



# UNIDO and Energy Efficiency



*A low-carbon path for industry*



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION



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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
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# Foreword

Today, we have the technologies and instruments to respond to the global challenge of climate change by addressing simultaneously cost-effective mitigation and sustainable development objectives.

Today, we know that acting now will cost far less than acting later.

We ultimately decide through our behaviour and investment decisions how efficiently energy is generated and used, and how its generation and end-use can impact the global climate.

If industrial development has to become sustainable, more needs to be done by the international community to accelerate the transfer of energy efficient and environmentally sound technologies and know-how to developing countries.

Kandeh K. Yumkella  
Director-General  
UNIDO



# Growing More with Less Energy

## UNIDO's mandate

Industrial development for poverty reduction, inclusive globalization and environmental sustainability is the overarching development objective under which UNIDO delivers on the mandate given by its Member States and contribute to the achievement of the Millennium Development Goals.

UNIDO's activities focus on three thematic areas:

- Poverty reduction: fostering the engagement of men and women into productive industrial activities
- Trade capacity-building: enabling industries in developing countries to produce and trade goods and services that meet national and international industrial standards
- Energy and environment: encouraging the adoption by industries of cleaner, resource-efficient and low-carbon patterns of production and investment

Increasing concerns over climate change, energy supply constraints in the face of growing global demand and volatile energy prices have brought the issues of energy security, productivity and impact on the environment at the forefront of the international political agenda and debate on sustainable development.

UNIDO is a leading provider of services for improved industrial energy efficiency, enhanced use of renewable sources of energy and promotion of cleaner technologies.



# Meeting the Energy and Climate Challenges

## UNIDO's energy strategy

The provision of reliable and affordable energy is a necessary prerequisite for industrial development and greater economic and social prosperity. At the same time, industrial development has to strike a balance between its growing demand for energy and the urgent need to mitigate its impact on the environment and the global climate.

In this context, UNIDO's energy-related activities promote cleaner and efficient use of energy in industry, facilitate productive activities in rural areas by providing modern and renewable forms of energy, and enhance the use of renewable energy for industrial applications.

UNIDO assists developing countries and emerging economies in achieving the following developmental objectives:

- Enhanced access of the poor to modern energy services based on renewables
- Increased competitiveness of industry by reducing its energy intensity
- Reduced industrial carbon emissions by increasing energy efficiency and promoting renewable energy technologies applications
- Increased enterprise viability, particularly in rural areas, through the provision of renewable energy for productive uses



# Energy Efficiency in Industry

## The issue

Energy efficiency in industry contributes to decoupling economic growth and environmental impact while reducing industrial energy intensity and improving competitiveness.

Industry is responsible for more than one third of global primary energy consumption and energy-related carbon dioxide emissions. Industrial energy use is estimated to grow at an annual rate of between 1.8 per cent and 3.1 per cent over the next 25 years. In developing countries, the portion of energy supply (excluding transport) required for industry can be up to 50 per cent. This often creates tension between economic development goals and constrained energy supply.

Still, worldwide, the efficiency with which industry uses its energy is well below the technically feasible and economic optimum. It has been estimated that industry has the technical potential to decrease its energy intensity and emissions by up to 26 per cent and 32 per cent providing a striking 8.0 per cent and 12.4 per cent reduction in total global energy use and CO<sub>2</sub> emissions (IEA).

Improving energy efficiency in industry is one of the most cost-effective measures to help supply-constrained developing and emerging countries meet their increasing energy demand and loosen the link between economic growth and environmental degradation, such as climate change.



# Promoting and Supporting Industrial Energy Efficiency

## UNIDO's services

UNIDO adopts a comprehensive approach to promoting and supporting continuous improvement of industrial energy efficiency in developing countries and emerging economies.

The Organization currently offers the following services:

### Policy support

- Expert advice to policymakers in developing and formulating policies and programmes aimed at supporting energy efficiency and increased energy productivity in industry.
- Technical assistance to develop policy and regulatory frameworks promoting and supporting adoption of energy management standards by industry.
- Facilitation of collaboration agreements between public authorities and industrial sectors in the field of energy efficient technologies and best energy management practices.

### Capacity-building and technology transfer

- Institutional capacity-building on development, implementation and monitoring of industrial energy efficiency policies and programmes, including energy management standards.
- Tailor-made intensive training programmes on industrial energy systems optimization (motor, pump, steam, compressed air systems, etc.).
- Intensive training programmes on the use and implementation of energy management standards.
- Project-specific technical assistance to industrial enterprises for demonstration and transfer of state-of-the-art energy systems and energy management technologies.

### Global Forum

- Organization of and participation in international and regional events targeted at decision makers (government and industry) and institutions to raise awareness and disseminate information about industrial energy efficiency and energy management standards.
- Organization of experts group meetings that discuss best practices as well as contribute inputs to the ongoing international debate on and developments related to industrial energy efficiency technologies.



# Continuous Improvement of Industrial Energy Efficiency

## UNIDO's focus areas

The UNIDO Industrial Energy Efficiency programme builds on more than three decades of experience and unique expertise in the field of sustainable industrial development. Combining the provision of policy development support services and capacity-building for all market players, UNIDO aims at removing the key barriers to continuous improvement of energy efficiency in industries and ultimately transforming the market for industrial energy efficiency.

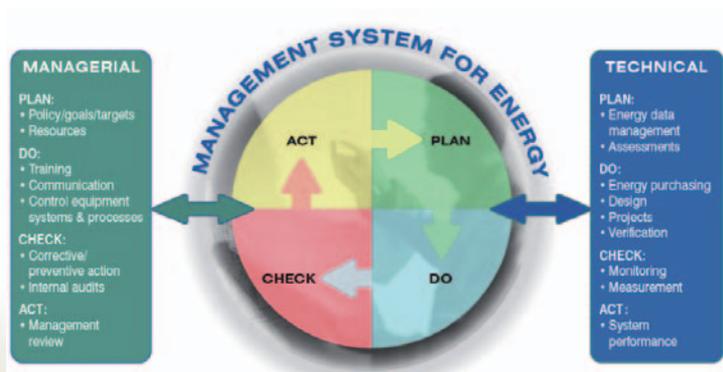
The UNIDO IEE Programme hinges on two core concepts:

### Energy system optimization



Industrial motor-driven pumps system

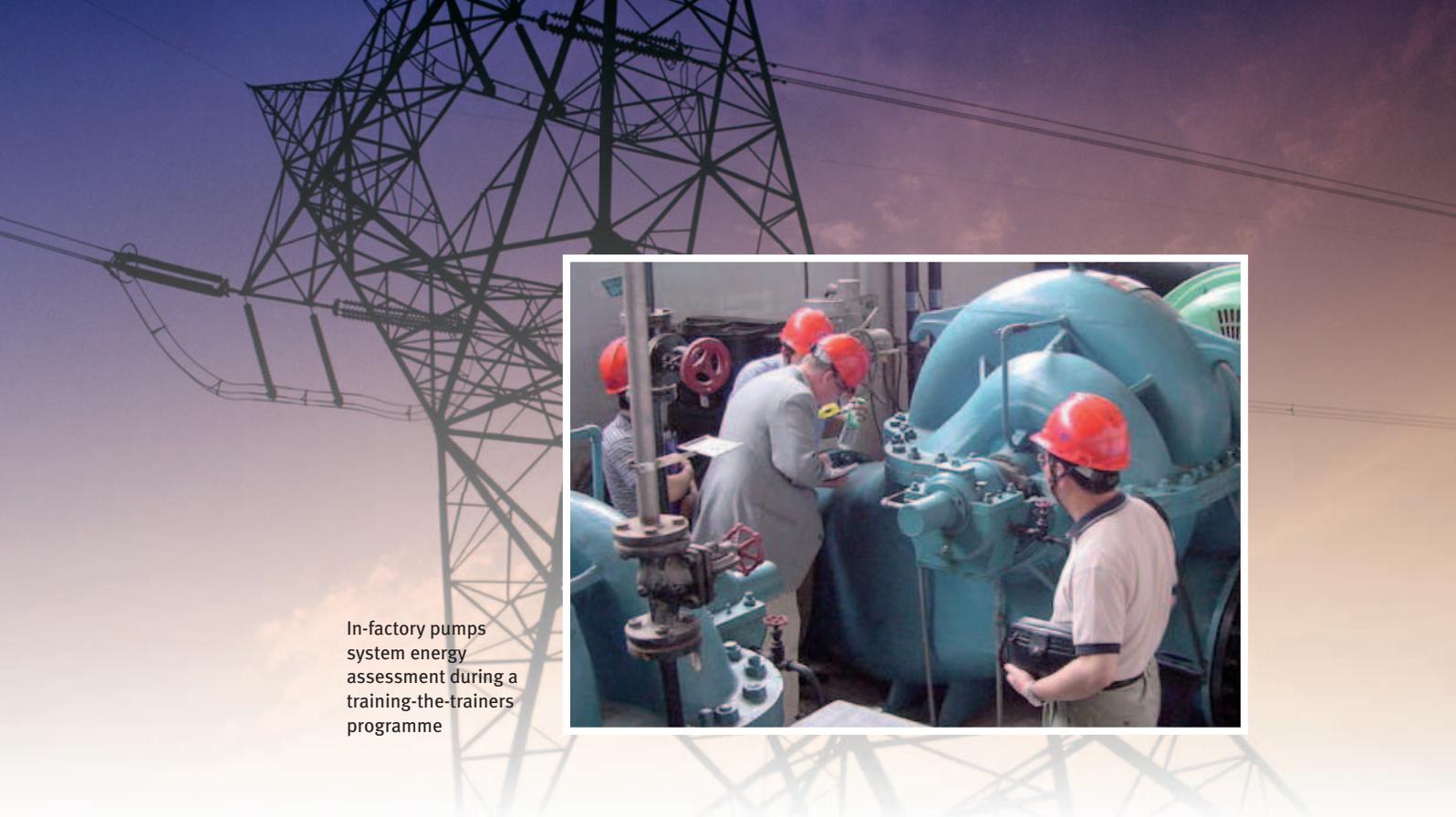
### Energy management standards



Energy management standards incorporate both management and technical aspects of energy management. Source: ANSI MSE 2000.

UNIDO's focus on system optimization and energy management standards aims to fully and sustainably deploy industry potential for reduced energy intensity, costs and GHG emissions.





In-factory pumps  
system energy  
assessment during a  
training-the-trainers  
programme



## Industrial Energy System Optimization

UNIDO's focus on system optimization in industry aims to go beyond the simple energy-efficient equipment approach to energy efficiency that is currently prevailing among policymakers and in the market.

Energy use in industry is much more related to operational practices than in the commercial and residential sectors. If energy efficient lighting or appliances are installed in a commercial or residential building, those devices supply the same level of service at a reduced energy use without any further intervention from the user. Benefits will accrue for the life of the appliances unless extraordinary measures are taken to negate them.

By way of contrast, an industrial facility may change production volumes or schedules and/or the type of product manufactured many times during the useful life of the factory. The energy-using systems designed to support these production patterns may be relatively energy efficient under the initial production design conditions but become typically significantly less so as production patterns change.

The presence of energy-efficient components in industrial systems, while important, provides no assurance that energy savings will be attained if the system of which the components are part is not properly designed and operated. Evidence from implemented national and international programmes shows that, while efficient components may bring about gains in the range of 2 to 5 per cent, systems optimization measures can attain average efficiency gains of 20 to 30 per cent with a payback period of less than two years.

The UNIDO's training-the-trainers programme aims at equipping local industry and energy efficiency experts with the expertise, methodologies and tools required to develop and implement energy system optimization projects and practices.



# Energy Management Standards

Energy Management Standards constitute a demonstrated effective policy tool and market-based mechanism to bring about sustainable energy efficiency in industry.

National and international experiences have shown that even when cost-effective energy efficiency projects are identified by plant engineers they frequently experience difficulty in getting implemented. This is primarily a consequence of the top management focus on production rather than energy efficiency and the existence of a budgetary disconnect between capital projects and operating expenses. Experience has also shown that the sustainability of energy efficient practices is a challenge in industry: most optimized systems lose their initial efficiency gains over time due to personnel and production changes.

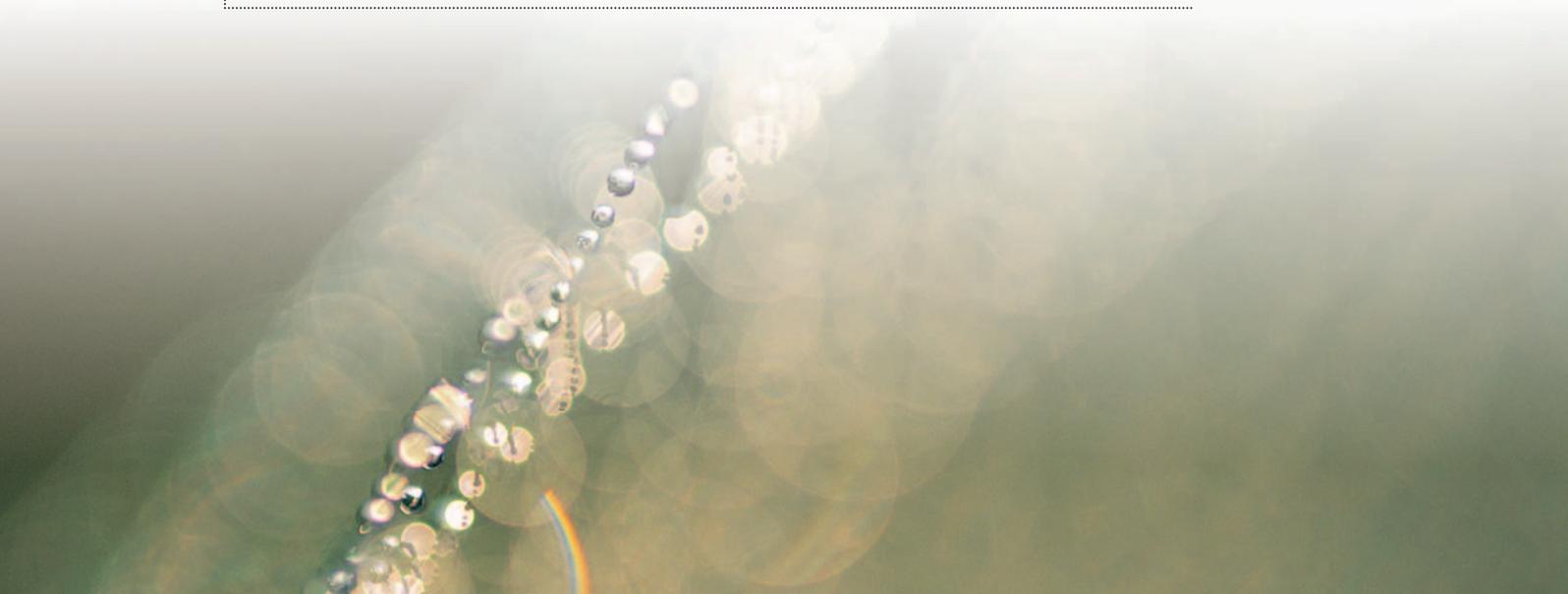
The same factors that make it so challenging to achieve and sustain energy efficiency in industrial energy systems (complexity, frequent operating changes) apply to the production processes that they support.

Using the well-known “plan-do-check-act” approach of worldwide adopted management system standards for quality and environment such as ISO 9001 and ISO14001, energy management standards provide structured and comprehensive guidance, primarily to industrial facilities, on how to integrate energy efficiency and system optimization into their daily management. Energy management standards establish closer linkage between business practices for the management of energy and core industry values of cost reduction, increased productivity, environmental compliance and global competitiveness.

The UNIDO IEE programme assists developing countries and emerging economies by providing policymaking technical assistance, institutional capacity-building and market transformation support instrumental to the adoption and implementation in industry of energy management standards.

## UNIDO and the International Management System Standard for Energy ISO 50001

Since 2007 UNIDO has been active in promoting and supporting the development of an international management system standard for energy through awareness-raising initiatives and experts meetings. Since February 2008, when the International Organization for Standardization (ISO) established Project Committee 242 – Energy Management, UNIDO has been supporting the development process of ISO 50001 providing technical inputs in drafting the new standard and facilitating the participation of developing and emerging countries in the process through industrial surveys and regional workshops. UNIDO has the status of organization-in-liaison with ISO Project Committee 242.



# Hydrogen Technology

In recent years hydrogen has come to the foreground of the international debate on sustainable development and climate change. Hydrogen represents a potentially important part of the comprehensive and balanced technology portfolio that any nation will need in order to address two most critical energy challenges associated with future global development and economic growth: reducing carbon dioxide and other greenhouse gas emissions, and lessening dependence on depleting and price-volatile fossil fuels.

Hydrogen is an energy carrier that can be produced from a number of primary sources including renewable ones that are abundant and locally available almost everywhere. Hydrogen can then be utilized for numerous applications. It can be used instead of fossil fuels for surface and air transportation, for heat production, and for production of electricity, directly in fuel cells or indirectly through gas and steam turbine-driven generators.

UNIDO promotes and supports the widespread development and adoption of hydrogen technologies in developing countries and economies in transition. From an industrial development perspective fuel cells are of particular interest since they can replace internal combustion engines and turbines as the primary way to convert chemical energy into kinetic or electrical energy. The cells are much more efficient than internal combustion engines and produce no harmful emissions.

## UNIDO International Centre for Hydrogen Energy Technologies

The International Centre for Hydrogen Energy Technologies (ICHET) is a UNIDO project with the mission of demonstrating viable implementations of hydrogen energy technologies and facilitating their widespread use in developing countries. The Centre pursues its objectives by providing a comprehensive set of services that include:

- Technical and financial support to the development and implementation of hydrogen energy systems demonstration projects
- Applied R&D for developing countries
- Training and education programmes
- Conferences and workshops

For more information please visit the website: [www.unido-ichet.org](http://www.unido-ichet.org)





## Energy Policy and Partnerships

National and international experiences have shown the primary importance of good energy policies in setting the framework for the achievement of sustainable energy development and climate change mitigation goals, and ensuring their sustainability. Depending on the context and objectives of its clients, drawing on a wide range of internationally demonstrated best practices, UNIDO provides advisory tailored services and technical assistance for the design of policies and relevant implementation mechanisms aimed to promote and support energy efficiency in industry, technology transfer and the transformation of the market for industrial energy efficiency products and services. The Organization benefits from a unique combination of access to high-level decision makers and an extensive international network that ensures on-the-ground deployment of solutions. Both dimensions complement and reinforce each other.

The formulation of efficient, effective and successful industrial energy efficiency policies requires the availability of good quality energy data. Such data are the basis for realistic targets, reliable cost-benefit analysis, the prioritization of interventions and the shaping of supporting programmes. Recognizing the deficiencies of many developing and emerging countries with respect to energy data for industry, a core component of the UNIDO energy programme focuses on assisting countries in the collection of better energy data for decision-making. This includes the development of tools and methodologies and their actual application: energy surveys, energy audits, benchmarking and energy performance indicators are some of the approaches that have been successfully applied.

Partnerships are essential to the development and implementation of successful energy policies. This includes partnerships between industry and government, but also international cooperation. Partnerships can create enabling conditions for stakeholders to formulate and pursue common strategies and objectives, and they can accelerate technology development. UNIDO is a honest broker that has had a proven track record in this field for four decades. The Organization helps developing countries and transition economies to access carbon markets and other financing mechanisms, and it helps donors in identifying opportunities to realize their international industrial development targets.





UNIDO is an active member of UN-Energy, the coordinating body for energy work within the United Nations system. Mr. Kandeh K. Yumkella, UNIDO's Director-General, is the current Chairman of UN-Energy.

In line with the outcomes of the United Nations Climate Change Conference in Bali in 2007, UNIDO, together with UN-DESA, acts as a co-convenor on technology transfer.

UNIDO works closely with the United Nations Environment Programme (UNEP) on promoting renewables and clean energy technologies, in particular through their joint network of National Cleaner Production Centres.

UNIDO is also partner of the Global Bioenergy Partnership and it is a member of the Governing Board of the Renewable Energy and Energy Efficiency Partnership (REEEP). UNIDO works with REEEP both at the technical cooperation and Global Forum level.



# Contributing to the Global Debate on Energy and Climate Change

## UNIDO's focus areas

UNIDO plays a leading role within UN-Energy, the interagency mechanism aimed at coordinating actions and policies on energy within the United Nations system. Since January 2008 UNIDO Director-General Kandeh K. Yumkella has been chairman of UN-Energy. Under his leadership the dynamism of the group has increased further and member organization participation has reached a higher level of engagement. Energy-related issues are gaining growing importance in the climate change agenda, and UNIDO's leadership provides decisive input to the current global debate.

Within UN Energy UNIDO has also been appointed as co-leader of the Energy Efficiency Thematic Cluster, one of the three themes, energy access and renewable energy being the other two, into which the work of UN-Energy has been divided to ensure a focused and comprehensive approach on the complex energy issues dominating the international arena. In this framework, UNIDO steers the debate on energy efficiency, with special reference to industrial energy efficiency.

To ensure continuing collaboration and exchange of information, views and knowledge, UN-Energy conducts regular meetings and video/telephone conferences among its members and collaborating international organizations and institutions. UN-Energy also organizes side events and seminars at key international events and conferences, such as United Nations General Assembly debates and the UNFCCC climate change conferences of the parties.

Presentations and reports relevant to the work of UN-Energy in the areas of energy efficiency are regularly posted at the UN-Energy website at <http://esa.un.org/un-energy/> and at the UNIDO Energy Efficiency web page, [www.unido.org/index.php?id=7505](http://www.unido.org/index.php?id=7505).

### About UN Energy

UN-Energy was established in 2004 to help ensure coherence in the United Nations system's multidisciplinary response to the World Summit on Sustainable Development (WSSD) and to ensure the effective engagement of non-United Nations stakeholders in implementing WSSD energy-related decisions. It aims to promote system-wide collaboration in the area of energy with a coherent and consistent approach, since there is no single entity in the United Nations system that has primary responsibility for energy.

The group focuses on substantive and collaborative actions both in regard to policy development in the energy area and its implementation as well as maintaining an overview of major ongoing initiatives within the system based on the UN-Energy work programme at global, regional, subregional and national levels



# Sharing Experiences and Information

UNIDO uses its convening power to organize global events to provide platforms for decision makers from the public and the private sectors, experts and stakeholders at large to get together to share experiences, lessons learned, best practices and openly exchange and discuss ideas on the issues that are shaping the global energy agenda. Outreach and advocacy initiatives of UNIDO are aimed at reinforcing its technical cooperation work while fostering actions and international partnerships, especially with regard to technology transfer.

The following are examples of industrial energy efficiency related events organized by UNIDO in 2008.

## UNFCCC COP14/MOP4, 1-12 December 2008, Poznan, Poland

Side event: Energy Efficiency in the Post-2012 Framework: Key Issues and Challenges

This High-Level Roundtable discussion was co-organized by UNIDO in the framework of UN-Energy. The event challenged representatives of UN-Energy agencies, Parties and experts to openly discuss the pros and cons of a focus on energy efficiency in the Bali Action Plan mitigation negotiations—in terms of implications for both a successful outcome to COP15 as well as for avoiding the worsening of climate change impacts.

The event aimed to continue and further substantiate the dialogue on the global potential for energy efficiency and its role in climate change mitigation, sustainable economic growth and development, energy security and energy access.

The side event provided an opportunity to focus on some specific issues that have been addressed in the post-Bali negotiation process, such as sectoral approaches, and discuss development of industrial sector energy efficiency approaches to climate change mitigation in a post-2012 framework, creating momentum on the way to COP15 in Copenhagen and the energy transformation path beyond.



## Towards an International Energy Management System Standard, 9-11 April 2008, China

This international working group meeting jointly organized by UNIDO and the Standardization Administration of China (SAC) brought together 58 participants representing energy management organizations, standards-making authorities, including the ISO Central Secretariat, and experts in industrial energy efficiency and energy management from 14 countries. The meeting discussed the development and implementation of the new standard, engaging in preliminary harmonization work of existing and proposed national energy management system standards. Participants presented the views and context of industry and standard authorities in developing countries and emerging economies.

The key output of the meeting was “Framework for Action”, a document presenting major themes that were analysed and discussed during the meeting in a series of breakout sessions. Framework for Action was produced as contribution to the preparatory work of the new ISO 50001 standard.



# Selected projects

The following projects are examples of UNIDO's work in the field of industrial energy efficiency and energy management standards.

## Support to the development of an International Energy Management Standard for Industry

Location: Global

Project description:

The project aims at supporting the development process of the international Management System Standard for Energy ISO 50001 by raising awareness and ensuring that the issues and perspectives of industry, government policymakers and other concerned stakeholders in developing countries and emerging economies are taken into consideration during the development of the standard. To that end, UNIDO has organized regional and international meetings targeted to prospective standard users, policymaking and standards institutions and experts to obtain inputs. Surveys on energy management practices in industry have been also carried out in selected emerging countries.

Project achievements:

The project has contributed significant preparatory work to the development of ISO 50001. UNIDO's work paved the way to the accelerated development schedule adopted by the ISO project committee 242 (ISO/PC 242) that is developing ISO 50001. Most of the findings of the meetings organized by UNIDO were incorporated and reflected in the first working draft of ISO 50001. As of October 2008, UNIDO's meetings and awareness-raising initiatives reached delegates and experts from more than 30 developing countries and emerging economies. While it is too premature to assess the full impact of UNIDO's work to enhance understanding of energy management standards in industry, it can be noted that many developing/emerging countries standards authorities that participated to UNIDO meetings are now either members or observers of ISO/PC 242. Several of them are prepared to collaborate in the execution of the UNIDO Survey.



## China Motor-Systems Energy Conservation Programme

Location: China

### Project description:

The developmental objective of the project was to assist the Chinese Government in controlling the growth of greenhouse gas emissions by establishing a national programme to promote motor system improvements in factories throughout the country.

The project aimed to demonstrate a methodology for establishing and training a network of motor-system optimization experts and identify suitable business models for the scaling-up phase of the programme at the national level.

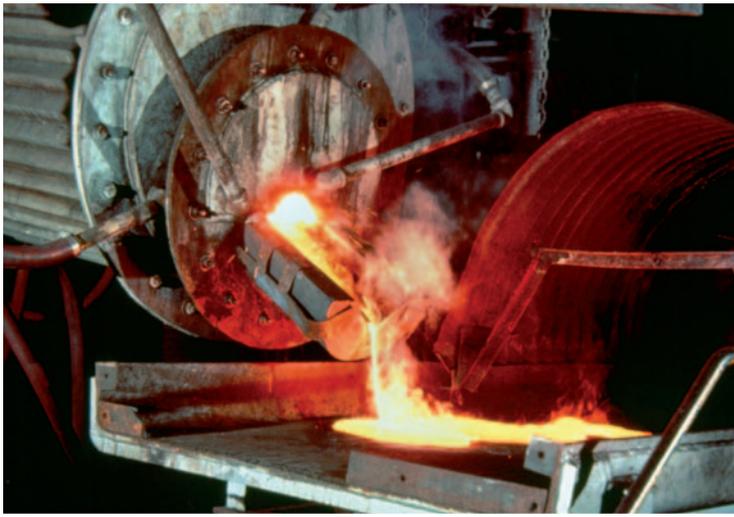
### Project achievements:

The China Motor-Systems Energy Conservation Programme has been successful in providing a strong foundation for building a national motor systems programme in China. The programme demonstrated an effective strategy of technology transfer in which Chinese motor system experts and factory enterprise personnel are trained by international experts and enabled to provide training and assessment services to factory enterprises in China. The UNIDO program trained 22 engineers in system optimization techniques in Jiangsu and Shanghai provinces. Within two years of completing training, these local experts trained more than 1,000 factory personnel, conducted 38 industrial plant assessments and identified nearly 40 million kWh in energy savings.



Energy assessment exercise in Chinese enterprises led by international energy system optimization experts





## UNIDO and the GEF

UNIDO is one of the 10 implementing agencies of the Global Environment Facility (GEF). The GEF is currently the main funding source of the UNIDO Industrial Energy Efficiency (IEE) Programme.

As of March 2009 the UNIDO-GEF IEE projects portfolio consists of nine approved country projects with a total budget allocation of about \$US 120 million over the next five years. Additional projects are either being or going to be developed over the next two years.

The ultimate and overarching objective of all UNIDO-GEF IEE projects is the reduction of global greenhouse gas emissions and consequent environmental impact through improved and sustainable energy efficiency of the industrial sectors.

### About the Global Environment Facility

The Global Environment Facility (GEF) is a global partnership among 178 countries, international institutions, non-governmental organizations (NGOs), and the private sector to address global environmental issues while supporting national sustainable development initiatives. It provides grants for projects related to six focal areas: biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants.

GEF is an independent financial entity. Its projects and programmes are implemented through the following ten agencies: the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the World Bank, the Food and Agriculture Organization (FAO), the Inter-American Development Bank (IaDB), the United Nations Industrial Development Organization (UNIDO), the Asian Development Bank (ADB), the African Development Bank (AfDB), the European Bank for Reconstruction and Development (EBRD), and the International Fund for Agricultural Development (IFAD).

Projects seek to address key existing barriers to industrial energy efficiency through the introduction of IEE supporting policy measures and the adoption and implementation in industry of energy management standards and energy system optimization.





These immediate objectives are pursued by each project through an integrated context specific approach that combines provision of technical assistance at the policy and regulatory level, institutional and industry capacity-building, and support services for industrial energy efficiency market transformation. The impact and cost-effectiveness of these country projects is further leveraged through and by the UNIDO IEE programme approach.



## Example of typical UNIDO GEF Industrial Energy Efficiency country project

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<b>Project objective:</b>	To reduce global greenhouse gas emissions through improved energy efficiency in industry and the transformation of the market for industrial energy efficiency products and services.
<b>Project components:</b>	
Policy support	Development and formulation of policies, regulation and programmes aimed to support: <ul style="list-style-type: none"> <li>• Adoption of energy management standards</li> <li>• Stimulation of market demand for energy efficiency goods and services</li> <li>• Sustainable industrial energy efficiency</li> </ul>
Capacity-building	Development and delivery of intensive technical training programme for energy efficiency, including energy management and systems optimization, in industry, and for the supply chain to support investments in energy efficient technologies and operation. <p>Development and provision of tools and methodologies to assist industry in developing and implementing energy system optimization projects and energy management as well as local experts in offering technical related services.</p>
Pilot IEE projects	Demonstration systems optimization and energy management projects in selected factories participating in the project.
Financing	Development and establishment of dedicated financing mechanism for energy efficiency investments



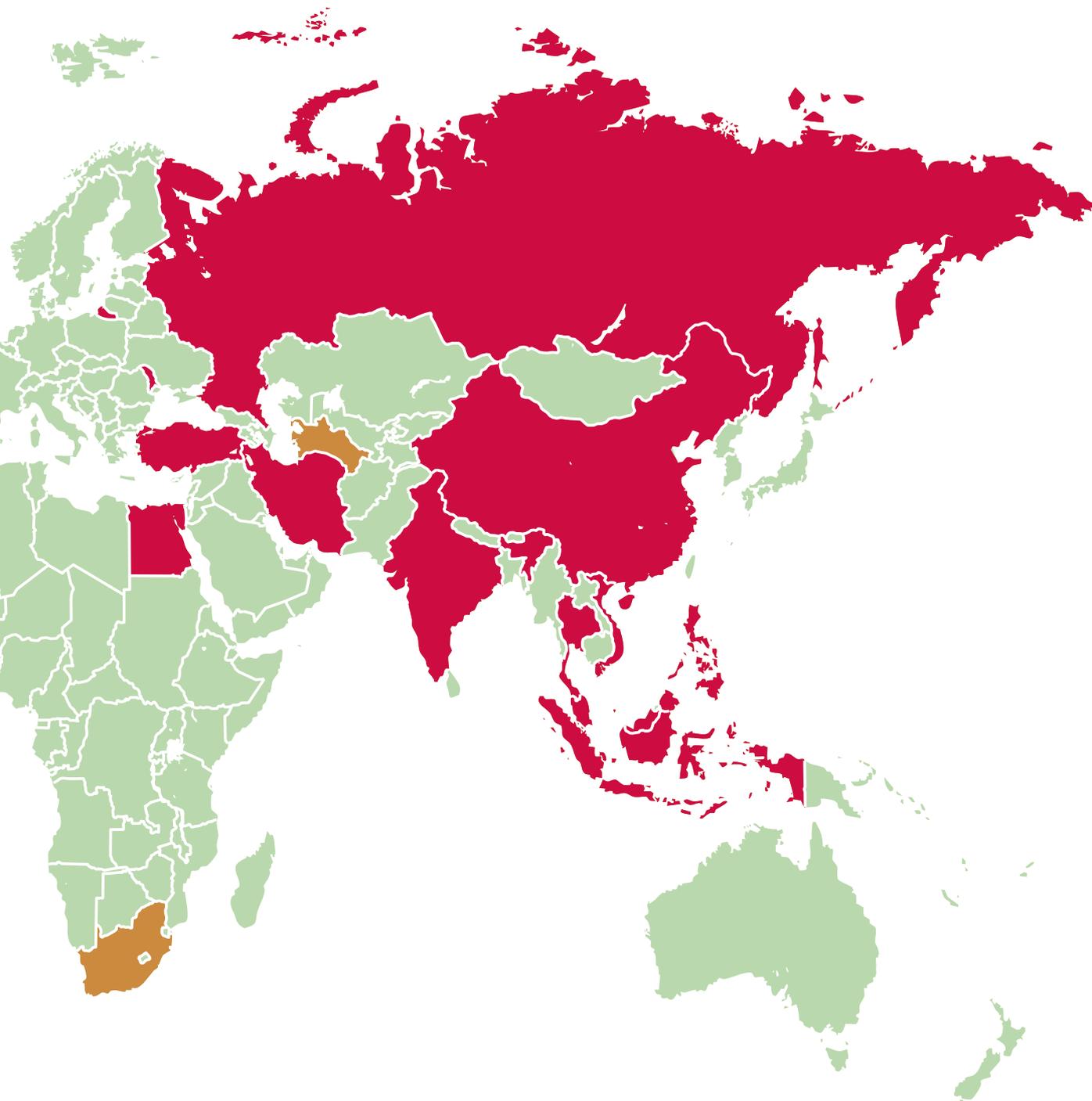
## List of countries covered by Energy Efficiency projects:

- Brazil\*
- Dominica
- Ecuador\*
- Indonesia\*
- Malaysia\*
- Philippines\*
- Russian Federation\*
- Republic of Moldova\*
- Egypt\*
- South Africa
- China\*
- Iran (Islamic Republic of)\*
- Grenada
- St. Kitts and Nevis
- India\*
- St. Lucia
- Thailand\*
- Turkey\*
- Turkmenistan
- Viet Nam\*

\* GEF projects



# Policy and Climate Change projects









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