

# GLOBAL PROMOTION AND IMPLEMENTATION OF CHEMICAL LEASING BUSINESS MODELS IN INDUSTRY

10  
YEARS

OUTLOOK





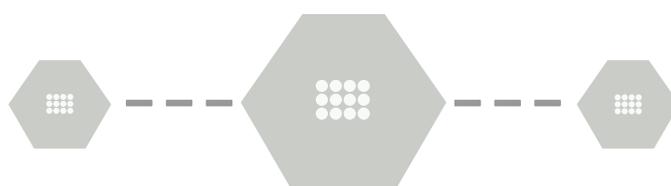
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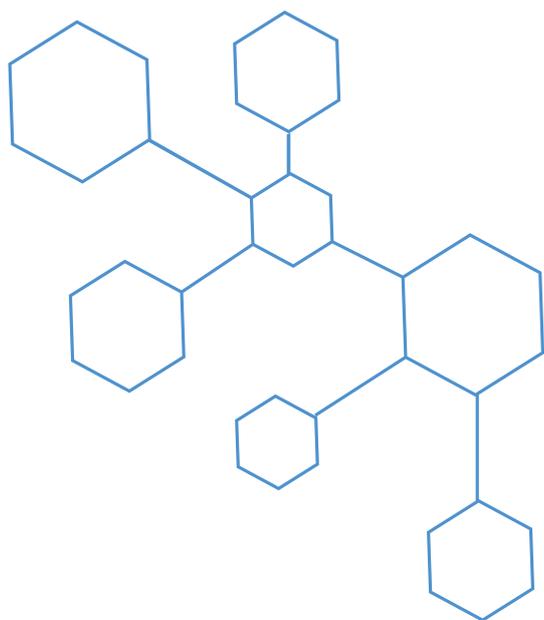
United Nations Industrial Development Organization (UNIDO) has been pioneering Chemical Leasing in developing and transition economies since 2004, with the direct financial support of the governments of Austria, Germany and Switzerland.

This report was prepared by Petra Schwager, Coordinator, and Nils Decker, Deputy Coordinator of the Global Chemical Leasing Programme, UNIDO, Environment Department. It was developed and refined through a participatory and iterative process. In assembling the various materials and inputs, UNIDO enjoyed the support of a vast collection of technical experts, policy-makers and writers.

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## PREFACE

“The 10th anniversary of UNIDO’s Global Chemical Leasing Programme is testament to the durability of partnerships based on shared values and goals. In 2004, UNIDO and the Austrian Ministry of Environment joined hands to promote and take advantage of a new business model for the sound management of chemicals – Chemical Leasing. Ten years later, with the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, and the Swiss State Secretariat for Economic Affairs coming on board as donors, Chemical Leasing is continuing to revolutionize the way we do business with chemicals, and address the urgent need to reduce the impact of chemicals production and consumption on the environment, water and human health.

UNIDO’s Global Chemical Leasing Programme was established to support enterprises in their efforts to enhance resource efficient and cleaner production, handle chemicals safely and establish sustainable business practices. It is based on comprehensive research that closes a substantial gap in knowledge of sound chemicals management. The initiative is fully in line with UNIDO’s mandate to promote inclusive and sustainable industrialization at the global level and contributes to the achievement of Sustainable Development Goal 9 and all the other goals adopted by the 2030 Agenda for Sustainable Development. Chemical Leasing aims to contribute to the implementation of the Strategic Approach to International Chemicals Management and to address the environmental, economic and social challenges facing the world.

This report provides insights into the Programme’s achievements and analyzes the challenges, potentials and opportunities of Chemical Leasing along the entire chemicals value chain in industry, services and agriculture. It comprises three parts: Chapter 1 outlines the Chemical Leasing Essentials, the basic concepts, key background information and its linkages to important global and regional policy initiatives and

frameworks, such as the Circular Economy and REACH. Chapter 2 guides the reader through the past 10 years of UNIDO’s Global Chemical Leasing Programme, from the first trials to regional up-scaling and global promotion. It also highlights distinctive features, for example the successful launch of the Global Chemical Leasing Award, sector-specific initiatives and tools developed. In an era of fast changing global agro-industrial markets, the “Chemical Leasing Goes Agro” initiative connects with innovation processes in sustainable agribusiness practices. Chapter 3 describes the Programme’s outlook, its vision, strategies and objectives, and the way forward to convert plans into action.

I hope that the 10 Years Report enjoys a wide readership and I am thankful to the project partners and all contributors for their dedication and support.”



A handwritten signature in black ink, consisting of stylized Chinese characters, positioned below the portrait.

LI Yong  
DIRECTOR GENERAL

# I. CHEMICAL LEASING ESSENTIALS

## 1.1 Context

*Chemicals have increasingly become part of the structure of our everyday life, constituting the materials used to build the cities we live in, manufacture the products we use, and grow the food we eat. In this sense, the production of chemicals and the development of chemical industries have also come to represent a marker of industrial and economic growth.*

Globally, the value of the chemicals industry has increased from 171 billion dollars in the year 1970 to over 4 trillion dollars in 2014. The chemicals industry thereby accounts for over 7 per cent of global income and 9 per cent of international trade volume. Accompanying this growth rate is a geographic shift of emphasis towards the global East and South. Of the top 30 largest chemicals producers, twelve are located in Asia, with Asian sales totalling 49.6 per cent of total global sales. It is projected that within five years' time, developing countries will be home to 31 per cent of global chemical production, and 33 per cent of global consumption. From an industrial development perspective, it remains to be emphasized that the chemical industry has a key role to play to achieve sustainable economic growth around the globe.

United Nations Industrial Development Organization (UNIDO) fully acknowledges the role the chemical industry plays in the global economics through contribution to wealth creation and poverty reduction. The development of sustainable consumption and production patterns across industries, including the sound management of chemicals, is at the core of UNIDO's mandate of promoting inclusive and sustainable industrial development (ISID). The mandate of UNIDO is an essential component of Sustainable Development Goal 9 as stated in the newly adopted UN Sustainability Agenda 2030, and is instrumental to the achievement of all the other sustainable development goals.

In the frame of UNIDO's programme portfolio to achieve the Sustainable Development Goals, UNIDO and the United Nations Environment Programme (UNEP) collaborate to foster the uptake of Resource Efficient and Cleaner Production (RECP) globally. RECP refers to the continuous application of preventive environmental strategies and total productivity methods to processes, products and services to increase efficiency and reduce risks to humans and environment. RECP achieves the three sustainability dimensions individually and synergistically: Production Efficiency - improving the productive use of resources, Environmental Protection - minimizing the impact of industry on nature and Social Enhancement - the support of communities and risk management for the well-being of workers and employees.

Under the RECP Programme, 50 developing and transition countries have been supported since 1994 with the creation of entities including the National Cleaner Production Centres (NCPCs). They deliver RECP services to enterprises, governments and other stakeholders through information sharing, professional training, plant level RECP assessments, policy advice and support for technology transfer and investment. In 2009, the NCPCs, UNIDO, UNEP, and development partners (led by the Government of Switzerland) resolved to establish a global network to improve and facilitate networking and knowledge sharing. "RECPnet" was formalized in November 2010 by 41 founding members. The first global Members' Assembly took place in October 2011 in Nairobi, Kenya.





Figure 1: The global RECPnet

The Network for Resource Efficient and Cleaner Production (RECPnet) brings together over 70 providers of RECP services on a global level in order to catalyze the effective and widespread application of RECP in developing and transition countries. It does so by providing specialized, quality-assured, technical and advisory services and by facilitating and synergizing its members' capacities.

UNIDO's Global Chemical Leasing Programme is based on the preventive Resource Efficient and Cleaner Production (RECP) concept and stands as an example for UNIDO's approach of counteracting the negative effects of industry on the environment while maintaining competitiveness and enabling sustainable growth. Chemical Leasing is UNIDO's response to the unsustainable management of chemicals in industries and lack of cooperation among chemicals producers and users.

The Global Chemical Leasing Programme was founded in 2004 with the direct support of the Government of Austria. Since its foundation, NCPCs and RECPnet have increasingly become engaged in the global adoption of Chemical Leasing business models across sectors. Chemical Leasing fits into a broad context of

international and national initiatives and obligations, and is intended to help policy- and decision-makers bring fresh momentum to chemical management and sustainable production.

From a business perspective, Chemical Leasing fully fits in with voluntary sustainability reporting tools and management systems. It can help companies meet legal requirements relating to, for example, substance control, environmental permits, and occupational health and safety requirements.

For now, you are invited to learn more about the development of the UNIDO's Global Chemical Leasing Programme, its achievements in the past and its objectives for the future.

## 1.2 What Is Chemical Leasing?

*Global Chemical Leasing Programme has been and continues to be UNIDO's response to unsustainable management of chemicals in industries and lack of cooperation among chemicals producers, suppliers and users. It forms part of UNIDO's strategy to assist enterprises around the globe in achieving inclusive and sustainable industrial development.*

## The Challenge

Traditionally, chemicals are sold to customers who use them to fulfil certain functions. Chemicals suppliers have an economic interest in increasing the amount of chemicals sold (“the more you sell, the more you earn”). Typically, their earnings increase if they sell chemicals at higher prices or in larger amounts. Higher prices, however, are difficult to be achieved due to international competition. As a result, it is a common business practice to place a main focus on higher sales volumes. However, in many cases this is associated with negative impacts on the environment and negative consequences for the future availability of resources.

## The Response

Chemical Leasing inverts a supplier's commercial interest in a higher consumption of chemicals. It shifts the focus from increasing the sales volume of chemicals to a value-added approach. Under Chemical Leasing the supplier sells the functions performed by the chemical and functional units (number of pieces cleaned, amount of area coated, etc.) become the main basis for payment.

*“For example, a producer of metal parts needs detergents to clean them. Instead of being paid for the amount of detergent provided, the chemical supplier sells the functions performed by the detergent, such as the cleaned metal parts.”*

In order to increase profit margins, the supplier trains the user's employees to optimize the usage of the detergent and reduce the amount of detergent consumed. By decoupling the payment from the consumption of chemicals, Chemical Leasing aligns incentives, bringing about a win-win situation for both the chemical supplier and the user. Figure 1 illustrates the distinctive approach of Chemical Leasing compared to traditional business models.

Since chemical products provide a broad variety of services (such as cleaning, coating, colouring and degreasing), Chemical Leasing is applicable in a multitude of industry sectors in large companies, as well as in SMEs. Experience has proven that best results are achieved when the model is applied to processes that are not the core know-how of the chemical user.

## The Benefits of Partnering

Chemical Leasing is a one-of-a-kind sustainable business model, bringing clear environmental, economic and social benefits. Chemical Leasing leads to more efficient and economic use of chemicals and to lower water, raw material and energy consumption, significantly reducing the environmental impact of the production process. By sharing the added value created through the more economic use of chemicals, both the chemical supplier and user can gain an economic advantage. Unlike the outsourcing model, Chemical Leasing involves a transfer of knowledge from the

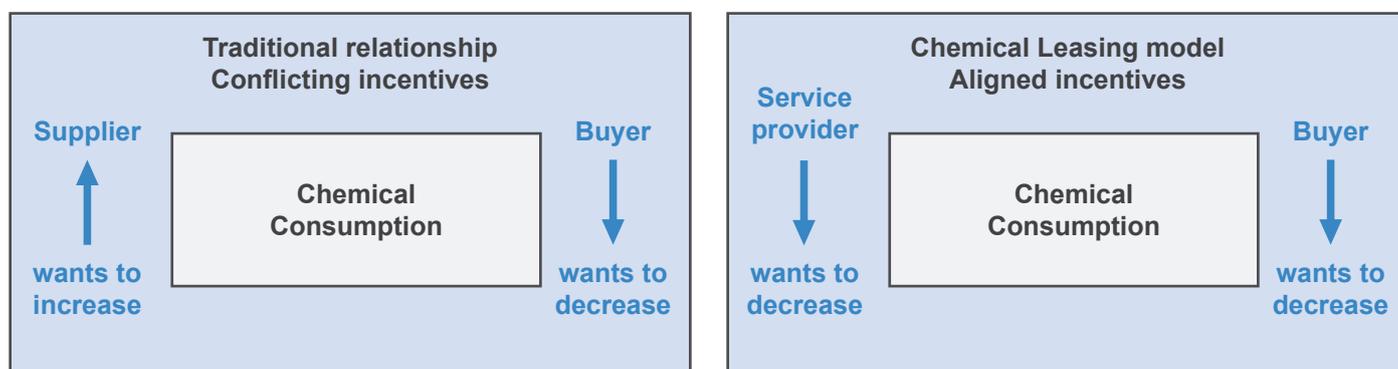


Figure 2: The Chemical Leasing approach

supplier to the user, so there is no loss of jobs at the user's location. It helps reducing occupational health and safety risks and protecting human health from the hazardous effect of chemicals. The companies are better positioned to respond to the latest changes in international chemical policies and can enhance their access to new markets. It can also foster long-term collaboration between the partners, leading to innovation and the transfer of environmentally sound technology.

### UNIDO definition of "Chemical Leasing"

For the dissemination and the establishment of Chemical Leasing in different industries and countries, a clear definition for a mutual understanding of Chemical Leasing is essential. As UNIDO plays a leading role in the development and implementation of Chemical Leasing around the world, in 2008 UNIDO defined "Chemical Leasing" jointly with an international working group as follows:

*Chemical Leasing is a service-oriented business model that shifts the focus from increasing sales volume of chemicals towards a value-added approach.*

*The producer mainly sells the functions performed by the chemical and functional units are the main basis for payment.<sup>1</sup>*

*Within Chemical Leasing business models the responsibility of the producer and service provider is extended and may include management of the entire life cycle.*

*Chemical Leasing strives for a win-win situation. It aims at increasing the efficient use of chemicals while reducing the risks of chemicals and protecting human health. It improves the economic and environmental performance of participating companies and enhances their access to new markets.*

*Key elements of successful Chemical Leasing business models are proper benefit sharing, high quality standards and mutual trust between participating companies.*

<sup>1</sup> Functions performed by a chemical might include: numbers of pieces cleaned; amount of area coated etc.

Table 1: Key benefits of the Chemical Leasing business model

Environmental benefits	Social benefits	Economic benefits
Reduction of resource consumption	Reduced risks in chemical handling	Reduced costs
Reduced emissions and waste	Better qualification of workers due to training	Improved competitiveness
Reduced energy demand	Reduced health hazards	Better business partnerships

### Chemical Leasing Sustainability Criteria

In line with the concept of sustainable development which became common language at the World's first Earth Summit in Rio in 1992, it is UNIDO's interest to ensure that all Chemical Leasing activities follow the principles of sustainability. In response, detailed Chemical Leasing Sustainability Criteria have been developed that must be fulfilled by projects in order to be considered as "Chemical Leasing" case. Five criteria were formulated by international Chemical Leasing experts as a result of the first national Chemical Leasing initiative driven by the German Federal Environment Agency in 2009.



Figure 3: The Chemical Leasing Sustainability Criteria

1. Reduction of energy and resource consumption and minimization of adverse impacts on the environment and health caused by chemicals, their application and production processes;
2. Improved handling and storage of chemicals to enhance risk prevention and protect human health;
3. No substitution of chemicals by substances with a higher risk;
4. Generation of economic and social benefits, continuous improvement and fair sharing of the benefits between the partners;
5. Monitoring and systematic recording of relevant data

The Sustainability Criteria aim to clearly point to the fact that Chemical Leasing projects shall be performed under consideration of measurable and concrete ecological and economic improvements that can be achieved. At the same time, they are designed to protect the positive image of Chemical Leasing and to prevent the misuse of the term “Chemical Leasing”,

e.g. for activities which are not beneficial to human health or the environment. The set of Sustainability Criteria has proven to be helpful not only for evaluating projects, but also for facilitating the negotiation process on Chemical Leasing projects by building trust between parties.

### Chemical Leasing and the Circular Economy

For many decades, companies have followed linear sales models based on the assumption that resources are abundant, available, easy to source and cheap to dispose of. However, natural resources do not follow linear cycles. In order to building towards a circular economy<sup>2</sup>, it requires new concepts that either replace existing ones or seize new opportunities. Innovative business models such as Chemical Leasing accelerate the shift to the Circular Economy, because they are characterized by thinking about chemicals sales from a zero-waste and holistic life cycle perspective. Chemical Leasing contributes to the Circular Economy by establishing closed loop systems, enhancing know-how exchange between business partners and incentivizing resource efficiency (illustrated in Figure 4 below).

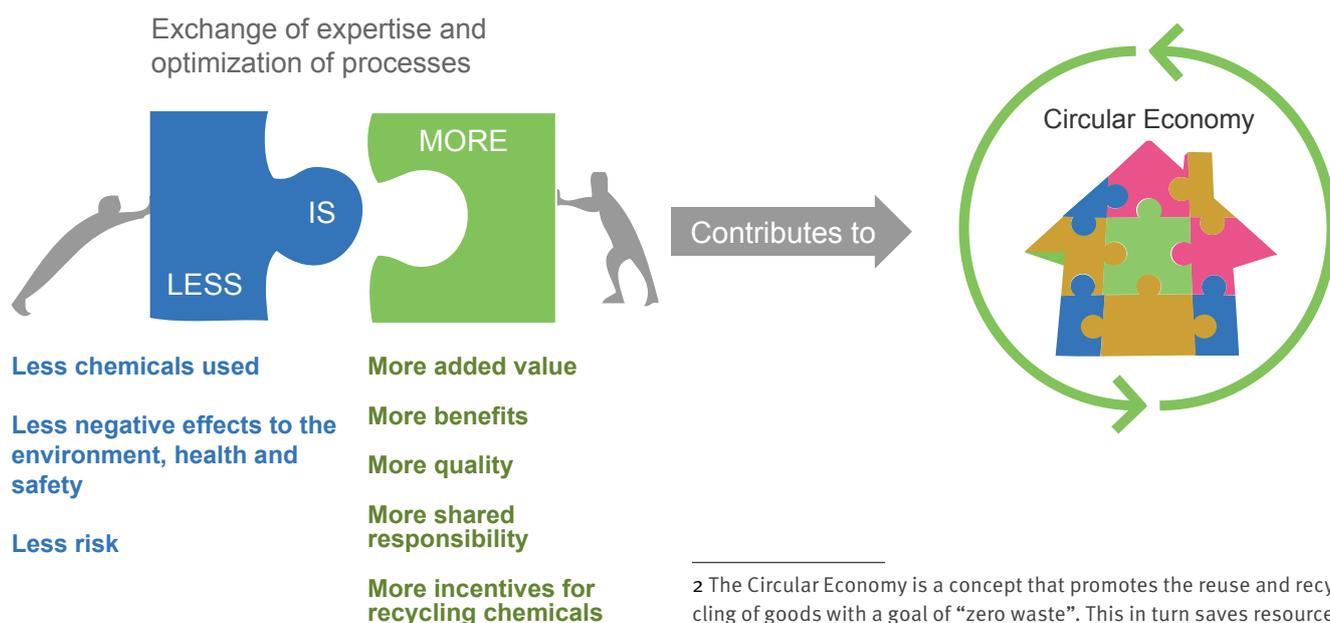


Figure 4: Chemical Leasing and the Circular Economy

<sup>2</sup> The Circular Economy is a concept that promotes the reuse and recycling of goods with a goal of “zero waste”. This in turn saves resources, reduces adverse effects on the environment, and promotes (green) jobs and economic growth. For more information, see <http://ec.europa.eu/environment/circular-economy/>.

## II. TEN YEARS TOGETHER: THE CHEMICAL LEASING STORY

*Encouraging innovative concepts that respond to new challenges constitutes an integral element of UNIDO's Resource Efficient and Cleaner Production strategy. Chemical Leasing is one such important and innovative concept. (UNIDO statement, 2008)*

The following chapter will guide the reader through the past 10 years of UNIDO's Global Chemical Leasing Programme. Since 2004, more than 50 projects have been successfully implemented in a dozen countries, and a growing number of companies have partnered with UNIDO and NCPCs to switch over from traditional sales models to the Chemical Leasing model. The evolution of the Global Programme will be told in three consecutive steps: first projects from 2004 until 2008; regional up-scaling and maturation from 2008 until 2011; and the global achievements of the Programme from 2011 until 2014.

### 2.1 First Projects [2004 – 2008]

#### 2.1.1 Overview

It all began in the early 2000s, when the Austrian Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) facilitated two research studies on the potential of Chemical Leasing for the Austrian chemicals market. The estimated positive ecologic and economic impacts of Chemical Leasing encouraged the pioneers to launch a national initiative. Soon, pilot projects were initiated jointly with industry partners: one in the application of solvents in the field of paint stripping, and one in the automotive industry for the cleaning of metal parts.<sup>1</sup> Followed by encouraging case study results, UNIDO joined the initiative in 2003 to act as a global driver of inclusive and sustainable industrial development through Chemical Leasing. UNIDO was particularly interested in the new approach due to its wide applicability across multiple sectors and countries.

<sup>1</sup> For a detailed description, see Jakl/ Schwager (2008), p. 27-55.

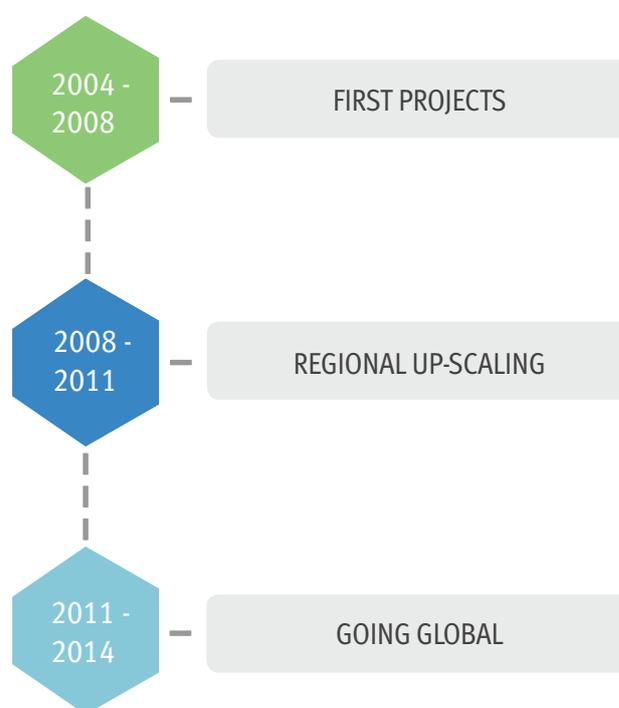


Figure 5: The Chemical Leasing Programme phases

In 2004, UNIDO and the Austrian government officially launched the project: “Promotion and implementation of closing-the-loops cooperation and business models in the chemical industry” which can be understood as the birth of UNIDO's Global Chemical Leasing Programme. In 2005, Chemical Leasing pilot demonstrations started in Egypt, Mexico and Russia, because these NCPCs showed high interest in changing the business practice in their countries and had excellent technical expertise to assist in achieving this. The main aim of this first project was defined as:

1. “Enhancing sustainable productivity of the chemical industries in the participating countries through the application of Chemical Leasing business models”; and
2. “Fostering the implementation of Chemical Leasing projects through national capacity building and Chemical Leasing demonstration projects”.

### 2.1.2 Global promotion and advocacy

Following the project start, the Global Programme featured a number of awareness raising events at global conferences, workshops and stakeholder meetings in order to present the new business model. Chemical Leasing side events were held, for example, at the 2006 SAICM African Regional meeting in Cairo, Egypt, and at the 2007 Ninth Annual Meeting of the UNIDO/UNEP National Cleaner Production Centres and Programmes in Semmering, Austria, with more than 100 participants at both events. There were also international Chemical Leasing workshops in Dubai and Brussels (both in 2006), Lund (2007) and Dakar (2008). In doing so, Chemical Leasing was brought to the attention of a broad range of stakeholders from the global chemicals policy arena and business.<sup>2</sup>

While advocating Chemical Leasing, it was found that the model needed to be explained in different ways to different stakeholders. Decision-makers from industry had other questions on the functioning and usefulness of the business model than policy-makers from government bodies or international agencies and institutions. Therefore, it was of particular importance to embed Chemical Leasing from early on in the context of binding and non-binding global initiatives. From 2004 until 2008, a number of international policy frameworks and global agreements for the sound management of chemicals were adopted, most notably REACH and SAICM. How this was accomplished will be described in the following.

#### Chemical Leasing and SAICM

The Strategic Approach to International Chemicals Management was adopted in 2006 by the International Conference on Chemicals Management (ICCM) “to foster the sound management of chemicals” around the world. SAICM provides a framework for efforts to achieve the 2020 goal set out in the Johannesburg Plan of Implementation. This goal renews the commitments

<sup>2</sup> A list of conferences with major Chemical Leasing contributions from 2006 – 2014 is provided in Annex 4.3.

made at the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, and reconfirmed at the UN Conference on Sustainable Development held in Rio in 2012. SAICM is supported by the Inter-Organization Programme for the Sound Management of Chemicals (IOMC), established in 1995. A major focus of the IOMC is to support countries in their efforts to implement SAICM.

The following excerpt from the Summary Report of the International Conference on Chemicals Management (ICCM1, Dubai, 2006) exemplifies how the Global Chemical Leasing Programme attracted the attention of the stakeholders of the SAICM process:

*“In 2006, at the ICCM1, the participating countries finally adopted a resolution on SAICM by signing the Dubai Declaration on International Chemicals Management. The signing countries thereby committed themselves to promote the sound management of chemicals and hazardous wastes at all levels. An effective means of translating this idea into public policy is the implementation of **Chemical Leasing**. The concept of Chemical Leasing is particularly in line with SAICM, because both aim at a sound management of chemicals throughout their life cycle, and a responsible way of use that leads to the minimization of adverse effects on human health and the environment. SAICM wants to encourage support of developing countries in strengthening their capacity for the sound management of chemicals. If applied in a transnational context, Chemical Leasing can contribute precisely to this objective and to technology transfer from industrialized to developing countries in general. **This conclusion was also drawn at the UNIDO-Austria side event at ICCM1, where the concept was introduced to the international community. More than 100 representatives from governmental institutions, industries, IGOs and NGOs participated in this side event.**”*

As an effective policy instrument, SAICM is a well-established mechanism that holds the potential to kick-start Chemical Leasing projects. SAICM presents the opportunity to promote innovative projects that

encourage the development of business cases for sustainable and green chemistry. Chemical Leasing can be applied in all areas identified by SAICM, as it is applicable across industrial sectors. They are designed to a) reduce risks; b) enhance cooperation and information exchange between stakeholders; c) support good governance of chemicals; and d) train employees in the sound management of chemicals. The only requirement is that the chemicals targeted in SAICM projects can be defined or “quantified” by means of a unit of payment rather than by their quantity. If this is the case, Chemical Leasing can support SAICM implementation.

### Chemical Leasing and REACH

The European Union (EU) regulation REACH was adopted in 2006 to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemical industry. REACH also promotes alternative methods for hazard assessment of substances in order to reduce animal testing. In principle, REACH applies to all chemical substances, not only to those used in industrial processes but also to those that are present in our day-to-day lives, for example in cleaning products, paints, in clothing, furniture and electrical appliances. The regulation therefore impacts most companies across the EU. REACH places the burden of proof on companies. To comply with the regulation, companies must identify and manage the risks linked to the substances they manufacture and market in the EU. They have to demonstrate how the substances can be used safely, and they must communicate risk management measures to the users.

Based on this context, a discussion arose on the subject of how Chemical Leasing could support the objectives of regulative legislations such as REACH:

1. **Chemical Leasing and REACH share the same philosophy** of sharing the costs, benefits, responsibility and know-how between chemical suppliers and users.

2. **Like Chemical Leasing, REACH aims to impact a wide range of companies** across many sectors, including manufacturers, importers, exporters and downstream users.
3. **Chemical Leasing secures compliance with the obligation or duty to handle chemicals with care.** This implies that chemicals and their applications are not only monitored but also managed with maximum accuracy. This is fully aligned to the principles of REACH.
4. **Chemical Leasing is also an effective tool for demonstrating adequate risk control**, as specific parameters must be fulfilled in order to obtain authorization. Adequate control is an inherent principle of REACH.
5. **Chemical Leasing has the potential, in the long run, to accelerate the substituting of the most hazardous substances with less dangerous ones.** In the future, Chemical Leasing models could be designed to trigger “fast track” licensing procedures and special conditions such as reduced registration/authorization fees within the REACH application process.

Obviously, there are many more linkages thinkable, and similar links can be made to analogous national regulations, laws and programmes that are in force or under development, such as the U.S. Toxics Release Inventory and Toxic Chemical Substance Inventory, the Chinese and Turkish “REACH”, the Japanese Chemical Substances Control Law, the Korean Toxic Chemicals Control Act, and comparable chemical laws and regulations in other countries.



### 2.1.3 Capacity building

The first Chemical Leasing projects were developed in close cooperation with UNIDO and UNEP's National Cleaner Production Centres in Egypt, Mexico and Russia (St. Petersburg). In this early phase, the focus of the work was placed on (1) organizing awareness-raising and capacity-building training events for national industry and other stakeholders on Chemical Leasing; (2) identifying and assisting companies to kick-start new Chemical Leasing projects, (3) disseminating information on the Chemical Leasing concept, (4) sharing project results and (5) further developing the methodology of applying the new business model.

#### Webpage, toolkit, book, international working group

The activities at plant level clearly showed the need to develop supportive features such as training methodologies, guidance tools and awareness-raising instruments. Therefore, an international multi-stakeholder working group was established in 2005. Here, experts from national administration, technical inspection agencies, industry and the consultant sector, as well as UNIDO and NCPC representatives, gathered together to discuss ways to promote Chemical Leasing around the globe. One

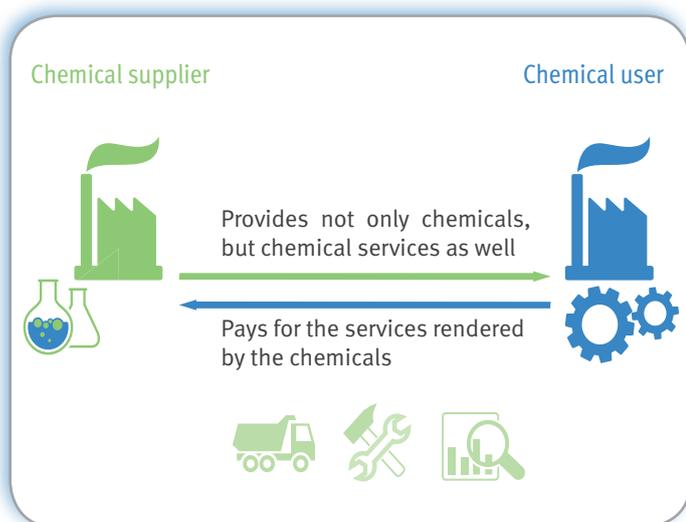


Figure 6: Illustration of the Chemical Leasing concept

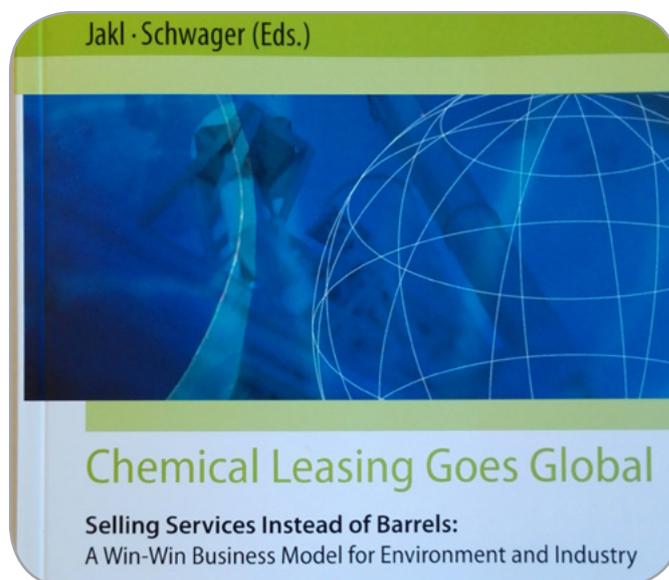


Figure 7: Chemical Leasing book, cover page

first outcome of the group work was the launch of the Chemical Leasing website in 2006 in order to inform about the business model, share news and increase the visibility of the Global Programme.

Another important achievement in 2006 was the development of an unambiguous definition of the term "Chemical Leasing". This was highly relevant not only to facilitate research on Chemical Leasing based on standardized criteria, but also to better communicate the purpose and scope of Chemical Leasing business models among stakeholders.

Furthermore, the book "Chemical Leasing Goes Global", published in 2008, marks an important milestone in the initiative's progress. The Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria and the United Nations Development Organization initiated this book and received the support of various companies, individuals, and institutions. It collects the experience gained from pilot projects in Austria, Egypt, Mexico and the Russian Federation and contains detailed descriptions and evaluations based on existing projects, as well as political and scientific interpretations and analyses.

### 2.1.4 National initiatives and business engagement

In the three pilot countries, different sectors were identified that could have a large potential to kick-start Chemical Leasing projects successfully. They are listed in Table 2 below.

Between 2004 and 2008, six pilot projects were initiated, including industrial partners from large, medium and small-sized enterprises. The selection of cases from different areas proves the applicability of the business model across sectors and regardless of company size. An overview of the pilot project partners is provided in the box on the right.<sup>3</sup>

**Egypt:** The NCPC Egypt involved from the very beginning companies in the training workshops for national experts. Three pilot demonstrations were initiated in the first period. Projects started in the automotive

#### Chemical Leasing: Pilot Projects [2004 – 2008]

<b>Egypt</b>	Electrostatic Powder Coating (Akzo Nobel/ ABB) Cleaning with Hydrocarbon Solvent (Badawi Chemical Work/General Motors Egypt) Hot Dip Galvanization (Zinc Misr El Sewedy)
<b>Mexico</b>	Sugar Mills (Chemical Mac Oil/Fideicomiso Ingenio San Cristóbal) Electroplating (Mardi/Cromadora Delgado)
<b>Russia</b>	Water Purification (Vodokanal/Aquatechservice Ltd.)

industry and in the electrical equipment sector (e.g. the project on powder coating of refrigerators, presented in 2.1.5). The role of the NCPC was highly appreciated by the stakeholders, as mediation from a neutral party was found to be crucial to encourage joint action based on mutual trust.

<sup>3</sup> For a detailed description, see Jakl/ Schwager (2008).

Table 2: Sectors and chemicals considered in the pilot projects in Egypt, Mexico and Russia (2004-2008)

	Egypt	Mexico	Russia
<b>Industry sectors/ processes</b>	<ul style="list-style-type: none"> <li>Automotive - Engineering sector</li> <li>Electrical equipment - Engineering sector</li> <li>Galvanization sector</li> <li>Metal surface finishing - Fabricated metal products manufacturing sector</li> </ul>	<ul style="list-style-type: none"> <li>Petrochemicals</li> <li>Electroplating</li> <li>Metallurgy</li> <li>Cleaning operations</li> </ul>	<ul style="list-style-type: none"> <li>Wastewater treatment</li> <li>Chemical waste treatment</li> <li>Electroplating</li> <li>Water purification</li> </ul>
<b>Chemicals</b>	<ul style="list-style-type: none"> <li>Solvents</li> <li>Paints</li> <li>Pre-treatment chemicals (degreasers, pickling acids, fluxing chemicals)</li> </ul>	<ul style="list-style-type: none"> <li>Solvents</li> <li>Catalysts</li> <li>Lubricants</li> <li>Brighteners</li> </ul>	<ul style="list-style-type: none"> <li>Solvents</li> <li>Detergents</li> <li>Flocculants</li> <li>Coagulants</li> <li>Acids</li> </ul>

**Mexico:** The Mexican National Cleaner Production Centre worked intensively with sugar mill factories, electroplating companies, as well as with companies from the petrochemical industry. A main achievement of the Centre's work was the development of a selection tool to find and engage with companies that could potentially participate in Chemical Leasing activities. The duration of projects was found to vary significantly between sectors. One main challenge turned out to be how to prepare contracts when state-owned companies are involved.

**Russia (St. Petersburg):** The Centre put a lot of emphasis on awareness raising activities, for example, at the 3<sup>rd</sup> All-Russian Ecological Conference in the Big Kremlin Palace (Moscow, November 2007). In addition, the Chemical Leasing business model was introduced to the authorities of selected enterprises in St. Petersburg during seminars, workshops, company visits and bilateral meetings. Significant progress was made in 2007, including project starts in the area of water purification. In St. Petersburg, water used to be disinfected with pure liquid chlorine, which meant high costs due to additional safety measures, e.g., storing and transporting significant quantities of this highly toxic chemical. In order to replace liquid chlorine, two plants for the production of diluted sodium hypochlorite (an effective and



*Figure 9: The official ceremony of discarding the last chlorine container*



“Some 4.5 million people as well as industrial customers are now getting purer water, and the new technology helps to guarantee that there will be no accidents.”

Feliks V. Karmazinov, General Director, Vodokanal of St. Petersburg



*Figure 8: Production of sodium chloride at the water purification plant in St. Petersburg*

significantly less harmful chemical) began to operate in St. Petersburg, at the Southern Waterworks (in 2006) and at the Northern Waterworks (in 2008). In 2007, the new production process of the disinfecting solution was introduced. The official ceremony of discarding the last chlorine container was held at the Northern Waterworks on June 26, 2009.

The case study exemplified how Chemical Leasing can contribute to the substitution of hazardous chemicals by safer alternatives. With a payment unit based on the amount (cubic meters) of purified water, the process optimization led to a reduction of wastewater purification costs from initially about €27 per m<sup>3</sup> of wastewater to €13 (according to the Chemical Leasing agreement).

## CASE STUDY

### Surface protection in the Egyptian fabricated metal products manufacturing industry



#### 2.1.5 Case study

##### Background information

The process of surface protection is essential to ensuring the high quality and durability of electrical equipment - the top layer is usually an electrostatic powder coating. Electrostatic powder coating is a common technique used in various branches of fabricated metal products manufacturing industry. It is an effective way of protecting metal surface from deterioration. In Egypt, the major end user sectors for such coatings are domestic appliances and air-conditioners manufacturers as well as the architectural metal finishing market.

##### Introduction

One of the largest Egyptian manufacturers of electric equipment, ABB ARAB, a specialist in high and low voltage equipment, faced high costs in the painting operations. The reasons being the large amount of powder waste, the need for considerable maintenance of equipment and the high quantity of rejects due to poor painting quality. To resolve these issues, the company started to seek solutions with its powder coatings supplier, Akzo Nobel Powder Coatings S.A.E., a multinational and global leader in the field. After several assessments and tests, cost benefit analysis and negotiations, a Chemical Leasing contract was signed in 2008.

##### Key changes and results

Optimization of the process resulted in a more efficient use of chemicals and resources. The consumption of powder coating per product area was reduced, powder waste was taken back for recycling (zero waste was achieved), energy consumption was reduced, and the frequency of maintenance was cut in half. Direct savings were around \$68,000 per year.

##### Unit of payment applied

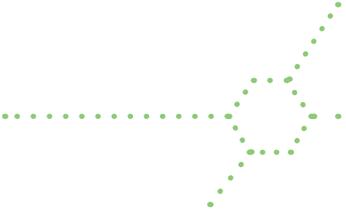
<b>Before Chemical Leasing:</b>	Egyptian pounds (EGP) per kg of powder coating purchased
<b>After Chemical Leasing:</b>	Egyptian pounds (EGP) per m <sup>2</sup> of coated metal surface

##### Technical measures tested and implemented

Line audits on using powder batches in a more efficient way were conducted, as well as data collection on powder loss calculations and input material assessments. Based on trials with modified samples of powder coatings (samples with varying shares of recycling material), modifications of the application process and maintenance procedures were implemented. They enabled an improved use of powder coating including lower consumption and less waste generation. Powder coating waste was taken back for recycling and an optimization of the top coating's thickness was achieved.



## Results achieved

Before Chemical Leasing	After Chemical Leasing
<ul style="list-style-type: none"> <li>• Consumption of 0.2 kg powder coating per square meter of coated articles; amounting to 140 metric tons of powder coatings applied (per year)</li> <li>• 2% rate of reworks and rejects – resulting in high maintenance efforts and two production line stoppages (per month)</li> <li>• High powder losses; 12% of used powder becomes waste (per month)</li> <li>• High energy costs due to application pressure of 2 bars</li> <li>• Environmental and safety issues (e.g. related to the solid waste generated, workplace safety)</li> <li>• Powder coating price – 3.80 Egyptian Pounds (per m2)</li> </ul> 	<p><b>Environmental benefits:</b></p> <ul style="list-style-type: none"> <li>• Closing the loop of powder coating and its waste</li> <li>• Consumption of 0.16 kg powder coating per square meter of coated articles (which is a reduction of 20%)</li> <li>• Less powder losses; quantity of waste reduced to 4 - 5% (per month)</li> <li>• Reduced energy consumption and costs due to 30% lower application pressure</li> </ul> <p><b>Economic benefits:</b></p> <ul style="list-style-type: none"> <li>• Direct savings of around \$68,000</li> <li>• ~ 0% rate of reworks and rejects – only one production line stoppage for maintenance work needed (per month)</li> <li>• Powder coating price - 3.20 Egyptian Pounds (per m2)</li> <li>• Long term business relationship established</li> </ul> <p><b>Social benefits:</b></p> <ul style="list-style-type: none"> <li>• Capacity building of operation staff by sharing know-how</li> <li>• Increased workers safety, environmental awareness</li> <li>• Quality of workplace environment complying with occupational health and safety regulations</li> </ul>

## 2.1.6 Interview

To finalize this section, an interview with Chemical Leasing expert Mr. Thomas Jakl from the Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria highlights the achievements of the first years of the Global Chemical Leasing Programme.

### The first years of Chemical Leasing - Mr. Thomas Jakl

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**Question:** *In a nutshell – What happened in 2004 that finally led to a joint UNIDO/ Austrian project on Chemical Leasing?*

**Jakl:** After having commissioned two studies in order to embrace the idea of “Chemical Leasing” and developing first ideas for concrete implementations we gained experience in Austria with first concrete projects. The results were promising – producers and users of chemicals joined forces by basing their business relationship on chemical services. They increased their profit while at the same time using less chemicals. Together with OECD we convened a conference in Vienna in 2003, putting Chemical Leasing in the context of other business models in the chemicals’ arena. UNIDO joined this conference and started actively to integrate Chemical Leasing in their project portfolio. From the very start, the Austrian government was happy to support these important endeavours.

**Question:** *In retrospect, what were the most remarkable milestones of this programme in the first years?*

**Jakl:** Apart from the outstanding results of the first projects, the active involvement of the regional centers with their excellent expertise and their networking capabilities were key success factors, along with excellent steering and co-ordination by UNIDO headquarters. Furthermore, it was crucial that Germany and Switzerland joined the initiative and actively contributed to the further development.



Subsequently, Chemical Leasing found its way into political discussions and into the scientific literature. In addition, the idea of establishing criteria within the framework of the Global Chemical Leasing Award was a very important step.

**Question:** *UNIDO and the Austrian Ministry of Environment have been successfully promoting Chemical Leasing for more than a decade. Could anyone have expected such a development 10 years ago at project start?*

**Jakl:** I have to admit – not in my wildest dreams could I have imagined such a success. Success in that we managed through our cooperation to demonstrate across a wide range of sectors that Chemical Leasing is not just a theoretical approach but has the potential to become a complete new, well established and widespread business model. Fostering innovation, introducing resource efficiency – making sustainability happen.

## 2.2 Regional Up-scaling [2008 – 2011]

### 2.2.1 Overview

From 2008 onwards, the Programme continued to devote its attention to disseminating and promoting Chemical Leasing at the regional and global level and to supporting technical cooperation at the national level. More and more countries joined the Programme, several NCPCs and other stakeholders such as the German Federal Agency came on board of the initiative. Table 3 illustrates the progress until December 2011, bringing Chemical Leasing to a whole new level of outreach.

*Table 3: Overview of results achieved until December 2011*

Countries involved:	6 (plus starting initiatives in 5 more countries)
Demonstration projects:	30
Companies contacted:	> 1000
Persons trained:	> 350
National working groups established:	3 (Colombia, Serbia and Sri Lanka)

Chemical Leasing was particularly strengthened in Latin and South America, Central and Eastern Europe and select Asian and African countries. The NCPCs from Sri Lanka, Serbia and Colombia engaged in demonstration projects in new areas, applying the model to fields ranging from cleaning operations to lubrication and crop protection. Moreover, Germany, which had become a main contributor to the Programme, launched a national Chemical Leasing initiative.<sup>4</sup>

### 2.2.2 Global promotion and advocacy

The following section presents a selection of annual global promotion highlights, providing a glimpse into the evolution of the Programme since 2008.

<sup>4</sup> Detailed information on the German Chemical Leasing initiative is presented in Annex 4.7.

#### **International training on Chemical Leasing for NCPCs, Vienna, Austria, 2008:**

A training session took place at UNIDO headquarters in Vienna on 3-5 March 2008. International experts explained the concept and strategy for Chemical Leasing, work plans were established and approaches for company visits discussed. This meeting was crucial for the transfer of know-how from experienced experts from the Cleaner Production Centres in Egypt, Mexico and Russia to new participating NCPCs and partners.

#### **International Conference “Getting Fit for REACH”, Balatonfüred, Hungary, 2008:**

This conference took place in Balatonfüred, Hungary on 6-7 March 2008, initiated by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management in cooperation with the Hungarian Government and UNIDO. The conference was an important milestone towards linking Chemical Leasing to REACH compliance. The event also focused on screening potential pilot projects for the second period of the Global Programme. Around 80 representatives of the private and public sectors from more than 10 countries participated in the conference. The book “Chemical Leasing Goes Global” was officially presented as a joint piece of work published by UNIDO and Austria.

#### **International training on Chemical Leasing & Chemicals Management Services (CMS), Belgrade, Serbia, 2009:**

A training session took place in Belgrade, Serbia, on 20-23 April 2009. 25 representatives of the seven participating NCPCs gave presentations on their Chemical Leasing activities and shared their experiences on implementation and monitoring of Chemical Leasing. 1½ days of the workshop were dedicated to a training session on CMS, lectured by senior CMS expert Ms. Jill Kauffman Johnson from Chemical Strategies Partnership, San Francisco, United States. This opportunity helped clarifying similarities and differences of the CMS approach and Chemical Leasing.

**ICCM2: Side event on Chemical Leasing, Geneva, Switzerland, 2009:**

The side event “Green Industry – innovative approaches to Sound Chemicals Management” took place on 13 May 2009, in Geneva, Switzerland, at the *Second Session of the International Conference on Chemicals Management* (ICCM2; <http://www.saicm.org>). The side event was co-organized by the Governments of Austria and Germany and UNIDO and attended by some 50 representatives from government and industry. The session was inaugurated by Mr. Alexander Nies, Deputy Director General, Ministry of Environment of Germany, who underlined the support of the German Government to UNIDO’s Chemical Leasing activities. At this occasion, the first Global Chemical Leasing Award was launched by the Austrian Government and UNIDO.

**Third Nevsky International Ecological Congress, St. Petersburg, Russia, 2010:**

The Congress was organized from 14-16 May 2010 at the Tavricheskiy Palace by the CIS Interparliamentary Assembly and the Federation Council of the Federal Assembly of the Russian Federation with the support of the Government of the Russian Federation. This was the third time the Nevsky Congress had taken place, and approximately 1,000 delegates participated. A side event was dedicated to Chemical Leasing. In addition, a high-level meeting between the UNIDO Director General and Vodokanal top management was held to discuss future cooperation.

**9<sup>th</sup> Asia Pacific Roundtable on Sustainable Consumption and Production, Colombo, Sri Lanka, 2010:**

The 9<sup>th</sup> Asia Pacific Roundtable on Sustainable Consumption and Production was held in Colombo, from 10-12 June 2010. Before the Roundtable, on 8 June 2010, representatives from the NCPCs participating in the Chemical Leasing Programme had the opportunity to take part in a training workshop organized by UNEP entitled *Responsible Production – A Framework for Chemical Hazard Management for Small and Medium Enterprises*.

**Chemical Leasing Annual Meeting, Colombo, Sri Lanka, 2010:**

On 9 June 2010, the Chemical Leasing Annual Meeting was held in Colombo, Sri Lanka. The agenda included the status update on Chemical Leasing activities around the world, the presentation of a code of conduct for business engagement, the new sustainability criteria and a discussion about ways to quantify the results of Chemical Leasing projects.



*Figure 10: Sharing experiences at the 9<sup>th</sup> Asia Pacific Roundtable, Colombo*



*Figure 11: Chemical Leasing experts at the Annual Meeting in Colombo*

**Promotional materials:** Several info flyers, brochures and other PR material was developed in the period from 2008 – 2011, including guidelines, specific worksheets, a PR video on Chemical Leasing and further information on how to properly address certain burdens and challenges. Info material was developed in many languages, e.g. in Arabic, English, French, German, Russian, Serbian, Sinhalese, Spanish and Tamil. They were developed by national and international Chemical Leasing experts in line with specific country needs and

sectoral specifications. Examples of the work can be found under [www.chemicalleasing.org](http://www.chemicalleasing.org).

It is important to point out that the 10 involved countries also promoted Chemical Leasing in various national workshops (for more information, please refer to Section 2.2.4). The international expert group met on an annual basis in order to discuss the development of the Global Programme. One particular outcome of these discussions is presented below.

## SUCCESS STORY - THE GLOBAL CHEMICAL LEASING AWARD

**First Idea in 2008** – In an effort to acknowledge best practices in Chemical Leasing implementation, science and promotion activities, and in order to enhance the visibility of Chemical Leasing worldwide, the idea of launching a global award was born. It is the first award of its kind and recognizes successful Chemical Leasing activities in four categories: (I) case studies (companies), (II) consulting services, (III) scientific publications, and (IV) public relations (reports, media, brochures, websites).

**Announcement and preparations in 2009** – The first award was officially announced at the ICCM 2 side

event in Geneva on 13 May 2009. The award was jointly organized by UNIDO and the Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management. An award jury was established, which was composed of international Chemical Leasing experts and high-level government representatives. They select the winners and successful participants according to the Chemical Leasing Sustainability Criteria (provided online under <http://chemicalleasing.org/sub/quality.htm>).

**First Chemical Leasing Award 2010** – The award ceremony took place in March 2010 at the CHEMCOM exhibition and conference in Prague, Czech Republic.



Figure 12: Chemical Leasing Award in Prague, 2010



Figure 13: Chemical Leasing Award in Frankfurt, 2012

Overall, 27 applications were received, 17 in category I, 3 in category II, 3 in category III and 4 in category IV. The award was jointly organized and sponsored by UNIDO and BMFLUW.

**Second Chemical Leasing Award 2012** – For the second award, an additional partner was found - the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB). In total, 43 applications from 12 countries were submitted across all categories. The award ceremony then took place in June 2012 at ACHEMA (the World Exhibition Congress on Chemical Engineering, Environmental Protection and Biotechnology) in Frankfurt, Germany, with around 100 high-level representatives from government, industry, consultants and research institutions.

**Third Chemical Leasing Award 2014** – A third external partner, the State Secretariat for Economic Affairs (SECO, Government of Switzerland), joined UNIDO in preparing and organizing the Award, and a new record in the total number of submissions was reached: 50 applicants from more than 20 countries. The number of submissions (34 applications) in the category “Case studies/ Companies” was doubled compared to 2010 and 2012. The award coincided with the First International Conference on “Sustainable Chemistry and Chemical Leasing: Paving the way for inclusive and sustainable industrial development (ISID)”. The conference examined the interrelations of green

chemistry, sustainable chemistry and Chemical Leasing to achieve an inclusive and sustainable industrial development.

The evening ceremony was held on 10 December 2014 under the umbrella of the 17th International Biocides Conference in Vienna, Austria. The winners of all awards and conformity declarations are listed separately in Annex 4.2. All companies applying for the award had to fill in the Chemical Leasing Sustainability Criteria Checklist that is illustrated in Annex 4.1. More details on the Chemical Leasing Award can be found here: <http://www.chemicalleasing.org/sub/Award/award.htm>.



Figure 14: SAFECEM and partner presenting the Chemical Leasing Conformity Declaration (Award 2014)



Figure 15: Group picture, Award Ceremony 2014

First Award 2010	27 applications
Second Award 2012	43 applications
Third Award 2014	50 applications

### 2.2.3 Capacity building

The regional up-scaling from 2008 onwards could only be reached through adequate capacity building in the regions. A comprehensive approach was developed to build capacity based on five main elements:

1. **Train National Chemical Leasing Experts** – Key to design high quality projects at the local level is the training of national experts, so that they can serve as multipliers for innovative chemicals management. International experts designed special trainings for employees from NCPCs and the private sector in order to establish a pool of national experts. Every participating NCPC has now designated experts who can conduct Chemical Leasing workshops, awareness raising and training events at the national level.
2. **Apply consistent methodology** – Based on the experiences gained over the years, a Chemical Leasing Toolkit was published in 2011 in order to support implementation at various levels, containing guidelines, worksheets, videos and presentations. It is divided into three parts, and enables the user to understand the implementation of the business model as a process. The toolkit is complemented by a cost-benefit analysis tool and a checklist on the Chemical Leasing Sustainability Criteria. The toolkit is available from UNIDO free of charge.

3. **Conduct workshops and training seminars in the regions and support company audits** - Based on the first two elements, UNIDO's Global Chemical Leasing Programme has accompanied local attempts to foster regional up-scaling. In the period from 2008 – 2011, more than 350 participants attended Chemical Leasing training events in the different regions supported by international experts. In addition, company audits prove to be efficient means to identify potentials of applying Chemical Leasing at the company level.
4. **Develop target-group-specific training** – Sector-specific training courses on Chemical Leasing are promising instruments for specialized capacity building. That is why the Global Programme established special training set-ups: For example, based on previous training experiences and tools developed, including the Chemical Leasing Toolkit, a training course was developed to target chemicals suppliers, traders and sales people in industry.

#### Systematic approach of the Chemical Leasing Toolkit:

1. *Screening of potential Chemical Leasing projects (sector level)*
2. *Selection of potential Chemical Leasing clients (company level)*
3. *Implementation & monitoring of Chemical Leasing (plant level)*



Figure 16: Toolkit



Figure 17: Training for company employees

5. **Establish international and national working groups** – To define and discuss the further development of training programmes, the multi-stakeholder International Working Group on Chemical Leasing was enlarged. Moreover, NCPCs created national working groups in the countries, consisting of representatives from government, technical agencies, industry, academia, the consultant sector and NCPC staff. In Colombia, Serbia and Sri Lanka, national working groups were established that serve as networking platforms for knowledge exchange and discussions. They are comprised of stakeholders from various backgrounds stemming from academia, the public and the private sector.

In addition to this conceptual approach, the Global Programme investigated how capacity-building could be supported by integrating Chemical Leasing into **quality assurance and certification systems**. Therefore, UNIDO and partners from TÜV SÜD Management Service GmbH developed a draft version for Chemical Leasing Certification. The idea was to apply a standard called “Certified Chemical Leasing” that would ideally integrate quality, environmental and occupational health and safety elements with specific requirements of the chemical industry. However, industrial partners argued that unless sector-wide mainstreaming of Chemical Leasing activities was achieved, such a certification

process might represent an additional cost-driver to users rather than an advantage. As a result, this idea has yet to be realized, but it remains an interesting option for the future.

#### 2.2.4 National initiatives and business engagement

From 2008 until 2011, several NCPCs showed their willingness to join the Global Chemical Leasing Programme and kick-start their own initiatives. Hot spots for Chemical Leasing implementation have been the countries Colombia, Serbia and Sri Lanka. Established members from Mexico, Russia and Egypt continued to participate actively in the Programme, and new initiatives started at the beginning of 2011 in Brazil, Croatia, Nicaragua, Russia (Volga Region/Kazan), and Ukraine in cooperation with the respective NCPCs. This brought fresh momentum to the initiative and created a huge potential for regional up-scaling. For example, the work of the NCPC Colombia provides a best-practices example of Chemical Leasing promotion at various levels. Over the years, the Centre facilitated four industry projects, provided technical assistance at company level, held many capacity-building and awareness-raising events and participated successfully in the Chemical Leasing Awards. More details on the Colombian Chemical Leasing initiative are provided in Table 4 below.



Figure 18: Company visit and on-site training



Figure 19: Training for international experts

*Table 4: Chemical Leasing in Colombia (2008 – 2011)*

<b>Key Activities on Chemical Leasing since project start</b>
<ul style="list-style-type: none"> <li>- The NCPD developed a manual on Chemical Leasing and chemical management strategies in Spanish (2010).</li> <li>- Participation in the Chemical Leasing Awards: Colombia wins Gold and Bronze in the categories “case studies” and “consultancy” (2010).</li> <li>- Dissemination of the concept through workshops, seminars, international missions, visits to companies, presentations during academic events, media, etc.</li> </ul>
<b>Ongoing / Closed projects (4)</b>
<ol style="list-style-type: none"> <li>1. Nalco (provider) – Ecopetrol (user): Chemicals consumption optimization in crude oil dehydration and water clarification processes.</li> <li>2. Nalco (provider) – Ecopetrol (user) : Integral chemical treatments; service for three oil fields: Castilla I, Castilla II and Acacias. This contract includes development of technological innovation projects, replacement of hazardous chemicals and optimization of the chemicals application.</li> <li>3. Polikem (provider) – Renault Sofasa (user): Surface treatment; anti-corrosion protection for automobile cabins at the Sofasa assembly plant. The case was honored with Gold at the Chemical Leasing Award 2014.</li> <li>4. Transform-Hidrotecnik (provider) – Colceramica (user): Recirculation of domestic wastewater to the ceramic process.</li> </ol>
<b>Companies contacted</b>
<b>More than 70 companies</b> contacted and encouraged to implement Chemical Leasing.

<b>Specific training workshops and seminars (8)</b>
<p><b>August 2008:</b> Bogota City / 42 participants  <b>August 2008:</b> Cali City / 22 participants  <b>August 2008:</b> Medellin City /28 participants  <b>20 – 21 May 2010:</b> around 20 participants  <b>21 – 25 June 2010:</b> Seminar on simulation process with PRO II / around 20 participants  <b>26 July 2011:</b> University EAFIT. Experience and innovation from the industry for green chemistry / 20 participants  <b>2 September 2011:</b> Special mission to Brazil, training of employees from the Brazilian NCPD - FIRJAN /SENAI  <b>5 September 2011:</b> Bogota City. University Jorje Tadeo Lozano / around 50 participants</p>
<b>Awareness Raising Workshops (9)</b>
<p><b>25 April 2008:</b> Yopal students. Chemical Leasing – Environmental aspects for the Industry / 22 participants  <b>29-30 May 2008 and 10-11 June 2008:</b> Monteria Enterprises. Chemical Leasing / 73 participants  <b>5-6 June 2008:</b> Cali Enterprises. Chemical Leasing and Eco-efficiency / 100 participants  <b>19 September 2008:</b> University of Pereira. Waste management and Chemical Leasing / 50 participants  <b>22 September 2008:</b> Environmental authority – CORNARE. Chemical Leasing / 10 participants  <b>9 October 2008:</b> University of Antioquia. Chemical Leasing and the analytical labs / 9 participants  <b>First half 2010:</b> Seminar on simulation tools related to chemical processes and Chemical Leasing / 17 participants  <b>22 July 2011:</b> Exploring potential applications of Chemical Leasing in leather sector / 9 participants</p>



“Ecopetrol is convinced that Chemical Leasing is the best model to achieve the highest sustainable level of performance”

Orlando Cortés Tulando, Coordinator,  
Strategic Supply Unit, Ecopetrol



*Figure 20: Experts visit to Ecopetrol, Colombia*

**Initiatives in other regions also obtained remarkable results:**

**Serbia** – The NCPC Serbia was established in 2007 and started Chemical Leasing activities in 2008. Its main focus is on:

- Identifying and contacting potential companies for new chemical leasing projects
- Promotion of the concept in training workshops and awareness raising events
- Technical assistance, project implementation and project monitoring

A particular highlight of the Centre's work was the successful implementation of the Chemical Leasing business model in the beverage and metalworking industries. Projects were developed in close cooperation with SME's as well as with internationally renowned companies. In addition, Serbia is on the forefront in the initiative "Chemical Leasing Goes Agro". In 2011 alone, the NCPC contacted 42 companies, initiated 5 pipeline projects, facilitated the signing of 3 letters of intent between companies, conducted 12 meetings and workshops and trained 23 experts on Chemical Leasing. Two pilot projects were successfully initiated: Bambi Banat with Henkel (bonding of boxes) and Knjaz Milos with Ecolab (dry lubrication of conveyor belts in PET bottle packaging lines).



*Figure 21: Successful partnership, Serbia*

**Sri Lanka** – The NCPC Sri Lanka started operations in 2002 and initiated Chemical Leasing activities in 2008. Since project start, the NCPC provided technical assistance in 13 projects and more than 240 companies were contacted. Special highlights of the work in Sri Lanka include pilot projects in the agricultural sector and projects for the wastewater treatment in the textile industry. A good example of the Centre's promotional work is the creative design of a cartoon explaining the Chemical Leasing model. The longstanding efforts of the NCPC Sri Lanka to raise awareness on Chemical Leasing were honored with Bronze in the category Public Relation at the Global Chemical Leasing Award.

**Mexico** – Since 2008, the NCPC has contacted more than 50 companies which belong to different sectors, mostly operating in the chemicals, metal finishing, metal mechanics and automotive industries. The NCPC organized several dissemination and awareness raising activities, for example at the Mexican Green Expo Conference (2009) and the big Coatech congress (2010), attended by more than 1,000 participants from industry and politics.

**Egypt** – After the first years of Chemical Leasing promotion in Egypt, three cases were successfully carried out. The long-lasting efforts of General Motors (GM) Egypt to apply Chemical Leasing to the cleaning of equipment in the automotive industry was awarded with Silver in the category "case studies" at the Global Chemical Leasing Award 2012.

**Russia** – While the partnering NCPC in St. Petersburg continued supporting the Global Chemical Leasing Programme in different events and training series, the newly created NCPC Russia in Kazan successfully kick-started pilot projects, e.g. in the metal working, beverage and automotive industries.

**More experience, more sectors** – The adoption of Chemical Leasing by various national initiatives came along with a substantial broadening of approaches. First sector-specific initiatives were initiated. Table 5 below elaborates on how Chemical Leasing expanded to new industry sectors and processes.

**Regional workshops** stimulated a screening of opportunities in Russia, Croatia, Brazil, Ukraine, Uganda and Nicaragua. In 2011 and 2012, first projects were launched successfully, for example in the Croatian beverage industry and in the Russian metal processing industry.

A project from the Serbian food processing sector is presented in the next section in detail. An overview of all project launches in the regions is provided in the Project Database that is continuously updated and to find online at [chemicalleasing.org](http://chemicalleasing.org).

*Table 5: Chemical Leasing applications across sectors*

<i>Industrial sectors</i>	<i>Chemicals identified (selection)</i>
Manufacture of electronic equipment	Powder coatings
Manufacture of fabricated metal products	Organic solvents, detergents
Various industries/steel treatment	Galvanizing and phosphating agents
Beverage production	Lubricants for packaging conveyors
Waste water and drinking water treatment	Water treatment chemicals
Accommodation and service sector	Cleaning chemicals
Beverage and food processing	Glues, adhesives, detergents, sanitizing chemicals
Petrochemical industry	Catalysts and water treatment chemicals
Printing industry	Ink, printing chemicals





## CASE STUDY

### Bonding of boxes in the Serbian food processing sector

#### 2.2.5 Case study

#### Background information

Adhesives are part of a variety of food packaging materials. They can be used to manufacture rigid cardboard packaging (bonding of boxes) or to seal flexible packaging, including wrappers, pouches and lidding films. They can bind together layers of materials that come in contact with food or they can attach labels to an article to designate its origin. It is strictly forbidden by legislation to use adhesives in a way that could negatively affect food, change the nature, substance or quality of the food or could make it harmful to health and/or environment.

#### Introduction

A Serbian confectionary company, Bambi Banat, was approached by Henkel, one of the global leaders of chemical solutions for adhesives in the packaging business, with a proposal to improve the packaging processes. Henkel proposed the usage of a new adhesive as it would enable the user to reduce packaging costs and improve environmental performance at the same time. Joint industrial trials were conducted to test the new solution before it was finally agreed that Chemical Leasing would be the most adequate means to introduce the new adhesive to the packaging processes of Bambi Banat. The Chemical Leasing contract was signed and prolonged on a yearly basis.

#### Key changes and results

The Chemical Leasing business model was successfully implemented on six packaging lines. A new adhesive was chosen for the bonding of more than 20 different types of boxes in varying shapes and sizes. The product innovation came along with several process innovations related to the adjustment of process parameters, bringing about a significant reduction of adhesive consumption. Chemical Leasing enabled the Serbian company to cut costs significantly and to achieve environmental, economic and social benefits at the same time.

#### Unit of payment applied

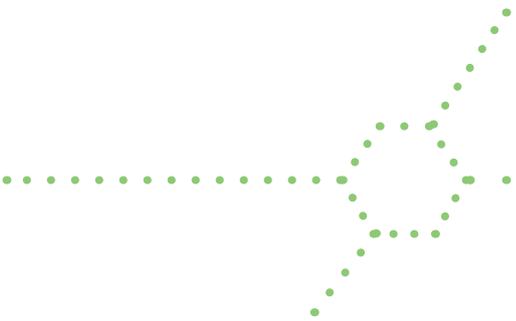
Before Chemical Leasing	EUR per kilo of adhesive
After Chemical Leasing	EUR per bonded box (taking into account the box type)

#### Technical measures tested and implemented

The former polyvinyl acetate based adhesive was replaced by a hydrocarbon resin based one. Technically, the adhesive was first melted and then dispensed to the surface of the boxes. For its efficient application, the process parameters, such as temperature and pressure, were optimized (lowered) compared to the situation before the introduction of Chemical Leasing.



## Results achieved

Before Chemical Leasing	After Chemical Leasing
<ul style="list-style-type: none"> <li>• Operating temperature was 160°C</li> <li>• Operating pressure was 2.9 bar</li> <li>• Adhesive was added manually into the reservoirs</li> <li>• Melted adhesive had an unpleasant smell</li> <li>• The dispensing nozzles got clogged during the application due to the high-temperature melting process of the PVA based adhesive. This led to shortages and additional maintenance work.</li> </ul> 	<p><b>Environmental benefits:</b></p> <ul style="list-style-type: none"> <li>• Consumption of the adhesive significantly reduced (more than 30%)</li> <li>• Energy consumption reduced (new operating temperature 130°C, new operating pressure 2 bar)</li> </ul> <p><b>Economic benefits:</b></p> <ul style="list-style-type: none"> <li>• Costs for the adhesive were reduced by €4,000 per year</li> <li>• Energy costs were reduced</li> <li>• Maintenance costs were reduced by €10,000 per year</li> <li>• The team efforts of user and supplier created the basis for a long-term relationship</li> </ul> <p><b>Social benefits:</b></p> <ul style="list-style-type: none"> <li>• The automatic dosing system reduced the possibility of workers suffering burning injuries</li> <li>• Working conditions were improved: the new adhesive was odourless</li> <li>• Workers were trained on the safe use of chemicals</li> </ul>

### 2.2.6 Interview

#### Chemical Leasing in practice - Ms. Vojislavka Satric (NCPC Serbia)

.....

**Question:** *When did you join the Chemical Leasing Programme and what do you particularly remember from the first year of participation?*

**Satric:** I joined the Programme in 2008. When I was at the first training course in Vienna, it seemed to me that I understood the model very well, that it would be easy to find partners and to start my first Chemical Leasing projects in the “real” chemical industry (for example in paint production). But then I realized that it can actually be quite difficult to initiate changes. I had to learn that it was challenging to find companies willing to change their business practices, even though we managed to receive eight signed letters of intent in the first year.

Success came slowly. In addition, we did not start our work in the “real” chemical industry, as I had initially assumed, but in the beverage and confectionery industries. I could not imagine any of this at the very beginning.

**Question:** *How would you describe the main tasks of the NCPC in promoting Chemical Leasing in the country during the period from 2008 until 2011?*

**Satric:** Chemical Leasing was a completely new idea for the Serbian industry. One of the main tasks was to spread word about the model and to kick-start change and business model implementation in companies. We organized many workshops and company visits, published articles and did promotion on the radio and on local TV shows. We also established a national working group with different stakeholders and partners for our projects. The first cases were launched successfully (they are still ongoing!) and triggered new projects. All these efforts resulted in an increased visibility of Chemical Leasing in Serbia.

**Question:** *How have you been personally involved in industry projects? How have you experienced your work in the Global Chemical Leasing Programme as an international expert?*

**Satric:** I go to companies, present the model and find out if there is a way of starting a Chemical Leasing project. Many years of experience in industry help me recognize opportunities and design reasonable test processes and scenarios for implementation. It is very important to find the right project set-up. This can include substantial process changes or chemical substitution, defining the right unit of payment and selecting robust baseline data for the project. It can be very different from case to case. Very often it turns out that the initially proposed solution is not the right one, but every single experience has enhanced my understanding, so that I am now very happy to help colleagues to be more successful. I have already supported Chemical Leasing projects in Sri Lanka and Colombia and could observe that there

are many good cases and an enormous potential for Chemical Leasing not only in Serbia. I strongly believe that Chemical Leasing is the business model of the future for many chemical applications.

**Question:** *In short: What has happened since 2011? What are the key opportunities and challenges for Chemical Leasing in Serbia nowadays?*

**Satric:** Several new projects have started in Serbia. I would single out the Coca Cola case because it is a replication of Chemical Leasing applied to the lubrication of packaging lines. I think that Chemical Leasing in this specific process will soon become the preferred way of doing business all over the world. In actual fact, I believe that for many countries, which are currently facing economic problems, innovative projects focusing on the reduction of production costs such as Chemical Leasing present a huge opportunity. For Serbia, it is a great opportunity to use Chemical Leasing to comply with EU environmental legislation. The challenges are the same as elsewhere in the world: the model is complex, and sufficient resources (time, staff, know-how) are needed. People are often conservative and not ready to change their way of doing things. But I am optimistic for the future!



## 2.3 Chemical Leasing Goes Global

[2011 – 2014]

### 2.3.1 Overview

The adoption of Chemical Leasing in industries had increased steadily from 2004 until 2011. In the third programme phase, national and regional undertakings were merged into one set of interconnected activities focusing on Chemical Leasing promotion and implementation. Table 6 highlights what was achieved in the first 10 years of UNIDO's Global Chemical Leasing Programme.

Table 6: Overview of achievements until December 2014

Countries involved:	14
Demonstration projects:	> 50
Companies contacted:	> 1,700
Persons trained:	> 450
National working groups established:	4 (Colombia, Serbia, Sri Lanka, Brazil)
Global Chemical Leasing Awards conducted:	3 (2010, 2012 and 2014)

The stakeholder basis enlarged significantly. Until December 2014, the Programme pursued activities in Egypt, Mexico, Russia - St. Petersburg/Kazan (since 2004/2012), Colombia, Serbia, Sri Lanka (since 2008) as well as in Brazil, Costa Rica, Ecuador, Croatia, Nicaragua, Peru, Uganda and Ukraine (in 2011 - 2014). More than 50 verified demonstration projects are on file and more than 450 persons received training on Chemical Leasing. National working groups were established in four participating countries. Switzerland joined the long-term donor countries Austria and Germany and provided direct financial support.

### 2.3.2 Global promotion and advocacy

From 2011 onwards, many promotional activities encouraged stakeholders to investigate the Chemical Leasing business model. Every year, more than a dozen presentations on Chemical Leasing were given at different high-level international policy events, business fairs or scientific conferences. Chemical Leasing side-events were organized with the purpose of raising awareness and providing information about the ways in which Chemical Leasing can contribute to the sound management of chemicals and shaping the circular economy in practice. Several global promotion and advocacy efforts deserve a particular mention:



Figure 22: UNIDO's Chemical Leasing Programme around the globe

## 1. 2011 – International Year of Chemistry

In 2011, the Global Chemical Leasing Programme carried out its activities under the umbrella of the *International Year of Chemistry*. As announced by the United Nations, “The achievements of chemistry and its contributions to the well-being of humankind were celebrated all over the world. A variety of activities and seminars were devoted to the topic of sustainable chemistry.” In consequence, Chemical Leasing was presented and promoted in a particularly large number of events (listed in Annex 4.3).

## 2. References to Chemical Leasing in official documents (selection):

Especially the following references highlight the increased recognition of Chemical Leasing as a modern policy instrument for sound chemicals management.

- **European Parliament resolution of 13 September 2011** on an effective raw materials strategy for Europe (2011/2056(INI)) where Chemical Leasing was explicitly mentioned and recommended to be actively supported by the European Commission (Article 10 of the resolution).
- **Official letter from the Serbian Government**, presented during the annual meeting of the International Working Group on Chemical Leasing (18 May 2011, St. Petersburg), where Chemical Leasing was recognized as an efficient tool for sound chemicals management and Serbia's support of the Global Programme was highlighted.
- **Information note entitled “Green Industry – UNIDO's contribution to waste avoidance and minimization” presented by UNIDO** at the plenary meeting of the Tenth Meeting of the Conference of the Parties to the Basel Convention (COP 10) on 19 October 2011. It was stated that Chemical Leasing is fully in line with waste minimization and avoidance, which is the new emphasis of the Basel Convention.

- The [publication](#) “Sustainability of products - What it's all about” issued by CEFIC (European Chemical Industry Council) described Chemical Leasing as a substance-by-service replacement and recommended it as an option among several substitution possibilities, emphasizing that its economic, environmental and social benefits have to be demonstrated in each case.
- In the **OECD-Environmental Performance Review, 2013-Austria**, a [chapter](#) is devoted to Chemical Leasing.
- The **European Commission, Environmental News Alert (November 2013 edition)** published an [article](#) highlighting that Chemical Leasing can complement political and scientific initiatives through intensive supplier and user collaboration to reduce the environmental impact of chemicals.
- **Chemical Leasing presented in a note to the European Council, 5 December 2014**: “Key issues in chemicals policy on the road to a non-toxic environment - Information from the Austrian, Belgian, Danish, German, French, Dutch and Swedish delegations, and Norway, supported by the Croatian and Luxembourg delegations”.

## 3. Sector-specific and special events

**Chemical Leasing at the European Forum Alpbach, August 2014** - This high-level event is organized annually and attended by representatives from governments, scientists, industrial stakeholders as well as students. It consists of different events, among them a seminar week and symposiums. UNIDO assisted the Austrian BMLFUW in a session on “Hygiene management in the health sector by way of Chemical Leasing”. Experiences from the German pilot project on Chemical Leasing in Hospitals (see Annex 4.7 for details) were discussed as well as new ideas on integrating Chemical Leasing into hygiene management at hospitals. For more information about the forum, see [www.alpbach.org](http://www.alpbach.org).



*Figure 23: Minister Rupprechter from BMFLUW at the Chemical Leasing workshop in Alpbach*

**First International Conference on Sustainable Chemistry and Chemical Leasing, December 2014** - The international conference "Sustainable Chemistry and Chemical Leasing: Paving the Way for Inclusive and Sustainable Industrial Development" examined the interrelations of green chemistry, sustainable chemistry and Chemical Leasing to achieve an inclusive and sustainable industrial development across sectors. This was discussed through the lens of the stakeholders, government representatives, businesses, academia and science. Approximately 100 persons took part in the conference, evenly distributed across the governments, NGOs, industry sectors as well as academia.

The keynote was given by Professor Paul Anastas, Director of the Green Chemistry and Green Engineering Institute,



*Figure 24: First International Conference on Sustainable Chemistry and Chemical Leasing*

Yale University. His speech underscored the challenge of raising global awareness on green chemistry and that Chemical Leasing can be seen as a very promising business model to achieve green chemistry. Award winning company representatives from Brazil, Colombia and Germany provided insights on their Chemical Leasing models. A draft "Guiding principle for sustainable chemistry" was presented by the German Federal Environment Agency, Öko-Institut and BiPro GmbH.<sup>5</sup>

#### 4. Further promotion of the Chemical Leasing concept

Chemical Leasing was included in the report "Global Chemicals Outlook" published by UNEP, which informs governments and industry on trends in chemicals production, use and disposal while offering policy advice aimed at meeting the 2020 goal. The Outlook strives to provide a coherent framework for assessing and setting priorities to support an integrated comprehensive chemicals policy, to stimulate international attention and action in this field, and to promote the transition to green/sustainable chemistry. Chemical Leasing is introduced as an attractive tool to stimulate innovation and to support the "greening" of enterprises and economies.

Chemical Leasing was also included in the European Commission publication - "Sustainable Industry: Going for Growth & Resource Efficiency". Chemical Leasing is presented as a "green" business model for enhancing resource efficiency and competitiveness of industry.

#### 5. Chemical Leasing in press and media

Various newspapers and magazines such as the Guardian, Chemical Watch, German VDI Nachrichten, Lubes Magazine Brazil etc. reported on Chemical Leasing, bringing it to the attention of a broad audience from all over the world. For example, an article "Chemical Leasing promises cleaner profits" was published on the website of the German radio station Deutsche Welle in English, Serbian and German language, describing a case from Serbia (Ecolab with Knjaz Milos).

<sup>5</sup> See more at <http://www.chemicalleasing.com/sub/news.htm>.

### 2.3.3 Capacity building

Among the main achievements of the years 2011-2014 can be underlined the publishing of the *Global Study on Chemical Leasing in Selected Cleaning Operations*, the launch of the *Chemical Leasing Hotline* and *Chemical Leasing Webinars*, as well as a major update and review of the *Chemical Leasing Toolkit* by international and national Chemical Leasing experts.

#### Global Study “Potential of Chemical Leasing in Selected Cleaning Operations”

The study explored the potential for and the required conditions to achieve a wider adoption of the chemical leasing business model within industrial and service sector cleaning operations. It provided case studies as well as technical and policy insights on the topic. The overall aim of the study was to deliver a basis for discussing how to unlock the potential and achieve a leap from individual pilot or case studies to a mainstream way of doing business.

The study revealed literature and case study reviews, interviews with case study participants and National Cleaner Production Centres (NCPC) as well as results from working discussions with experts and UNIDO for reflection and peer review of indicative results to guide the expert analysis. No statistic analysis was included, instead some hypothetical scenarios were used to illustrate the potential that the business model has for increasing efficiency, creating financial gain and reducing impacts on the environment and health.

The study found that in order to reduce the global chemical footprint and other negative environmental/health impacts through wider adoption of Chemical Leasing, more emphasis on marketing the model to businesses is required. Four areas of recommendations were identified, all related to making the Chemical Leasing business model easier to understand, adopt and develop as a mainstream tool within a wide number of suppliers and users:

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- Create market pull and make it easy for potential users to grasp Chemical Leasing
- Support chemical companies in offering Chemical Leasing
- Make the available guidance and examples easy and accessible
- Link to current trends in concepts and terminology

The full version of the sector study on Chemical Leasing in cleaning operations is available on the Chemical Leasing [website](#).

#### Chemical Leasing Hotline

In autumn 2012, the Chemical Leasing Hotline was established in order to support the implementation and promotion of national and international activities. The main tasks of the hotline team include assisting in the development of ongoing projects (analyzing technical data, implementation assistance); collecting new information on Chemical Leasing and sound chemicals management and dissemination; assisting in drawing up different reports and updating the website; revising and updating a database on Chemical Leasing cases and developing a library of supportive documents and tools; reviewing national PR materials, etc.

## Chemical Leasing Hotline

First help & assistance in implementation  
and promotion

hotline.chemicalleasing@gmail.com

## Chemical Leasing Toolkit

The Toolkit received a thorough update in 2014 and 2015, including tailor-made features for managers, technicians and policy-makers. This project was made possible with the funding from the European Union under its support to UNIDO for the development of the IOMC Toolbox for Decision-Making in Chemicals Management; as well as from the Government of Switzerland, Austria and Germany under their support to UNIDO's Global Chemical Leasing Programme. **The revised toolkit now addresses companies and policy-makers separately, allowing tailor-made guidance** on how to use Chemical Leasing in practice. By using this Toolkit, companies learn in a systematic way how to integrate Chemical Leasing in daily operations at plant level. Policy-makers can understand the potential of Chemical Leasing as a modern policy instrument for chemicals policy initiatives (binding and non-binding) and for other voluntary activities to foster the sound management of chemicals from a policy point of view.

## Webinar

In 2014, the NCPC Nicaragua developed, organized and conducted a series of webinar sessions for interested stakeholders and technical experts in the Latin

American region (comprising the countries: Nicaragua, Costa Rica, El Salvador, Honduras, Guatemala, Ecuador, Dominican Republic, Mexico). This resulted in effective knowledge sharing with six NCPCs as well as among 6 NCPCs as well as 3 representatives of the countries' Environmental Ministries. Overall, 21 companies and 9 consultants were trained on the Chemical Leasing business model on-line. Moreover, the presentations on the Chemical Leasing Toolkit as well as the application forms for the Global Chemical Leasing Award 2014 were made available in Spanish.

## 2.3.4 National initiatives and business engagement

A pool of committed Chemical Leasing experts networked to advance the business model in their countries. The NCPCs conducted different training programmes on Chemical Leasing, for example for the following sectors: Printing, Paint, Agriculture, Water Treatment, Wood Preservation, Cosmetics, Metal Cleaning, Hospitality, Food Processing, Textiles, etc. One- or two-day training workshops were designed to instruct national experts in Chemical Leasing. Until late 2014, more than 450 individuals were trained in such workshops in a dozen countries.

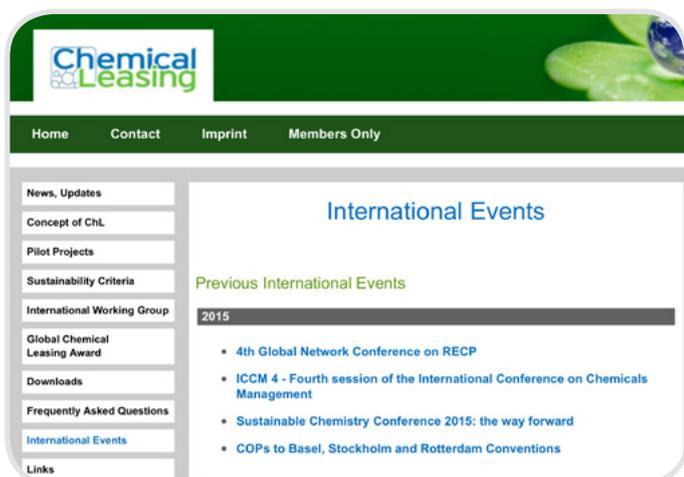


Figure 25: Resource pool and Chemical Leasing event calendar at [www.chemicalleasing.org](http://www.chemicalleasing.org)



Figure 26: Group picture from an international Chemical Leasing Network Meeting in 2012

Table 7: Project database – National initiatives and case studies 2004-2014

Country [NCPC]	# Companies contacted	# Projects assisted	Partner companies (User-Supplier) / Sector
Egypt	> 200	5	1. General Motors – Dr. Badawi / Automotive 2. ABB – Akzo Nobel / Metalworking 3. El Sewedy – Zinc Misr Company / Metalworking* 4. Masour Group – SuperClean / Automotive* 5. Delta Group – Akzo Nobel / Washer manufacturing*
Mexico	> 70	4	1. Cromadora Delgado – MARDI / Metalworking 2. Fideicomiso Ing. San Cristobal – Chemical Mac Oil / Food processing* 3. Owens Corning Mexico – Lubricon / Construction* 4. MARECSA – Química APOLO / Oil & gas*
Russia / St. Petersburg	> 30	3	1. SUE Vodokanal – Aquatech Service / Water supply 2. SUE Vodokanal – ZAO KEMIRA / Water supply* 3. ERG – Henkel ERA / Water supply*
Colombia	110	6	1. Ecopetrol – Nalco / Oil & gas [2 cases] 2. Renault Sofasa – POLIKEM/ Automotive [2 cases] 3. Corona-Colceramica – TransformEcoSkandia / Construction & ceramics 4. Haceb – POLIKEM/ Electric domestic appliances*
Sri Lanka	240	13	1. Finlays Tea Plantation – Hayleys / Agriculture 2. MAS Linia Intimo – Watercare Technologies Pvt Ltd / Water treatment 3. Several local farmers – Kandurata Agro Advisory Service / Agriculture 4. Madushika Paints Chemicals Pvt – Sri Lanka Broadcasting Corporation/ Painting* 5. St Regis – General Ink, promoter Holcim Lanka / Printing* 6. Wijeya Newspaper – Kumar Namasivayam / Printing* 7. Wijeya Newspapers Pvt Ltd – Watercare Technologies Pvt Ltd / Water treatment*
Serbia	>100	6	1. FKL – SAFECHEM Europe / Metalworking 2. Bambi – Henkel / Food processing; Bonding of boxes 3. Knjaz Milos – Ecolab / Beverages 4. Coca Cola – Ecolab / Beverages 5. Oto Varga – Agro Fito Pharm [Distributor] / Agriculture [2 cases]
Croatia	24	2	1. Coca-Cola HBC – Ecolab / Beverages [2 cases]
Ukraine	21	1	1. Interagro Skvira – Enzim / Agriculture*
Brazil	30	2	1. Odebrecht – Fumajet / Mosquito control 2. Windsor – Ecolab / Hospitality
Russia / Kazan	78	5	1. Ferrum System – Ergostroy / Metalworking 2. Olma – Lates / Metalworking 3. Ronis Pak – CVK Trading / Glue application 4. Avto-Lux – Perota / Cleaning (car wash) 5. Aqua-Lux – Multitech SPB / Cleaning (car wash) 6. Pozis – Rabika / Lighting** 7. Pozis – RT Energo / Lighting**
Nicaragua	35	3	1. Protena – Q&S Solquisa / Food processing
Costa Rica***	/	/	2. Extralum – Qaisa / Metalworking 3. Unilever – Ecolab / Food processing
Uganda	21	2	1. Crown Beverages Limited (CBL) – Diversey / Beverages 2. Nile Breweries – Diversey / Beverages
Ecuador	25	1	1. Coca Cola Ecuador – TENSID CHEMIE / Beverages

\* Case initiated/ negotiated by the NCPC and/or letters of intent signed.

\*\* Not a Chemical Leasing case by definition, solely based on Chemical Leasing principles.

\*\*\* Case studies developed in Costa Rica were technically assisted by the NCPC Nicaragua.

In addition, it was reported to UNIDO that national awareness raising events were held with more than 500-1,000 individuals participating throughout the years (e.g. > 1,300 in Colombia, > 1,000 in Serbia). The NCPC Sri Lanka, for example, counted 887 participants in 24 awareness raising workshops provided at different events in the country from 2008-2014. Usually, such awareness raising workshops last up to 2 hours and are attended by 20-30 policy representatives, technicians, businessmen, academic or other stakeholders.

The companies participating in Chemical Leasing projects operate in different sectors, including powder coating, metal finishing, printing, water treatment, the oil and gas sector and agriculture. By carrying out assessments, the NCPCs play an important role as independent facilitators and quality assurance entities. Table 7 gives an overview of all projects carried out by NCPCs since project start.

As outlined in Table 7, more than 50 demonstration projects are on file in which programme stakeholders either played an important role in encouraging the project initiation and facilitating the project implementation or acted as mediators between the different partners.

More information, including specific project data for each single case (e.g. unit of payment, project results, financial savings, chemicals used etc.) can be found in the online database provided under <http://www.chemicalleasing.com/docs/database.pdf>, which is updated on a frequent basis.<sup>6</sup>

The ultimately achieved resource and economic savings may vary highly depending on the type of application and chemicals used within the processes. Total cost savings can amount to \$1,000 per year, but can also add up to much higher figures if implementing Chemical Leasing unlocks high innovation potential. For example,

<sup>6</sup> It shall be noted that UNIDO's Global Chemical Leasing Programme has received also information on Chemical Leasing projects in other countries and companies. These cases are also listed in the on-line database, for example cases from the United Kingdom, Germany, Austria, Slovenia and India.

UNIDO received the following information about the Colombian case of Ecopetrol and Nalco (extract):

*Table 8: Benefits reported from Ecopetrol and Nalco based on implementing the Chemical Leasing business model*

<i>Environmental benefits</i>	<i>Social benefits</i>	<i>Economic benefits</i>
<ul style="list-style-type: none"> <li>• 80% packing material reduction</li> <li>• 66% carbon footprint reduction</li> </ul>	<ul style="list-style-type: none"> <li>• Risk to human health through chemical substances considerably reduced</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction of polymer flocculant consumption by 18-21%</li> <li>• Annual savings achieved by Ecopetrol*: more than \$20 million</li> <li>• Annual additional income for Nalco: \$150,000</li> </ul>

*\* For May 2011-Dec 2012; total impact in the cost of the operation. These savings were realized due to the fact that Ecopetrol had to replace the pumps in the wells less frequently. The full case study is available from the Chemical Leasing Programme Annual Report 2013, p.30-32, provided under <http://www.chemicalleasing.com/sub/down.htm>.*

It should be highlighted that all listed projects have to define a unit of payment that distinguishes the case from traditional business models. At the same time, UNIDO encourages stakeholders to also start such projects and to search for innovative solutions even if it is initially difficult to imagine how the unit of payment can be changed (as is sometimes the case in the agro-industry). In Peru, for example, the NCPC identified very promising projects operated by the company FARMEX that are not fully in line with Chemical Leasing criteria, but might lead to more sustainable business practices in the Peruvian agro-industry.

The importance of establishing partnerships needs to be underlined, especially considering issues like risk management and data monitoring. Fair benefit sharing can be fostered by neutral stakeholders facilitating the implementation process, such as NCPCs or UNIDO. The case of Chemical Leasing public-private partnerships

was evaluated by an independent thematic evaluation team in 2013, and the results are presented below:

In 2013 an **independent thematic evaluation** of the overall UNIDO business partnership programme was carried out. The primary focus of the evaluation was on selected ongoing partnerships, including Chemical Leasing. The evaluation addressed the following key criteria: relevance, design and ownership, effectiveness, sustainability, impact, cross-cutting issues, efficiency in the implementation of business partnerships, institutional arrangements and lessons learned.

The Chemical Leasing initiative received high recognition by the evaluation team as a multi-stakeholder partnership that “achieved remarkable results from partnering with the private sector and has led to positive changes for the environment”. The report recommended to “give priority to multi-stakeholder platforms like the Green Industry Platform and the Chemical Leasing approach as they offer significant leverage and scaling-up potential. The approach should be brought to a higher level and UNIDO should establish partnerships with big chemical companies at the corporate level”. Selected statements of the evaluation report in regard to Chemical Leasing:

Relevance: “the partnerships with Metro, Carlsberg and the Chemical Leasing initiative have a direct effect on production processes”.

Monitoring and reporting system: “the success of each Chemical Leasing partnership between companies that is facilitated through UNIDO is thoroughly monitored and evaluated along the following criteria (in addition to the sustainability criteria): 1) Situation before Chemical Leasing; 2) Chemicals applied; 3) Changes due to the implementation of Chemical Leasing. Furthermore, the impact of the Chemical Leasing business model on the individual companies is well documented.”

Sustainability: “Chemical Leasing is an interesting case as it promotes an entirely different concept, which

*hugely contributes to the sustainability of results achieved – financial incentives. Most companies that have changed the use of chemicals are not likely to go back to the previous old modalities, as Chemical Leasing reduced the cost of procurement of the chemicals. Also, the companies selling chemicals will probably continue promoting the Chemical Leasing concept, as it makes business sense for them.”*

Impact: “Two partnerships stand out in terms of impact: the HP partnership, due to the multiplier effects and national coverage, and the Chemical Leasing initiative, due to its direct effects on the environment. [...] The Chemical Leasing initiative has led to positive changes. Over 40 projects have been successfully implemented. The use of chemicals was significantly reduced (up to 90%) in participating companies which very likely had a positive impact on the environment”

Replicability: “The Chemical Leasing business model is being replicated in an increasing number of countries but there is a much higher potential and the approach is not promoted on a large scale or at corporate levels by UNIDO. However, the model gained global visibility through the Global Chemical Leasing Award, potentially raising the interest of other companies.”



Figure 27: Thematic evaluation of Chemical Leasing

## CASE STUDY

### Lubrication in the Ugandan beverage industry

#### 2.3.5 Case study

#### Background information

The beverage industry in general is a major consumer of water that is used for the lubrication of conveyor belts and the cleaning of returnable glass bottles, among other processes. Lubricants reduce the friction of the conveyor belt so that bottles can move smoothly down the production line. Sodium hydroxide and additives are used to wash returnable glass bottles.

#### Introduction

Crown Beverages Limited (CBL) is an Ugandan beverage company that operates under Pepsi-Cola International Franchise. It produces several soft drink brands for clients in the Ugandan local market as well as for export markets in the African region. The company decided to integrate the Chemical Leasing business model in its operations, closely cooperating with one of its main suppliers, the American chemicals producer Diversey Eastern and Central Africa (U) Ltd. The common goal was to find synergies for joint product and process innovations and to increase CBL's process efficiency, particularly with regard to the company's water treatment processes and chemicals consumption.

#### Key changes and results

Chemical Leasing was successfully introduced (1) to the lubrication of conveyor belts on three returnable glass

bottle lines and (2) in the cleaning of returnable glass bottles and cases. Within six months, CBL obtained direct savings of \$175,000 and significant additional indirect savings related to the effluent treatment. Diversey largely increased the satisfaction of its customer without compromising the financial benefits from the collaboration. Encouraged by the results, both companies intend to scale up the Chemical Leasing concept to include other operations in the region.

#### Unit of payment applied

Before Chemical Leasing:	Uganda Shillings per litre or kilogramme of chemicals purchased
After Chemical Leasing:	Uganda Shillings per litre of beverage produced



Waste water foaming before Chemical Leasing



Foaming eliminated after implementation of the model

## Results achieved

Before Chemical Leasing	After Chemical Leasing
<ul style="list-style-type: none"> <li>• High water consumption both in bottle and case washing (116,000 m<sup>3</sup> per year) and conveyor belt lubrication (29,000 m<sup>3</sup> per year)</li> <li>• High consumption of sodium hydroxide (500 kg per day)</li> <li>• The soap based lubricant required additional cleaning and produced a high amount of foam in the effluent treatment plant and thus caused high treatment costs</li> <li>• Overstepping of relevant waste water discharge reference values</li> <li>• Lack of appropriate chemicals storage rooms</li> <li>• Poor management of obsolete chemicals at plant level</li> </ul> 	<p><b>Environmental benefits:</b></p> <ul style="list-style-type: none"> <li>• Chemical use in bottle washing and conveyor belt lubrication reduced by 40% and 48%, respectively</li> <li>• Water consumption for the conveyor lubrication reduced by about 13,000 m<sup>3</sup></li> <li>• Less consumption of chemicals in the waste water treatment plant</li> <li>• Compliance with the waste water discharge standards</li> <li>• No more overconsumption of sodium hydroxide</li> <li>• Less energy consumption resulting in reduced CO<sub>2</sub> emissions (about 150 tons per year)</li> </ul> <p><b>Economic benefits:</b></p> <ul style="list-style-type: none"> <li>• Economic savings of \$350,000 per year</li> <li>• Long-term business partnership</li> <li>• Improved stock management</li> </ul> <p><b>Social benefits:</b></p> <ul style="list-style-type: none"> <li>• Better working environment with reduced chemical spillages</li> <li>• Reduced risk of chemical injuries due to substitution of solid sodium hydroxide by a diluted one</li> <li>• Constant information exchange between the supplier and the user of chemicals</li> <li>• On-site technical support from chemicals supplier to train the company's employees</li> </ul>

### 2.3.6 Chemical Leasing Goes Agro

Large amounts of agrochemicals are produced and consumed worldwide. Globally, more than one million tonnes of pesticides and 50 million tonnes of fertilizers are consumed every year. In addition, dealing with and applying agrochemicals is a complex task with various activities and parameters involved. There are many factors associated with crop cultivation that cannot be predicted with accuracy (weather conditions, pests and diseases, etc.) or that largely depend on know-how. However, traditional business models for chemicals used in agricultural applications have neither offered good incentives to prevent overconsumption of chemicals, nor have they promoted knowledge transfer between stakeholders. Hence, there is a great potential for optimizing the use of agrochemicals by means of innovative chemicals management.

Chemical Leasing can become a mainstream solution for applying agrochemicals in an eco-friendly and efficient manner, because the concept offers ways to better interlink actors along the supply chain. Key to the successful implementation is the concept's inherent approach of a fair benefit and risk sharing between partners at any time. By creating sustainable business partnerships, Chemical Leasing can unlock innovation potential and increase economic welfare for all involved parties. If applied, a number of benefits are conceivable:

- Environment: reduced pollution of soil and water, lower air emissions, increased resource efficiency
- Health: less exposure of field workers to hazardous chemicals; less contaminated foodstuff for consumers; low risks
- Economic/Farmers: Reduced consumption of chemicals; cost savings
- Economic/Suppliers: compensation for know-how transfer; generation of innovative solutions; higher profit based on delivery of product-service solutions

Under the umbrella of UNIDO's Global Chemical Leasing Programme, in the past 10 years more than 55 Chemical Leasing pilot projects have been carried out across industrial sectors. First pilot projects have been implemented with success, for example in Serbia and Sri Lanka. They focused on the optimization of chemicals use in the cultivation of potatoes, wheat, corn and in tea plantations.

1. In Serbia, the Chemical Leasing business model was applied on a wheat field and resulted in a reduction of fertilizers consumption and higher yield (2% higher compared to the neighbouring field using the traditional business model). The economic benefit was around 210 EUR/ha.
2. In Sri Lanka, Finlays (a UK-based multinational tea producer) introduced a pilot project of applying Chemical Leasing on the cultivation of tea. The cost benefit analysis revealed economic savings of \$60 to \$70 per hectare of tea plantation compared to the conventional business model. Finlays aims at scaling up Chemical Leasing projects in its operations.

UNIDO's Global Chemical Leasing Programme and the involved National Cleaner Production Centres of Serbia and Sri Lanka will continue to provide technical assistance and support in the dissemination and awareness-raising activities on Chemical Leasing in agriculture. The next steps shall focus on:

- Lock Chemical Leasing into frameworks of other Sustainable Agrobusiness Practices and initiate more pilot projects and country initiatives
- Encourage national policies to include Chemical Leasing in their environmental policy programmes as best practice example for sustainable business in agriculture
- Develop sector-specific criteria for applying Chemical Leasing in agriculture based on the existing general Chemical Leasing Sustainability Criteria

- Find solutions to facilitate the definition of the unit of payment, to thoroughly address liability issues and to ensure proper risk and pest management (e.g. involve insurance companies, distribute the potential burden among the partners)

To conclude, UNIDO’s Global Chemical Leasing Programme has 10 years of experience in implementing Chemical Leasing. It is a fact that the principles of the model can be transferred from industrial applications to agriculture. At the operational level, a distinction between fertilizers and pesticides is useful, as different mechanisms apply concerning over- and underuse. The results from pilot projects in Serbia and Sri Lanka encourage the further up-scaling and mainstreaming of Chemical Leasing in agriculture.

**Time table on developments in "Going Agro"**

2009	Discussion initiated
2012	First pilot project in Sri Lanka and Serbia
2013	Thematic group in agriculture formalized
2014	Award applications from Sri Lanka & Serbia: receiving “Special Acknowledgements”

An overview on the Sri Lankan business case of Chemical Leasing in Agriculture is provided in the Annex 4.5. An overview on the Serbian project was presented by the National Cleaner of Serbia on the local television channel and is accessible [on youtube](#) (English subtitles).



Figure 28: Agro-projects in Sri Lanka

Figure 29: Agro-projects in Serbia

## III. THE WAY FORWARD

### 3.1. Chemical Leasing Strategy [2015 - 2025]

#### A new strategic approach for the post-2015 era

Over the past 10 years, much has been done to promote Chemical Leasing. Starting with pilot projects in solely three countries, the Programme grew up and is now a global and vital platform for innovators and supporters from several industries, policy backgrounds and academia. Various case studies were developed, a number of research studies written and a variety of tools and instruments created. However, there are many opportunities that have not yet sufficiently been targeted. Therefore, UNIDO, jointly with a multi-stakeholder and multi-sectoral expert group, has developed a post-2015 strategy for the wider adaption of Chemical Leasing that is aligned with national and regional activities. It provides the narrative for the future path of the Global Chemical Leasing Programme.

#### Programme vision

For the first time, a vision has been defined for the Global Programme, highlighting the strong linkage between the Programme, the newly adopted UN Sustainability Agenda 2030 and the corresponding Sustainable Development Goals, in particular, SDG 9.

*“Chemical Leasing is a mainstream, state-of-the-art business model widely used for contracts in industry, services and public procurement. The use of Chemical Leasing contributes to Inclusive Sustainable Industrial Development by helping to safeguard the environment and people, creating shared prosperity for the partners and encouraging innovation.”*

It shall be emphasized that Chemical Leasing also remains closely connected to the Resource Efficiency

and Cleaner Production Concept. This is incorporated into the mission statement and the four strategic objectives, as outlined in the following.

#### Programme mission

The mission of UNIDO’s Chemical Leasing Programme is *“to promote the resource-efficient and safe use of chemicals in an inclusive and cooperative manner”*.

#### Programme objectives

The four objectives were derived from the vision and mission statement based on different levels or strategic areas: Objective 1: Policy-making/public-sector intervention, Objective 2: Industry/sector intervention, Objective 3: Business/company (organizational) intervention. Objective 4 is crosscutting as it targets market change in a holistic approach that includes all three levels of intervention.

In terms of action, the programme partners shall continue to foster activities and joint projects, which have been proven to be successful in the past, such as the

- Production and dissemination of books, a toolkit, sector studies and several publications for conferences and journals
- Co-funding, organization and promotion of the Global Chemical Leasing Award
- Training and capacity building measures
- Promotion of research, scientific publications and academic support
- Participation at international events
- Management of the Chemical Leasing website

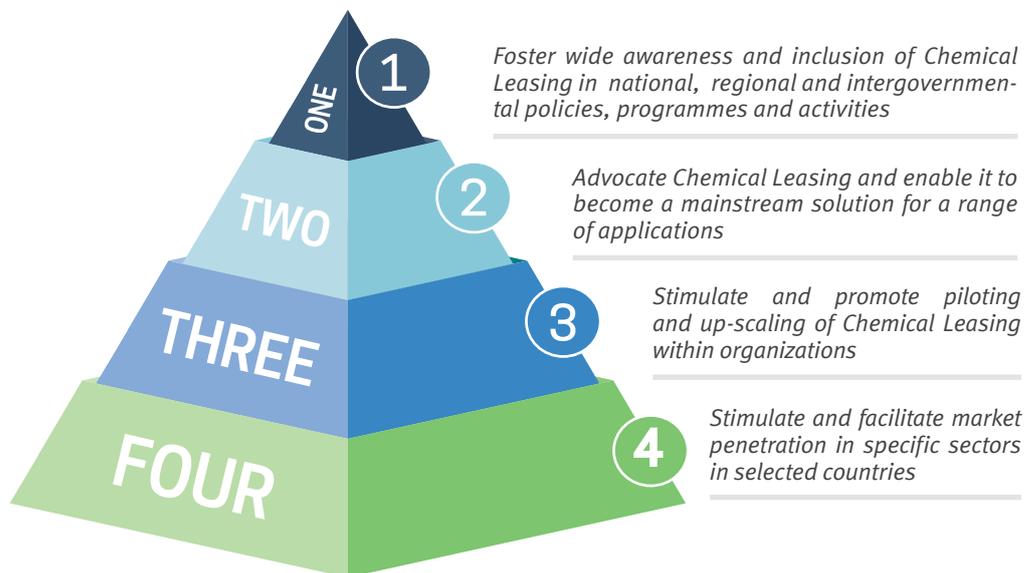


Figure 30: Chemical Leasing Strategy - Objectives

In addition, new mechanisms of promoting the business model shall be designed to meet the objectives. Therefore, a set of five programmatic workstreams was developed. They correspond to the three levels of intervention and the related main target groups, political stakeholders, industrial stakeholders and individual companies (organizations). In addition, a fourth, cross-cutting workstream, aiming at “market change”, was defined that targets all groups within a geographic area. An overarching fifth workstream consists of supporting actions related to research, facilitation, networking and recognition. This new programmatic approach is illustrated in Figure 31 and briefly described thereafter.

**WS1: Policy** - It is intended that the programme partners promote inclusiveness and transfer of knowledge and experiences relating to Chemical Leasing to low- and middle income countries. It shall contribute to a circular economy that is restorative or regenerative by intention and design. Specific care will be taken to ensure that the benefits can be reaped by all segments of populations, and across gender and age. The following three actions will contribute towards achieving this workstream's objective:

1. Develop and execute a **Roadmap for the Chemical Leasing model in the policy arena** to develop and strengthen the connections and synergies with the public sector, including:
  - Other UNIDO Member States, EU Agencies, UNIDO and UN organizations’ programmes and projects in line with UNIDO’s mandate of promoting ISID
  - International, regional and national programmes and initiatives
  - Legislation and conventions that address chemical sourcing, production, use, transport and end-of life treatment
2. Stimulate awareness of, and discussion on, the potential of including Chemical Leasing considerations in international, regional and national public programmes and policies
3. Support the adoption of Chemical Leasing as preferred contract model within public procurement criteria for services and products, wherever applicable

## WS5: Facilitation, networks and recognition

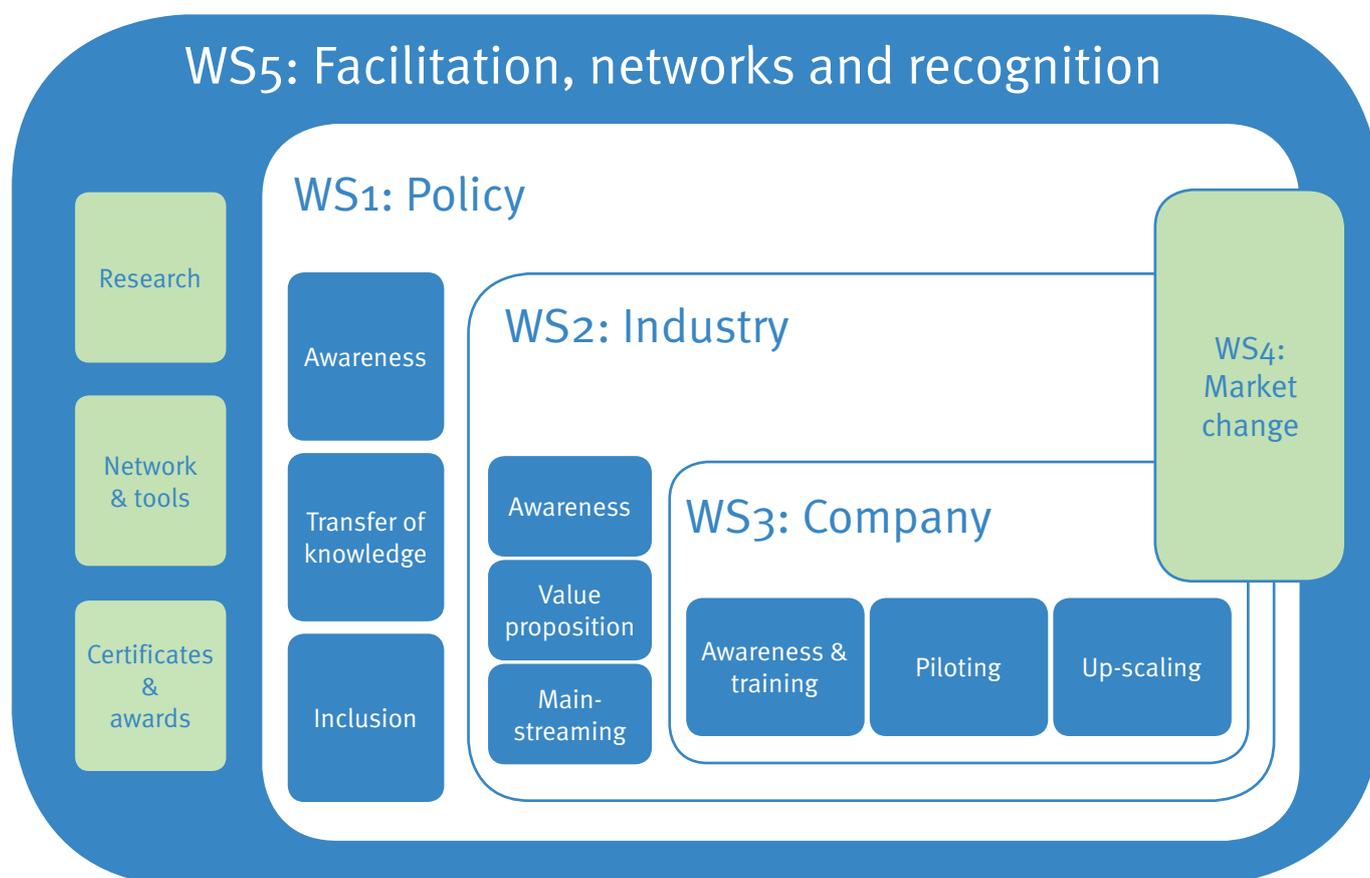


Figure 31: Chemical Leasing Strategy - the five workstreams

**WS2: Industry** - The Programme shall actively raise awareness of the business model in the industrial sector. It shall actively search for new applications and industries where Chemical Leasing could be used. The following two actions will contribute towards achieving the theme's objective:

1. Develop and execute a **Roadmap for Mainstreaming Chemical Leasing**. This will include consideration of the circular economy approach and especially be dependent on how to:
  - Define and take measures to make the business model widely recognized and used across industries
  - Select target industries for prioritized further work, and encourage the wider adoption of Chemical Leasing within these selected industries by actively introducing the model to representatives of new potential users and providers, including SMEs

- Raise awareness of the model's benefits with a view to company management across value chains and to designing out waste with Chemical Leasing
- Support the development of procurement criteria for Chemical Leasing contracts as performance-based contracts
- Support efforts to rethink incentives for sales force
- Explore and utilize potential synergies with existing industry health, safety, environment or sustainability programmes and tools
- Support the wider adoption of Chemical Leasing by encouraging new industry representatives to pilot the model in their business;

2. Establish criteria for identifying new substances, applications and industries, where Chemical Leasing could reduce the participant's chemical footprint and create business benefits.

**WS3: Company** - This workstream refers to the objective of up-scaling Chemical Leasing within such companies where the potential for the model has already been proven in pilot projects. This shall be pursued in line with the SAICM objectives and the Circular Economy approach. Four actions will contribute towards achieving the theme's objective:

1. Develop and execute a **Roadmap for Up-scaling** the use of Chemical Leasing within companies. This will include consideration of how to:
  - Support existing piloting companies to make the move from piloting in a specific application to full-scale process use (user industries)
  - Identify and support the development of purchasing criteria that allow for Chemical Leasing bids in other units (user industries)
  - Support and training for chemical suppliers, including small distributors, in how to include Chemical Leasing in bids and proposals (suppliers)
2. Encourage companies with experience from Chemical Leasing to extend the use of the model to other applications and processes
3. Encourage and support individuals with experience from Chemical Leasing to become Chemical Leasing ambassadors within their company and with their business partners
4. Provide training to all level of users, from purchasers to marketing departments

**WS4: Market change** - This crosscutting stream refers to the objective of stimulating and facilitating market penetration in specific sectors in selected countries. It

is intended to work together with the government and industry in selected countries to achieve transition from Chemical Leasing being used as an occasional business model, to becoming the norm within specific sectors or applications. The following two actions for achieving market change shall contribute towards achieving the workstream's objective:

1. Evaluate countries, industry sectors and applications and identify those combinations where a market change could be achieved within the strategy period; select up to three countries as priority targets for market change
2. Prepare and participate in a national plan for each target country, working with the national government and key stakeholders and participants to achieve the market penetration

**WS5: Facilitation, networks and recognition** - As well as the tasks that specifically support the individual objectives, six overarching actions have been recognized that serve two or more of the objectives:

1. Create a coherent and inclusive communication and marketing plan for Chemical Leasing, that strives to support industrial prosperity creation whilst actively taking into account the role of women and youth employment and empowerment
2. Maintain and develop means for public recognition of achievements, such as the Global Chemical Leasing Awards, and further promote the use of the existing UNIDO certificate "Compliant with Chemical Leasing" (Conformity Declarations)
3. Conduct and stimulate research into Chemical Leasing, in particular with a view on the synergies with other innovative business models and the linkages to emerging paradigms such as Sustainable/ Green Chemistry and the Circular Economy; develop e.g. academic papers, case studies, guidelines, e-learning tools etc.



4. Coordinate the international multi-stakeholder, multi-sectoral Chemical Leasing advisory group and develop a clear mandate for it
5. Identify potential new partner organizations, including NGOs, industry associations and public-private partnerships, and initiate discussions to explore potential joint benefits and means of collaboration
6. Establish a mandate for, and means of recognizing, a network of Chemical Leasing Ambassadors and engage experts to enter into this role to support broad awareness within and across industries

### 3.2 Final remarks

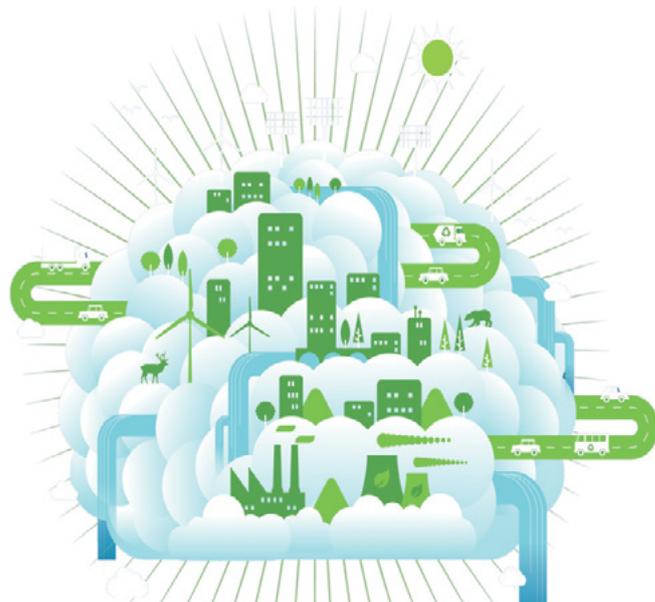
The strategy was developed at a time when a new global agenda was launched to address the three interconnected elements of sustainable development: economic growth, social inclusion and environmental sustainability. On 25 September 2015, the 193-Member United Nations General Assembly formally adopted the 2030 Agenda for Sustainable Development, along with a set of 17 Sustainable Development Goals, which Secretary-General Ban Ki-moon hailed as a universal, integrated and transformative vision for a better world. The SDGs are a new, universal set of goals, targets and indicators that UN Member States are expected to use to frame their agendas and political policies over the next 15 years. Mr. Ban urged the world leaders and others convened at the event to successfully implement the Global Goals by launching “renewed global partnership”.

UNIDO’s mandate falls into this undertaking by promoting and accelerating inclusive and sustainable industrial development (ISID) to achieve shared prosperity and environmental sustainability around the world. The concept of ISID is included in the Sustainable Development Goals, namely Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

In addition, in December 2015, at the Paris climate conference, 195 countries adopted the first-ever

universal, legally binding global climate deal. Under the agreement, all countries will be required to report on “national inventories of emissions by source” and also to report on their mitigation efforts. The same month, on 2 December 2015, the European Commission adopted an ambitious new Circular Economy Package to stimulate Europe's transition towards a circular economy which aims to “boost global competitiveness, foster sustainable economic growth and generate new jobs.”

Such developments may stimulate increased recognition of sustainable business practices and global initiatives aiming to foster resource efficiency and sound chemicals management. Such developments encourage pro-active policy-making to advance sustainable production and consumption patterns. Instead of remaining locked in an endless cycle of merely reacting to deep-seated environmental, economic and social problems, innovating for global partnerships becomes more important than ever before. The post-2015 UNIDO Global Chemical Leasing Programme can be one of those initiatives to drive innovation and “global partnerships” for more sustainability. Formed by the network of national, regional and supranational initiatives, and building upon 10 years of experience, it aims at creating the platform on which the Chemical Leasing concept can flourish and grow to become a familiar, widely used business model that significantly contributes to global sustainability.



## IV. ANNEX

### 4.1 Chemical Leasing Sustainability Criteria Check List

Company name _____		Date _____		
<i>Chemical Leasing Sustainability Criteria Check List</i>	<i>YES, the case complies</i>	<i>NO</i>	<i>DETAILS</i>	
Criterion I – Reduction of energy and resource consumption and minimization of adverse impacts on the environment and health caused by chemicals, their application and production processes				
<b>Please take into consideration the following issues:</b>				
<ul style="list-style-type: none"> <li>Reduced environmental impact measurable by reduced material flows (including waste and emissions generated and energy savings) and compared to the situation before Chemical Leasing. For the overall balance, the manufacture of chemicals and the impact of equipment and machinery also need to be considered.</li> <li>Reduced impact on health (reduced exposure to chemicals and/or reduced hazardousness of chemicals used) measurable by material flow analyses and hazardousness classification (GHS).</li> </ul>				
Criterion II – Improved handling and storage of chemicals to prevent and minimize risks				
<b>Please take into consideration the following issues:</b>				
<ul style="list-style-type: none"> <li>Reduced risks due to improved handling and storage as a consequence of the increased collaboration between user and supplier. Since measurements are difficult to perform, a qualitative description is necessary for actions regarding the prevention and/or reduction of risks. This can be carried out by means of classical risk assessment, i.e. describing the probability of accidents and their potential impacts.</li> <li>Apart from improvements in the environmental situation and health issues, economic impacts (change of liability for Chemical Leasing partners) might also be relevant. This can be checked in the contract.</li> </ul>				
Criterion III – No substitution of chemicals by substances with a higher risk				
<b>Please take into consideration the following issues:</b>				
<ul style="list-style-type: none"> <li>Contradictions in terms of sustainability can occur if chemicals are substituted by substances that pose a higher risk for the environment and health.</li> <li>Experience has shown that this criterion does not apply to many pilot projects (no substitution intended). In cases where chemicals are substituted, it needs to be determined at which level higher risks occur for the environment and health (references might be REACH/GHS classifications and exposure data). For the risk assessment, the exposure (real and potential) as well as the hazardousness of the substance need to be considered.</li> </ul>				
Criterion IV – Generation of economic and social benefits, continuous improvement and fair sharing of the benefits between the partners				
<b>Please take into consideration the following issues:</b>				
<ul style="list-style-type: none"> <li>Economic benefits for both partners are essential if the contract is to continue and for the success of Chemical Leasing as a business model. Economic improvements are relatively easy to quantify.</li> <li>Typical social benefits include better working conditions. It is not the aim of Chemical Leasing to increase the efficiency of processes by reducing the number of jobs involved.</li> <li>The objective of continuous improvement as well as the fair and transparent sharing of benefits between the partners should be included in the Chemical Leasing contract.</li> </ul>				
Criterion V – Providing for the possibility to monitor improvements				
<b>Please take into consideration the following issues:</b>				
<ul style="list-style-type: none"> <li>Highly relevant for most pilot cases;</li> <li>Easy to check whether the data corresponds to that fixed in the contract; important to check whether fully implemented.</li> </ul>				
<i>Challenges:</i>				
<ul style="list-style-type: none"> <li>Agreeing on specific monitoring measures with sufficient transparency and acceptable levels of work involved.</li> <li>Preservation of confidentiality when monitoring sensitive data.</li> </ul>				

## 4.2 Results of the Global Chemical Leasing Awards

**First Global Chemical Leasing Award 2010** - The first Global Chemical Leasing Award ceremony took place on 1 March 2010 in Prague during the international CHEMCON Conference. 27 applicants submitted proposals judged by an international expert jury. Gold Medal Winners in each category received a prize money of \$5,000, sponsored by the BMFLUW (Austria).

*Table 9: Winners of the Global Chemical Leasing Award 2010\**

Category I – Companies/Case studies		
Gold	Silver	Bronze
Ecopetrol, Colombia	<ul style="list-style-type: none"> <li>Ecolab, Serbia</li> <li>Knjaz Milos, Serbia</li> </ul>	<ul style="list-style-type: none"> <li>SAFECHM Europe, Germany</li> <li>Cabot, UK</li> </ul>
Category II – Consulting services		
Gold	Silver	Bronze
Mr. Yuan Kuan, NCPC Colombia	Mr. Juneja Naveen, DNA Expert Services, India	Mr. Ali Abo Sena, NCPC Egypt
Category IV – Public relations		
Gold	Silver	
<ul style="list-style-type: none"> <li>Mr. Anurag Priyadarshi, IKEA Trading HK, India;</li> <li>Ms. Vojislavka Satric, NCPC Serbia</li> </ul>	Chemical Strategies Partnership, Ms. Jill Kaufmann, USA	
* In addition to the listed winners, a “Special Award for Outstanding Efforts in Implementing Chemical Leasing in the Supply Chain” was presented to IKEA India. No winner was selected in the Category III – Scientific publications.		

**Second Global Chemical Leasing Award 2012** - Based on the success of the first award, UNIDO, together with the BMFLUW, Austria and the BMUB, Germany, organized the second Global Chemical Leasing Award. The award ceremony was held on 19 June 2012 during the AICHEM congress, one of the leading international forum for chemical engineering and environmental



*Figure 32: The Global Award as discussion forum, picture taken at the Award Ceremony 2012*

protection, in Frankfurt, Germany. In total, 43 applications from 12 countries were submitted and judged by an international jury panel based on the Chemical Leasing Sustainability Criteria. The winners are listed in Table 10 below.

*Table 10: Winners of the Global Chemical Leasing Award 2012*

Category I – Case studies		
Gold	Silver	Bronze
<ul style="list-style-type: none"> <li>SAFECHM Europe, Germany;</li> <li>Bambi-Banat &amp; Henkel, Serbia;</li> <li>Ecolab &amp; Knjaz Milos, Serbia</li> </ul>	General Motors, Egypt	Manjula S.K. Jayasena and C.A.K. Jayasena, Sri Lanka
Category II – Consulting services		
Gold	Silver	Bronze
Mr. Vojislavka Satric, NCPC Serbia	Ms. Ylva Gilbert, Gaia Consulting, Finland	Mr. Yuan Kuan, NCPC Colombia
Category IV – Public relations		
Gold	Silver	Bronze
Mr. Ralph Heinrich Ahrens, journalist, Germany	NCPC Serbia	SAFECHM Europe, Germany

**Third Global Chemical Leasing Award 2014** - The third Global Chemical Leasing Award was celebrated under the umbrella of the 17th International Biocides Conference and was the highlight of the evening's conference agenda on 10 December 2014. The ceremony was held at Hotel Royal Palace in Vienna, Austria, in the presence of representatives from UNIDO and the sponsoring countries, Austria, Germany and Switzerland. More than 50 applications from more than 20 different countries were submitted across all categories - a new record in applications.

*Table 11: Winners of the Global Chemical Leasing Award 2014*

<i>Category I – Case studies</i>		
<b>Gold</b>	<b>Gold</b>	<b>Bronze</b>
Windsor Hotel Atlantica, Rio de Janeiro, Brazil <i>Cleaning in the hospitality sector</i>	Colombia – POLIKEM SA, Colombia <i>Anti-corrosion painting in the automotive industry</i>	Crown Beverages Ltd., Uganda <i>Lubrication processes</i>
<i>Category II – Consulting services</i>		
<b>Gold</b>	<b>Silver</b>	<b>Bronze</b>
Ms. Vojislavka Satric, NCPC Serbia	Team NCPC Nicaragua	Ms. Lakmini Edirisinghe & Mr. Sena Peiris, NCPC Sri Lanka
<i>Category III – Scientific papers</i>		
<b>Gold</b>		
Mr. Rodrigo Lozano/Ms. Angela Carpenter/Ms. Vojislavka Satric <i>“Fostering green chemistry through a collaborative business model: A Chemical Leasing case study from Serbia”</i>		
<i>Category IV – Public relations</i>		
<b>Gold</b>	<b>Silver</b>	<b>Bronze</b>
Ms. Gladis Sierra & Mr. Fredisman Herrera, NCPC Colombia	Ms. Ana Maria Oestreich, CTS Ambiental – SENAI / RJ – Sistema FIRJAN, Brazil	Ms. Lakmini Edirisinghe & Mr. Sena Peiris, NCPC Sri Lanka



*Figure 33: Gold for POLIKEM SA, Award 2014*



*Figure 34: Keynote speech given by Mr. Stephan Sicars, Director Environment Department, UNIDO*



*Figure 35: Award winners 2014 with high-level representatives from the donor countries*

Table 12: Special acknowledgement and Conformity Declaration cases

Special acknowledgement for cases “Chemical Leasing goes Agro”	Special acknowledgement for advanced cases
<ul style="list-style-type: none"> <li>Oto Varga and Agro Fito, Serbia (maize and wheat)</li> <li>Finlays, Sri Lanka (tea)</li> <li>Kandurata Agro, Sri Lanka (carrots, leaks, potatoes)</li> </ul>	<ul style="list-style-type: none"> <li>Ecopetrol, Colombia (wastewater treatment and oil dehydration)</li> <li>Colceramica, Colombia (wastewater treatment)</li> </ul>
<p>The following companies received a Conformity Declaration Certificate:</p>	
<ul style="list-style-type: none"> <li>Becker, Brazil</li> <li>Fumajet, Brazil</li> <li>Qaisa, Costa Rica</li> <li>Unilever, Costa Rica</li> <li>Coca Cola - Ecolab Hygiene, Croatia</li> <li>Tensid Chemie, Ecuador</li> <li>Safechem, Germany/UK</li> </ul>	<ul style="list-style-type: none"> <li>Protena, Nicaragua</li> <li>Ponis Pak, Russia</li> <li>BRCS - FKL, Serbia</li> <li>Coca Cola - Ecolab, Serbia</li> <li>Knjaz Milos - Ecolab Hygiene, Serbia</li> <li>Nile Breweries, Uganda</li> </ul>

### 4.3 List of conferences with major contributions on Chemical Leasing

2006
<ul style="list-style-type: none"> <li>International Conference on Chemicals Management (ICCM<sub>1</sub>), Dubai</li> <li>International Workshop on Getting Fit for REACH, Brussels, Belgium</li> <li>SAICM African Regional meeting, Cairo, Egypt, 11-14 September</li> </ul>
2007
<ul style="list-style-type: none"> <li>9th Annual Meeting of the UNIDO/UNEP National Cleaner Production Centres and Programs, Semmering, Austria</li> <li>International Workshop on Chemicals Management and Risk Reduction, Lund, Sweden</li> </ul>

2008
<ul style="list-style-type: none"> <li>12th Annual Chemical Management Services Conference, San Francisco, USA</li> <li>International Conference “Getting Fit for REACH – Applying Chemical Leasing”, Balatonfüred, Hungary</li> <li>6th session of the Intergovernmental Forum on Chemical Safety, Dakar, Senegal</li> <li>SCORE (Sustainable Consumption Research Exchanges) Conference, Brussels, Belgium</li> </ul>
2009
<ul style="list-style-type: none"> <li>13th Annual Chemical Management Services Conference Seoul, Korea</li> <li>International Conference on Chemicals Management (ICCM<sub>2</sub>), Geneva, Switzerland</li> </ul>
2010
<ul style="list-style-type: none"> <li>3rd Nevsky International Ecological Congress, St. Petersburg, Russia</li> <li>9th Asia Pacific Roundtable on Sustainable Consumption and Production, Colombo, Sri Lanka</li> </ul>
2011
<ul style="list-style-type: none"> <li>4th Nevsky International Ecological Congress, 16-17 May 2011, St. Petersburg, Russia</li> <li>Act Clean Workshop “Chemical Leasing – Example for resource and material efficiency”, by the German Federal Environment Agency, 6 June 2011, Berlin, Germany</li> <li>Conference on Sustainable Chemistry, 6-7 October 2011, Berlin, Germany</li> <li>RECP Network meeting and African Regional Workshop on Chemical Safety Management, October 2011, Nairobi, Kenya</li> <li>Chemical Leasing side event at the 10th Meeting of the Conference of the Parties to the Basel Convention (COP 10), 20 October 2011, Cartagena, Colombia</li> <li>SAICM Open-ended Working Group, 14-18 November 2011, Belgrade, Serbia</li> <li>Chemical Leasing presented at the 25th anniversary of APELL (UNEP Tool on “Awareness and Preparedness for Emergencies at Local Level”), November 2011, Beijing, China</li> </ul>

2012

- European Roundtable on Sustainable Consumption and Production, Bregenz, Austria
- FECC (The European Association of Chemical Distributors) Annual Congress, Lisbon, Portugal
- International Conference “Clean Water Kazan 2012”; Kazan, Russian Federation
- Special session on Chemical Leasing within the ACHEMA Congress; Frankfurt, Germany
- Green Chemistry Conference; Moscow, Russian Federation
- Presentation on Chemical Leasing at the Global South-South Development Expo (UNIDO event); Vienna, Austria
- Brazil-German Symposium for Sustainable Construction, Rio de Janeiro, Brazil

2013

- IOMC3 Meeting, Johannesburg, South Africa
- Green Chemistry Conference, Moscow, Russia
- 39th meeting of the Inter-Organization Programme for the Sound Management of Chemicals, Geneva, Switzerland, hosted by the World Health Organization
- European Roundtable on Sustainable Consumption and Production, Istanbul, Turkey
- International Experts Group Meeting, Global RECP Network Meeting, Montreux, Switzerland
- Ecochem, (European Conference and Exhibition on Sustainable Chemistry and Engineering), Basel, Switzerland
- IOMC Meeting, Vienna, Austria

2014

- European Forum Alpbach, Austria
- International Conference on Sustainable Chemistry and Chemical Leasing: Paving the way for ISID, Vienna, Austria
- 'Transforming jobs and skills for a resource efficient inclusive circular economy' - 17th European Forum on Eco-innovation, organized by the EU DG Environment and the EcoAP Secretariat



**S** Sustainable management  
**M** Monetary benefits  
**A** Additional safety and health  
**R** Resource efficiency  
**T** Technology innovation

*Chemical Leasing – a SMART business for green industry*

[www.chemicalleasing.com](http://www.chemicalleasing.com)

## 4.4 Chemical Leasing Research Articles and Reports (Selection)

	Author(s)	Title of article	Source
2002	BMLFUW	Chemikalien-Leasing – Modell für eine nachhaltige Stoffwirtschaft	Publication series of the BMLFUW; Volume 13/2002
2003	Thomas Jakl, Reinhard Joas, Rainer Nolte, Rudolf Schott, Andreas Windsperger	Chemical Leasing - An Intelligent and Integrated Business Model with a View to Sustainable Development in Materials Management	Verlag Österreich; ISBN-13: 978-3704658920
2006	Petra Schwager, Frank Moser	Application of Chemical Leasing business models in Mexico	Environmental Science and Pollution Research, 03/2006, 13(2)
2007	Frank Moser, Cornelia Ohl	Chemical Leasing Business Models—A Contribution to the Effective Risk Management of Chemical Substances	Risk Analysis, 27(4)
2008	Jutta Geldermann, Anke Daub, Martina Hesse	Chemical Leasing as a model for sustainable development	Göttingen: Schwerpunkt Unternehmensführung, Georg-August-Univ.; Research Paper Nr. 9
2009	Vojislavka Satric, Branko Dunjic, Ivan Masanovic	The Business Model Chemical Leasing as a Tool for Process, Environmental and Occupational Health and Safety Improvements	Research Paper, presented at ERSCP-EMSU conference, Delft, The Netherlands, October 25-29
2010	Thomas Jakl, Petra Schwager	Chemical Leasing goes global – selling services instead of barrels: A Win-Win model for Environment and Industry	Springer Wien New York; ISBN-13: 978-3211737514
2010	BiPRO, German Federal Environment Agency	Chemical Leasing as a model for sustainable development with test procedures and quality criteria on the basis of pilot projects in Germany	Dessau Rosslau
2013	Rodrigo Lozano, Angela Carpenter, Vojislavka Satric	Fostering green chemistry through a collaborative business model: A Chemical Leasing case study from Serbia	Resources Conservation and Recycling, 09/2013, 78:136-144
2014	Rodrigo Lozano, Angela Carpenter, Francisco J. Lozano	Critical reflections on the Chemical Leasing concept	Resources Conservation and Recycling, 05/2014, 86:53–60
2014	Frank Moser, Thomas Jakl, Reinhard Joas, Francesco Dondi	Chemical Leasing business models and corporate social responsibility	Environmental Science and Pollution Research, 09/2014, 21(21)
2014	Frank Moser, Vassilios Karavezyris, Christopher Blum	Chemical Leasing in the context of sustainable chemistry	Environmental Science and Pollution Research, 12/2014, 22(9)
2014	Frank Moser, Thomas Jakl	Chemical Leasing —a review of implementation in the past decade	Environmental Science and Pollution Research, 12/2014, 22(8)
2014	German Federal Environment Agency	Resource efficient businesses in practice by applying the alternative business model Chemical Leasing	Dessau Rosslau

## 4.5 Publication from the Sri Lankan NCPC on “Chemical Leasing Goes Agro”

**Chemical Leasing Sri Lanka**

**SMART**

- Sustainable management
- Monetary benefits
- Additional health and safety
- Resource efficiency and
- Technology transfer and innovation

### Sustainable Agricultural Practices through Chemical Leasing

#### Chemical leasing redefines the sustainable management of chemicals

Traditionally, suppliers sell bulk quantities of chemicals to end-users, and sell as much as possible in the interest of profit. By using such a model, the inefficient use of chemicals is being “rewarded”. Chemical leasing provides a more sustainable solution, through which users only pay for the services rendered by the chemicals (e.g. volume of water treated, number of parts painted, lengths of pipes cleaned, etc.) and not for the volume of chemicals consumed. By decoupling the payment from the consumption of chemicals, chemical leasing encourages better chemicals management. The result can be seen in environmental advantages, as well as in consequential economic benefits for both suppliers and users of chemicals.

#### Chemical leasing brings benefits for both supplier and user

- ✓ Innovative business approach: reducing chemicals increases the financial benefits of both partners
- ✓ Optimization of production process/less environmental impact
- ✓ Waste reduction and waste recycling is encouraged
- ✓ Long-term business relationships are formed/partnership development
- ✓ Improved competitiveness for both partners/continuous learning
- ✓ Sound technology transfer/sharing of know-how

#### Chemical Leasing Application in Agriculture Sector Background Information

Consumption of agrochemicals are very popular in Sri Lankan agriculture and application of chemicals has a major impact on the economy, health and environment of the country. Rice, Vegetable and home garden cultivation have recorded the most severe harm adding very high levels of heavy metals to the environment. Chemical Leasing is an innovative business model which is a good solution for this issue which will reduce chemical usage while maximizing profits to major stakeholders.

NCPC is introducing the new model to the Sri Lankan agriculture sector, four case studies were conducted to identify the application potential of business model in the sector. During the study, chemical leasing approach was applied to two potato cultivation, paddy and carrot cultivation parallel to conventional farming approach. The results showed that chemical leasing approach accounted for 40%, 21%, 55% and 31% cost savings on chemicals respectively in particular cultivations. The result of the four case studies clearly demonstrates that both agrochemical manufacture and user can benefit by the application of Chemical Leasing. Besides it demonstrates the environmental and the occupational health and safety benefits achieved by the application of Chemical Leasing in the particular study.

## 4.6 Chemical Leasing National Best Practices for Policy-Makers

Chemical Leasing policies have already been implemented with success in several countries. The different measures taken by Germany and Austria, listed below, illustrate how Chemical Leasing National Best Practices can contribute to economic and environmental policy programmes.

**Best practices at the national level in Austria** - The measures taken by Austria to promote Chemical Leasing include:

- Sharing information on Chemical Leasing on the official website of the Federal Ministry of Environment, with a reference and link to the UNIDO website [www.chemicalleasing.org](http://www.chemicalleasing.org);
- Initiation, support and consulting on new Chemical Leasing projects (Pero-Dow, Initiative “Chemical Leasing goes Agro”) in Austria;
- Sponsoring, participating in, and promoting the biennial Chemical Leasing Award through publication on the official website of the Ministry, press releases, high-level participation in the award (Minister or high-level official), and sending out of invitations using different mailing lists to disseminate the information;
- Sponsoring, promotion and organisation of expert panels, discussions, workshops on Chemical Leasing (e.g. during the European Forum Alpbach, etc.) and publication of conference papers;
- Sponsoring of studies and scientific publications on Chemical Leasing (e.g. OECD, national studies, research at universities etc.);
- Promotion of Chemical Leasing in other international organizations and fora (SAICM, OECD, EU Council, etc.) and panel discussions on the circular economy, green economy and green chemistry;

- Launching and coordination of a national multi-stakeholder working group.

**Best practices at the national level in Germany** - The political instruments and non-binding initiatives adopted in Germany that support the Chemical Leasing business model include:

- Several Chemical Leasing projects implemented by the German Environmental Ministry and the Federal Environment Agency and partners that contribute to the dissemination and awareness raising of the business model;
- Creation of a steering committee for the national projects with stakeholders from the policy arena and industry;
- Authorizations under REACH;
- Activities to further develop the Sustainable Chemistry concept and the integration of Chemical Leasing into this concept;
- Adoption of a German resource efficiency programme (ProgRes) as one of the first European comprehensive concepts to increase resource efficiency.<sup>1</sup>

## 4.7 The German Chemical Leasing Initiative

**The German initiative** stands out from the other country initiatives. In 2007, the German Federal Environment Agency (UBA) launched a first national project encouraged by the work of UNIDO’s Global Chemical Leasing Programme.<sup>2</sup> Remarkably, the German Government also joined as a direct financial supporter for the Programme and the Global Award.

<sup>1</sup>Source: [www.bmub.bund.de/themen/wirtschaft-produkte-ressourcen/ressourceneffizienz/progress-das-deutsche-ressourceneffizienzprogramm](http://www.bmub.bund.de/themen/wirtschaft-produkte-ressourcen/ressourceneffizienz/progress-das-deutsche-ressourceneffizienzprogramm)

<sup>2</sup> This projects falls under the environmental research of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. The final report [www.chemikalienleasing.de/sub/info.htm](http://www.chemikalienleasing.de/sub/info.htm).

The first German project started with the objective to conduct Chemical Leasing pilot projects throughout multiple sectors of the German industry based on systematic quality processes and test procedures. It was jointly implemented by UBA and the three main project partners: BiPRO GmbH (an engineering consulting company), the University of Göttingen and TÜV SÜD. The stakeholders established a national working group with regular annual meetings, and they initiated a webpage support and exchange forum in German ([www.chemikalienleasing.de](http://www.chemikalienleasing.de)).

In terms of the content, a major contribution of the German initiative was the development of quality criteria on the basis of prior analysis and evaluation of pilot projects. Developed with UNIDO assistance, they help applying highest environmental and health safety standards in all projects covered by the Global Programme or the German national initiative. These quality criteria finally evolved into the UNIDO Chemical Leasing Sustainability Criteria presented in Chapter 1.

In addition to this project, Germany is also pioneering in the area of applying Chemical Leasing in hospitals. The German Federal Environmental Foundation, one of Europe's largest foundations promoting innovative and exemplary environmental projects, teamed up with Schülke & Mayr GmbH and Opal Service GmbH to coordinate a pilot project at Worms Hospital to test Chemical Leasing as an efficient and sustainable solution for hospital hygiene. The final report from 2012 comes to a positive conclusion.<sup>3</sup>

A consecutive second national project was then initiated in 2011, entitled "Resource efficient businesses in practice by applying the alternative business model Chemical Leasing". The project team estimated the potential contribution of Chemical Leasing to resource-efficient and sustainable production, quantifying the economic, energetic and, to some extent, environmental potential of the Chemical Leasing business model in Germany. It came to the

<sup>3</sup> The final report is available at <https://www.dbu.de/OPAC/ab/DBU-Abschlussbericht-AZ-26035.pdf>.

conclusion that the full nationwide implementation of Chemical Leasing could lead to savings of 25 to 50 metric tons of chemicals in the German chemical industry. This could be accompanied by reductions in the corresponding risks, resources and emissions and could also lead to a decrease in the energy demand during the use and life cycle of a chemical of up to 50%. The economic savings potential associated with the application of the Chemical Leasing business model is given in a range between €46 and €100 million. The full report is available from UBA.

## 4.8 Chemical Leasing and Green/Sustainable Chemistry

**Background notes on the links between the concepts of Green and Sustainable Chemistry and Chemical Leasing:**

Green Chemistry has been an emerging area of sustainable design since its introduction in the 1990s. It is a concept that seeks to reduce and eliminate hazardous chemical substances through the improved design of chemical products and processes. The 12 Principles of Green Chemistry, coined by Anastas and Warner in 1998, provide a framework and help to define green chemicals, processes or products. These principles are accompanied by the 12 Principles of Green Engineering. Implementing these sets of principles will enable the chemical industry to become more sustainable from an economic, ecological, and social perspective.

**Link to Chemical Leasing:** Chemical Leasing addresses several of these principles, such as waste prevention and the use of less hazardous chemicals due to process optimization and the coupled reduction in chemical quantities. The integration of innovative business models such as Chemical Leasing into green chemistry projects can provide a powerful solution to overcome the barriers involved in promoting the green chemistry concept among stakeholders.

**Sustainable Chemistry:** The concept of sustainable chemistry exists to link preventative protection of the environment and health with an innovative economic strategy that will also result in more jobs. It is a broad-ranging area that concerns stakeholders in the scientific community, the economy, public authorities, and environmental and consumer advocate associations. By this, it contributes to the improvement of resource efficiency and risk minimization in the chemical industry and aims at an environmentally friendly production and use of chemicals including, for example, the prevention of pollution and waste, the inclusion of the entire life cycle of a product, or the enhancement of a product's recyclability and durability.<sup>4</sup>

**Link to Chemical Leasing:** Chemical Leasing is a beneficial business model for companies, enabling them to engage in sustainable chemistry and to improve

<sup>4</sup> Source: [www.umweltbundesamt.de/en/topics/chemicals/chemicals-management/sustainable-chemistry](http://www.umweltbundesamt.de/en/topics/chemicals/chemicals-management/sustainable-chemistry).

resource and energy efficiency, reduce waste, decrease risks caused by hazardous chemicals and lessen the adverse environmental impact. In addition, Chemical Leasing increases the competitiveness and profitability of the business partners.

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Chemical Leasing can serve as business model and policy instrument for moving towards Green/Sustainable Chemistry. The 10-year record of successful Chemical Leasing case studies worldwide provides an excellent basis for representing Chemical Leasing more prominently in the concept of Sustainable Chemistry.

It shall be highlighted that Chemical Leasing provides the business case to pursue green/sustainable chemistry. There are noticeable overlaps to the three Conventions of Basel, Rotterdam and Stockholm: the Green/Sustainable Chemistry concepts could provide the narrative for implementing the Conventions at the operational level and for bringing the Conventions' life cycle approach into the mindset of business.

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