and then in a detailed evaluation to give a thorough picture of these methodologies.

3.1. Evaluation status of large-scale methodologies

As of December 2006, 202 large-scale New Methodologies (NMs) had been submitted to the EB. After evaluation of these submitted methodologies, the EB has made available 38 Approved Methodologies (AMs) and 10 Approved Consolidated Methodologies (ACMs). Figure 2 shows a wide variety of submitted methodology types. However, most of them are designed for a specific technology/ measure or a host country. As discussed above, only a few widely applicable methodologies have been approved so far.

Importantly, the energy efficiency category has received the largest number of methodology submissions (81) as well as the highest rejection rate by the EB (48%). Despite the continuous efforts of the methodology developers, the rejection rate has not been improved significantly over time. Because application of AMs or ACMs is mandatory to submit CDM projects to the EB, the lack of suitable methodologies has been a major hurdle for energy efficiency projects. The next section will focus on large-scale methodologies for energy efficiency projects and give an overview of their submission and approval status.

[1] Refer to Müller-Pelzer and Michaelowa (2005) for lessons from approved SSC methodologies.

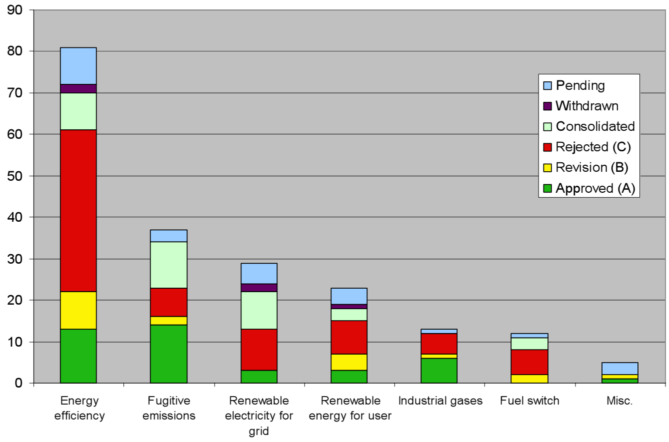


Figure 2. Status of large-scale methodology evaluation (December 2006)
Source: UNFCCC (2006b) and authors' calculation

3.2. Evaluation status of large-scale energy efficiency methodologies

As of December 2006, the following 81 methodologies had been submitted for energy efficiency project activities (including 16 resubmissions upon C ratings). In Table 1, these methodologies are categorized into seven types according to the six SSC energy efficiency methodology categories with an addition of "energy efficiency and fuel switching measures for transport."[2]

Out of the 81 energy efficiency methodologies submitted, 13 have been approved as AMs (A ratings), nine consolidated to ACMs, 39 rejected (C ratings), two withdrawn, and 18 are still in process. The last category includes nine methodologies which the EB has not made final decisions on (pending) and nine methodologies where the project participants have received B ratings.

[2] Transport methodologies are commonly much broader than "energy efficiency and fuel switching." However, the category is set as specified for convenience.

Table 1. Status of large-scale energy efficiency methodology evaluation (December 2006)

Methodology	Status	Type[a]
NM0003: Construction of new methanol production plant (called: M 5000)	C	4
NM0017-rev: Steam efficiency improvements by replacing steam traps and reusing hot-water condensate	A (AM0017)	4
NM0018-rev: MGM baseline methodology for natural gas based package cogeneration	A (AM0014)	2
NM0031-rev2: OSIL baseline methodology for electricity generation projects from utilization of waste heat from waste gases	Consolidated (ACM0004)	4
NM0033: Baseline methodology for cement kiln replacement	Withdrawn	4
NM0037-rev: IGFL baseline methodology for steam optimisation system	A (AM0018)	4
NM0042-rev: Water pumping efficiency improvement	A (AM0020)	4
NM0044: Power factor improvements	C	4
NM0045-rev2: BCL methodology for GHG emission reduction in cement industry	Consolidated (ACM0005)	4
NM0046: Simplified project-level least cost and scenario analysis for the rehabilitation of district heating systems	C	1
NM0047-rev: Baseline methodology for project activities that substitute Ordinary Portland Cement (OPC) with blended cement/ fossil fuels with alternative fuels in cement kilns	Consolidated (ACM0005)	4
NM0049: Combined margin methodology applied to electricity grid (BOF gas waste heat recovery)	C	4
NM0052: Public transport sector energy efficiency and modal change baseline	C	7
NM0058: Heat supply baseline in China for district heating based on surplus heat from power production	C	1
NM0059: Methodology for energy co-generation from steel making gas recovery	C	4
NM0064: Methodology for electronic energy consumption reduction in steel making process	C	4
NM0070: Open cycle to combined cycle gas turbine conversion connected to an economically dispatched, centrally controlled grid	Consolidated (ACM0007)	2
NM0071-rev: Avoiding flaring of waste gases from steel manufacturing operations and its utilization for substituting GHG intensive fuel in power generating units and/ or generating power to supply to grid	C	4[3]
NM0072: Energy efficiency through mandatory national-level appliance standards	Withdrawn	3
NM0074: Baseline methodology for technological improvements in industry	C	4
NM0077: Fuel switching and changes in self-generation and/ or cogeneration at an industrial facility	C	4
NM0078-rev: Conversion from single-cycle to combined-cycle power generation	Consolidated (ACM0007)	2
NM0079-rev: Baseline methodology for greenhouse gas reductions through waste heat recovery and utilisation for power generation at cement plants	A (AM0024)	4
NM0080-rev: Baseline methodology for grid connected electricity generation plants using non-renewable and less GHG intensive fuel	A (AM0029)	2
NM0086: Baseline methodology for project activities involving energy efficiency, self-generation, cogeneration, and/ or fuel switching measures at an industrial facility	C	4
NM0087: Baseline methodology for electricity generation using waste heat recovery in sponge iron plants	Consolidated (ACM0004)	4
NM0088: Baseline methodology for electricity production from waste energy recovery in an industrial or manufacturing process	Consolidated (ACM0004)	4

[3] Resubmission of NM0049.

NM0089: CECL methodology for power generation for captive use, which is grid connected, using non-renewable and less GHG intensive fuels	C	2
NM0092-rev: Baseline methodology for energy efficiency on electricity and fossil fuel consumption through technological improvements in the metal production industry through smelting	C	4
NM0095: Methodology for increase of additive percentage in PPC blended cement	Consolidated (ACM0005)	4
NM0096: Energy efficiency improvements in district heating production and distribution	C	1[4]
NM0097: Improvement in recovery of waste biomass from process streams and use of that biomass in energy generation	C	4
NM0099: Energy efficiency improvement in process and manufacturing industries	C	4
NM0100: Activities for the promotion of electricity efficiency, through the replacement of unitary equipment, by parties that are not the energy consumers	C	3
NM0101: Grasim baseline methodology for the energy efficiency improvement in the heat conversion and heat transfer equipment system	C	4
NM0103: Baseline methodology for district heating rehabilitation, possibly reducing use of in house devices	C	1[5]
NM0105-rev: Baseline methodology for bus rapid transit projects	A (AM0031)	7[6]
NM0106: Baseline methodology for optimization of clinker use in the cement industry through investment in grinding technology	Consolidated (ACM0005)	4[7]
NM0107-rev: Baseline methodology for waste gas-based cogeneration system for power and steam generation	A (AM0032)	2 and 4
NM0112-rev: Increased electricity generation from existing hydropower stations through decision support system optimization	C	2
NM0113: Gas powered combined cycle cogeneration replacing coal based steam generation and grid electricity	C	2 and 4
NM0114: Improved efficiency of electrical power system generation through advanced SCADA control systems and related Energy Management Protocol	C	2
NM0116: Reduction in the use of OPC for concrete mix preparation	C	4
NM0118-rev: Introduction of integrated demand-side energy saving system for existing beer brewing system	C	4
NM0119: Baseline methodology for energy integration project activities involving energy efficiency, self-generation, and/ or cogeneration measures at an industrial facility	C	4[8]
NM0120: Demand-side electricity management for food retailers, supermarkets, hypermarkets, shopping centers and other similar commercial activities	C	5
NM0122: Cogeneration at an industrial facility	C	4[9]
NM0123-rev: Methodology for use of non-carbonated calcium sources in the raw mix for cement processing	A (AM33)	4
NM0128: Baseline methodology for modal shifting in industry for product/ feedstocks	C	7
NM0136: Reduction of technical losses in electricity distribution systems	C	1
NM0137: Energy efficiency improvements in cement industry	C	4[10]
NM0138-rev: Fuel switching from coal and/ or petroleum fuels to natural gas and cogeneration at an industrial facility	C	4

[4] Resubmission of NM0058.
[5] Resubmission of NM0046.
[6] Resubmission of NM0052.
[7] Resubmission of NM0074.
[8] Resubmission of NM0086.
[9] Resubmission of NM0077.
[10] Resubmission of NM0099.

NM0141-rev: New cogeneration facilities supplying electricity and/ or steam to multiple customers	B	2
NM0144-rev: Energy efficiency improvements carried out by an Energy Service Company (ESCO) through boiler rehabilitation or replacement	A (AM0044)	4 and 5
NM0146: Baseline methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of silicomanganese	A (AM0038)	4
NM0150-rev: Lighting retrofit for residential use	B	3
NM0153: Baseline methodology for grid connected electricity generation plants using Natural Gas (NG) / Liquefied Natural Gas (LNG) fuels	A (AM0029)	2
NM0154: Grasim baseline methodology for the energy efficiency improvement in the heat conversion and heat transfer equipment system	B	4[11]
NM0155-rev: Baseline methodology for waste gas and/or heat utilization	B	4
NM0157-rev: Methodology for DSM program switching from incandescent lamps to CFLs	B	3
NM0158: GHG emissions reductions in urban transportation projects that affect specific routes or bus corridors or fleets of buses including where fuel usage is changed	C	7
NM0159-rev: Activities to increase market penetration of energy efficient appliances	B	3[12]
NM0160: Cogeneration at an industrial facility	B	4[13]
NM0161: Baseline methodology for gas powered cogeneration for an industrial facility	B	4[14]
NM0163: Baseline methodology for project activities using alternative materials in clinker manufacturing to reduce GHG emissions in a cement kiln	A (AM0040)	4
NM0169: Baseline methodology for reducing GHG emission by efficient utilization of energy in the form of fuel, power and steam	C	4
NM0171: Energy efficiency improvement through oil/ water emulsion technology incorporated into an oil-fired thermal and/ or electricity power production facility	Pending	2
NM0177: Utilization of coke oven gas for cogeneration	C	4
NM0179: Waste gas and/ or waste heat utilization for 'process steam' generation or 'process steam and power' generation in an industrial facility	Pending	4
NM0181: Introduction of a new primary district heating system	B	1[15]
NM0182: Improved efficiency of electrical power system generation through advanced SCADA control systems and related Energy Management Protocol Software (EMS)	C	2[16]
NM0183: Baseline methodology for the GHG avoidance project through environment friendly technology in refinery/ petrochemical process	C	4
NM0184: Improved heat rates and capacity enhancement of power plant through retrofit of equipment(s) such as retrofit of existing gas turbine for inlet air cooling	C	2
NM0186: Increased electricity generation from existing hydropower stations through Decision Support System optimization	Pending	2[17]
NM0190: Baseline methodology for heavy fuel-oil trigeneration	C	4
NM0192: Baseline and monitoring methodology for the recovery and utilization of waste gas in refinery facilities	Pending	4
NM0195: Methodology for efficiency improvement in electricity generation by steam turbine replacement in a production facility where process steam is required for production	Pending	2

[11] Resubmission of NM0101.
[12] Resubmission of NM0072.
[13] Resubmission of NM0122.
[14] Resubmission of NM0113.
[15] Resubmission of NM0096.
[16] Resubmission of NM0114.
[17] Resubmission of NM0112.

NM0197: Power saving through accelerated replacement of electrical equipment with variable load under a program of activities	Pending	3
NM0199: GHG emission reductions through reduced energy consumption of the furnace due to enhanced heat content of the raw material(s) input(s) to the furnace	Pending	4
NM0201: Modal shift for the transport of bulk goods within a two node network	Pending	7[18]
NM0202: Power plant rehabilitation and/ or energy efficiency improvement combined with an optional change in fuel mix	Pending	2

[a] Methodology type definitions

1. Supply side energy efficiency improvements for transmission and distribution
2. Supply side energy efficiency improvements - generation
3. Demand-side programmes for specific technologies
4. Energy efficiency and fuel switching measures for industrial facilities
5. Energy efficiency and fuel switching measures for buildings
6. Energy efficiency and fuel switching measures for agricultural facilities and activities
7. Energy efficiency and fuel switching measures for transport

Source: UNFCCC (2006b) and authors' categorization

The number of energy efficiency methodologies by evaluation status is summarized in Table 3. Around three quarters of the energy efficiency methodologies have been submitted in category 4 (energy efficiency and fuel switching measures for industrial facilities) and 2 (supply side energy efficiency improvements - generation) together. The category 4 is the only category where the submissions have been relatively successful. However, again, applicability of the methodologies of this category is usually limited to a specific technology. Attempts to achieve wider applicability incorporating multiple technologies or measurements have been unsuccessful so far (e.g. NM0099, NM0119, NM0137). Category 2 takes the second position. The methodologies of the category also follow the trend of narrow applicability so far. An exception is AM0029, which is applicable to new installation of natural-gas power plant(s) and has been applied by as many as 14 projects since its approval in May 2006.

Methodology submissions to other categories have been limited. Category 3 (demand-side programmes for specific technologies) has received only six submissions, all of which are applicable to energy efficient equipment for buildings, e.g. efficient light bulbs and room air conditioners. Although a programmatic approach is essential for this kind of projects (and the first methodology for this category, NM0072, was submitted long back in November 2004), a clear guidance on the definition of "a programme of activities under the CDM" had not been given by the EB until its 28th meeting in December 2006 (see UNFCCC 2006c). This has lead to great confusion among stakeholders and tardy development of demand-side energy efficiency methodologies. Category 7 (energy efficiency and fuel switching measures for transport) has also lagged behind due to a complex nature of transport projects. Although AM0031 has become available in July 2007, its applicability is very specific to the project attached to the methodology (BRT Bogotá, Colombia: TransMilenio Phase II to IV). Consequently, AM0031 has not been applied to any other projects so far.

[18] Resubmission of NM0128.

Table 3. Number of large-scale energy efficiency methodologies by evaluation status (December 2006)

Methodology type	Submitted	AM	ACM
1: Supply side energy efficiency improvements for transmission and distribution	6	-	-
2: Supply side energy efficiency improvements – generation	16	2.5	1
3: Demand-side programmes for specific technologies	6	-	-
4: Energy efficiency and fuel switching measures for industrial facilities	46.5	8	2
5: Energy efficiency and fuel switching measures for buildings	1.5	0.5	-
6: Energy efficiency and fuel switching measures for agricultural facilities and activities	0	-	-
7: Energy efficiency and fuel switching measures for transport	5	1	-
Sum	81	12	3

Note: "2 and 4" or "4 and 5" is allocated to methodology type 2, 4, and 5 respectively with 0.5 points. NM0107, NM0113, and AM0032 are of the former category. NM0144 and AM0044 are of the latter.
Source: UNFCCC (2006b) and authors' categorization

4. Analysis of submission and approval process of large-scale energy efficiency methodologies

Based on the analysis of the submission and approval process of large-scale energy efficiency methodologies, this chapter will discuss lessons learned from the experience focusing on i) applicability, ii) baseline approach, iii) baseline scenario selection and additionality assessment, and iv) emission reductions calculation. The analysis will mainly focus on lessons specific to energy efficiency methodologies, based on the submission and approval process from August 2005 to December 2006. For more generic methodological issues (e.g. transparency, conservativeness, formatting, and other basic methodological rules) or earlier lessons specific to energy efficiency methodologies, refer to Müller-Pelzer and Michaelowa (2005). In addition, preliminary analysis will be given to methodologies for energy efficiency CDM programmes, which have recently gained great momentum.

4.1. Applicability

As discussed above, applicability of energy efficiency methodologies has typically been limited to a specific technology or measurement. Such a bottom-up approach, based on engineering analysis of each relevant component, allows for accurate calculation of emission reductions and has been preferred by the MP/ EB. Again, a drawback of this approach is that a methodology tends to have technology-/ measurement-specific applicability by nature. Although a majority of energy efficiency methodologies are based on the bottom-up approach, several attempts to achieve wider applicability have also been observed. These can be categorized into i) empirical model approach and ii) performance parameter approach.

Examples of the empirical model approach are NM0119 and NM0122. Both of them employ an empirical model (as opposed to the bottom-up engineering approach as a "theoretical" model) to estimate the baseline emissions. For example, NM0119 applies regression analysis assuming that there is a relationship between the fuel use in the baseline scenario and the production of an industrial facility. Such an approach can "skip" each production component but is likely to face difficulty in attributing emission reductions to the project activity. Although the approach is attractive in terms of simplicity and wider applicability (because it does not require process-specific analysis; e.g. NM0119 is applicable to any energy efficiency improvement measurements in industrial facilities that produce only one product), the MP/ EB have taken unfavourable decisions on such an approach mainly due to inappropriate establishment of causality between emission reductions and the project activity.

Another approach for wider applicability is based on performance parameters. An example of performance parameters is specific electrical/ thermal energy consumption measured as final electricity/ thermal energy consumption divided by quantity of production (NM0120 for building electrical efficiency, NM0099 and NM0137 for cement plant efficiency). Such performance parameters are typically estimated based on historical performance data (e.g. three years for NM0120 and one year for NM0137). Endogenous energy efficiency improvement in the baseline scenario is not considered at all in NM0120. NM0137 takes into consideration such effects by choosing a baseline scenario with an endogenous efficiency improvement rate based on a historical trend (although guidance to justify the historical improvement trend is vague). These attempts have failed mainly because of improper treatment of causality between emission reductions and the project activities. For example, although NM0099 and NM0137 are designed for project activities reducing emissions through energy efficiency measures, the proposed methodologies also account for emission reductions that result from activities other than efficiency measures, such as changes in a clinker factor or product/ fuel mix. In addition, the lack of proper consideration of endogenous energy efficiency improvements is another critical issue of these methodologies.

These experiences give an insight into development of widely applicable energy efficiency methodologies. Facility-level-bundling (or complex type methodologies), which bundles multiple processes at a facility into one methodology, is essential to achieve wider applicability. However, it is important to note that such an approach is likely to fail unless it is built on bottom-up engineering model, not an empirical one, and endogenous energy efficiency improvement is properly taken into account.

4.2. Baseline approach

A majority of the energy efficiency methodologies has aimed at retrofit or replacement activities of existing equipment. Consequently, most of the methodologies are based on the baseline approach 48.a (historical emissions). The share of the approach 48.b (emissions of an economically attractive course of action, taking into account barriers to investment) is much lower due to the lack of methodologies designed for new installations. The approach 48.c (emissions of the top 20% of similar project activities undertaken in the previous five years) has hardly been applied successfully mainly due to difficulties in data collection (from potential competitors) and definition of "a similar circumstance" (e.g. NM0003, NM0116).

Table 4. Number and share of baseline approaches applied to large-scale energy efficiency methodologies (December 2006)

	Submitted		AM/ACM	
48.a	61	75.3%	10	66.7%
48.b	19	23.5%	5	33.3%
48.c	1	1.2%	0	0.0%
Sum	81	100.0%	15	100.0%

Note: "48.a or 48.b" is allocated to 48.a and 48.b respectively with 0.5 points. ACM0004 and ACM0007 are of this category.
Source: UNFCCC (2006b) and authors' calculation

Wrong choice of a baseline approach has been one of the reasons for rejection of methodology submissions (see Müller-Pelzer and Michaelowa 2005). In most cases, the use of 48.a has been supported by the MP/ EB for retrofit or replacement projects, while 48.b for new installation projects. However, the MP/ EB have occasionally taken different stances on the baseline approach choice. For example, NM0136 is considered as a methodology for discretionary retrofit energy efficiency projects (see below for the definition). Against its choice of the baseline approach 48.a, the MP recommended 48.b stating "48.a is more appropriate to projects that derive no financial benefits other than the carbon income." If such reasoning is always applied, all the energy efficiency projects have to be based on 48.b, which is not necessarily reasonable. Another example is NM0159 which is based on 48.a. The MP also recommended 48.a even though NM0159 is only applicable to end-of-life replacement. At the end of technical lifetime of equipment, the equipment purchase decision is usually widely open and 48.b suits better to such a situation than 48.a does.

UNFCCC (2006d) states that "project participants proposing new baseline methodologies shall ensure consistency between the determination of additionality of a project activity and the determination of a baseline scenario" and "ensure consistency between baseline scenario derived by this procedure and the procedure and formulae used to calculate the baseline emissions." As per these guidelines, project participants shall ensure consistency among i) baseline scenario selection, ii) calculation of the baseline emissions, and iii) demonstration of additionality. Because a baseline approach, in principle, serves as a basis for calculation of the baseline emissions, it is considered to determine how the above three procedures should be carried out. Therefore, to avoid further confusion, it is important to reconsider which baseline approach should be applied in the context of energy efficiency CDM projects.

Niederberger and Spalding-Fecher (2006) proposed distinction among three energy efficiency markets: i) discretionary retrofit, ii) planned replacement, and iii) new installations markets. The discretionary retrofit market serves for decisions to prematurely replace existing technology with high-efficiency equipment for the primary purpose of improving energy efficiency. The planned replacement market concerns decisions to replace existing technology at the end of its useful lifetime (e.g., failure, replacement schedule) with high-efficiency equipment. The new installations market is for decisions to select high-efficiency equipment over other alternatives at a time of new installation.

Different baseline approaches are required for the three different energy efficiency markets. First of all, 48.a is recommended for discretionary retrofit since such a project is replacing existing, functioning equipment before the end of its technical lifetime. As for the planned replacement, 48.b is generally the most suitable baseline approach since it generally involves new investment decisions. However, if replacement equipment has already been purchased, 48.a may become more appropriate since not employing the already purchased equipment would represent a sunk cost. Lastly, 48.b is the first choice for new installations since the equipment purchase decision is widely open and there is no historical data for such projects by nature (see Niederberger and Spalding-Fecher 2006). Applicability of 48.c is difficult to assess because the experience is scarce so far. It would lend itself mainly to the market for new installations where one could look at the market for comparable new technologies. But it could also be applicable for a situation where one looks at a retrofit/ replacement activity if there is a common characteristic of a retrofit/ replacement (e.g. "normally technology x is replaced after 10 years with technology y") and data for the retrofitted/ replaced technology are available. As long as necessary data is available and the choice does not lead to less conservative calculation of the baseline emissions than 48.a or 48.b does (i.e. cherry picking of a baseline approach to reap more CERs is most likely rejected by the MP/ EB), 48.c can also play a role. It is important to note that 48.c can readily address a rebound effect issue (see below for detailed discussion) where historical data is not available. Emissions from an increased output level due to energy efficiency improvement must be taken into account in calculation of the baseline emissions. The problem with 48.b-based new installation energy efficiency projects is that they tend to set an output level of the baseline scenario equal to the one of the project activity since such projects do not have historical output data (i.e. no consideration of rebound effects). 48.c could solve this problem by taking an output level of "similar" project activities although such an approach has never been applied successfully so far. A summary of baseline approach choice for the three different energy efficiency markets is given in Table 5.

Table 5. Suitable baseline approach for different energy efficiency project types

Energy efficiency project type	Suitable baseline approach
Discretionary retrofit	48.a is preferable. 48.c is also applicable if necessary data is available and the choice does not lead to less conservative calculation of the baseline emissions than 48.a does.
Planned replacement	48.b is preferable (a possible exception is a case where replacement equipment has already been purchased. In such a case, 48.a might be more preferable). 48.c is also applicable if necessary data is available and the choice does not lead to less conservative calculation of the baseline emissions than 48.b does.
New installations	48.b is preferable. 48.c is also applicable if necessary data is available and the choice does not lead to less conservative calculation of the baseline emissions than 48.b does.

Source: Adopted from Niederberger and Spalding-Fecher (2006)

4.3. Baseline scenario selection and additionality assessment

Energy efficiency projects are often economically/ financially viable even without CER revenues. Due to the limited contribution of CER revenues to the overall project finance, such projects have faced difficulty with demonstrating additionality. As a consequence, project participants have attempted to exclude the investment analysis from baseline scenario selection and additionality assessment. The examples are NM0119, NM0122, and NM0136 which are all based on the baseline approach 48.a and suggested application of the barrier analysis only. None of these attempts have been supported by the MP/ EB. A partial use of the additionality tool (i.e. predominantly exclusion of the investment analysis in the context of energy efficiency projects) has triggered second thoughts of the MP/ EB and become one of the major reasons for methodology rejections. Although it is not mandated by the additionality tool, application of both the barrier and investment analysis has been the first priority recommendation by the MP/ EB.

Compared to the investment analysis, the barrier analysis tends to be more qualitative and subjective, hence prone to more gaming. In the case where barriers exist to all the alternatives, demonstrating the barriers to the alternative chosen as the result are clearly "less likely" to prevent this alternative than the barriers affecting the other alternatives is considered invalid (e.g. the MP recommendation on NM0136). In case of an inconclusive result of the barrier analysis, methodologies have to provide a way to come up with a single result e.g. either by the investment analysis or the choice of a scenario with the lowest emissions (e.g. NM0141). However, although a combination of the barrier and investment analysis can be conclusive, energy efficiency projects are likely to face difficulty in passing the investment analysis. Also, the barrier analysis complemented by the choice of a scenario with the lowest emissions is conclusive, but the result is likely to be the project activity itself if the option is not screened out by the barrier analysis.

In order to systemize the baseline scenario selection and additionality assessment process, the combined tool to identify the baseline scenario and demonstrate additionality (the combined tool) has established a flow chart to select the most plausible baseline scenario and demonstrate additionality (see UNFCCC 2006e). It basically sets two options in case the barrier analysis is not conclusive. First, if the remaining alternatives include the project undertaken without the CDM, project participants should apply the investment analysis to single out an alternative. Second, if the remaining alternatives do not include the project undertaken without the CDM, project participants can either apply the investment analysis or choose the baseline scenario alternative with the least emissions. Here again, the barrier analysis plays a key role especially in the context of energy efficiency projects, where the investment analysis is likely to end up with unfavourable results for the project activities.

Niederberger and Spalding-Fecher (2006) argues that major barriers to energy efficiency projects can be that capital investment decisions are generally not made on the basis of what is cost effective, but rather on the basis of which investment bears the least risk and will give the greatest/ most rapid return on investment. Also, those who purchase energy-using capital equipment or appliances are often not the ones who pay energy bills. Therefore, their main concern is a low equipment purchase price, not operating costs such as energy bills.

In order to incorporate the barriers mentioned above and overcome the additionality challenge which energy efficiency projects have been facing with, additionality assessment has to be streamlined by defining one-step criteria and simple barrier analysis as far as possible. Also, the investment analysis has to take into account the risk premium which projects in developing countries face with. Possible options could be additionality assessment based on i) a list of "first of its kind" technologies, ii) an internal rate of return below the lending rate of commercial banks for the maximum loan duration available for private debtors at the date of PDD submission, and iii) a payback period commonly used as cut-off for projects in the associated economic sector in the host country. For more details, refer to Michaelowa (2005).

Another upcoming problem is additionality assessment of projects which employ a facility-level-bundling approach. Such an approach typically incorporates multiple processes at a facility into one methodology (e.g. NM0099, NM0122, NM0137). Therefore, additionality assessment can be applied either at a facility level or each production process level. Although the experience with this kind of approach is scarce, a general lesson can be drawn from the methodology submission and approval process so far. The MP/ EB have been very cautious in establishment of causality between the emission reductions and project activity (e.g. the MP recommendation on NM0137 and NM0159). Also, the EB guidance on programmatic CDM clearly states that a programme of activities must demonstrate that the emission reductions for each project activity under the programme are uniquely attributable to the programme (see UNFCCC 2006c. For further discussion, see Section 4.5.3.). If the MP/ EB are consistent, it would mean that each component of a bundle of activities at an industrial facility would have to show additionality, which is likely to be difficult.

4.4. Emission reductions calculation

There are three major methodological challenges which energy efficiency methodologies have continuously been faced with: i) remaining technical lifetime of existing equipment, ii) output increase by the project activity, and iii) endogenous energy efficiency improvement in the baseline scenario.

4.4.1. Remaining technical lifetime of existing equipment

The EB, at its eighth meeting, gave guidance on the treatment of existing and newly built facilities, stating that "the baseline may refer to the characteristics (i.e. emissions) of the existing facility only to the extent that the project activity does not increase the output or lifetime of the existing facility (see UNFCCC 2003)." The 22nd meeting of the EB gave further guidance on treatment of the technical lifetime of plants and equipment (see UNFCCC 2005a). However, despite the EB guidance, many energy efficiency methodologies have failed to take into account the issue properly (e.g. NM0118, NM0119, NM0141, NM0169, NM0171).

A solution could be to either i) limit the applicability to the case where the retrofit undertaken does not increase the technical lifetime of existing equipment (e.g. NM0163, NM0171, AM0040, ACM0009), or ii) determine the remaining technical lifetime of existing equipment without any retrofit and issue CERs only as long as the this technical lifetime would not be reached by the facility (e.g. NM0144, the MP recommendation on NM0184). In the latter approach, the methodology has to clearly describe the procedure to estimate the technical lifetime of existing equipment (for detailed guidance, see UNFCCC 2005a).

4.4.2. Output increase by the project activity

There are two types of output increase caused by the project activities: i) capacity expansion by the project activity and ii) rebound effects due to an increased energy efficiency level. In either case, as discussed above, the baseline may refer to the characteristics (i.e. emissions) of the existing facility only to the extent that the project activity does not increase the output of the existing facility. For any increase of output of the facility which is due to the project activity, a different baseline shall apply (see UNFCCC 2003).

Capacity expansion

Two approaches have been applied so far to address emissions from output increase by capacity expansion due to the project activity: i) to limit the applicability to the case where the retrofit undertaken does not expand the capacity of existing equipment (e.g. NM0163, NM0171, AM0040, ACM0009), or ii) not to claim for CERs for emission reductions associated with project activity output above the maximum capacity of existing equipment.

The former is very similar to the first approach addressing the remaining technical lifetime issue discussed above. An example of the latter can be found in AM0044. It applies a capping factor (i.e. "average historic thermal energy output from the baseline boiler" divided by "thermal energy output by the project boilers") so that project participants do not claim for CERs for reduction of emissions from fuel consumption associated with any thermal energy output above the maximum capacity of the baseline boilers.

Rebound effects

The MP/ EB have occasionally given recommendations to consider emissions from an increased output level caused by energy efficiency improvement by the project activity (i.e. rebound effects). However, clear and consistent methodological guidance is lacking and decisions by the MP/ EB have been extremely inconsistent. Although some large-scale energy efficiency methodologies have been rejected because they did not take into account rebound effects (e.g. NM0096, NM0103), SSC energy efficiency methodologies do not consider rebound effects and project with serious rebound effects (e.g. Kuyasa low-cost urban housing energy upgrade project) has been registered. In addition, a few large-scale energy efficiency AMs also lack of appropriate treatment of this issue (e.g. AM0020, AM0029).

The issue poses another debatable question: rebound effects and suppressed demand. In the case of many developing countries, any rebound effect resulting from energy efficiency projects is often linked to situations of suppressed demand due to insufficient supply (see Figueres and Bosi 2006). There is a view that meeting suppressed demand through an energy efficiency project activity should not be penalized because the CDM is to promote sustainable development in developing countries (see James 2005). To avoid further confusion, more clarification/ consistency is needed on treatment of rebound effects by the MP/ EB.

4.4.3. Endogenous energy efficiency improvement in the baseline scenario

Over time, baseline emission might be reduced by a certain percentage due to modernisation, better maintenance and new equipment installations, etc. In most cases, the MP/ EB have recommended to take into account such endogenous energy efficiency improvement in the baseline emission calculation (e.g. the MP recommendations on NM0120 and NM0136). However, again, the MP/ EB decisions have sometimes been inconsistent. For example, NM0042 was approved as AM0020 even though it did not consider any endogenous energy efficiency improvement.

Possible approaches to tackle this issue are application of i) a default factor for endogenous energy efficiency improvement, ii) benchmarking (e.g. based on 48.c or other criteria), and iii) a project and baseline sample group approach. The first approach was employed by NM0137, which applied a default factor for endogenous energy efficiency improvement based on regressions analysis on a historical energy efficiency improvement rate. However, the methodology was rejected because of the lack of guidance as to the time periods over which a trend in performance must exist in order to justify its reflection in the baseline. Also, in case of a deteriorating energy efficiency trend, the MP rejected the application of historical (deteriorating) trend and recommended the use of a constant baseline emission level based on data for the year prior to project start (see the MP recommendation on NM0137).

The second approach is benchmarking. If ex-post monitoring is applied, 48.c inherently addresses this issue because it calculates the baseline emissions as the average emission of similar project activities undertaken in the previous five years, in similar circumstances, and whose performance is among the top 20% of their category (but no example of successful application so far). Another example of benchmarking is ACM0005, which sets the benchmark of a clinker to cement ratio (c/c ratio) for baseline emission calculation as the lowest value among the following three options: i) the production-weighted-average of the five highest c/c ratio for the relevant cement type in the region, ii) the production-weighted-average c/c ratio in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region, and iii) the c/c ratio of the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity, if applicable.

The third approach is a project and baseline sample group approach, or (quasi-) random experimentation. This is applied in NM0150 and it basically accounts for "continuation of the current practice + endogenous energy efficiency improvement" by setting a control group, which receives no intervention by the project activity, and an intervention group, which is given the project intervention (see Rossi et al. 2004 or Cook and Campbell 1979 for further details of (quasi-)random experimentation methods). Although the approach, based on statistical sampling, is relatively complicated, it can address the issue in the most rigorous manner among the three approaches.

4.5. Programmatic approach

The EB has issued guidance on programmatic CDM in December 2006 (see UNFCCC 2006c). Due to the nature of many activities for energy efficiency improvement where small technologies (e.g. lighting equipment, electric motors) are distributed and installed in large numbers, the programmatic approach could become crucial for the role of energy efficiency projects under the CDM.

4.5.1. Evolution of programmatic CDM

Programmatic CDM is not a new phenomenon. As mentioned above, the first methodology of this category, NM0072, was submitted long back in November 2004. The methodology, which addresses a mandatory energy efficiency standard for room air conditioners in Ghana, opened a long-standing discussion on whether local/ regional/ national policy or standard can be considered as a CDM project activity. The 1st session of the Conference of the Parties serving as the Meeting of the Kyoto Protocol (COP/ MOP1) in December 2005 decided that "a local/ regional/ national policy or standard cannot be considered as a CDM project activity, but that project activities under a programme of activities can be registered as a single CDM project activity (see UNFCCC 2005b)."

Since the COP/ MOP1 decision, programmatic CDM has gained greater momentum, driven by the expectation that the approach could mobilize more CDM projects with higher sustainable development benefits such as energy efficiency and renewable energy projects. The MP/ EB have worked on guidance related to the registration of project activities under a programme of activities as a single CDM project activity and recently finalized its work. Among the several existing methodologies for programmatic CDM activities, this section gives an overview of NM0150 and NM0157, both of which were developed for energy efficiency improvement of light bulbs.

NM0150 is designed for distribution of compact fluorescent lamps (CFLs) by donation or sales at a reduced price (not via a retailer). As mentioned above, the methodology employs a project and baseline sample group approach, or quasi-random experimentation, which is based on a statistical sampling method. The baseline sample group, or the control group, is given compensation for not participating in the programme. On the other hand, the project sample group, or the intervention group, is distributed CFLs to replace less energy efficient lighting appliances currently in use. Additionality assessment is to be conducted on the CFL distributor level (i.e. on the programme level). The selected major issues raised by the MP are i) lack of appropriate description of the method to establish the control group, ii) risk of manipulation in the control group (e.g. by giving incentives not to use CFLs through the crediting period), and iii) potential leakage (e.g. through export of CFLs to Annex I countries, re-use of incandescent lamps, and residential and/ or non-residential free-riders). The additionality assessment only on the programme level was not criticized by the MP.

NM0157 is designed for distribution of CFLs through a general retail channel. As opposed to the quasi-random experimentation approach employed by NM0150, the methodology calculates emission reductions based on a technology penetration approach. The approach compares penetration rates with and without the proposed CDM activity. Those penetration rates are monitored ex-post by using the "unbiased" questionnaire to the customers of the CFLs, which is aimed to identify the customer's purpose of purchase.[19] In order to exclude free-riders, a swapping method, i.e. to introduce new CFLs by swapping usable incandescent lamps, as well as confirmation

[19] "Unbiased" implies that the subsidy for answering the questionnaire is to be provided whatever the answer is (see NM0157).

of usability of the incandescent lamps (less efficient light bulbs used in the baseline scenario) by the unbiased questionnaire is applied. Additionality assessment is to be conducted both i) on the individual participant level and ii) on the programme level. The selected major issues raised by the MP are i) lack of full description of the "unbiased survey," ii) doubtful additionality assessment both on the individual participant level (because of the lack of check on reliability of the survey answers) and on the programme level (it is not appropriate to automatically assume additionality of the programme based on the fact that the subsidy is provided by the CER revenue; this kind of programme could benefit from non-CDM-based subsidies), and iii) potential leakage through the same channels pointed out in the MP recommendation on NM0150.

From these two examples, some general lessons can be drawn. Firstly, programmatic CDM may require relatively complex and sophisticated emission reduction calculation methods (e.g. (quasi-)random experimentation or technology penetration rate approaches). Full description of the methods shall be given in methodologies. In addition, it is important to ensure that the intermediary (i.e. programme coordinator) has enough capacity to carry out such complicated methods (otherwise, the programme will face problems at a time of verification). Secondly, additionality assessment (to exclude free-rider effects) needs careful consideration. It is not very clear yet on which level additionality assessment must be conducted: on the programme level, on the individual participant level, or both?

4.5.2. Emission reductions calculation

In calculation of emission reductions of a programme, two elements play a crucial role: i) free riders and ii) spill over. Taking a CFL distribution programme as an example, free riders, who would have installed CFLs anyway, act to decrease the gross energy savings of the programme. On the contrary, spill over increases the gross energy savings of the programme by accounting for the influence the programme has had on the market. Such influence is a combination of the following three types of spill over:

1. Within project spill over: Participants purchased CFLs through the programme;
2. Outside project spill over: Participants purchased additional CFLs through other outlets;
3. Non-participant spill over: Non-participants were induced to purchase CFLs because of suggestions from participants, greater availability in the marketplace, etc.

The effect of free riders and spill over is aggregated to the net-to-gross ratio (NTG), which represents the share of the programme's gross energy savings that can be properly attributed to the programme's influence (see Skumatz and Howlett 2006). The NTG is mathematically expressed as follows:

$$NTG = (1-FR) \times (1+SO)$$

where:
FR is the share of free riders (fraction); and
SO is the share of spill over (fraction).

Even if programmes employ the same technology, the NTG can vary significantly depending on programme designs. For example, a nationwide study of CFL programmes in the U.S. shows variations of i) free rider estimates ranging from 1-50%, ii) spill over estimates from 8-32%, and iii) the NTG from 80-91% (see Skumatz and Howlett 2006). This example shows the importance of well-designed programme evaluation methods to properly calculate emission reductions by the programme. In the CDM context, only the free rider effect has attracted much attention so far, apparently because underestimation of actual emission reductions in non-Annex I countries would positively contributes to the environmental integrity of the Kyoto Protocol. However, if project participants do not want to unnecessarily give away their emission reductions (which is normally the case), they have to contemplate proper estimation of spill over as well.

Importantly, methodologies for estimation of free riders and spill over are usually complicated and likely to involve high transaction costs. Such methodologies include comparison of programme participants and non-participants by a (quasi-)random experimentation method (e.g. NM0150). Another approach could be to determine trends in autonomous market penetration of high-efficiency equipment targeted by the CDM programme (e.g. NM0157). However, considering the fact that the MP/ EB have hardly supported simple extrapolation of historical trends so far, such an approach needs careful consideration. It may be questionable to assume that past trends are a good indication of future trends (see Niederberger and Spalding-Fecher 2006).

4.5.3. Additionality assessment

Additionality can principally be assessed at two levels in the context of a programme: i) on the level of an intermediary who organizes the programme and ii) on the level of the actors who actually install/ use the efficient technology. The problem is that investment analysis tends to apply on the intermediary level, whereas the activity level is usually characterized mainly by non-monetary barriers (e.g. lack of trust in the new technology, lack of information, lack of servicing in case of failure).

The EB is still making up its mind whether additionality has to be assessed on both levels. The guidance states that the programme of activities (PoA: on the programme level) shall ensure that additionality is unambiguously defined for each CDM program activity (CPA; on the individual participant level) within the PoA (see UNFCCC 2006c). However, it lacks of clear guidance on the aggregation level of a CPA. Is each light bulb replaced by a PoA considered as an individual CPA and must project participants weed out every single non-additional light bulb replacement? In addition, the guidance does not explicitly state the need of additionality assessment on the programme level.

The MP/ EB decisions on this issue have been inconsistent. First of all, as discussed above, the EB guidance on programmatic CDM clearly requires additionality assessment on the individual participant level, but not explicitly states the need of additionality assessment on the programme level. Secondly, in the case of NM0150 which conducts additionality assessment only on the programme level, the MP did not raise any issues on which level additionality assessment should be carrier out. Thirdly, however, the MP recommendation on NM0198, which relates to a project type similar to demand-side energy efficiency (distribution of efficiency increasing technology to farmers), asks for additionality assessment on the two levels: i) on the choice of the individual farmer on a particular fertilizing technique and ii) on the choice of the distributor to carry out the inoculant rebate/ subsidy program. This suggests that the two-tiered additionality assessment would be required for programmatic CDM. Clearer and more consistent guidance on additionality assessment of programmatic CDM is essential to fully realize its potential.

Experience with evaluation of demand-side management programmes in the U.S. has shown that it is extremely difficult and expensive to assess additionality on the actor level. Thus, Trexler et al. (2006) and Sathaye (2006) have proposed aggregated additionality assessment, which discounts emission reductions of the programme by the percentage of ex-ante estimated non-additional activities in the programme. The problem with that suggestion is that both non-additional and additional activities would receive the same amount of CERs; the non-additional ones would thus crowd out the additional ones. A solution might be to allow aggregated additionality assessment if the programme intermediary can show that he has measures in place to deter non-additional activities.

5. Conclusions

Energy efficiency methodologies have so far been the stepchildren of the CDM. They have been assessed very critically by the MP/ EB and their success rate has been very limited. Those that managed to come through suffer from narrow applicability criteria and cover only a part of potentially interesting project types. Although facility-level-bundling could be a way to achieve wider applicability, such an approach is likely to follow a difficult track as far as the existing methodology submission and approval process tells. The baseline approach of "20% best comparable technology," which was originally thought to be applicable to energy efficiency projects, so far is almost not used due to heavy data collection and difficulty in setting "similar" circumstances. Moreover, practices used in demand-side management programmes such as empirical modelling or performance benchmarking have not been accepted. The MP/ EB are still grappling with key concepts such as rebound effects and endogenous energy efficiency improvement. It remains to be seen whether the rules on programmatic CDM will be set in a way that reduces the barriers for the implementation of energy efficiency projects under the CDM.

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The Carbon Finance Unit at the World Bank

ACHIEVING GREENHOUSE GAS EMISSION REDUCTIONS IN DEVELOPING COUNTRIES THROUGH ENERGY EFFICIENT LIGHTING PROJECTS IN THE CLEAN DEVELOPMENT MECHANISM (CDM)

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November 2006

The electronic version of this paper can be downloaded from the World Bank's Carbon Finance website (www.carbonfinance.org)

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DISCLAIMER

This paper was prepared by Ms. Christiana Figueres (independent consultant) and Ms. Martina Bosi (World Bank Carbon Finance Unit). The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the view of the World Bank, its Executive Directors, or the countries they represent, or the view of the Carbon Finance Unit (CFU) or of the Participants in any of the carbon funds the CFU manages. They should in no way be taken to represent the official view of any institution with which the authors are associated.

ABSTRACT

Energy efficiency can help address the challenge of increasing access to modern energy services, reduce the need for capital-intensive supply investments as well as mitigating climate change. Efficient lighting is a promising sector for improving the adequacy and reliability of power systems and reducing emissions in developing countries. However, these measures are hardly represented in the CDM portfolio. The COP/MOP decision to include programs of activities in the CDM could open the door to the implementation of a large number of energy efficiency projects in developing countries. Since GHG reductions are essentially the emission equivalent of energy savings, the CDM can benefit from long established energy efficiency methodologies for quantifying energy savings and fulfilling CDM methodological requirements. The integration of the CDM into energy efficiency programs could help spur a necessary transformation in the lighting market.

ACKNOWLEDGEMENTS

The authors would like to thank the following experts and colleagues for their valuable input to this paper: Anne Arquit Niederberger, Brian Dawson, Johannes Heister, Peter Johansen, Benoit Lebot, Luiz Maurer, Michael Philips, Klaus Oppermann, Mahesh Sharma, Russell Sturm, Ed Vine, Paul Waide, and Stephen Wiel.

INTRODUCTION

The World Bank's "*Clean Energy and Development: Towards an Investment Framework*" (2006)[1] notes that one of today's greatest sustainable development challenges is accelerating access to reliable and affordable modern energy services to the estimated 1.6 billion people in developing countries that are currently lacking it, while addressing the threat posed by climate change. There is no silver bullet and a suite of measures and technologies will be necessary. However, improvements in energy efficiency, both at production and end-user level, are a fundamental part of the solution.

Energy efficiency can reduce the need for capital-intensive supply investments and is one of the most promising sectors for improving the adequacy and reliability of power systems, increasing energy security and reducing emissions in developing countries. Unfortunately, these energy efficient options are not common practice due to well-documented market failures and barriers.

In the medium term, what is likely needed is a planned phasing out of the least energy efficient lighting techniques and systematic dissemination of the most efficient technologies, akin to the process under the Montreal Protocol. In the meantime, the Kyoto Protocol's Clean Development Mechanism (CDM) could channel carbon finance to cover the cost of some of the programs that would eventually bring about the desired market transformation. The CDM could help these projects overcome some of the barriers facing greater energy efficiency. However, the international emission reduction market has bypassed this opportunity to reduce emissions and contribute to sustainable development. Out of the 1,276 projects currently in the CDM pipeline, 174 are energy efficiency projects (mostly industrial efficiency), representing 9.7% of the expected annual certified emission reductions (CERs) of the market.[2] Among those there are only 4 projects targeting end-use applications. This is possibly due to the greater complexity of implementing and administering end-user energy efficiency projects that typically involve a large number of users in different sites, compared to the more common single-site CDM project activities that dominate the CDM pipeline. It may also be due to the CDM-related transaction costs and uncertainty regarding structuring/designing these activities as an eligible project activity under the CDM. Fortunately, the COP/MOP 1 decision to include "programs of activities" in the CDM, and the ensuing expected guidance from the CDM Executive Board, have the potential to open the door to the implementation of more energy efficiency (EE) projects in developing countries.

There are several end-use applications around the world where the CDM could help stimulate greater energy efficiency, contribute to sustainable development and reduce GHG emissions, such as household appliances, air conditioning, heat and water pumps as well as buildings. This paper addresses the opportunity to use the financial leverage of the CDM to facilitate end-user energy efficiency projects. It focuses specifically on the efficient lighting sector as a promising sector[3], given (i) the potential of national or regional programs to deliver the volume of GHG reductions necessary for a feasible CDM project; (ii) the possibility to monitor GHG reductions based on metered energy savings; and (iii) the broad applicability of efficient lighting projects throughout the developing world. The paper highlights the potential for GHG reductions from energy efficient lighting and notes how established efficient lighting methodologies and practices can be used to comply with CDM methodological requirements. The purpose of the paper is to show the complementarities and synergies between the implementation of energy efficiency measures and the CDM.

[1] Document produced by the World Bank in response to the Communiqué on Climate Change, Clean Energy and Sustainable Development resulting from the Gleneagles G8 Presidential Summit of 2005.

[2] Calculated based on CD4CDM website updated October 20, 2006 (http://www.cd4cdm.org/)

[3] There are also other interesting energy efficiency opportunities in other sectors which need to be further examined.

1. POTENTIAL FOR GHG REDUCTION THROUGH EFFICIENT LIGHTING

Although frequently overlooked, the lighting sector is a major source of GHG emissions. World-wide, grid-based lighting is responsible for 19% of total global electricity consumption (IEA 2006). Annual emissions from the lighting sector currently reach almost 1,900 $MtCO_2$, equivalent to 70% of the emissions of the world's passenger vehicles and three times more than aviation emissions. Over the past decade, global demand for electric lighting increased at an annual rate of 1.8% in industrialized countries and 3.6% in developing countries. Over the next 25 years, demand will continue to grow. By 2030 developing countries are expected to account for 60% of global lighting electricity demand due to new construction, ongoing electrification, and rising illumination levels.

Hence, the International Energy Agency (IEA) concludes that there is a "very large cost-effective potential to reduce energy demand and GHG emissions through more energy efficient lighting" (IEA 2006). It estimates that approximately 735 TWh and 456 MtCO2 could be reduced in non-OECD countries (or 385 Mt CO2 excluding former Soviet Union countries) by 2020[4], representing one half of the worldwide savings potential. At least part of these savings could be realized under the CDM.

The universe of lighting includes different markets: indoor lighting (domestic and commercial/industrial), outdoor lighting (street, external building, stadiums, etc.) and vehicle lighting (the latter not considered further in this paper). Lighting energy can be saved in many ways, including (i) improving the efficiency of the light source; (ii) improving the efficiency of the specific component of lighting system, typically the ballast; (iii) improving the efficiency of the luminaries; (iv) improving the efficiency of the control gear deployed; and (v) making better use of daylight inside built environment.

[4] From the IEA World Energy Outlook's Reference Scenario (IEA 2004).

The general lack of implementation of these measures "reflects the fact that although there are already many cost-effective energy efficient lighting technologies available on the market, they are currently underutilized. Despite substantial improvements in average lighting-system efficiency, inefficient systems and practice are still commonplace" (IEA 2006). As further elaborated below, energy efficient lighting faces various barriers, some of which the CDM could help to overcome.

2. PROGRAMS TO PROMOTE EFFICIENT LIGHTING

Governments have been implementing EE lighting programs since the energy crisis of the 1970's. Multilateral institutions such as the World Bank, the International Finance Corporation (IFC), the Global Environment Facility (GEF), and the United Nations Development Program (UNDP) have promoted efficient lighting programs in developing countries. Today all industrialized countries and some developing countries have various sorts of EE programs for lighting, differing in nature, scope and effectiveness. The most common types are:

- Energy labels, ratings and certification schemes used to inform consumers about the energy use, energy costs and environmental consequences of their intended lighting purchase — by far the most widely spread type of EE program.
- Minimum energy performance standards (MEPS) that determine (voluntary or mandatory) minimum efficiency levels for lighting products sold in a particular country or region.
- Building codes that either set explicit lighting installation specifications, or indirectly include lighting in the general building energy performance specifications.
- Bulk procurement programs that seek to lower the information gathering and purchasing costs of large quantities of equipment and lighting systems.
- Financial and fiscal incentives in the form of either a rebate or a tax deduction, to motivate consumers to purchase energy-efficient lighting equipment.
- Performance contracts executed by energy service companies (ESCOs) that on the basis

of a mutually agreed energy baseline, assist their customers to reduce energy costs and share the savings.
- Market transformation programs that seek to positively influence consumer behavior and market trends on a voluntary basis through a combination of labeling, building certification, technical support, and incentive schemes.
- Utility driven EE programs.

3. BARRIERS TO EFFICIENT LIGHTING

The slow uptake of efficient lighting (and energy efficiency in general) is one of the most discussed ironies in the electricity industry. Technological developments over the past 30 years enable today's investments in efficient lighting retrofits to enjoy short payback periods and high internal rates of return. Compact fluorescent lamps (CFLs), for example, are now often sold in bulk for little more than one dollar apiece. In the face of rising oil prices and increasing power shortages in developing countries, EE in general, and efficient lighting in particular, are clearly cost-effective strategies. And yet, this economic rationale has not led to a mainstreaming of efficient lighting systems in practice.[5] Traditional cost-benefit analyses are typically not applied to individual lighting decisions. Indeed, while rational economic behavior suggests that users would be better served by efficient lighting with lower life cycle costs, there are many reasons why this does not actually occur. Impeding factors and market failures differ by end-use sector, but they tend to fall into six broad areas that are well documented, and thus here only listed in Box 1. Moreover, it is important to keep in mind that even for seemingly cost-effective projects, these may not be undertaken due to their relatively high opportunity cost, i.e. the possibility to invest in other, more attractive activities/projects, especially in cases.

[5] This is also true in the case of industrialized countries, where there is still significant potential for energy efficient improvements.

BOX 1. MAIN BARRIERS TO ENERGY EFFICIENT LIGHTING IN DEVELOPING COUNTRIES

1. Policy Barriers

a. Lack of institutional capacity, particularly at national level, to implement EE programs in the end-use sector
b. Energy efficient technologies, including lighting, is not given due consideration at the fiscal policy level
c. Lax, if any, Minimum Energy Performance for most end-use equipment.
d. Pricing of electricity below costs and poor recovery of electricity bills.

2. Finance Barriers

a. Price sensitivity of the lighting market
b. No financial incentive for manufacturers to invest in energy efficiency
c. Lack of financial incentives and mechanisms to promote EE products in the market
d. Financial misalignment or split incentives: those who make the decision on EE investments are often not the final users who pay the energy bill

3. Business and Management Barriers

a. Manufacturers uncertainty about market demand of high efficiency models
b. Lack of resources amongst small-scale manufacturers for developing and marketing energy efficient products

4. Information Barriers

a. Lack of awareness about residential sector energy end-use, and therefore the energy efficiency potential, amongst consumers as well as the policy makers
b. Lack of information about the precise energy saving potential from energy efficient lighting
c. Lack of information about state-of-the-art energy efficient design and manufacturing of energy efficient lighting system.

5. Technology Barriers

a. Limited access to the state of the art energy efficiency technology among manufacturers
b. Lack of EE driven applied R&D by the manufacturers as well as the government labs and research institutes
c. Lack of adequately equipped and staffed independent test labs for energy efficiency testing of lighting system
d. Limited experience of energy efficiency testing amongst engineers

6. Common Practice Barrier

a. Lack of trust of new equipment
b. Local customs and inertial behavior working to maintain the status quo in the design, selection and operation of energy-using equipment.

4. INTEGRATING THE CDM INTO EFFICIENT LIGHTING PROGRAMS

The CDM cannot overcome all these barriers, but as a financial instrument, the CDM can help meet some of the above financial and other challenges. In addition to the usual energy savings, the CDM provides energy efficiency projects with a new asset (emission reductions) which has market value that can be converted into an additional income flow.

This second source of income is key to the dissemination of efficient lighting because it can help close the financial gap created by the split incentives, whereby those who invest in the lighting system and who want to keep upfront costs low, are frequently not those who will use the system in the long term and would be benefited by efficient systems that have low life cycle costs. Although CERs are the emission reduction equivalent of the energy savings, the income from the sale of CERs need not flow to those who benefit from the energy savings, but rather can be intentionally directed to the cost centers of the project, thus providing the missing financial link. Under the CDM, projects consisting of programs of activities could enable the revenue flows of the CERs to go to the entity which implements the efficiency program in order to defray the costs of the program, while the consumer/end-user is, as usual, benefited by the energy savings. Several concrete examples can illustrate this: *(A)* Projected income from the CERs could be used by the producers of high efficiency bulbs and lighting systems to lower the net cost of production, thus diminishing the cost to distributors, retailers, and consumers. *(B)* The cost incurred by landlords and developers to improve lighting installations could be offset by CERs. *(C)* The steady income flow from the sale of CERs could help fund the incentive scheme for consumers to purchase and install the more efficient equipment. Finally, *(D)* the up-front cost of setting up and running a labeling and testing program or implementing minimum energy performance standards would be covered by front-loading the payment of future CER flows. It is also important to recognize the contribution that CDM can make to a project in terms of hard currency. Experience thus far in carbon finance highlights the fact that financial institutions may be more open to financing CDM operations if at least one income stream is in hard currency, as CERs are paid in US dollars or Euros (CDCF 2004). Thus by bridging the financial disconnect in a few ways, the CDM can help accelerate the implementation of efficient lighting programs in developing countries.

The COP/MOP 1 decision to include "programs of activities" (See Box 2) opens the door to integrating the CDM into energy efficiency activities.

BOX 2. PROGRAMS OF ACTIVITIES UNDER THE CDM

The inclusion of "programs of activities" under the CDM was decided at COP/MOP 1 in November, 2005. At its 27th meeting in November, 2006, the Executive Board of the CDM considered the following components for the definition of a program, with a final decision expected at its next meeting on 12-15 December 2006:

- ***Multiple sites:*** The program involves several project activities within a country or several countries.
- ***Legal nature:*** each individual project activity is voluntary. Mandatory GHG-mitigation options implemented by each project activity may be allowed if the policy or standard is not otherwise enforced.
- ***Additionality:*** each project activity has a direct, real and measurable impact on emission reductions.
- ***Traceability:*** each project activity must be identifiable at either the validation or verification stage, including by sound sampling techniques.
- ***Coordinating entity:*** the entity providing the technical or financial assistance can be private or public.
- ***Actors implementing the GHG-reducing activities:*** they are not necessarily the same as the coordinating entity, and they enter into agreements with the coordinating entity in order to prevent double counting.
- ***Project types:*** a program can involve various project types, as long as each project type applies an approved CDM baseline and monitoring methodology.

The following section highlights some of the key methodological issues that need to be addressed by efficient lighting projects from the perspective of the CDM modalities and procedures, and suggests how current EE lighting practices can be used to comply with the CDM methodological requirements.

5. METHODOLOGICAL ISSUES FOR ASSESSING EFFICIENT LIGHTING PROJECTS UNDER THE CDM

At the core of the CDM modalities and procedures is the accurate quantification of emission reductions. Since in energy efficiency projects emission reductions are essentially the emission equivalent of energy savings, the CDM can benefit from long established energy efficiency methodologies for quantifying energy savings. Fortunately, "a wide range of evaluation methodologies has been developed and refined over the past 30 years to estimate energy savings with acceptable levels of precision. These evaluation techniques have featured many sophisticated methods to rigorously assess energy efficiency impacts, including quasi-experimental methods where program participants are compared to a comparison group of non-participants, direct measurements of 'before and after' energy use, estimation of 'free riders', utility bill analysis with adjustments for variations in weather and other factors where appropriate, accounting for the persistence of energy savings through measure retention studies and analyses of energy usage over time, and the analysis of program spillover and market transformation. All of these concepts are well established and widely used to estimate the energy savings of energy efficiency programs" (Vine et al. forthcoming).

Under the CDM, a number of project design and eligibility issues need to be addressed/reflected by projects seeking to be registered as programs of activities, as outlined in Box 2. The key methodological issues that need to be addressed by project activities seeking to reduce GHG emissions through improvements in lighting efficiency include (a) project boundary, (b) baseline, (c) additionality, (d) predictability, (e) free riders and positive spillover, (f) rebound effects and suppressed demand, (g) double counting, (h) leakage, and (i) monitoring.

(a) Project boundary

The boundary of an efficient lighting program is the physical location of the targeted replacement or installation activities plus the grid supplying the electricity saved. The locations of the individual activities can be spread over an area, a city, a region or the whole country, depending on the design of the program. In some programs the exact location of the individual lighting activities is known at the outset (e.g. specific public sector buildings or specific municipal lighting systems). In other programs, the geographic coverage of the program is known at the outset, but not the specific location of the individual GHG reducing actions (e.g. a program of incentives to improve public street lighting in a region or country). In these cases, the targeted geographic coverage of the program (city, province or country) is made explicit and is considered fixed for the duration of the crediting period. The exact locations where actual emission reductions occur over time (e.g. cities where outdoor lighting is actually increased from 10 lumens per watt to 20, 50 or 100 lumens per watt) are determined *ex post*.

(b) Baseline

For purposes of the CDM, emission reductions are the difference between a counterfactual baseline emission level and the actual project emissions. The counterfactual baseline scenario is defined at the time of project validation. The calculation of the respective baseline emissions is based on a baseline 'methodology' - either an existing (already approved methodology by the CDM Executive Board[6]), or a new methodology developed specifically for the project (also requiring the approval of the CDM EB).

The lighting sector could include different types of energy efficiency project activities under the CDM; as a result, a single baseline methodology may not cover *all* types of lighting projects. Baseline methodologies for efficient lighting projects could reflect three different

[6] A list and description of all approved CDM methodologies can be found on the UNFCCC website: http://cdm.unfccc.int/methodologies

markets: discretionary retrofit, planned replacement, and new installations (for a full discussion see Arquit Niederberger and Spalding-Fecher, 2006). For discretionary retrofits (premature replacement of existing technology for the primary purpose of improving energy efficiency), the baseline scenario of efficient lighting programs would usually be the existing actual or historical emissions, in the absence of the implementation of the program. The baseline emissions are the emissions associated with the energy use that would have occurred in the absence of the EE project. The baseline energy use is derived as is typically done for energy efficiency projects through an energy audit of existing conditions; it is then multiplied by an emission factor determined with base year electricity use data and characteristics of the power plants supplying the electricity. The baseline of planned replacement projects (spurred by the decision to replace existing technology at the end of its lifetime with high efficiency equipment) and new construction projects (decision to install high-efficiency equipment at the time of construction) must refer to the energy use - and related emissions - that *would* occur without the CDM projects, e.g. referring to cases similar to the CDM project but where the intended EE program has not been performed (i.e. "common practice").

(c) Additionality

"A CDM project is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity" (UNFCCC decision 17/CP.7). The additionality of a CDM project can be demonstrated in any of three ways: (i) economic/financial analysis (the project is not the least cost option/most attractive option); (ii) barrier analysis (without the CDM the project could not be realized due to lack of finance or non availability of technologies or other resources or due to lack of appropriate incentives or information), or (iii) an indication that the project is not common practice in the host country. In the case of discretionary retrofits, the sale of the CERs may be the only source of cash income to the project implementer. As a result, additionality can be demonstrated by the fact that without the CER revenues the entity implementing the program would lack the resources to disseminate the efficient lighting equipment, or to establish the necessary controls to ensure that manufacturers are complying with the standards and labeling requirements.[7] In the case of planned replacement or new construction, the demonstration of additionality must again be seen from the perspective of those who fund and implement the program. While efficient lighting is the least cost option from the perspective of the eventual energy bill payer, it is clearly not the least cost option from the perspective of the builders/developers and landlords who take the decision on the investment.

(d) Predictability of emission reductions

An issue that is often raised in the context of most energy efficiency projects is how well *ex-ante* estimates of energy savings compare with the *ex-post* measurement of the achieved savings. In the case of CDM efficient lighting projects, the issue is the required comparison of the expected emission reductions (forecasted prior to the installation of the efficient lighting equipment and typically based on engineering calculations) to the actual achieved reductions (based on post-implementation monitoring and verification). Once again, the efficiency industry has addressed this. "Energy savings projections now are much more accurate than they used to be, because we have decades of data from experience in the field. Also, with improvements in program design over the years, especially toward increasing market transformation and "spillover" effects, it is not at all uncommon for programs now to have realization rates[8] in excess of 100%" (Vine et al, forthcoming). It remains to be seen how dependable energy saving projections turn out to be in the context of the CDM, but in any event, it is important to underscore that CERs are issued only after emission reductions have been actually verified (*ex-post*), and are thus independent of projections.

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[7] This reflects the reality of most developing nations that are just introducing EE measures. In countries that are already on the verge of market transformation such as China, the demonstration of additionality may need to take into account expected trends and barriers to further market penetration.

[8] The realization rate is calculated as the *ex-post* estimate of net savings divided by the *ex-ante* estimate of net savings. Net savings refer to the program impacts over-and-above naturally occurring energy efficiency.

(e) Free riders and positive spill over[9]

For certain programs, it is possible that some of the individual actions implemented might not be additional even if the program is demonstrated to be additional. These individual actions are considered "free riders". The energy efficiency industry has for a long time evaluated free riders, either explicitly or implicitly (Wiel and McMahon 2005). Explicit evaluations can be made using a control group, econometric methods, participant surveys, review of documents in business decision processes, payback comparisons, and engineering modeling. Implicit evaluations are often made comparing the target users' behavior to that in other regions or in other countries where there are similar baseline conditions and no program in place (Wiel and McMahon 2005). Not all of the approaches are suitable for a given program, and the approaches differ with respect to their cost and the accuracy of their estimates. A program of activities needs to specify the proposed approach used to estimate the emission reductions attributed to free riders as part of the proposed baseline and monitoring methodology. All other emission reductions would be deemed additional.

Independently of how free riders are measured, in many efficiency projects free riders are more than offset by positive project spillover, i.e. additional energy efficiency impacts that result from the project, but are viewed as indirect rather than direct impacts. In these projects, actual reductions in energy use are greater than those strictly attributed to the project activity (Vine and Sathaye 1999, Quality Tonnes 2005). In efficient lighting programs, positive spillover effects can occur through a variety of channels including: an individual hearing about the benefits of the efficient equipment and deciding to purchase it on his/her own ("free drivers"); or program participants that, based on positive experience with the equipment, exchange additional equipment beyond the maximum allotted per user by the program, or continue to purchase and use equipment with higher efficiency after the program's end. Spillover is an unintended but welcome consequence of energy efficiency programs, and could make free riders a non issue.

[9] For a more elaborate definition of these concepts, see, for example IEA 2003 (p. 160).

(f) Rebound effect and suppressed demand

The rebound effect refers to the increase in the demand for energy services (heating, refrigeration, lighting, etc.) when the cost of the service declines as a result of technical improvements in energy efficiency. The argument is that because of the lower cost, consumers and businesses change their behavior, e.g. raise thermostat levels in the winter; cool their buildings more in the summer; buy more appliances and/or operate them more frequently, thus eroding the savings from energy efficiency. There is a large body of literature suggesting that the rebound effect is indeed real in many situations and that it varies among countries and socioeconomic income levels, but that it does not usually wipe out projected savings. Empirical evidence suggests that the size of the rebound effect is small to moderate, with the exact magnitude dependent on the location, sector of the economy, and end-use. The rebound effect for residential lighting in industrialized countries has been shown to vary between 5-12%, while that for commercial lighting varies between 0-2% (IEA 2005:6). In efficient lighting CDM projects the energy savings of lighting projects could be adjusted for the level of rebound effect (e.g. through an agreed default discount factor that could be the midpoint of the various estimates), thereby avoiding the cost of measuring the rebound in each individual project.

However, in the case of many developing countries, it is important to recognize that any rebound effect resulting from projects improving energy efficiency is often linked to situations of suppressed demand due to insufficient supply. At a December 2005 World Bank-organized expert workshop discussing CDM methodologies and issues associated with energy efficiency, it was largely felt that "since CDM is promoting sustainable development, meeting suppressed demand through an energy efficiency project activity should not be penalized." (Quality Tonnes 2005). This would be consistent with the CDM modalities and procedures which stipulate that "the baseline may include a scenario where future anthropogenic emissions by sources are projected to rise above current levels…" (Para

46 of the CDM modalities and procedures[10]), as well as the treatment of suppressed demand in the context of CDM methodologies for power generation projects using renewable energy (see Approved Consolidated Methodology ACM002[11] and Report of the 22nd meeting of the CDM Executive Board, Annex 2) where the activity level in the project scenario is used to determine the activity level in the baseline scenario.

(g) Double counting

Under the CDM, double counting of emission reductions must be avoided. Efficient lighting programs involve various stakeholder groups, all of which in theory could claim ownership of the energy savings and the associated CERs: the manufacturers of the technology, the intermediaries (wholesalers, retailers, utilities, etc.) the consumers (who may or may not pay the lighting energy bill), the entity that manages the financing, etc. However, double counting can be avoided by stipulating that the entity running the program is the only one authorized to claim CERs for the program, in order to defray the costs of running the program. The other potential claimants would have to cede their claims to this entity in a separate agreement or in the agreement regarding the distribution of CERs. The avoidance of double counting must be checked by a Designated Operational Entity (i.e. the entity designated to validate proposed CDM project activities as well as to verify and certify emission reductions). In the case of two programs that overlap geographically, the first program to be registered must delineate its boundary. Any subsequent program wanting to claim credit for its actions within that boundary, must prove that it is additional and different to the first project, and does not claim ERs that occur due to the first program.

(h) Leakage

Leakage is the net change of GHG emissions outside the CDM project boundary that is measurable and attributable to the CDM project activity. A CDM project activity must estimate the associated leakage, and if it occurs, deduct the net leakage from the emission reductions achieved within the project boundary. In efficient lighting programs, any leakage would mostly come from the unauthorized recycling of still functioning lighting equipment that has been displaced by the more efficient equipment. Strictly speaking, in order to minimize leakage, efficient lighting programs that replace equipment would likely need to include a monitored scrapping component that ensures that replaced equipment is not used by others[12]. However, from a scarce resources and development point of view, one might question the advisability of destroying functioning equipment in countries where there is evidence of unmet demand and elastic supply.[13] From this perspective the methodological challenge would be to structure the project such that leakage is minimized to ensure GHG reductions as a result of the CDM project activity but lamps are not destroyed. More research might be warranted to better understand substitution effects in a developing country context.

(i) Monitoring and verification

Monitoring and verification are key to ensuring that CERs correspond to actual emission reductions. Emission reductions from single-site projects are rather straight-forward to monitor and verify. Efficient lighting programs that typically involve a large number of activities at different sites over a period of time require a feasible - but still rigorous and effective - approach. For such projects, monitoring can be done through statistically robust sampling techniques. A sampling plan can be used to select the sites to be monitored and to extrapolate the monitored results to the full program with an acceptable level of statistical precision. Sampling is already part of the approved CDM methodologies for some small and large-scale CDM project activities. Depending upon the measures implemented, the energy savings, and hence emission reductions, may be monitored by combinations

[10] Text of the 2001 Marrakech Accords (FCCC/CP/2001/13/Add.1) can be found on the UNFCCC website (www.unfccc.int).

[11] ACM0002 is the "consolidated baseline methodology for grid-connected electricity generation from renewable sources", which can be found on the UNFCCC website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html)

[12] Ensuring safe disposal could address the environmental problem associated with the mercury content of light bulbs and waste material created by the destruction.

[13] On the margin, replaced equipment could replace even less efficient equipment.

of metering and calculations, billing analysis, and/or use of models, as has been credibly done by the ESCO community for years (Vine et al, forthcoming).

The vast experience with EE programs worldwide over the past fifteen years has produced a series of widely accepted monitoring protocols.[14] Since energy savings are easily translated into the equivalent GHG reductions - using CO2 emission factors for the relevant grid or source of power (e.g. see the CDM Approved Consolidated Methodology ACM0002) - these protocols can be effectively incorporated into monitoring methodologies for CDM programs of activities. The International Performance Measurement and Verification Protocol (IPMVP)[15] is perhaps the internationally preferred approach for monitoring and evaluating energy efficiency projects. The Protocol offers four options for calculating energy savings depending on the type of energy conservation measure. While the IPMVP is not detailed enough to serve as a CDM monitoring methodology, it does provide a common conceptual framework and terminology as a basis for the specific CDM methodology that must be developed for each type of EE measure.

6. EXAMPLES OF CDM IN EFFICIENT LIGHTING PROGRAMS

There is currently only one registered CDM project where efficient lighting is being used as a source of CERs. The Kuyasa energy upgrade project[16] focuses on retrofitting existing low-cost urban housing in Cape Town, South Africa with energy efficient installations. The small-scale project has three components: insulated ceilings, solar water heater installation, and energy efficient lighting. In the lighting component, two incandescent lamps are replaced with two CFLs in each participating household, and income from the CERs is used to cover the cost of the replacement. The project uses an approved small scale CDM methodology (i.e. Demand-side energy efficiency programmes for specific technologies AMS-II-C) for the lighting component. The proponents are now considering upscaling this project to include 2 million homes.

At the time of writing, two other efficient lighting projects had been submitted for review: (i) an Efficiency Lighting Retrofit project in Ghana, that intends to replace incandescent lamps with labeled CFLs in 20,000 households, and (ii) the Green Lighting project in Shijiazhuang City, China, that intends to increase the penetration of CFLs by using the CER revenues to lower the purchase price of CFLs. Both of these projects are large-scale, and there is no approved large-scale CDM methodology for efficient lighting. Hence, each of the projects has submitted a proposed new methodology, currently under consideration on the part of the Methodology Panel and the Executive Board of the CDM. If they are approved they will provide helpful guidance on the methodological issues discussed above.

The upcoming guidance will affect the CDM's potential to stimulate GHG reductions through higher energy efficiency in lighting. Given the barriers facing EE lighting and the dispersed nature and often small individual size of the activities to be covered by lighting programs, guidance covering the following elements would likely be most helpful in paving the way for a potential take-off of EE lighting activities in developing countries under the CDM:

- Clear and practical implementation of the COP/MOP1 decision on Programs of Activities;
- Simple (without compromising environmental integrity) and broadly applicable (consolidated or standardized) baseline and monitoring methodologies, which can build on established efficient lighting methodologies and practices.
- Provisions to take into account - and not penalize - situations of suppressed demand for energy services.
- A practical means of addressing potential free-ridership, taking into account the often greater spill-over effect.
- Additionality assessment which takes into account the barriers and market failures

[14] See Hirst and Reed, 1991; Vine and Sathaye, 1999; FEMP, 2000; IPMVP, 1996-2004; ASHRAE, 2002; and TecMarket Works Framework Team, 2004.

[15] http://www.ipmvp.org

[16] See the UNFCCC CDM website: http://cdm.unfccc.int/Projects/DB/DNV-CUK1121165382.34/view.html

facing EE projects and the fact that traditional financial analysis of EE activities may not appropriately address the costs of these barriers and market failures.

7. CONCLUSION

Energy efficiency is one of the most promising sectors for making energy more affordable, improving energy security and reducing emissions in developing countries. End-use energy efficiency accounts for about 50% of energy-related abatement potentials identified in International Energy Agency analyses such as the World Energy Outlook (2004) and the Energy Technology Perspectives (2006). As discussed, the adoption of energy efficient options is not common practice because of well-documented market failures, and largely because they have thus far not received the same attention as renewable energy in government energy policies and in the lending portfolio of the multilateral banking system.

Energy efficient lighting could contribute to the long term objective of stabilizing greenhouse gas concentrations in the atmosphere, particularly if the global lighting market is transformed to high efficiency. The CDM cannot achieve this on its own, but it could jump start some of the programs that lead to the desired market transformation.

In the meantime, the greater complexity of implementing end-user energy efficiency projects, and the uncertainty as to their "fit" under the CDM prior to the inclusion of programs has kept the proportion of energy efficiency projects in the CDM pipeline very low. It is hoped that the new option of "programs of activities" in the CDM will open the door to the implementation of a larger number of end-user energy efficiency projects in developing countries, serving as a learning ground for future energy market transformations.

Established efficient lighting practices can be used in new methodologies that comply with CDM requirements. The development of rigorous evaluation practices and protocols, along with years of experience in assessing the impacts and results of energy efficiency programs, has done much to improve the ability to accurately estimate program impacts on energy use. Experience has shown that the only effective way to accelerate the efficient use of energy is to combine the "push" of minimum performance standards with the "pull" from financial mechanisms. By integrating the CDM into energy efficiency programs, the market value of the CERs can facilitate both the push and the pull.

ANNEX I

OVERVIEW OF RESOURCES FOR THE ASSESSMENT OF EFFICIENT LIGHTING PROJECTS

1- Standards and labeling programs:

Collaborative Labeling and Appliance Standards Program (CLASP) **—** An outgrowth of Lawrence Berkeley National Laboratory and supported by UNDP/GEF, CLASP is an independent global technical non profit institution that promotes efficiency standards and labels worldwide. The CLASP Handbook for Energy Efficient Labels and Standards is the leading guidebook on how to establish labeling and/or standard setting programs. Authored by Stephen Wiel, and James McMahon, *Energy Efficient Labels and Standards: A Guidebook for Appliances, Equipment and Lighting* is published by Collaborative Labeling and Appliance Standards Program, Washington DC, February 2005 and available for download at no cost. It is available in English, Chinese, Korean and Spanish.

Further information: www.clasponline.org

2- Certification of equipment:

Efficient Lighting Initiative (ELI) **—** Facilitated by the International Finance Corporation (IFC) with funding from the GEF, ELI is a voluntary international program that certifies the quality and efficiency of lighting products. It is operated by a non-profit organization, the ELI Quality Certification Institute, whose mission is to provide a transparent mechanism for certifying the quality and efficiency of lighting products sold worldwide. Lighting manufacturers can submit their products to the ELI Quality Certification Institute, and if the products comply with the ELI specifications, they may bear the ELI "Green Leaf" logo. So far the ELI Quality Certification Institute has developed technical specifications for self-ballasted compact fluorescent lamps, double-capped fluorescent lamps, and fluorescent lamp ballasts.

Further information: www.efficientlighting.net

3- Monitoring and verification:

International Performance Measurement and Verification Protocol (IPMVP) **—** The most preferred approach for monitoring and evaluating energy efficiency projects. It is the result of approximately 20,000 hours contributed by over 300 experts worldwide over an eight-year period. North America's energy service companies have adopted the IPMVP as the industry standard approach to measurement and verification. Translated into 10 languages, it is used in over 30 countries as the basis for quantifying, monitoring and verifying energy savings, the ultimate purpose of energy efficiency programs. The IPMVP centers around two components: (1) verifying proper installation and the measure's potential to generate savings; and (2) measuring actual savings. The protocol offers four options for calculating energy savings depending on the type of energy conservation measure.

Further information: www.ipmvp.org

ANNEX II

GLOSSARY OF CDM TERMS USED

(as defined by Methodology Panel and approved by the Executive Board of the CDM)

Baseline: The scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity.

Baseline Methodology: A methodology is an application of a baseline approach, defined in paragraph 48 of the CDM modalities and procedures, to an individual project activity (reflecting aspects such as sector and region).

Certified Emission Reductions (CER): A "certified emission reduction" or "CER" is a unit issued pursuant to Article 12 and requirements there under, as well as the relevant provisions in these modalities and procedures, and is equal to one metric tonne of carbon dioxide equivalent, calculated using global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5 of the Kyoto Protocol.

Designated Operational Entity (DOE): An entity designated by the COP/MOP based on the recommendation by the CDM executive board as qualified to validate proposed CDM project activities as well as verify and certify reductions in anthropogenic emissions by sources of greenhouse gasses. A designated operational entity shall perform validation or verification and certification.

Issuance of Certified Emissions Reductions: Issuance refers to forwarding the CERs to the registry accounts of project participants involved in a project activity.

Leakage: The net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity.

Monitoring methodology: A monitoring methodology refers to the method used by project participants for collection and archiving of all relevant data necessary for the implementation of monitoring plan.

Small scale project activities: There are three types of small scale project activities:

- ***Type I:*** Renewable energy project activities with a maximum output capacity of 15 MW (or an appropriate equivalent);
- ***Type II:*** Energy efficiency improvement project activities, which reduce energy consumption, on the supply and/or demand side, by up to a maximum of 60 GWh per year (or an appropriate equivalent);
- ***Type III:*** Other project activities that result in emission reduction of less than or equal to 60 ktCO2e annually.

Small scale project activities follow simplified modalities and procedures as defined by Decision 21/CP.8.

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www.apec-esis.org International CFL Harmonization Initiative

www.ashrae.org American Society of Heating, Refrigerating and Air-Conditioning Engineers

www.carbonfinance.org Carbon Finance Unit of the World Bank

www.cd4cdm.org Capacity Building for the Clean Development Mechanism

www.clasponline.org Collaborative Labeling and Appliance Standards Program

www1.eere.energy.gov/femp Federal Energy Management Program

www.efficientlighting.net The Efficient Lighting Initiative

www.eu-greenlight.org European Union Green Light

www.gefweb.org Global Environment Facility

www.ipmvp.org International Performance Measurement and Verification Protocol

www.undp.org United Nations Development Programme

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