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## **Resource efficient businesses in practice by applying the alternative business model Chemical Leasing**

Extended version

by

Dr. Reinhard Joas, Veronika Abraham  
BiPRO GmbH, Munich

BiPRO GmbH  
Grauertstraße 12  
81545 Munich  
Germany

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Author(s) (Family Name, First Name)	Joas, Reinhard Abraham, Veronika
Performing Organisation (Name, Address)	BiPRO GmbH Grauertstraße 12 81545 Munich Germany
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Autor(en) (Name, Vorname)	Joas, Reinhard Abraham, Veronika
Durchführende Institution (Name, Anschrift)	BiPRO GmbH Grauertstraße 12 81545 München
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## Abstract

Chemical Leasing is an innovative business model in which the traditional unit of payment for chemicals shifts towards a service-oriented approach. This alters especially the motivation of the chemical suppliers as their profits increase when reduced amounts of chemicals are applied. Due to this change in motivation, chemical suppliers and industrial users work more closely together in order to optimise the processes with regard to the optimised consumption of chemicals. This leads not only to energy and resource savings, but also results in decreased risks attributed to the handling of chemicals as well as to reduced environmental burdens. In addition, the business model generates economic benefits for the partners. Chemical Leasing can thus contribute significantly to sustainability.

In order to estimate the potential contribution of Chemical Leasing to resource-efficient and sustainable production, the project team has quantified the economic, energetic and, to some extent, environmental potential of the Chemical Leasing business model in Germany. Overall, the full national-wide implementation of Chemical Leasing could lead to savings of 25 to 50 kt of chemicals in the German chemical industry accompanied by reductions in the corresponding risks, resources and emissions and can 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 application of the Chemical Leasing business model lies between 46 and 100 M€.

The project team has also investigated the inhibiting factors for the comprehensive dissemination of Chemical Leasing and has elaborated suggestions and recommendations to better overcome those factors in the future. In this context, the project team perceives the targeted communication of the business model's benefits and several political activities on the German and international level to be the most important measures.

Five sustainability criteria for Chemical Leasing, which contribute to the establishment of high standards for the business model, have already been developed in a previous project. The project team has analysed these criteria regarding their acceptance and practicability on the basis of existing Chemical Leasing projects. In this process, also the current status of the projects was determined.

The analysis revealed that all investigated cases applied and complied with two of the criteria (1: reduction of adverse impacts and 4: economic benefits). Likewise, criterion 3 (substitution) plays an important role in the context of process optimisation and has been fulfilled in all cases where the criterion is relevant. The criterion 2 (improved chemicals handling) is seen substantially less important in Germany and is often only marginally considered. The last criterion (5: monitoring of improvements) is usually fulfilled indirectly through agreements amongst the partners concerning the verification of resource consumption (raw materials and energy) and product quality; however, it is often not explicitly labelled as such. Generally, the criteria have proven to be very useful for the acquisition and initiation of new Chemical Leasing projects.

The project team has also been able to show that the involvement of chemical distributors in Chemical Leasing projects can still be improved. To work towards this target and to generally foster the dissemination of the business model, the project team – partially with support of different partners – has initiated or supported various initiatives: amongst others, these included workshops, presentations, national industry initiatives and international activities. Moreover, the German webpage [www.chemikalienleasing.de](http://www.chemikalienleasing.de) has been updated continuously to support the mainstreaming of the Chemical Leasing business model in Germany.

## Kurzbeschreibung

Chemikalienleasing ist ein innovatives Geschäftsmodell, bei dem die mengenmäßige Bezahlung von Chemikalien durch eine nutzenorientierte Bezahlung ersetzt wird. Dies führt insbesondere beim Chemikalienanbieter zu einer geänderten Motivation, da sein Gewinn steigt, wenn weniger Chemikalien eingesetzt werden. Chemikalienanbieter und –anwender arbeiten aufgrund der damit geänderten Interessenlage enger zusammen, um Prozesse im Hinblick auf einen verringerten Chemikalienverbrauch zu optimieren. Dies führt sowohl zu geringeren Risiken im Umgang mit der Chemikalie, als auch zu einer Reduktion der Umweltbelastung und zu Energie- und Ressourceneinsparungen. Zusätzlich werden bei den Partnern des Geschäftsmodells wirtschaftliche Vorteile generiert. Chemikalienleasing kann so einen wichtigen Beitrag zur Nachhaltigkeit liefern.

Um den potenziellen Beitrag von Chemikalienleasing zu ressourceneffizientem und nachhaltigem Wirtschaften zu analysieren, hat das Projektteam die wirtschaftlichen, energetischen und einige umweltbezogene Potenziale des Geschäftsmodells in Deutschland quantifiziert. In Summe könnten durch die flächendeckende Implementierung von Chemikalienleasing in der deutschen Chemischen Industrie zwischen 25 und 50 kt Chemikalien sowie die korrespondierenden Risiken, Ressourcen und Emissionen eingespart werden. Außerdem kann Chemikalienleasing den Energiebedarf im Laufe von Anwendung und Lebenszyklus einer Chemikalie um bis zu 50 % senken. Das ökonomische Einsparpotenzial liegt zwischen 46 und 100 Mio. €.

Das Projektteam hat weiterhin die Hemmfaktoren für eine flächendeckende Verbreitung von Chemikalienleasing untersucht und Vorschläge bzw. Empfehlungen erarbeitet, diese zukünftig besser zu überwinden. In diesem Zusammenhang sieht das Projektteam die zielgerichtete Kommunikation der Vorteile des Geschäftsmodells sowie verschiedene politische Aktivitäten auf deutscher und auch internationaler Ebene als die wichtigsten Maßnahmen an.

Fünf Nachhaltigkeitskriterien für Chemikalienleasing, die zur Etablierung eines hohen Standards für das Geschäftsmodell beitragen, wurden bereits in Vorgängerprojekten entwickelt. Das Projektteam hat diese Kriterien hinsichtlich ihrer Akzeptanz und Praktikabilität anhand von bestehenden Chemikalienleasing-Projekten untersucht. Dabei wurde auch der aktuelle Stand der Projekte analysiert.

Die Untersuchungen haben gezeigt, dass zwei der Kriterien (1: Verringerung negativer Auswirkungen und 4: wirtschaftliche Vorteile) in allen untersuchten Fällen angewendet und eingehalten wurden. Auch das Kriterium 3 (Substitution) spielt in Zusammenhang mit Prozessoptimierungen eine große Rolle und wurde in allen relevanten Fällen eingehalten. Das Kriterium 2 (Verbessertes Handling der Chemikalie) wird von den Akteuren in Deutschland als wesentlich weniger wichtig angesehen und wird oft nur am Rande beachtet. Das letzte Kriterium (5: Monitoring der Verbesserungen) wird in der Regel indirekt über Vereinbarungen der Partner zur Überprüfung des Ressourcenverbrauchs (Rohstoffe und Energie) und der Produktqualität erfüllt, jedoch nicht explizit so benannt. Insgesamt erweisen sich die Kriterien als sehr hilfreich bei der Akquise und Initiierung neuer Chemikalienleasing-Vorhaben.

Das Projektteam hat auch zeigen können, dass die Einbindung von Chemikalienhändlern in Chemikalienleasing-Projekte noch verbessert werden kann. Um darauf hin zu wirken, und um generell die Verbreitung des Geschäftsmodells zu fördern, hat das Projektteam – teilweise mit Unterstützung verschiedener Partner – diverse Initiativen initiiert oder unterstützt. Dazu gehören u. a. Workshops, Präsentationen, nationale Industrieinitiativen und internationale Aktivitäten. Außerdem wurde die deutsche Internetseite [www.chemikalienleasing.de](http://www.chemikalienleasing.de) fortlaufend aktualisiert, um Chemikalienleasing in Deutschland weiter zu verbreiten.



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## List of acronyms

BMLFUW	Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management
BMUB	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BVL	Federal Office of Consumer Protection and Food Safety
ChL	Chemical Leasing
CIP	Cleaning in Place
DBU	German Federal Foundation for the Environment
ECHA	European Chemicals Agency
FAO	Food and Agriculture Organization of the United Nations
FAQ	Frequently Asked Questions
Fecc	European Association of Chemical Distributors
ICCA	International Council of Chemical Associations
LINEG	Cooperative for the drainage of the left bank of the Rhine
NABU	Nature And Biodiversity Conservation Union
NCPC	National Cleaner Production Centre
NGO	Non-governmental organisation
R&D	Research and development
RAC	Committee for Risk Assessment
REACH	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
SEA	Socio-economic analysis
SEAC	Committee for Socio-economic Analysis
SME	Small and medium-sized enterprises
SVHC	Substances of Very High Concern (Candidate List of Substances of Very High Concern for Authorisation – REACH)
UBA	German Federal Environment Agency
UNEP	United Nations Industrial Development Programme
UNIDO	United Nations Industrial Development Organization
VCH	German association of chemical trade
VCI	German Chemical Industry Association
VDI	Association of German Engineers

## 1 Background and approach

Finite resources and the growing global demand require the reduction of raw materials consumption. For this purpose, the increase in resource efficiency is a decisive factor. Since conventional economics predominantly aim at the increase in consumption, alternative business models need to be found and established that promote the efficient use of resources and give priority to sustainable products and services.

Despite numerous efforts with regard to the improvement of resource efficiency, the chemical industry consumes large amounts of energy and raw materials. In Germany for instance, the sector has increased its resource efficiency by 35 % between 1994 and 2007 and reduced its overall energy demand by 21 % between 1990 and 2010. Nevertheless, the chemical industry was responsible for about a quarter of the manufacturing industry's energy demand in 2012<sup>1</sup> (IG BCE 2011; p. 4; Statista 2015a; VDI ZRE 2014; p. 23).

Moreover, being the third largest sector, the chemical industry constitutes an important and indispensable pillar of the German economy and it provides starting products for almost every economic sector (Cefic and EPCA 2004; p. 7). In 2013, the chemical industry contributed about 11 % to the manufacturing industry's turnover. In Europe, Germany is the leading producer of chemical goods and ranks in fourth place of the world's largest chemical producers; after China, the United States and Japan (VCI 2014a; VCI 2014b; pp. 13 and 15). The sustainable use of resources through increased resource efficiency in the chemical industry can thus contribute considerably to the reduction of resource scarcity and to a sustainable economy. Several political and industrial initiatives and principles on different societal levels already foster and demand these features. For example, these initiatives include the Production Integrated Environmental Protection<sup>2</sup>, ecodesign, sustainable consumption, recycling and reuse, waste prevention, the sharing economy, durable products, eco-efficiency, the green economy, and the circular economy.

However, the achievement of these targets regarding increased resource efficiency necessitates the research, development and implementation of new substances for substitution purposes as well as new future-oriented technologies and innovative concepts and approaches. Chemical Leasing offers such an approach.

Chemical Leasing is an innovative business model that aims at the efficient and sustainable use of resources and may significantly contribute to a more sustainable chemistry. The business model promotes both environmental and economic aspects of the chemical industry through the increased resource efficiency.

Similar to concepts such as the leasing society, eco-leasing, and product-service systems, Chemical Leasing builds upon the fact that the ownership of a product is not in every case the aim of consumption but that solely the service of the product is required (Jakl and Schwager 2008; p. 18; Tukker et al. 2013; pp. 61 and 85).

Since 2002, the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) has been promoting Chemical Leasing. Since 2007, also the German government in the form of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and the Federal Environment Agency (UBA) have been supporting the business model. Furthermore, Chemical Leasing has been promoted by the

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<sup>1</sup> In 2013, the chemical industry contributed about 11 % to the manufacturing industry's turnover (Statista 2015b).

<sup>2</sup> Production Integrated Environmental Protection (PIUS or Cleaner Production) [http://www.pius-info.de/en/projekt\\_u\\_partner/pius/index.html](http://www.pius-info.de/en/projekt_u_partner/pius/index.html)

United Nations Industrial Development Organization (UNIDO) since 2004 and by the Swiss government since 2014.

Throughout the last years, numerous companies of different branches have been able to successfully introduce and implement Chemical Leasing. Chapter 3 contains some of the successful examples in Germany. On the international level, successful projects include Chemical Leasing in the following areas<sup>3</sup>:

- ▶ the utilisation of adhesives in the packaging industry in Serbia
- ▶ the use of agrochemicals in Sri Lanka
- ▶ the cleaning of bottles in the beverage industry in Uganda
- ▶ degreasing of aluminium profiles in the metal-processing industry in Costa Rica
- ▶ corrosion protection on vehicles in Colombia
- ▶ cleaning in hotels in Brazil

Regardless of the tremendous savings in chemicals quantities and the significant economic benefits that national and international Chemical Leasing projects could generate in the past, yet no comprehensive nationwide dissemination of the business model has occurred; neither in relevant industries or production processes nor in science and public. The objective of the research project was to estimate the potentials for Chemical Leasing in terms of resource reduction and profitability as well as the further dissemination of the business model.

In the following section, the concept of Chemical Leasing is explained in more detail. Subsequently, chapter 1.2 outlines the project aims.

## 1.1 Introduction of the business model

Typically, chemicals are sold per quantity (e.g. €/t). Hence, chemical suppliers have an interest in selling large amounts of chemicals in order to increase their turnover. On the other hand, costs are generated for the user via the purchasing of the chemical, which leads to contrary motivations of supplier and user (Figure 1, left). Chemical Leasing is an innovative, service-oriented business model in which the chemical's traditional quantitative unit of payment is replaced with a service-oriented approach (e.g. €/m<sup>2</sup> cleaned surface). Within the new business model, the manufacturer or distributor of the chemical does no longer sell the chemical itself but its service. Thus, the chemicals consumption becomes a cost rather than a revenue factor for the chemical manufacturer or supplier, which generates an economic interest for the supplier to reduce the user's consumption of chemical products through process optimisation. Figure 1 (right) illustrates how Chemical Leasing unifies the interests of supplier and user of chemicals, which implies that both business partners work towards a reduction in chemicals consumption.

As a consequence, this results in an intensified cooperation between chemical supplier and user as well as in an improved transfer of know-how. This in turn leads to new economic incentives and benefits for both partners and especially – via the reduced chemicals consumption – to resource conservation, reduction of environmental burdens, energy savings and prevention/reduction of risks stemming from the chemicals use.

Some concrete benefits that accompany the implementation of Chemical Leasing are listed below:

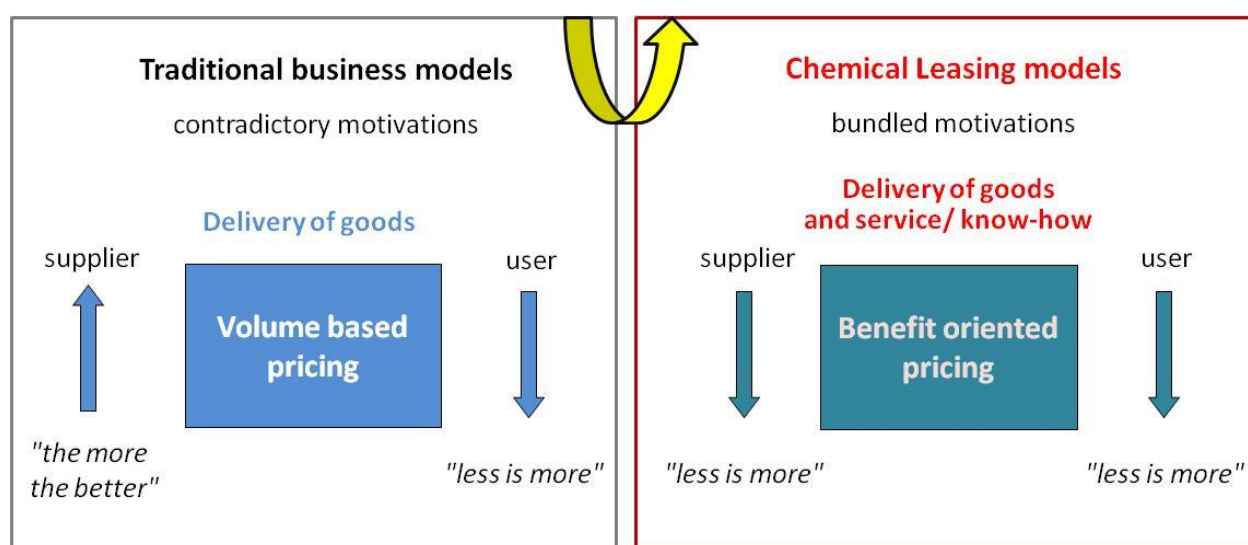
- ▶ reduction of the chemical quantity used
- ▶ bundled motivations

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<sup>3</sup> Further examples can be obtained from <http://www.chemicalleasing.com/sub/pilot.htm>

- ▶ know-how transfer and intensive cooperation
- ▶ improved handling of chemicals
- ▶ continuous process optimisation
- ▶ resource and energy savings
- ▶ reduced exposure of workplaces and outputs (exhaust air, wastewater)
- ▶ reduced emissions and waste quantities
- ▶ risk reduction for humans and the environment
- ▶ economic benefits

Figure 1: Bundled motivations generated through the alternative, service-oriented business model Chemical Leasing.



Source: UBA 2010; p. 7.

Thus, Chemical Leasing presents an important contribution to sustainable chemistry as well as to environment and health protection and simultaneously contributes to an increased profitability and competitiveness of the partners.

Five sustainability criteria for Chemical Leasing serve to ensure a high standard and smooth functioning of the business model. Only if a project fulfils all criteria it is considered a “real” Chemical Leasing business model. Chapter 3.1 describes the criteria in more detail.

## 1.2 Aim of the project

In 2010, within a previous project<sup>4</sup>, six Chemical Leasing pilot projects were initiated. In addition, it was part of the project to develop sustainability criteria that support the establishment of a high standard for Chemical Leasing and deliver valuable findings for the advancement of the concept (UBA 2010). The pilot projects show significant improvements with regard to economic and ecologic aspects and a successful introduction and implementation of the business model in different sectors and countries worldwide. However, these targeted measures do not suffice to establish a mainstream for Chemical Leasing. A comprehensive, nationwide dissemination of the business model is still pending on the national as well as on the international level.

<sup>4</sup> “Chemical Leasing as a model for sustainable development with test procedures and quality criteria on the basis of pilot projects in Germany” (German title: “Chemikalienleasing als Modell zur nachhaltigen Entwicklung mit Prüfprozeduren und Qualitätskriterien anhand von Pilotprojekten in Deutschland”; FKZ 3707 67 407)

It was the aim of the current project to analyse the marketability and the potentials for the increased resource efficiency in Germany due to Chemical Leasing and to examine the sustainability criteria with respect to their application, practicability and acceptance.

Specifically, during the project the BiPRO GmbH has evaluated and roughly quantified **potentials for Chemical Leasing** in Germany from an economic, energetic and environmental perspective (chapter 2.1).

Furthermore, the project team has investigated the different **inhibiting factors** for a nationwide dissemination of Chemical Leasing (see chapter 2.2) and has elaborated **recommendations** for their future overcoming. These are summarised in chapter 7.

In chapter 3, the project team has conducted a review of the **sustainability criteria** by means of the pilot projects initiated within the previous project. Here, the focus lies on the practical implementation and acceptance of the sustainability criteria. The project team also elaborates on the status of the already initiated Chemical Leasing projects.

Another focus of the project was the analysis of the tasks, possibilities and obstacles for **chemical distributors** with respect to the Chemical Leasing business model. The results are described in chapter 4.

Another key element of the project was the **dissemination of and information improvement about Chemical Leasing**.

In order to disseminate the business model nationwide and to increase the knowledge about Chemical Leasing among all actors, the project team – partially with support of the contracting agency or representatives of industry and National Cleaner Production Centres (NCPCs) during larger events – has initiated miscellaneous **activities, initiatives and projects** both on the national and international level or have supported companies and organisations in their initiatives. Chapter 5 provides further details about these activities and investigates them concerning their success and potential.

In addition, within the project the **media presence** of the business model has been analysed. For this purpose, company's initiatives and research projects as well as publications and contributions in different media have been considered.

In the course of the nationwide dissemination of Chemical Leasing and to provide sufficient current information, the national **Chemical Leasing webpage**<sup>5</sup> has been updated continuously during the entire project duration. Essential updates of the webpage are presented in chapter 6. The webpage contains not only general information about the business model itself and about, e.g., the sustainability criteria, but it also comprises information about current events or international developments and references to further information.

To conclude, the project team summarises the future possibilities in form of **recommendations** for the further support of the business model (chapter 7).

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<sup>5</sup> [www.chemikalienleasing.de](http://www.chemikalienleasing.de)



## 2 Chemical Leasing in Germany

As Germany is the world's leading exporter of chemical products (ChemistryViews 2011), the German chemical industry can very much affect other markets and can generally contribute to the sustainability of the branch. The dissemination of Chemical Leasing in Germany may therefore also have a positive impact on the overall dissemination of the business model.

Taking numerous initiatives, the project team has been trying to further disseminate Chemical Leasing in Germany. Amongst others, this includes the planned initiation of new pilot projects, which the project team aspired to do by e.g. introducing Chemical Leasing to interested company representatives of different sectors: drinking water treatment and treatment of water in swimming pools, wastewater treatment, chemicals trade, application of agrochemicals, and cleaning and disinfection in hospitals. However, no new pilot project could be established in these sectors, which can be ascribed especially to the following reasons:

- ▶ **The potentials for the optimisation and reduction of the chemicals consumption are too low:**

In Germany, the use of chemicals is already highly optimised and savings potentials for the chemical quantities are regarded as rather low in the selected sectors. Since the introduction of Chemical Leasing into a company is initially accompanied by administrative and, if necessary, monetary efforts, the potentials are too low to convince companies of the shift towards Chemical Leasing. This would require approximately 15 - 20 % reduction potential.

- ▶ **International chemical trade: chemical distributors increasingly see potentials abroad, whereas the domestic situation is more challenging:**

The project has focused on chemicals trade. German chemical distributors act internationally and they see better possibilities and potentials for the optimisation of chemical applications abroad, resulting in comparably few domestic Chemical Leasing projects (chapter 4.1.2).

- ▶ **Confidentiality of the business partners in new Chemical Leasing projects:**

Subsequent to keynote speeches or to the introduction of the business model to company representatives, the project team was often now longer involved in the talks among the business partners as they preferred bilateral negotiations and, often contractually, agreed on confidentiality about the application of Chemical Leasing.

Companies in the industrial location of Germany shall apply the business model more often. To generate the prerequisites for this development, the project team has analysed the potentials for Chemical Leasing from an economic and environmental perspective in the following chapters. This involves especially the evaluation of resource and energy savings potentials, which are induced by the reduction of the chemicals quantities.

However, several inhibiting factors exist in the dissemination of Chemical Leasing that have already been analysed within the previous project. The most important current obstacles with regard to the marketability and implementation of the business model as well as approaches for the overcoming are summarised in chapter 2.2.

### 2.1 Potentials for Chemical Leasing in the industrial location of Germany

Normally, Chemical Leasing leads to a reduction in chemical quantities. This results in several additional advantages, such as:

- ▶ reduction of raw material consumption (improved resource efficiency)
- ▶ reduction of energy demand (climate protection, improved resource efficiency)

- ▶ reduction of waste (waste prevention, improved resource efficiency)
- ▶ reduction of emissions (climate protection, hazardous substances, pollution control of environmental media)
- ▶ reduced risks through hazardous substances (risk reduction for man and the environment)

In 2012, the Heinrich Böll Foundation conducted a qualitative estimation of the potentials for Chemical Leasing in cooperation with the Nature And Biodiversity Conservation Union (NABU). They evaluated the business model regarding five criteria. Except for the criterion *communicability*, all analysed aspects were allocated a medium to high potential. The results of the brief study are shown in Table 1.

**Table 1:** Rough assessment of Chemical Leasing within the brief study “Nutzen statt Besitzen” (“use instead of ownership”) by the Heinrich Böll Foundation.

Criterion	Resource efficiency potential	Reduction of other environmental impacts	Feasibility	Commercial relevance and transferability	Communicability
Chemical Leasing	2-3	2-3	2-3	2-3	0-1

Scale: 4 = very high; 3 = high; 2 = medium; 1 = low; 0 = non/negative

Source: based on Leismann et al. 2012; pp. 44

Yet, the German chemical industry is using these potentials only to a minor degree, as several inhibiting factors prevent the introduction of Chemical Leasing (see chapter 2.2.1). These potential implementation obstacles combined with the considerable efforts of a precise quantification of the potentials for Chemical Leasing in Germany were the reason why the project team has updated the data available from previous projects for the current project and has differentiated the information concerning environmental and economic dimensions.

The results are presented in the following chapters.

### 2.1.1 Economic potentials

From an economic perspective, the potential for Chemical Leasing refers to the reduction of costs for the user and increased profits for the manufacturer or distributor of chemicals. In both cases this results in positive effects on their competitiveness. Table 2 provides an overview of the economic potentials in Germany for selected groups of chemicals.

**Table 2:** Economic potentials for Chemical Leasing in Germany \*.

Group of chemical	Savings potentials in M€
Solvents	20 – 40
Paints and varnishes	6 – 12
Adhesives	3 – 6
Disinfectants and detergents	15 – 30
Others	2 – 12
Sum	46 - 100

\* without consideration of export opportunities

### 2.1.2 Potentials for reducing the energy demand

In 2012, the chemical industry was responsible for 24.1 % of the energy demand of the manufacturing sector (VCI 2014b; pp. 37). As for resource savings, Chemical Leasing harbours a great potential for reducing the energy demand since a decrease in the chemicals quantities, which usually accompanies the introduction of Chemical Leasing, involves that less chemicals need to be produced. Thus, energy for the chemicals production can be saved already in the upstream chain.

For example, the consumption of solvents in metal cleaning could be reduced by 60-80 % after the traditional business model has been replaced by the quantitative payment in Chemical Leasing. When including process energy and electricity, the corresponding energy demand could be reduced by an order of magnitude of 30-50 % (VDI ZRE 2014; p. 75).

However, according to the project team, the links between Chemical Leasing and energy savings are not present enough for potential applicants of the business model. During the meeting of the national working group in February 2012, the participants<sup>6</sup> have been able to ascertain that energy savings or additional energy expenses through optimised processes usually play only a minor role (BiPRO 2012; p. 4).

The project team has calculated the effects of Chemical Leasing on energy savings for three case studies. In all cases Chemical Leasing has led to energy savings.

#### Energy savings due to Chemical Leasing

Two aspects need to be considered: first, the direct changes in energy demand within the process that emerge from altered processes. This may be caused by higher/lower temperatures or pressures. Measures in terms of increased recycling that reduce the consumption of chemicals can also have energetic consequences.

Considerably more important than those primary effects are, in most cases, secondary effects that occur due to the fact that fewer chemicals need to be produced after the chemicals consumption decreased. Depending on the respective chemicals, energy savings range between 20,000 to 100,000 MJ/t of chemical<sup>7</sup>.

The following examples illustrate the energy savings generated through Chemical Leasing:

The required process energy for the cleaning of surfaces and floors in hotels and hospitals is negligible; energy savings can predominantly be generated via the reduced consumption of chemicals.

An average metal cleaning plant consumes between 100 and 200 MWh/a. A reduction of the chemicals consumption by 1 t results in energetic savings between 6 and 30 MWh/a. The process energy required for cleaning in hotels and hospitals is negligible; here, energy savings can be primarily realised through the reduced chemicals consumption. Table 3 shows a comparison between metal cleaning with and without Chemical Leasing. This highlights also very well the compliance with the sustainability criteria.

<sup>6</sup> Representatives of the Federal Environment Agency, BMUB, UNIDO, and BiPRO

<sup>7</sup> The basis for the estimations were values for the cumulative energy demand (CED) for selected chemicals (e. g. different solvents, single disinfectants and fertilizers, epoxy resin) from the ProBas- and ecoinvent databases.

**Table 3:** Comparative observation of metal cleaning before and after the implementation of Chemical Leasing (ChL).

Consumer	Unit	Consumption/year before ChL	Consumption/year after ChL	Savings due to ChL
Electricity plant	kW/year	310,483	155,000	155,483
Electricity cooling water recoolers	kW/year	56,850	43,700	13,150
Spare parts and service costs	€/year	12,500	4,200	8,300
Change of solvents	kg/year	1,554	0	1,554
Solvent consumption through waste oil	kg/year	906	0	906
Solvent consumption through activated carbon	kg/year	319	45	274
Solvent consumption of plant	kg/year	177	0	177
Disposal of waste oil	kg/year	9,958	9,958	0
Stabiliser	l/year	26	6	20
Stabiliser	l/year	4	2	2
Defoaming agent	kg/year	25	25	0
Activated carbon	kg/year	700	90	610
Disposal of activated carbon	kg/year	700	90	610
Filter material	pieces/year	1,400	1,400	0

Unmodified boundary conditions before and after the implementation of Chemical Leasing:  
 operating hours per year: 3,520 h/a, duty cycle of heating: 4,373 h/a, batches: 29,481 pieces/a  
 Source: own data and representation

This table has also been used for the assessment of the profitability (sustainability criterion 4). However, the respective prices per unit, which are obtained by the supplier, are confidential and thus cannot be mentioned here. But applying typical costs quickly reveals that Chemical Leasing can reduce operating costs by more than half.

### 2.1.3 Potentials for improving resource efficiency

The chemical industry is characterised by high raw material and energy demand. Almost 50 % of the utilised raw materials are accounted for by minerals (2011: ~ 21 Mt) and 44 % by fossil fuels such as petroleum derivatives or coal (nearly 19 Mt). In 2011, merely 6 % of the raw materials were covered by renewable raw materials (VCI 2013; p. 29).

According to the German association of the chemical industry (VCI), the potentials for resource conservation in the chemical industry are mostly exploited. VCI explains this with the fact that a decoupling of products and raw material input is almost impossible. Between 1990 and 2009, great savings regarding the raw material input have already been achieved due to the reduction of the waste quantities by almost 80 % (VCI 2013; p. 29).

Chemical Leasing is best to be applied in processes where chemicals are used and not produced or formulated. Thus, the business model can contribute to the optimisation of the processes using the chemicals, which reduces the consumption of chemicals and thus results in increased resource efficiency.

Moreover, the project team was able to work out Chemical Leasing's potential for resource conservation within a project for the VDI Zentrum Ressourceneffizienz GmbH, which was successfully completed in 2014 (VDI ZRE 2014; pp. 67). It involved the comparison of energy and material balances over the entire life cycle; including the manufacturing of chemicals and their feedstock as well as the disposal between the traditional business model and Chemical Leasing. The amount of inputs, the energy demand and the emission quantities have been investigated. Regarding the inputs, Chemical Leasing has led to a reduction of solvents of 73 % and a reduction of the stabiliser of 65 %, respectively. As already outlined in chapter 2.1.2, the energy demand could be reduced up to 50 %.

This quantification example underlines the contribution that Chemical Leasing can make to resource efficiency from a material and energetic perspective. By changing from the traditional business model to Chemical Leasing a new benchmark develops, too: The use of the chemicals is optimised, which normally reduces the chemicals demand. This constitutes a new value for comparison, a new standard or a new example for best practice for the application of chemicals in a specific sector.

A rough estimation of the environmental potentials for Chemical Leasing in Germany is illustrated in Table 4 for different groups of chemicals. The project team has elaborated the calculations on the basis of estimations from the previous project and has underpinned them with current data<sup>8</sup>.

**Table 4: Environmental potentials for Chemical Leasing in Germany.**

Group of chemical	Amount in kt/a	Waste reduction (referring to amount)	Emissions reduction (referring to amount)	Risk reduction with regard to handling
Solvents	10 – 20	10 %	90 %	medium*
Paints and varnishes	2 – 4	90 %	10 %	low**
Adhesives	1 - 2	90 %	10 %	medium*
Disinfectants and detergents	10 - 20	10 %	90 %	low**
Others	2 - 4	?	?	?
Sum	25 - 50	-	-	-

\* „medium“ means expected exposure reduction to hazardous (partially cancerogenic) substances, reduced risks from accidents

\*\* „low“ means expected exposure reduction to non-hazardous substances, few risks from accidents

<sup>8</sup> For instance, the project team has received price ranges for different chemicals from Brenntag AG.

## 2.2 Obstacles to the implementation of Chemical Leasing in Germany and their overcoming

Despite the various advantages of the Chemical Leasing business model that have been demonstrated in successfully implemented projects, there are several reasons that hamper the introduction of Chemical Leasing as a new business model. An attempt for a systematic assessment of promoting and inhibiting factors was conducted within the previous project. Within the current project, these inhibiting factors have been considered again and have been expanded. Furthermore, strategies for the future overcoming have been elaborated. These are presented in chapter 2.2.2.

The most important inhibiting factors identified in the previous project can be summarised as follows:

- ▶ accounting modalities: a lack of trust or problems concerning fluctuations of raw material prices
- ▶ transfer of know-how: competitive problems at the supplier side and loss of expertise at the user side
- ▶ optimisation potentials small or considered small
- ▶ liability issues and collateral with respect to technology and profitability

A complete list and detailed description of the inhibiting factors can be obtained from the report of the previous project (UBA 2010; pp. 25).

The project team has evaluated the status and the development of the obstacles identified within that project and has summarised the results in the following chapter.

### 2.2.1 Inhibiting factors

A prerequisite for Chemical Leasing is the existence of potentials for the optimisation of the chemicals use. The chemical manufacturer's know-how regarding the applications is associated with this. However, the experience during both the initiation and the implementation of Chemical Leasing projects so far shows that despite the economic and ecologic benefits for the participants – manufacturers or suppliers, users and, if applicable, third parties such as equipment suppliers – an additional range of aspects impedes or hinders the successful implementation of Chemical Leasing. For example, this includes the manufacturer's lack of trust in the accounting modalities or competitive problems as regards the transfer of know-how.

Furthermore, it has to be noted that a larger number of corporates exists that successfully practice Chemical Leasing with several partners. Due to the generated competitive advantages, e.g. through reducing the chemical quantities or the energy demand, the involved companies do not want to communicate the use of Chemical Leasing. Thus, inhibiting factors regarding the communication of successful Chemical Leasing are mentioned.

In addition, there are inhibiting factors concerning the name "Chemical Leasing" or company's own names for the business model that shall be addressed here. A number of applications exist where precisely Chemical Leasing is practiced but referred to differently. Partly, Chemical Leasing is captured as "Chemical Management Services", sometimes it is practiced as "Single Source Supply", "Cost per Unit" or under specific brand names such as "COMPLEASE™". More specifically, the currently present inhibiting factors identified by the project team can be summarised as follows:



*Inhibiting factors for the nationwide implementation on the user's side*

- ▶ reduction potentials are too low (normally, at least 15 - 20 % reduction potential must be given), thus the effort of changeover is considered as not justified
- ▶ other types of cooperation between the manufacturer and the user (especially joint research and development projects) for the reduction of the chemicals consumption

*Inhibiting factors for the nationwide implementation on the manufacturer's side*

- ▶ lack of application expertise and therefore no possibility to support the user in the reduction of consumption
- ▶ optimisation of the end application (improvement of profits) is overcompensated by losses in upstream products
- ▶ no willingness to invest in process optimisation due to a lack of human resources
- ▶ obstructionist attitude of the sales employees (commission linked to turnover and therefore to quantity)

*Inhibiting factors with regard to the term "Chemical Leasing"*

- ▶ Existing business models with a service-oriented payment are not called "Chemical Leasing" because the term is considered misleading.
- ▶ The established service-oriented payment has emerged independently of the national and international Chemical Leasing activities, so that a different term has been chosen.

*Inhibiting factors with regard to the communication of successful projects*

- ▶ Chemical Leasing as a business model embraces confidential information
- ▶ The application of Chemical Leasing generates competitive advantages (new benchmarks) whose communication to others would be counterproductive for the companies involved.
- ▶ The contract between manufacturer and user prohibits the passing on of information to third parties.

## 2.2.2 Strategies to overcome the obstacles

Amongst others, it has been the aim of the project to show in how far the obstacles identified in the previous project have already been overcome and to suggest or implement strategies for overcoming the still existing inhibiting factors. Overcoming obstacles is useful as it would not only contribute to an increase in resource efficiency in Germany and thus to the resource efficiency targets of the German Federal Government, but it is also in the interest of many actors (UBA 2014). For example, users and manufacturers of chemicals have an economic interest in the overcoming, if the business model increases their profit and competitiveness. The reduction of the chemical quantities is in the interest of the chemical user, because it reduces the risks at the workplaces and hence increases occupational safety. Reduced risks and emissions to the environment are also a concern of the public as well as all authorities and organisations concerned with environment and health.

However, many of the inhibiting factors mentioned in chapter 2.2.1 have proven to be difficult or impossible to be overcome. Here, the partially conflicting interests between companies and public institutions may serve as an example. Some companies applying Chemical Leasing do not want or must not communicate the application, as this has either been agreed upon in the contracts among the partners or because competitors take increasing notice of the benefits

induced by Chemical Leasing. But a dissemination of the business model in the respective sector can lead to the loss of competitive advantages for single companies. On the other hand, public institutions have a large interest in the disclosure of different Chemical Leasing applications, as this would stimulate the further dissemination of the business model.

With respect to other inhibiting factors, such as insufficient information, attempts for overcoming the obstacles are yet useful. These approaches are listed in the following paragraphs.

In addition, there have been numerous initiatives for the nationwide dissemination of Chemical Leasing throughout the last years especially in the field of public relations work and communication that are related to the tackling of the obstacles. To avoid repetitions, a comprehensive summary of the current communicative measures and activities for disseminating Chemical Leasing is provided in chapter 5.

### **Building trust among the participants**

One of the most important inhibiting factors is the lack of trust among the partners. Usually, it leads to the failure of the business model if no suitable measures (e.g. measurement of important process parameters) are installed to build up trust. This is an essential step in the preparation and contractual design of Chemical Leasing projects that should be considered in the beginning of every project. Removing this inhibiting factor in general is not possible but must be accomplished on a case-by-case basis.

### **Improved information**

One of the major problems regarding the communicability is the complexity of the business model or the lack of knowledge about the concrete benefits. In the course of an analysis of different “use instead of ownership”-models, Chemical Leasing has been attributed a medium to high potential in different categories, nevertheless, the criterion *communicability* has been assessed with a negative to low potential (see Table 1; Leismann et al. 2012; pp. 44).

In this context, BiPRO – partly in cooperation with the contracting authority or partners from the international expert group – has continued to provide information about Chemical Leasing and has conducted targeted public relations work throughout the project duration. This includes, amongst others, continuous updates of the website or publications about Chemical Leasing (e.g. BMU & BDI 2013). Detailed information about the website can be found in chapter 6 and paragraph 5.3 lists examples of media presence and articles.

A special focus also lies on the targeted group-oriented communication, as different stakeholders require different information. For example, representatives of governmental authorities require different information than chemical distributors, suppliers or users. Companies also require quickly accessible and targeted information, which should be oriented towards the respective branch and function of the company. Therefore, the project team has informed relevant target groups about the business model via respective channels such as associations.

Overall, improved information about the Chemical Leasing model in general and also about the advantages, potentials, and experiences in particular are necessary. Regarding the potentials, the project team has increasingly pointed out the opportunities for German manufacturer in emerging countries, where respective activities have been started (e.g. Henkel, BASF, SAFECHEM). In this context, the project team has e.g. initiated the introduction of Chemical Leasing on the German-Brazilian Economic Meeting in Rio de Janeiro. The keynote speech was given on 22 November 2012 by partners of the NCPC Brazil (see event announcement in Figure 9 of the Annex).



In addition, the project team has worked out and communicated in parallel projects, such as the analysis of resource efficiency potentials in small and medium-sized enterprises (SME) of the chemical industry (VDI ZRE 2014) that, in many cases, greater reduction potentials exist for the chemicals consumption than participants expect. Here, the BiPRO GmbH has emphasised that particularly Chemical Leasing presents a chance to detect these potentials that are not or only hard to see for the individual company.

Furthermore, easily accessible information about similar projects and their basis (contract, unit of payment, challenges, successes) as well as concrete and quickly comprehensible guidelines or support for the introduction of Chemical Leasing are crucial. The latter one can be facilitated by the UNIDO Chemical Leasing toolkit, which is currently under revision. It is the aim of the revised toolkit to process the basics of Chemical Leasing target group-specific. The information in the toolkit is presented in such a way that the user, depending on his function (supplier or user of chemicals, distributor, non-governmental organisation (NGO), politician, equipment manufacturer, etc.) or depending on the desired information (e.g. “How does Chemical Leasing work?”) is directly referred to the relevant parts of the toolkit. The revision of the existing toolkit is substantially supported by the project team: on the one hand, experiences of the past years regarding target groups and their respective information demand directly inform the content and structure of the toolkit; on the other side, the project team repeatedly conducts reviews of the current or final versions and, if necessary, provides indications for options for improvement.

#### Promoting transparency of existing Chemical Leasing projects

In order to improve the information situation about existing Chemical Leasing projects, institutions supporting Chemical Leasing activities, such as BMUB, UBA and UNIDO, should try to achieve more transparency with regard to existing Chemical Leasing projects. In order to do so, the institutions can combine a mandatory disclosure of information in return for the support to companies.

Moreover, the following aspects could be relevant for the communication in terms of overcoming some of the inhibiting factors, as they underline the benefits induced by Chemical Leasing.

#### Competitiveness

A core argument of Chemical Leasing is the reduction of costs due to process optimisations and the sharing of the economic benefits for the participants.

In this way, a functioning Chemical Leasing business model always leads to an improvement of the competitiveness of both partners.

A precondition is however, that no data of contractual and competitive value of the user is transferred, as otherwise the chemical supplier would improve its competitive position (attractive arguments for new clients!) to the expense of the user (loss of know-how).

Besides the cost advantages, another important criterion for the competitiveness is resulting from the close relation between the partners. This results in benefits for the supplier because he can react more quickly to new developments on the user side (e.g. increases in capacity, assortment changes) as information is available earlier.

The competitiveness improves for the user when the closer relation leads to the generation of faster support in case of problems and the possibility of joint developments for future-oriented solutions.

## **Technology and know-how transfer**

Traditionally, the German economy is strongly export-oriented and supplies to emerging and developing countries have a high importance. Especially these countries offer a large optimisation potential for many processes that currently still consume excessively high quantities of chemicals.

Against this background, it quickly becomes clear that Chemical Leasing may provide access to new markets for German chemical manufactures that are equipped with profound knowledge of application.

One example is the area of pesticides, where BASF is testing business models that result in Chemical Leasing but are currently not yet advanced. Also during surface cleaning and the use of adhesives German manufacturers conduct international Chemical Leasing projects (Bi-PRO GmbH b). The higher quantitative price of German products (e.g. adhesives) is more than compensated by their higher efficiency (less adhesive per area) during Chemical Leasing.

Thus, the transfer of technology and know-how within Chemical Leasing provides access to new markets.

## **Public procurement**

Public procurement is an important element for steering sustainable development and it supports the idea of product-based environmental protection. "In Germany, the public procurement comprises about 13 percent of the gross domestic product" (BMUB 2014) and can thus considerably influence the industry and act as a role model. The implementation of Chemical Leasing into public procurement would not only lead to an increasing publicity of the business model but could also increasingly motivate or oblige companies to integrate Chemical Leasing into their proposals and their assortment. Public procurement could make Chemical Leasing compulsory and specifically promote innovative solutions. In this context, the project team has conducted an exchange with public procurement experts of the water treatment and health sector, where the participants discussed important elements of Chemical Leasing in public procurement.

The project team has held concrete talks with experts from public drinking water supply and waste water treatment. The representatives of the procurement departments have identified problems that counteract the introduction of Chemical Leasing in the sector. For instance, Chemical Leasing would discriminate those suppliers that do not know the plants and can thus not address the specific needs and potentials in their tenders. Another reason are the small potentials for the reduction of the chemical quantity that, according to industry representatives, do not offset the considerable effort that accompanies the introduction of Chemical Leasing. Moreover, the chemical supplier did not show interest in the implementation of Chemical Leasing.

Besides the great potentials of public procurement for Chemical Leasing, some possible risks must be considered in advance, like in the example of the health sector. A small number of suppliers in this sector may hamper the success of such projects if not sufficient information and willingness on the part of the companies are provided. This is complemented especially in the health sector by the high need for safety of the issuing institution, because hospitals want to minimise all risks as far as possible. Thus, normally the existing experiences and references are used and innovative approaches are avoided. Furthermore, it has to be specified already during the tender which parameters are used to measure the quality of the service in order to ensure a fair service-oriented payment.

## Support the integration of Chemical Leasing into public procurement

To counteract the mentioned risks, a first step should include the initiation of pilot projects in selected branches and the sustainability criteria, which are explained in more detail in chapter 3, should be applied. As requested by the criteria, systems for monitoring and control must be installed to be able to measure the success. Service-oriented business models in general and Chemical Leasing in particular could be integrated to a greater extent into the handbook on green public procurement (*Handbuch Umweltfreundliche Beschaffung*) published by the Federal Environment Agency or into the European Commission's guidance document 'Buying Green!' in order to support the integration of Chemical Leasing into public procurement. A targeted communication to inform procurers about Chemical Leasing would be use- and helpful, too.

## Governmental support

Surveys among corporates in the past as well as long-term experiences with the business model have revealed that governmental support of Chemical Leasing measures does not support the dissemination of business model. This has been demonstrated on the basis of the existing governmental funding in Austria, which covers parts of the company's costs associated with the implementation of the business model. It has been shown that companies either see sufficient incentive for the introduction of Chemical Leasing directly in the business model itself or they attribute such a small potential to the business model that the introduction would not pay off despite the governmental support.

## Promotion of Chemical Leasing via marketing-effective measures

Voluntary and marketing-effective measures should rather exist, e.g. in form of a German sustainability award for Chemical Leasing. Such an additional award should be restricted to national projects only and should be presented for different categories. These categories could include e.g. different steps during the production or within a company, such as cleaning, coating, printing, disinfection, lubrication, etc.

In order to successfully participate in such an award presentation and to be admitted, the companies would have to disclose their Chemical Leasing projects. Hereby, other actors in the branch would become aware of the business model's advantages and its usefulness (economic and ecologic) which would create increased interest.

## Example: financial sector

A positive trend with regard to overcoming the inhibiting factors can be found in the financial sector; but eventually did not lead to a successful project.

In the past, UNIDO, the Austrian Environment Ministry and BiPRO have tried to integrate the financial sector. However, the integration failed so far because of a lack of interest among the financial institutions. Yet, along with the increasing dissemination of Chemical Leasing, the project team has been actively approached by the financial sector (Savings Bank Association (*Sparkassenverbund*), Deutsche Leasing).

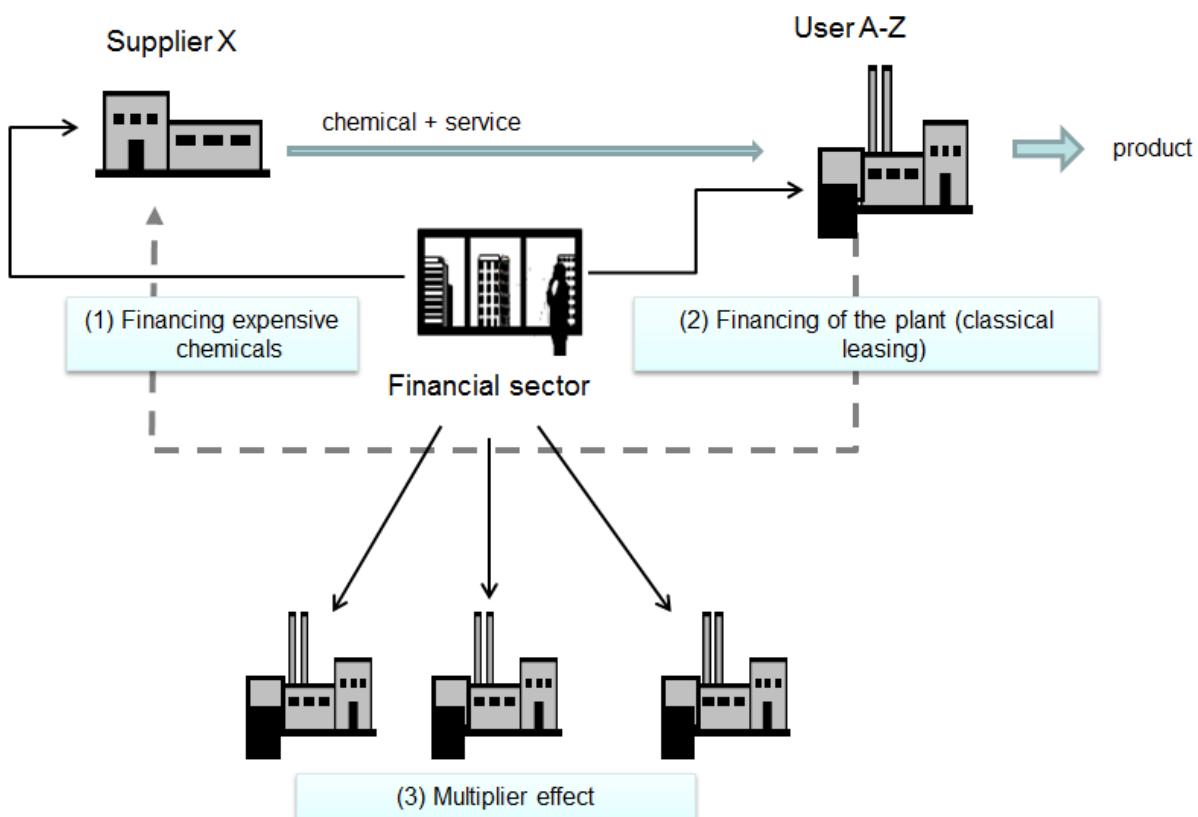
Within a first exchange, the actors have identified three basic starting points for the integration of the financial sector:

1. Financing of particularly expensive chemicals which are not consumed (e.g. noble metal catalysts)
2. Financing of plants required in the context of Chemical Leasing business models via a "classical leasing"

3. Utilising the contacts of classical plant leasing to a variety of clients in order to draw attention to the enhanced possibilities of an additional Chemicals Leasing

Figure 2 illustrates the three possibilities. In order to reinforce the integration of the financial sector in the future, already during the initiating phase an increased emphasis will be put on the questions whether an integration of financial institutions is useful and whether it should be tested. Moreover, representatives of the financial sector were informed about Chemical Leasing within a meeting with the project team and opportunities for the integration were presented. However, the introduction of specific projects failed due to factors such as the collateral for financial institution, since chemicals, unlike e.g. leased plants, present consumer goods and thus do not present sufficient hedge for the institutions in the event of insolvency.

Figure 2: Possibilities for the integration of the financial sector into Chemical Leasing projects.



Source: own graphic.

### 3 Analysis of already initiated Chemical Leasing projects and review of the sustainability criteria based on these projects

First, the following chapter introduces the sustainability criteria which have been worked out in the previous project and have been further developed by the members of the national working group Chemical Leasing. Subsequently, the already initiated Chemical Leasing projects are briefly summarised and their current status is presented. It is mentioned for every project in how far the criteria were considered. Afterwards, chapter 3.2 consolidates the analyses regarding practicability and acceptance and evaluates whether the criteria are generally applied and considered useful also outside the projects.

#### 3.1 Sustainability criteria

The five sustainability criteria elaborated in the previous project aim at supporting to establish a high standard for Chemical Leasing. The criteria read as follows:

1. Reduction of adverse impacts for environment, health, energy and resource consumption caused by chemicals and their application and production processes
2. Improved handling and storage of chemicals to prevent and minimize risks
3. No substitution of chemicals by substances with a higher risk
4. Economic and social benefits are generated; a contract should contain the objective of continuous improvements and should enable a fair and transparent sharing of the benefits between the partners
5. Monitoring of the improvements needs to be possible

In the meantime, UNIDO has also introduced the sustainability criteria into the international frame where they are acknowledged and applied. Yet, an assessment of the practicability and acceptance was lacking so far. This has now been conducted by the project team by means of the pilot project initiated in the previous project. Chapter 3.2 summarises the analysis results. Chapter 3.3 afterwards lists specialties of the single projects. The project team has also reviewed the pilot projects concerning their current status and their effectivity and has analysed whether follow-up projects could be generated.

#### 3.2 Summary of the findings of the review and evaluation of the sustainability criteria on the basis of the project experience

The project team's experiences with national as well as international Chemical Leasing projects (including the cooperation with the international expert group) during the entire research project period have shown that the sustainability criteria for Chemical Leasing make an essential contribution to the implementation of the business model in many cases. This has been visible especially in the following contexts:

- For different suppliers of Chemical Leasing business models the sustainability criteria fulfil a **critical function during the acquisition** as Chemical Leasing providers can better work out the advantages of the business model from the very beginning. Moreover, the use of the criteria enables the suppliers to emphasise their initiatives and engagement with regard to sustainability more strongly.
- The criteria effectively **prevent** the **substitution** of chemicals with **substances of higher risks**. Such concerns may arise among users of chemicals, when Chemical Leasing is communicated only in terms of process optimisation and a reduction in the chemicals quantities that could theoretically be achieved by using a more efficient, but also more hazardous chemical. In this case, chemical suppliers use the criteria to address the

concerns of the users in terms of higher risks in their processes, as the criteria prohibit a substitution with substances of higher risk.

- ▶ In **contract negotiations** between potential partners the sustainability criteria have also proven to be useful as they serve as a quality assurance instrument in case the partners have concerns about the project's success. The project team was able to ascertain this for both the examined national and several international Chemical Leasing projects. The benefits of the sustainability criteria mainly lie in the fact that the progress and quality of the project become verifiable for the partners. Thus, the success of the Chemical Leasing project becomes measureable and controllable (UNIDO 2011c; p. 4).
- ▶ The criteria are explicitly included in **Chemicals Leasing contracts**. Not all criteria are used in every case, but the partner companies usually set individual priorities. For example, a fair distribution of economic benefits is covered by a contract or the companies ensure that the energy demand of the processes must not rise. Contrary to the energy savings induced by the reduced amounts of produced chemicals (see chapter 2.1.2), the energy savings or the additional energy inputs due to process optimisation are less present for users of Chemical Leasing (BiPRO 2012; p. 4).
- ▶ In several cases, the sustainability criteria are included into the envisaged **measurement programmes** for resource consumption.

#### Chemical Leasing sustainability criteria at the Global Chemical Leasing Award

The criteria are also used within the Global Chemical Leasing Award. As a prerequisite for a successful application, the submitted cases have to fulfil the sustainability criteria (see e.g. UNIDO 2012; pp. 31 and 37). However, it should be noted that there is a certain risk that the sustainability criteria are simply “ticked off” when the applicants are asked about the fulfilment of the criteria. Usually, they do not provide a serious examination of the criteria, e.g. how the business partners have analysed the criteria or which quantifications were conducted. Thus, the project team takes the view that the award criteria should increasingly demand the fulfilment of the sustainability criteria and should explicitly ask for the kind of fulfilment. To support the applicants here, e.g. UNIDO could provide model examples of a successful examination of the sustainability criteria.

Furthermore, cases to be advertised as a successful example of Chemical Leasing by UNIDO have to fulfil the five criteria. Since the resolution of the international working group, the same holds true for financial support of pilot projects. Hence, the fulfilment of the sustainability criteria constitutes an important element of quality control for Chemical Leasing projects (UNIDO 2011c; p. 46).

Moreover, the sustainability criteria have proven themselves during the introduction of the business model Chemical Leasing for instance on conferences and at workshops. From the authors' perspective, it is important to present the sustainability criteria in order to remove potential concerns about environmental benefits. This debilitates, for example, the accusation of “greenwashing”, which can arise when the economic success of the business model has too much priority.

The criteria also stress the synergies of Chemical Leasing to other similar programmes and activities of the chemical industry, such as UNEP's Responsible Production approach<sup>9</sup>, the Global Product Strategy (GPS) of the International Council of Chemical Associations (ICCA)<sup>10</sup> or UBA's Guide on sustainable chemicals<sup>11</sup> (see also UNIDO 2011a; p. 41). Each of these pro-

<sup>9</sup> <http://www.unep.org/responsibleproduction/>

<sup>10</sup> <http://www.icca-chem.org/en/Home/Global-Product-Strategy/>

<sup>11</sup> Reihlen et al. 2010



grammes presents its own set of criteria that partially overlaps with the sustainability criteria for Chemical Leasing. The application-oriented and substance-related criteria of the Guide on sustainable chemicals may serve as an example. The guide's criteria support the identification of Chemical Leasing as an important instrument towards the sustainability of the chemical industry because criteria like *emission of greenhouse gases* and *resource consumption* (Reihlen et al. 2010; pp. 11 and 19) are positively influenced by Chemical Leasing, as has been shown already in chapters 1.1, 2.1.2 and 2.1.3.

A systematic investigation of different programmes in the field of Sustainable Chemistry is currently conducted within the UFOPLAN project "Contributions to the Sustainability Strategy: reduction of resource consumption in the chemical industry by means of sustainable chemistry" <sup>12</sup> on behalf of the Federal Environment Agency. The sustainability criteria for Chemical Leasing also have an influence on this project. The objective is to harmonise and reduce the variety of existing criteria and indicators on Sustainable Chemistry. The results are still pending.

For the communication and understanding about Chemical Leasing, better links between single initiatives and programmes and their criteria can be useful and supportive. Therefore, it is recommended to further investigate the possibilities of the integration of the Chemical Leasing sustainability criteria into other programmes.

Within the frame of a publication (Moser et al. 2014a) differentiated goals have been elaborated similar to the sustainability criteria in order to capture Chemical Leasing's contributions to a Sustainable Chemistry. The goals can be obtained from Table 5. The analyses has been conducted on the basis of eight case studies whereof the first four (label A) are international Chemical Leasing projects and the examples with the label B are German projects. The German projects correspond to the ones initiated by the project team within the previous project and which have been analysed within the current project regarding the sustainability criteria. As can be seen from the table, the energy and material demand could be reduced in all German case studies. However, no concrete quantification has happened in most cases. Furthermore, in all cases the amount of waste and wastewater was reduced. Solely the criterion *use less water* was usually not fulfilled in category 1 (increase overall resource efficiency).

Also the goals of category 3 (increase economic value and strengthen chemicals management) could be accomplished with the exemption of one case. In particular goal 4, an increased sustainability in surrounding systems, could only be considered for some of the case studies as often not enough data was available for an analysis.

**In summary, the project team has derived the following individual evaluations for the five sustainability criteria on the basis of the project experience:**

#### Importance of the sustainability criteria 1 and 4

From the project team's point of view, criterion 1 "Reduction of adverse impacts for environment, health, energy and resource consumption caused by chemicals and their application and production processes" is applied the most besides criterion 4. It is used especially during the initial discussions as well as in the phases of "process optimisation" and "testing" and is, in almost all cases, also quantified (for internal use).

<sup>12</sup> FKZ 3713 93 425 – German title: "Beiträge zur Nachhaltigkeitsstrategie: Minderung des Ressourcenverbrauchs in der Chemiebranche durch Instrumente der nachhaltigen Chemie" (Contributions to the Sustainability Strategy: Reduction of Resource Consumption in the Chemical Industry by Applying Sustainable Chemistry Instruments)

The criterion 2 “Improved handling and storage of chemicals to prevent and minimize risks” is much less important to the actors and is often only assessed at the end of the project (or ignored). In Germany, the aspect of risk avoidance with regard to accidents is rather less important due to the high (occupational) safety standards that guarantee high levels of safety and minimise risks as far as possible.

The criterion 3 “No substitution of chemicals by substances with a higher risk” plays no role whenever the same substance is used prior and after the process optimisation.

The criterion 4 “Economic and social benefits are generated; a contract should contain the objective of continuous improvements and should enable a fair and transparent sharing of the benefits between the partners” is usually examined at the beginning of a Chemical Leasing cooperation in relation to questions such as “Are economic benefits even possible?”. In many cases, the participating companies are able to generate major economic benefits by introducing Chemical Leasing, as illustrated in Table 3. The criterion has again a high significance during the contract negotiations.

From the project team’s point of view, the criterion 5 (“Monitoring of the improvements needs to be possible”) is often not understood as a sustainability criterion. Only a few partners speak about monitoring. Generally it is agreed upon an inspection of the resource consumption (raw materials and energy) and of the archived product quality.



Table 5: Evaluation of the potentials for Chemical Leasing to promote Sustainable Chemistry.

Promoting sustainable chemistry through chemical leasing				A. Case study 1: painting of washing machines			A. Case study 2: drinking water			A. Case study 3: conveyor lubrication in the beverage industry			A. Case study 4: news paper printing			B. Case study 5: cleaning pipes in the food industry			B. Case study 6: abrasives in the metal industry			B. Case study 7: metal cleaning			B. Case study 8: surface coating		
Basic goals	Sub-goals	Achievement	Score	Total	Achievement	Score	Total	Achievement	Score	Total	Achievement	Score	Total	Achievement	Score	Total	Achievement	Score	Total	Achievement	Score	Total	Achievement	Score	Total		
1. Increase overall resource efficiency	1.1. Use less energy	.	0	0	.	0	0	.	0	0	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	1.2. Use less raw and auxiliary materials	yes	1	1	.	0	0	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	1.3. Use less water	.	0	0	.	0	0	yes	1	1	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
	1.4. Produce less waste / waste water	yes	1	1	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
2. Reduce adverse effects on health and environment of the chemicals of concern	2.1. Reduce impacts on labour health	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	2.2. Substitution of carcinogenic, mutagenic and toxic for reproduction (CMR) chemicals	n. r.	0	0	n. r.	0	0	n. r.	0	0	no	-1	-1	n. r.	0	0	n. r.	0	0	yes	1	1	n. r.	0	0		
	2.3. Substitution of persistent, bioaccumulative and toxic (PBT) chemicals	yes	1	1	yes	1	1	yes	1	1	no	-1	-1	n. r.	0	0	n. r.	0	0	n. r.	0	0	n. r.	0	0		
	2.4. Reduce impacts on water	.	0	0	.	0	0	yes	1	1	.	0	0	yes	1	1	.	0	0	.	0	0	.	0	0		
	2.5. Reduce impacts on air	.	0	0	.	0	0	yes	1	1	.	0	0	n. r.	0	0	yes	1	1	yes	1	1	.	0	0		
	2.6. Reduce impacts on soil	n. r.	0	0	.	0	0	n. r.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
3. Increase economic value and strengthen chemicals management	3.1. Increase output with desired properties	.	0	0	.	0	0	.	0	0	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	3.2. Optimise handling / storage / logistics / processes	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	3.3. Increase economic gain: increase revenue for supplier	.	0	0	.	0	0	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	3.4. Increase economic gain: increase revenue for user	yes	1	1	yes	1	1	yes	1	1	yes	1	1	no	-1	-1	yes	1	1	yes	1	1	yes	1	1		
	3.5. Increase competitiveness for supplier	.	0	0	yes	1	1	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
	3.6. Increase competitiveness for user	.	0	0	.	0	0	.	0	0	yes	1	1	yes	1	1	yes	1	1	yes	1	1	yes	1	1		
4. Increase sustainability in surrounding systems	4.1. Use less fossil resources	.	0	0	n. r.	0	0	.	0	0	.	0	0	.	0	0	n. r.	0	0	.	0	0	.	0	0		
	4.2. Reduce impacts on health of consumers	.	0	0	yes	1	1	yes	1	1	.	0	0	.	0	0	n. r.	0	0	.	0	0	.	0	0		
	4.3. Promote recycling / use in cascades	yes	1	1	.	0	0	.	0	0	.	0	0	yes	1	1	no	-1	-1	yes	1	1	yes	1	1		
	4.4. Increase economic gains in the region / country: increase revenue for trade	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
	4.5. Increase economic gains in the region / country: revenue for other stakeholders in the supply chain	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
	4.6. Reduce poverty in the region	yes	1	1	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
	4.7. Increase employment in the region	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
	4.8. Reduce impacts on water in the region	yes	1	1	yes	1	1	.	0	0	yes	1	1	.	0	0	.	0	0	.	0	0	.	0	0		
	4.9. Reduce impacts on air, including greenhouse gases	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
	4.10. Reduce impacts on ecosystems / biodiversity	yes	1	1	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0		
Total score		9			7			9			7			10			10			13			11				
Promotion achieved (every criterion > 0, i.e. at least 1)		yes			uncertain			yes			uncertain			yes			uncertain			yes			yes				
Missing data		15			17			15			15			11			10			12			13				

Source: Moser et al. 2014a

### 3.3 Analyses examples of existing Chemical Leasing projects

The Chemical Leasing projects that BiPRO has used for the analyses within this project are the ones that originated from the previous project and cover the following processes:

- ▶ Cleaning of pipes and vessels in the food industry
- ▶ Production, processing and use of catalysts
- ▶ Cleaning, pretreating and coating of metal surfaces
- ▶ Use of abrasives in the metal industry
- ▶ Optimisation of the usage of adhesives

For the analysis the project team has assessed the status and effectiveness of each pilot project. An essential element during this analysis was the question whether the goals defined at the beginning of the project have been reached by the business partners and to which degree the Chemical Leasing sustainability criteria have been applied and fulfilled. During the data collection it has also been investigated how the cooperation between the business partners has developed.

The analyses has not only embraced the directly initiated pilot projects but has also included the activities concerning Chemical Leasing on both the supplier and user side that have been triggered by contacts and efforts at persuasion of the previous project.

#### 3.3.1 Cleaning of pipes and vessels in the food industry

The pilot project for cleaning of pipes and vessels in the food industry was successfully implemented. According to suppliers, about 300 contracts for cleaning of pipes and vessels by means of a service-oriented payment now exist, where the consumed amount of chemicals could be reduced.

The most important areas of application are the following:

- ▶ breweries
- ▶ dairies
- ▶ fruit juice industry
- ▶ bakery products and confectionary
- ▶ fish processing
- ▶ meat processing

Usually, the unit of payment for the required chemicals is €/amount of product (e.g. hl beer), €/1000 filled bottles or €/operating hour of cleaning plant.

In Germany, the supplier structure is characterised by 14 equipment suppliers and about 120 chemical suppliers. Important suppliers of Chemical Leasing are Ecolab, Diversey, Tensid-Chemie and Stockmaier.

The realised savings are in the order of 10 to 30 %. They are achieved especially through the following measures:

- ▶ use of optimised cleaning in place (CIP) systems
- ▶ continuous measurements of process parameters
- ▶ coordinated design during plant and pipe construction
- ▶ using specific additives and stabilisers

Moreover, there is a remarkable new development of including Chemical Leasing already during the designing and construction of production facilities for instance in a brewery. Within the project a preliminary talk between Tensid-Chemie and Paulaner has been initiated.

Difficulties and inhibiting factors during the use of Chemical Leasing business models refer to the distribution of efficiency improvements that predominantly benefit the user.

A great potential for comparable projects is visible abroad, which is why the project team has established contacts between the German manufacturer Tensid-Chemie and companies in Latin America that eventually have led to successful applications for the Global Chemical Leasing Award.

For those Chemical Leasing contracts where the contracting parties provided information for the project team, the sustainability criteria were fulfilled. In particular the authors have been able to determine that the first criterion is fulfilled in all known cases. Measurements of the chemicals consumption are constantly conducted during the test phase as well as after the implementation, which entails that permanent attention is given to the reduced chemicals consumption.

Regarding criterion 2 the team rarely detected an explicit inspection by the partner companies. Solely the supplier advertises the improved handling of chemicals.

In order to examine criterion 3, the project team has compared safety data sheets of the applied chemicals for individual cases before and after the introduction of the business model. In those cases, the criterion has been fulfilled. However, the partners rarely check this criterion themselves.

Criterion 4 regarding the economic benefits is always adduced for the contract design and is fulfilled in many cases. Nevertheless, this special type of application often shows that the economic benefits due to optimisation are claimed by the chemical user. This reduces the attractiveness of the Chemical Leasing business model as chemical manufacturers do not improve their profitability. This may also endanger the economic sustainability of the existing contracts. Thus, it should be taken care already during contract design that a fair distribution of the future benefits takes place.

The fifth criterion was fulfilled in all known cases as monitoring always takes place.

### 3.3.2 Use of catalysts

HC Starck did not pursue the pilot project because the involved partner BASF preferred a different solution. Consultations with various suppliers however revealed that Chemical Leasing is used for catalysts.

From the user's perspective, obstacles arise especially from the liability of suppliers of catalysts as well as concerning price fluctuations of noble metals; risks on the side of the catalyst manufacturer refer to the impact of external, catalyst-independent factors on the outcome of the production process and thus on their payment.

At the moment there are about ten Chemical Leasing contracts in the field of catalyst production and use known to the project team. Potentials are mainly to be seen in the export. Some calls for tenders (e.g. petrochemical industry) explicitly demand Chemical Leasing concepts for catalysts, often combined with leasing of equipment components. Such cases are known from Colombia and China. According to the information available to the project team, these are Chemical Leasing examples because the supplier provides the catalyst, is being paid for its use and finally takes back the catalyst. However, the project team did not receive enough data

to assess whether the efficiency of the catalyst, and hence a process optimisation, are integrated into the unit of payment.

A precise examination of the sustainability criteria has not been possible for individual cases. However, the project team was integrated into the evaluation of international tender documents in one case. Here, it could be determined that all five criteria were listed in the requirements of the user (refinery) and were considered and integrated by suppliers in their tenders. Yet, the project team has not been part of the realisation phase so that the practical implementation cannot be investigated.

From different telephone calls the project team got the impression that the business model partners consider particularly criteria 1 (reduction of adverse impacts), 4 (economic benefits), and 5 (monitoring) as important during the introduction and implementation of Chemical Leasing projects, whereas substitution and improved handling play a minor role for the implementation.

### 3.3.3 Cleaning, pretreating and coating of metal surfaces

After the successful implementation of the pilot project 20 additional Chemical Leasing contracts have been implemented in the field of metal surface treatments.

Different service-oriented units of payment are applied in these cases, such as €/m<sup>2</sup> coated surface or pretreated surface, €/basket of cleaned parts, €/operating hour of the plant or €/month.

Both industry partners and the project team have been able to identify several factors of success which include the detailed explanation of the advantages for the clients and a simple design of the contracts. In particular this refers to intuitive and easily understandable formulations and especially a possibly simple reference unit for the service of the chemical. For example, it has been tried and tested to use the operating hours of a cleaning unit as the reference unit, as it is usually proportional to the number or the area of cleaned parts. Furthermore, pragmatic rules have been found for an increased consumption caused by the user, which entail additional costs for the party having caused the increased consumption. These contracts considerably contribute to the success of a Chemical Leasing project.

BiPRO has examined the use of and compliance with the sustainability criteria for individual cases. In these cases all criteria have been fulfilled. For the involved partners, all criteria are important in the field of chlorinated solvents. The chemical manufacturer SAFECHEM has gone even further and has advanced the existing criterion 3 to a general substitution criterion. The screening for alternatives is expanded to the extent that a Chemical Leasing business model for substances of very high concern (SCHV) is only offered if no substances with lower risks are available.

### 3.3.4 Use of abrasives in the metal industry

The pilot project has been implemented successfully. Meanwhile, more than 100 Chemical Leasing contracts exist in the abrasives industry. In particular they are concerned with the metal treating industry and foundries. Through service-oriented Chemical Leasing contracts especially measures for extending the service life (reduced materials consumption) of abrasives have been initiated. Both user and supplier profit from products with reduced materials consumption (e.g. diamond grinding tools).

In particular, liability problems and accounting modalities are mentioned as hurdles for a broader dissemination ("We only do that with well-known, long-term clients whom we trust").

Potentials and opportunities can mainly be seen in other EU member states, where diamond tools show a strong growth. The implementation in emerging economies is regarded as rather sceptical because the abrasives manufacturers expect problems with the inspection of the polished surfaces and with a fair and comprehensible account.

The project team only received very limited data for the exemplarily examinations of the sustainability criteria. But in general, the reduction of the quantities can be determined through the service life. However, this is depending on different parameters that are not communicated by the business partners. Thus, quantification is only possible via the amount of ordered abrasives which the project team has not been informed about. In general, the safe use of abrasives is of great importance. For example, this can be seen in the safety precautions and the special leaflets which are used. Nevertheless, these measures happen independently from the business model Chemical Leasing and a changeover from the conventional business model did not have any influence on the cases discussed. The topic of substitution is important is so far as producers generally try to reduce the hazardous components of their products. However, with respect to Chemical Leasing this has not been an issue. The take back of used abrasives is still rare but is gaining more and more awareness. Due to the economic sustainability, criterion 4 is essential and is examined on a regular basis. According to the project team's insights, no other measures of monitoring are conducted.

### 3.3.5 Optimisation of the usage of adhesives

Within the previous project, it was originally planned to optimise the bonding of windows in façade elements of buildings by employing adhesive tapes within a Chemical Leasing contract with the company 3M and to reduce the amount of required adhesive. However, due to unanswered liability issues, the project could not be implemented in this way.

Yet, the business model has been embedded within 3M and Chemical Leasing is applied in another area of the enterprise. In personal conversations, the participating companies have provided the project team with confidential information regarding these activities. For example, 3M is responsible for the bonding of labels in vehicle's engine compartments. The labels contain special information on motor and design data and Chemical Leasing is now being used for this application. 3M is no longer selling the adhesive for affixing the labels but the entire service of the insertion of necessary information into the engine compartment. To optimise the process, only one larger label, which contains all relevant information, is now used instead of several smaller ones.

For reasons of secrecy, no more details with regard to the contract and the development of measurable parameters can be provided at this stage. Nevertheless, due to the information provided, the project team has been able to examine and approve the fulfilment of the sustainability criteria. Only the second criterion (improved handling) could not be analysed by the project team.

## 4 Chemical Leasing in chemicals trade

Between chemical manufacturers and users there is often the chemicals trade in the supply chain. However, the existing projects, in which Chemical Leasing is successfully applied, usually take place without this partner.

This chapter analyses the position of the chemicals trade in Germany and assessed the deficits which still exists in the context of Chemical Leasing and trade. Strategies for the reduction of the deficits are discussed and possibilities are proposed on how to generate more knowledge about the business model and its application among chemical distributors.

### 4.1 Analysis of the position of chemical distributors

First, this chapter provides an overview of the chemicals trade in Germany. Then, successful examples of the application of Chemical Leasing in chemicals trade are presented as well as the currently existing deficits. After the identification of the deficits, a second step involved the development of measures by the project team to reduce the deficits. The respective measures have been implemented in a third step.

#### 4.1.1 Overview of chemicals trade in Germany and advantages due to Chemical Leasing

The chemicals trade in Germany concerns an industry with more than 100 companies and a turnover of more than 13 billion euros (years 2011 and 2012). The development over the last years has shown a positive trend, in particular jobs have been created in 2011 and sales were extended (increase in sales from 2010 to 2011: 12.7 %) (VCH 2012, VCH 2011).

Chemicals trade competes with chemical manufacturers who sell their products directly at least to important customers. A worst case scenario for chemicals trade would be that more and more chemical users buy chemicals directly or via the internet from the manufacturers. In that case, the trade would be limited to niche products.

Therefore, it seems important for the future of chemicals trade which strategies and responses are found to the major megatrends on the market. The current megatrends are the following:

- ▶ sustainability
- ▶ service orientation
- ▶ cooperation within the supply chain
- ▶ increase in efficiency (regarding energy and materials)

Chemical Leasing clearly possesses some characteristics which qualify the business model as a response to the aforementioned megatrends. The characteristics include an intensified cooperation within the supply chain, improved efficiency of the chemicals use which reflects in substance and energy related indicators.

Moreover, Chemical Leasing can lead to a monetarisation of already provided services (which are often unpaid). Thus, the distributor can generate more turnover and increase its competitiveness.

Chemicals trading companies are characterised by ideal conditions for the implementation of the business model because of their proximity to the end customer in case they possess application-oriented technical know-how, which allows them to improve processes in combination with the user. This is particularly given in large chemicals trading companies, as mostly technically trained staff keeps customer contacts and thus also has process knowledge. Due to the intensified customer relation within Chemical Leasing, the relationship to the customer is



long-term oriented, which, together with the environmental and health benefits, results in more ecological and also economic sustainability.

The potentials for development, which Chemical Leasing can exploit for companies in the field of trade, refer to both the economic possibilities and the improvement of the strategic position within the value chain. This is reflected by a stronger cooperation within the process optimisation that leads to a stable supply relationship. Furthermore, the chemical distributors get to know the plans of their customers much earlier and can consequently better react to those plans.

Within this project these benefits were continually presented and emphasised at companies of the chemicals industry. This serves as a contribution to the extensive dissemination of the Chemical Leasing business model. Details on specific initiatives or presentations are provided in chapter 5.

#### 4.1.2 Successful examples

The companies CSC JÄKLECHEMIE GmbH & Co. KG, the Brenntag AG, and SAFECEM have successfully conducted Chemical Leasing in the field of chemicals trade. These companies use the business model to a varying extent and some have successfully applied for the Global Chemical Leasing Award with their projects and participated at the respective events<sup>13</sup>.

In addition, the project team has achieved that the German and the European association (VCH and Fecc, respectively) actively support Chemical Leasing and participated in the award ceremony in Frankfurt in 2012.

On the occasion of a meeting of the international expert group on Chemical Leasing, the Brenntag AG in Frankfurt was visited. A future cooperation of the world market leader in chemicals trade with various National Cleaner Production Centres (NCPC), UNIDO and UNEP is in the planning phase (UNIDO 2012; p. 59f.).

#### 4.1.3 Shortcomings

Chemical Leasing shows a significant development potential for companies in chemicals trade by helping them to address current megatrends and to create more turnover and a more intense customer loyalty through know-how transfer. Yet, shortcomings with regard to Chemical Leasing within chemicals trade exist.

The analysis of the deficits took place by personal interviews with companies as well as with the Association of Chemicals Trade (VCH).

Besides the general inhibiting factors described in chapter 2.2, the project team has identified the following essential shortcomings for chemicals trade:

- ▶ The Chemical Leasing business model is not known in chemicals trade or there are false notions about the business model (latter resulting from the frequently observed interpretation of the term "leasing" in the sense of a financial model).
- ▶ There are already service concepts in chemicals trade, so that companies think they already practice Chemical Leasing under a different name. However, essential components of the alternative business model are missing, such as for example a use-oriented payment, no substitution with substances with higher risks and the compliance with the sustainability criteria for Chemical Leasing.

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<sup>13</sup> CSC JÄKLECHEMIE – 2012: Conformity Declaration Certificate

SAFECEM – 2012: winner in the category "Case Studies"; 2014: Conformity Declaration Certificate

- ▶ Basic information about Chemical Leasing is available but the companies have no information about the opportunities and possibilities or risks and limitations of the application. Corresponding analyses for the improvement of their market and revenue situations by implementing the Chemical Leasing business model do not exist.
- ▶ Information on the suitability of chemicals for the business model is not available.
- ▶ The companies have no information on existing experiences.
- ▶ Companies that know the business model and interpret it correctly have, in most cases, no information on applicable contracts or options of the contract design.
- ▶ Generally, a lack of knowledge exists within the companies with regard to authorisation requirements under REACH. Trading companies do not or not to a sufficient extent see the connection between REACH and Chemical Leasing.

This analysis of the deficits shows that an essential obstacle for Chemical Leasing in chemicals trading companies is that the addressees in the companies receive no or too little information. Here, overlaps exist between the inhibiting factors and approaches for solutions that generally apply to Chemical Leasing in Germany (see chapters 2.2.1 and 2.2.2). Hence, the project team perceives targeted information of the actors in the field of chemicals trade to be essential in order to reduce the shortcomings – this is described in the following chapter.

## 4.2 Build-up of know-how and strategies for the reduction of shortcomings

As a suitable measure to reduce the shortcomings, the project team has identified targeted public relations work regarding chemicals trade. With this strategy especially executives (managing directors and owners of chemicals trade companies) should be informed about Chemical Leasing via presentations and newsletters. Within these presentations and newsletters information is presented in a way that the strategic importance of Chemical Leasing becomes clear and that an interest in further insights to the topic is created.

For the implementation of the measure, the project team contacted – with the involvement and with the support of the VCH and selected companies - the European Association of Chemical Distributors (Fecc). As result of this initiative, the project leader presented the Chemical Leasing business model at the annual meeting of the Fecc at a meeting on sustainability with approximately 200 representatives of management boards of chemical distributors. The association agreed to further continue to include information on Chemical Leasing events or corresponding news in their newsletter. According to information of industry partners of the project team, information on Chemical Leasing is published regularly in the newsletter particularly in the context of event announcements. Furthermore, all materials referred to the German and the international website which provide more detailed and comprehensive information.

On the German Chemical Leasing website, the project team has develop a specific webpage<sup>14</sup> for the chemicals trade, which summarise first information on the benefits of the business model for chemicals trade (BiPRO GmbH a).

As further measures to reduce the general lack of information at chemicals trade, various actors (project team, Federal Environment Agency, UNIDO, German Federal Environmental Foundation - DBU) have implemented the following measures:

- ▶ Presentation of the Global Chemical Leasing Award 2012 in Frankfurt by the chairman of the European Association of Chemical Distributors Fecc
- ▶ Visit of the international working group on Chemical Leasing at the global leader of chemicals trade (Brenntag AG)

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<sup>14</sup> <http://www.chemikalienleasing.de/sub/National/Chemiehandel.html>



- ▶ Participation of chemicals trading companies in the national working group on Chemical Leasing
- ▶ Visits of individual companies (e.g. Brenntag AG, CSC JÄKLECHEMIE)
- ▶ Implementation of two workshops with German chemicals trading companies in Switzerland in June 2013 (see programme sample in the annex)
- ▶ Invitations of chemicals trading companies to various Chemical Leasing workshops and events, including the international conference in December 2014 in Vienna

#### Future measures for the remaining deficits for Chemical Leasing in chemicals trade

A clear need for research is remaining in order to reduce the aforementioned shortcomings and supply sufficient information to chemical distributors regarding specific issues such as opportunities and risks of Chemical Leasing in chemicals trade, information about improved market and revenue situations induced by Chemical Leasing and the suitability of different chemicals for the business model. Currently, these aspects can only be analysed for individual cases (particular company, process, chemical substance, etc.). In order to investigate and assess the entire branch's situation, comprehensive studies in the field of chemicals trade are necessary that include economic estimations and an analysis of a number of chemicals or chemical substances and their applications.

## 5 Initiatives for the extensive nationwide dissemination of Chemical Leasing

The previous project discussed incentive and communication possibilities to promote the future dissemination of Chemical Leasing. These incentive and communication systems aim at overcoming the inhibiting factors identified for the different groups of participants and at emphasising the promoting factors.

Incentive systems have to fulfil certain requirements or tasks, which are summarised in the following list:

- ▶ Decrease information deficits with regard to the functioning and the advantages of the business model among suppliers and users
- ▶ Provide information on process optimisation and handling of chemicals
- ▶ Support the necessary build-up of trust among the partners
- ▶ Facilitate the build-up of applied know-how amongst manufacturers of chemicals and chemical distributors
- ▶ Contribute to the successful overcoming of the traditional sales concept (quantitative unit of payment for chemicals)
- ▶ Develop suitable monitoring and control systems

The improved communication and information about Chemical Leasing has been identified by the project team as the essential strategy to overcome the inhibiting factors (see chapter 2.2.2). Therefore, the project team has compiled measures and initiatives for the extensive nationwide dissemination of Chemical Leasing in this chapter that support this strategy. Communicative measures include workshops and keynote speeches, which increase the prominence of the business model as well as the knowledge about it, and national and international activities on the part of companies, organisations, research institutions or authorities.

### 5.1 Workshops and keynote speeches

The following chapter briefly introduces workshops and keynote speeches on the Chemical Leasing business model that have been presented by different experts at e.g. conferences or conventions. Due to the diverse initiatives and measures, which partially build on or originate from one another, no strict demarcation to the subsequent chapters (5.2 and 5.3) is possible for every case, explaining why single measures are listed repeatedly but are only described in more detail in one chapter.

#### 5.1.1 Workshop in Berlin

On 21 May 2014, a workshop was held by BiPRO in agreement with the BMUB and the Federal Environment Agency at the Permanent Representation of the Hesse State in Berlin. Invitations were sent to eleven industrial associations (i. a. Association of Research-Based Pharmaceutical Companies, German Association of the Automotive Industry, Federal Association of the Metal Industries) and approximately 140 companies, to which the project team has contacts to, have been contacted and invited directly. The participants as well as the agenda and the minutes of the workshop can be obtained from the Appendix.

#### 5.1.2 Meetings of the national working group

The advisory committee, which has been established in the previous project, has subsequently been transformed into a national working group on Chemical Leasing that is supported by the project team within the current project. This working group constitutes the interface between

the German activities and the ones of the international working group and supports national activities and projects in the field of Chemical Leasing (initiation, discussions, information, knowledge transfer).

Two meetings of the national working group took place in February 2012 and February 2013. In addition, another meeting took place in Berlin in 2014. The contents and results of these meetings are included in this report and thus, are only briefly summarised below.

#### 1. Meeting: 24 February 2012

During the national working group meeting, the link between Chemical Leasing and the European chemicals regulation REACH, especially its candidate list, has been underlined (see chapter 5.2.1). Further topics included the possibilities of Chemical Leasing and plant protection products, Chemical Leasing and standards and the Global Chemical Leasing Award. The meeting also focused on national and international Chemical Leasing projects and their current status as well as on systems for incentives and deficits that occur during the implementation of Chemical Leasing projects. Furthermore, a special focus was put on the integration of chemicals trade (see chapter 4.1) and first experiences with the quality criteria were presented (see chapter 3.2). The restructuring of the homepage was another issue during the meeting.

#### 2. Meeting: 6 February 2013

The agenda of the meeting included an overview of the integration of chemicals trade into Chemical Leasing projects and an exchange regarding the UNIDO training for chemicals trade<sup>15</sup>. In addition, new initiatives concerning Chemical Leasing and the certification of Chemical Leasing were discussed.

### 5.1.3 European Forum Alpbach

On 19 August 2014, a working group within the Alpbach Health Symposium during the *European Forum Alpbach 2014* was concerned with the topic “*Can Chemical Leasing Improve Hygiene Management in Health Care?*” (European Forum Alpbach 2014; p. 26). The working group was opened by the Austrian environment minister Andrä Rupprechter. Four presentations, a subsequent discussion and a “Chemical Leasing Café” enabled the presenters and participants to exchange detailed information about the past applications of Chemical Leasing in the health sector and the potentials of the business model in this sector. The following presentations stimulated the discussions:

1. Chemical Leasing – the concept and the role of the Austrian Federal Environment Ministry (Dr. Thomas Jakl, BMLFUW)
2. Global trends and challenges for Chemical Leasing (Petra Schwager, UNIDO)
3. Chemical Leasing is possible – but what is the goal (Wolfgang Merkens, Schuelke & Mayr GmbH)
4. Sustainability in hospitals – the contribution of Chemical Leasing (Dr. Anke Joas, BiPRO GmbH)

Within a ‘Chemical Leasing Café’, the participants discussed about the following topics:

- ▶ Education and training: How can new innovative business models (e.g. Chemical Leasing) and hygiene management be integrated into education and training?
- ▶ Cooperation and the interaction of actors: How could the optimal cooperation work in a hospital? What can policy (environment, health), economy, research, and the hospital itself contribute to innovative solutions?

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<sup>15</sup> The planned training for representatives of chemicals trade was cancelled due to a lack of participants.

- **Public procurement:** to which extent are innovations, e.g. Chemical Leasing, possible and what are the prerequisites, boundary conditions and legal instruments? How is it possible?

Participants of the working group included representatives of the health sector, industry, German and Austrian authorities and the international Chemical Leasing expert group. A publication of the results is currently in progress. Representatives of the BMLFUW are going to present the latest developments within the international Chemical Leasing conference in Vienna in December 2014.

#### 5.1.4 International Chemical Leasing conference in Vienna

On 10 December 2014, the *Conference on Sustainable Chemistry and Chemical Leasing: Paving the way for Inclusive and Sustainable Industrial Development* took place in Vienna. At the conference, the third Global Chemical Leasing Award was presented. The conference programme can be obtained from the Appendix. Besides the latest developments and case studies, the advantages of the business model were underlined and presented to an international audience. Representatives of different industrial sectors, governments and international organisations discussed about the possibility of mainstreaming Chemical Leasing.

#### 5.1.5 Chemical Leasing keynote speeches

In the past, the project team used several events and contacts to representatives of industry and research to present and disseminate the Chemical Leasing concept in order to generate an interest for future Chemical Leasing projects at companies. Table 6 provides an overview of these events and briefly summarises the topics of the event with regard to Chemical Leasing. Some of the events have already been described within the workshops but are listed again for the sake of completeness.

**Table 6:** Overview of keynote speeches on Chemical Leasing (ChL) between October 2011 and November 2014.

Name of the company or event	Date	Brief description of the topic
LINEG (Cooperative for the drainage of the left bank of the Rhine)	21 February 2014	ChL for wastewater treatment, presentation of successful comparable projects abroad
ACHEMA Frankfurt	19 June 2012	Half-day presentation event at the international leading fair for the process industry ACHEMA, prior to the presentation of the Global ChL Award
VDI Zentrum Ressourceneffizienz GmbH	15 November 2013	Presentation of the business model and its contribution to all dimensions of resource efficiency (material flow, energy flow, transport, etc.)
ChL Workshop Berlin	21 May 2014	Presentation of the business model and its contribution to sustainable chemistry and REACH as well as the experiences and steps towards implementation
European Forum Alpbach	19 August 2014	ChL in hospitals for the disinfection, experiences from Worms and World Café for the discussion of drivers and obstacles
European Roundtable	14 - 16 October	Presentation of the ChL concept in agriculture, in health

on Sustainable Consumption and Production

2014

management, and cleaning to a large and thematically broad audience

## 5.2 International activities

Throughout the last years numerous activities about Chemical Leasing have been conducted in different industry and agricultural fields. The following chapter contains a selection of the most important international Chemical Leasing projects and initiatives for this project but is not an encompassing list.

Overall, the project team has pursued the target to generate synergies between the German and international activities on Chemical Leasing. Amongst others, results of these efforts include the following:

- ▶ Germany, Austria and Switzerland jointly organised the Global Chemical Leasing Award. A concept was elaborated on how the final workshop of the research project can be integrated into the programme of the international award and the activities on Green Industry.
- ▶ Concrete Chemical Leasing projects and possibilities for market development for German manufacturers and distributors (solvents for metal cleaning through SAFECEM GmbH in Serbia (FKL) with chances for the metal cleaning market in Serbia and Croatia).
- ▶ Compatibility of the German and the international website
- ▶ Coordinated approach of national governments, UNIDO or other UN organisations and NCPCs with regard to potential Chemical Leasing certificates
- ▶ Workshops for German suppliers of Chemical Leasing with international customers (two events with support of the environment ministry Mexico)
- ▶ Planning of an international Chemical Leasing conference with a focus on trading companies as part of the next award presentation
- ▶ Global Chemical Leasing sector study
- ▶ Coordinated approach with regard to Chemical Leasing training
- ▶ Substantial contributions to the international expert group as well as to the subgroup on Chemical Leasing in agriculture
- ▶ Linking the Chemical Leasing concept with numerous other projects of the contractor, such as a project on Sustainable Chemistry as a contribution to the sustainability strategy
- ▶ Promotion of the integration of BMUB and Federal Environment Agency activities into international initiatives of UNIDO

### 5.2.1 Chemical Leasing and REACH

#### Background

In 2007, the regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) entered into force. This Europe-wide chemicals regulation simplifies and harmonises the European chemicals legislation and calls for a consistent risk management system.

An important aspect of REACH is the cooperation and communication of the involved actors along the value chain. This can be seen for instance during the elaboration of exposition scenarios (Article 14), obligations for information for downstream users (e.g. Article 33) and dur-

ing the authorisation of substances that are listed under Annex XIV (Authorisation List) of the REACH regulation.

In its core, Chemical Leasing is based on intensified cooperation and communication along the supply chain for chemicals, too. Insofar, it is useful to identify and analyse potential mutual synergies.

Furthermore, Chemical Leasing shows possibilities how the involved companies can generate economic benefits by reducing their chemicals consumption. Thus, the business model implements REACH's aspiration to improve the competitiveness of industry (UBA 2010).

### **Chemical Leasing within the authorisation process**

For the authorisation of a substance listed under Annex XIV of the REACH regulation for a certain application, the applicant has to guarantee that the risk during the use of the substance is adequately controlled and the exposure is minimised as far as technically and practically possible. Such an authorisation can be requested by the supplier or the user. In particular in those cases, where a small number of suppliers (in extreme cases only one) faces a high number of users it can be expected that the authorisation is requested by the supplier.

The authorisation process defines which boundary conditions have to be adhered to during the placing on the market and use of a certain chemical. Amongst others, this includes the maximum exposure limit for risk control. A synergy with Chemical Leasing can develop when the supplier decides to combine the market launch of the chemical with a Chemical Leasing business model. Thus, the supplier remains the owner of the chemical throughout the entire use phase and can guarantee the correct use through his know-how supply. Hence, suppliers retain the control over the application of their chemicals and thus over the risks and exposure at work and can assure the adherence to the criteria relevant for authorisation.

In addition to the improved internal monitoring established within industry, the supplier has a commercial interest in reducing the chemical quantity as far as possible for a given use. This increases the credibility of the authorisation application with regard to the reduction of exposure of workers and the environment.

Another advantage for suppliers is that they can better monetarise their services.

From an environment and health protection perspective, Chemical Leasing generates additional benefits for the authorisation process because chances for the improved exposure and emission conditions increase since the supplier bears responsibility for the entire life cycle of his chemical and competences for the reduction of risks are bundled and concentrated. The increased commercial motivation to reduce the amount of SVHC on the market also supports the goals of environment and health protection. The substitution requirement valid for Annex XIV substances is not being undermined by Chemical Leasing as the business model is only mentioned within the authorisation application as a measure to improve exposure and emission during the transition period until the presence of alternatives for SVHC.

From the users' perspective, Chemical Leasing provides benefits during the authorisation process, too. Costs become more transparent and users take part in the added value due to reduced material amounts.

From the perspective of equipment manufacturers advantages are generated when Chemical Leasing is included into authorisation applications. Since the optimisation of the chemicals use is often accompanied by technical and plant optimisations, an additional market for the equipment manufacturers is created when Chemical Leasing becomes an element of the authorisation application. The integration of the equipment supplier and the improvement of the



existing plants also have a positive influence on environment and health protection as they reduce emissions and exposure. The user of chemicals may be critical about the integration of an equipment supplier via the authorisation application (as this is often achieved by the manufacturer of the substance) because this may raise costs for the user. However, this fact may be mitigated with suitable funding instruments (see chapter 2.2.2, financial sector).

Two situations have to be distinguished in terms of the function of Chemical Leasing in authorisation processes:

#### 1. 'Adequate Control Route'

- ▶ Here, Chemical Leasing is a suitable instrument in order to achieve or maintain the control of risks.
- ▶ Chemical Leasing can be combined and controlled with adherence to occupational exposure limit values, e.g. in form of higher leasing rates when limit values are exceeded or bonuses for the reduction of exposure.

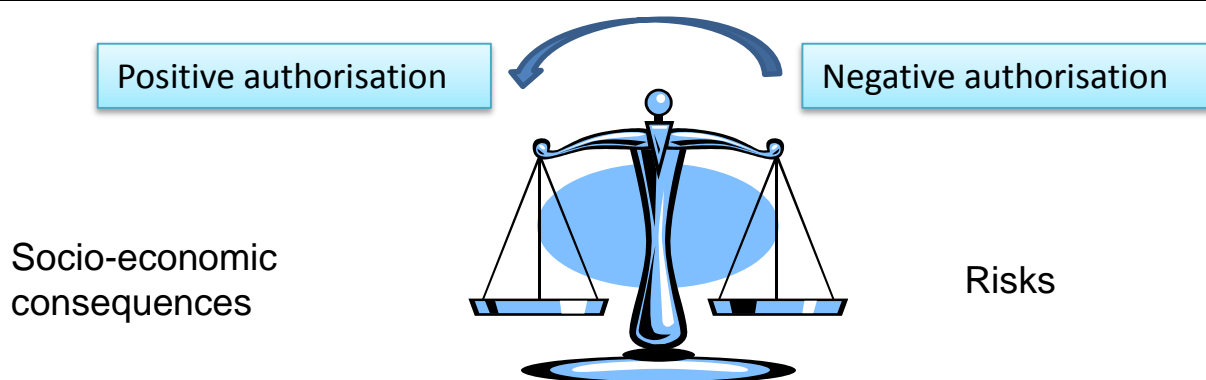
#### 2. 'SEA' and 'exemptions'

- ▶ Combinations of Chemical Leasing and socio-economic analysis (SEA) increase their credibility
- ▶ Chemical Leasing reduces risks and the relative weight of the socio-economic benefit of the application of a substance rises, which generates a higher chance for a positive decision on the authorisation, if no viable alternative for the applicant exists
- ▶ A Chemical Leasing concept for exemptions can lead to risk minimisation

Figure 3 depicts the relation of Chemical Leasing and SEA under REACH.

The related discussion within the national working group noted that Chemical Leasing must not be a legal requirement for a positive decision on an authorisation. The authorisation has to be decided per application.

Figure 3: Relation of Chemical Leasing and REACH during the preparation of SEA and the effect on the authorisation process.



Source: own representation.

#### Authorisation of Trichloroethylene und Chromium(VI) oxide

A successful implementation of the relation of Chemical Leasing and REACH has already been conducted using the substance trichloroethylene. In this case, the supplier of trichloroethylene possesses comprehensive knowledge about the best available use of the chemical and



applied for the authorisation of its use exclusively using the Chemical Leasing business model. Because Chemical Leasing reduces the chemical quantities, which in turn reduced exposure and because it aims at a continuous improvement of the processes, the supplier is able to guarantee the authorisation-compliant use.

On the other hand, the example of chromium(VI) oxide has shown that a lack of specific know-how on the supplier side does not lead to a successful implementation of Chemical Leasing. Despite initial attempts to use the business model also for the authorisation of chromium(VI) oxide, the activity was not successful since no exchange of know-how on process optimisation was possible. This example underlines the importance of suppliers' comprehensive know-how about the chemical as a prerequisite for the success of the service-oriented business model. This also has to be taken into account when embedding Chemical Leasing into the REACH process.

### Linking Chemical Leasing and REACH

For the increased implementation of Chemical Leasing in the context of REACH authorisations augmented political will is required. Although in principal the industry is willing to introduce the Chemical Leasing business model in a compulsory way for the authorisation of Annex XIV chemicals, this is not conceivable without political guidelines and obligations. Therefore, it should be considered to introduce Chemical Leasing into authorisation processes as a condition under REACH (Article 60(8)). Also the introduction into the respective guidance documents seems to be recommendable. This placement of Chemical Leasing has already raised great interest in Austria.

### Innovation due to Chemical Leasing

REACH claims to be a source for innovation and improved competitiveness of European companies (European Union 2006; Article 1). In general, it is being criticised that this objective is not sufficiently realised to date (CSES 2012; p. 30).

Chemical Leasing on the other hand is a source for innovation and improved competitiveness due to the intensified cooperation and the know-how transfer of suppliers and users, which successful business relations with Chemical Leasing have shown throughout many years. Thus, this raises the question how the potentials beyond Chemical Leasing can be implemented in the context of REACH.

One opportunity is the aforementioned integration of Chemical Leasing into authorisation processes. However, it has to be considered that this is only relevant for Annex XIV substances that eventually shall be substituted. Innovations in this context would only have a temporary character.

Another possibility is the integration of innovative measures, which have been developed in the course of Chemical Leasing, into exposure scenarios and the respective protective measures. Examples include the hermetic plant enclosure, vacuum facilities, continuous monitoring of process parameters with improved dosimetry and process control.

### Expansion of Chemical Leasing with regard to joint research and development activities of supplier and user on substitutes

A constant topic in the discussions about Chemical Leasing is the question to what extent Chemical Leasing hampers the substitution of hazardous with less hazardous substances. In this context a German supplier currently develops a business model in cooperation with several users that contains joint research and development (R&D) on less hazardous substances. The required expenditures will be included into the business model.

This pilot project again shows the diversity with which Chemical Leasing can contribute to a realignment of the cooperation within the supply chain. Within a classical business model, the chemical supplier's interest in supporting substation projects is rather limited. Such development projects generally require that the customer also buys a new product directly from the chemical manufacturer.

Under Chemical Leasing, the payment is rendered for the service of a chemical. This induces a new dimension of interest in substitution products for suppliers that they cannot produce themselves but that they can obtain from third parties too. This emphasises the service character of the model.

### 5.2.2 Initiatives in cooperation with UNIDO

Already during the previous project as well as throughout the course of this project, the project team has maintained close contact to international UNIDO initiatives and has been in constant exchange with the international expert group.

Meetings of the international expert group took place e.g. in June 2012 and September 2013. Representatives of German authorities are actively involved into the Chemical Leasing activities of UNIDO so that the comprehensive dissemination of the business model can be organised more effectively.

UNIDO and UNEP jointly manage the National Cleaner Production Centres (NCPCs). The NCPCS are responsible for the provision of information for companies and authorities and for the demonstration and dissemination of 'Resource Efficient & Cleaner Production' (UNIDO). This also comprises the information about and implementation of Chemical Leasing business models. The NCPCs' work is supported by the project team via the exchange of experiences about national activities. This also includes substantial inputs for the revision of the Chemical Leasing toolkit, as explained below. In their respective countries, the NCPCs are very actively involved into the dissemination of the business model and support proactively e.g. the implementation of new Chemical Leasing projects in agriculture or in cleaning processes in the textile industry. This in turn has consequences for German Chemical Leasing activities since German companies, usually in the form of suppliers, are involved into these projects in many cases. Thus, the NCPCs present a multiplier for information and implementation of Chemical Leasing projects.

In 2011, UNIDO has developed a toolkit for Chemical Leasing that shall accomplish a systematic approach for the implementation of the business model at company level (UNIDO 2011b). Until early 2015, the toolkit is under revision with the aim of a better adjustment of the toolkit to specific interests of different stakeholders. The project team has already been involved into the preparation of the toolkit and is now supporting the revision. Thus, experiences of the project regarding the best possible and targeted information transfer to interested parties can be embedded in order to accelerate the extensive dissemination of Chemical Leasing.

#### Adaptation of the UNIDO toolkits to the German circumstances

After the finalisation of the revised version of the UNIDO Chemical Leasing toolkit, the Federal Environment Agency should examine whether single elements of the toolkit should be adapted specifically for German companies or policy representatives to the circumstances in Germany. This mainly refers to the political boundary conditions and information about the German chemical policy as well as to a potential partner list or the provision of German model contracts.

### 5.2.3 Chemical Leasing and Corporate Social Responsibility

Chemical Leasing increases the efficiency of chemicals use. It is not an instrument for the often addressed economic increase of efficiency by reducing jobs. This is an important message when talking about the topic ‘efficiency increase and Chemical Leasing’. Important aspects in this context are the impacts with regard to the reduction of exposure at work places, which is usually achieved, as well as the effect of the generation of better qualified jobs in the consulting for chemical users.

These positive effects on Corporate Social Responsibility are also described in Moser et al. 2014b. The traditional business model and the modifications due to Chemical Leasing are compared using the following aspects:

- ▶ Consequences for jobs (quantitatively and qualitatively)
  - At the supplier
  - At the user
  - Along the supply chain
- ▶ Exposure of workers
- ▶ Risks for workers
- ▶ Additional effects regarding Corporate Social Responsibility

### 5.2.4 Protection of the right to the names “Chemikalienleasing” and “Chemical Leasing”

An international consulting company has advertised Chemical Leasing in brochures. Basically, this fact is welcome, since the extensive dissemination of the application of the business model is in the public’s interest. However, it is critical that the company used the term “Chemical Leasing” with the symbol for a registered trademark. It is the common understanding of the Federal Environment Agency, BMLFUW and UNIDO that Chemical Leasing cannot be registered as a trademark because it is a commonly used business model that has been developed using public funding. Exclusiveness with regard to Chemical Leasing is not in the Federal Environment Agency’s interest. In this context, a letter to the consulting company has been prepared together with BMLFUW and UNIDO which asked them to omit the use of the registered trademark symbol for Chemical Leasing. The company has complied with this request.

In order to prevent similar cases in the future, the project team has suggested asking the European Patent Office for a confirmation that the names cannot be registered as a trademark. The Austrian Ministry of Life has sent a corresponding request to the Austrian Patent Office; however, such a confirmation is not possible. Nevertheless, the patent office confirmed that business models as such cannot be registered, especially if the name is already being used for more than a decade.

### 5.2.5 Chemical Leasing in the agricultural sector

Worldwide, substantial amounts of plant protection products and fertilisers are applied in agriculture. Due to the globally increasing demand, in particular the use of fertilisers has risen steadily since 1992; especially Asia has a high demand for fertilisers as they apply double the amount of mineral fertilisers compared to the international average (FAO 2011; pp. 16). German manufacturers play an important role in this market: Bayer and BASF rank among the three manufacturers of agrochemicals with the highest turnover (Statista 2015c) and Germany ranked fifth among the exporters of fertilisers between 2006 and 2009 (FAO 2015). In particular in emerging and developing countries, it can be observed that a growing amount of plant protection products is deployed due to the increasing industrialisation (Ecobichon 2001; pp. 28). This involves an interesting application potential for Chemical Leasing, which so far has been used only in a few projects. In Serbia, Chemical Leasing is successfully applied for

growing corn and wheat and in Sri Lanka the use of agrochemicals in tea cultivation is optimised with the new business model. For the tea plantations a reduction of 10 % of the amount of chemicals is to be expected. Moreover, a number of projects exist in Sri Lanka for the implementation of Chemical Leasing in agriculture for different vegetables.

Contrary to Chemical Leasing in industry, some particularities exist for the agricultural sector:

1. The quality of the result is influenced by external factors and is not solely depending on process optimisation by the business partners. Besides the soil conditions as an important (but constant) impact factor, in particular the weather conditions within a season and the occurrence of extreme events (e.g. droughts, heavy rainfall, floods) have an effect on the yield. In addition, the infestation with pests and diseases can have negative impacts on the yield.
2. In the agricultural sector, the know-how lies mainly with the service provider and not so much with the manufacturer of the agrochemicals. The service provider is familiar with the local agricultural boundary conditions and is thus essential for a successful Chemical Leasing project in agriculture.
3. The payment differs from that common in industry. The farmer continues to buy the pesticide or fertiliser and obtains ownership of the chemicals. Only the profits generated through Chemical Leasing are shared among the business partners according to the contractual arrangements. This can be investigated, like in the case of Sri Lanka, using a reference plot that is tilled without Chemical Leasing.
4. The risk of harvest losses remains with the farmer and is not distributed via the service-oriented payment.

Overall, a rather reluctant attitude on the agrochemical manufacturer side did exist in the past, which now increasingly seems to change due to the interest shown by the Food and Agriculture Organization of the United Nations (FAO), different activities of UNIDO, and of the Austrian environment ministry. Within a UNIDO mission to Sri Lanka in November 2013, the start of pilot projects was arranged with representatives of BASF.

So far, no pilot project could be implemented in Germany. However, in the German agriculture, some common practices exist that resemble Chemical Leasing in many principles but not all criteria of the business model are fulfilled.

Common practice with regard to the distribution of plant protection products in Germany is that the farmers either obtain information about the optimal amount of plant protection products via governmental advisors or official recommendations; or consultants of the manufacturing companies directly commercialise their products and inform about the application. The Federal Office of Consumer Protection and Food Safety (BVL) defines and discloses the maximum application rates. Moreover, governmental test sites conduct tests aiming at the determination of the optimal application rate of plant protection products. The obtained data provide references for the farmers. Suppliers confirm that a know-how transfer in terms of advice on the optimal amount does already take place. Hence, an important element of Chemical Leasing is fulfilled and only the ownership and unit of payment are not changing according to quantity-based business models. Furthermore, several models exist in Germany where the service provider is responsible for plant protection or coordinates and conducts parts of the application of plant protection products. An analysis of the variety of these models has not been possible within this project. Therefore, the project team recommends analysing the business models typical in agriculture and compare them to Chemical Leasing in order to identify similarities and differences and to use synergies, e.g. complementing existing models with important aspects of the Chemical Leasing business model. These concepts can also be trans-

ferred to emerging and developing countries, after the feasibility and potentials have been analysed.

A reduction of the chemical quantities that is typical for Chemical Leasing is, however, not to be expected in Germany. The estimations for the costs of plant protection products differ strongly, from under 10 % up to approximately 20 % of the variable costs of farmers for instance in Upper Bavaria (e.g. Eberl 2014). The costs influence the amount of agrochemicals applied by the farmer (especially the ones for plant protection products) and thus determine the existing reduction potentials. In order to better describe the potentials for Chemical Leasing in agriculture, more detailed information about the actually applied amounts are necessary, but it can be assumed that further reductions of the amount of plant protection products due to Chemical Leasing in Germany are not to be expected.

Since the governmental test sites cannot provide reliable values for all regions and since it cannot be assumed that optimal advice, application and execution are conducted in every case, the project team believes that Chemical Leasing in the German agriculture is still useful.

#### Possibilities to strengthen Chemical Leasing in the agricultural sector

The German chemical policy could take a leading role by fostering and supporting Chemical Leasing in agriculture on a global level more strongly. In this way, not only agrochemicals from German manufacturers could be exported to emerging and developing countries in the future but also the German knowledge for the optimal application of the chemical could be embedded and applied by the farmers. A pilot project for the application of the Chemical Leasing model in agriculture is already planned in Austria.

This strengthening of Chemical Leasing in agriculture can be achieved by the initiation of a pilot project on 'Chemical Leasing in agriculture' in Germany. In addition, the Federal Environment Agency should analyse existing service models in agriculture and compare them with Chemical Leasing. In individual cases, similar or comparable models could already be common practice. Synergies should be exploited and existing models could be complemented with important aspects of Chemical Leasing. Chemical Leasing, to which Chemical Leasing can be linked, should be analysed regarding their transferability to emerging and developing countries.

Furthermore, the German policy can integrate Chemical Leasing into international bodies, especially into the activities and initiatives of the FAO. Chemical Leasing could e.g. become a part of the guidelines on good agricultural practice.

Moreover, the establishment of a German consulting system is conceivable that globally supports Chemical Leasing projects in agriculture by know-how provision.

Additionally, this strategy would help mainstreaming the Chemical Leasing business model - in the agricultural sector as well as in general.

### 5.3 Publications, media presence and research activities in the field of Chemical Leasing

An internet and literature research on the communicative measures concerning the Chemical Leasing concept has revealed that the business model is well described in relevant magazines and internet portals. Currently, such information or publications are rather rare; however, a trend towards more publications especially on the international level can be observed in the last years. This also becomes visible when looking at the applications for the Global Chemical Leasing Award 2014, which the project team due to its cooperation with the international expert group is reviewing. Within the category PR more and more activities are conducted that are partially also submitted for the award. A selection of these communication activities is listed in Table 7.



Table 7: Examples for the presence of Chemical Leasing in different media since 2011 with a focus on German publications.

Publication or measure to disseminate the Chemical Leasing concept	Link, Source, or reference
Article on 'Deutsche Welle' online: "Mit weniger Chemie mehr Profit" by Dr. Ralph Heinrich Ahrens	<a href="http://www.dw.de/mit-weniger-chemie-mehr-profit/a-15665300">http://www.dw.de/mit-weniger-chemie-mehr-profit/a-15665300</a>
YouTube-Video "Chemical Leasing explained" by UNIDO	<a href="https://www.youtube.com/watch?v=3Vvcp4TGG0w">https://www.youtube.com/watch?v=3Vvcp4TGG0w</a>
YouTube-Video "Chemical Leasing en Ecopetrol S.A" by Ecopetrol S.A	<a href="https://www.youtube.com/watch?v=nYiUkilwHlo">https://www.youtube.com/watch?v=nYiUkilwHlo</a>
YouTube-Video "An Innovative Business Model" by UNIDO	<a href="https://www.youtube.com/watch?v=VhlkvZvy_yM">https://www.youtube.com/watch?v=VhlkvZvy_yM</a>
YouTube-Video "Chemical Leasing Award 2014" by UNIDO	<a href="https://www.youtube.com/watch?v=W_6jnkVOT6M">https://www.youtube.com/watch?v=W_6jnkVOT6M</a>
Article in Resources, Conservation and Recycling "Fostering green chemistry through a collaborative business model: A Chemical Leasing case study from Serbia"	Lozano et al. 2013
Article in Environmental Science and Pollution Research "Chemical Leasing business models and corporate social responsibility"	Moser et al. 2014
Article in Technology and Investment "Global Chemical Leasing Award 2010" by T. Jakl	Thomas Jakl in Technology and Investment 2011, 2, 20-26
Brief study by the Heinrich Böll Foundation and the NABU: "Nutzen statt Besitzen. Auf dem Weg zu einer ressourcenschonenden Konsumkultur" 2012	Leismann et al. 2012
Interview with Petra Schwager in the VDI news by Ralph H. Ahrens 2011	<a href="http://www.ingenieur.de/Branchen/Chemie-Pharmaindustrie/Der-Lieferant-verantwortlich-fuer-korrekten-Gebrauch-Chemikalien">http://www.ingenieur.de/Branchen/Chemie-Pharmaindustrie/Der-Lieferant-verantwortlich-fuer-korrekten-Gebrauch-Chemikalien</a>
Publications, flyer, brochures for conferences and workshops (e.g. Alpbach,ACHEMA or Ecochem)	See chapter 5.1 and 5.2
Article in The Guardian "Will green chemistry save us from toxification?" by Wayne Visser 2014	<a href="http://www.theguardian.com/sustainable-business/2014/sep/24/green-chemistry-save-toxification-chemicals-business">http://www.theguardian.com/sustainable-business/2014/sep/24/green-chemistry-save-toxification-chemicals-business</a>
Article in the magazine Ensia "Cleaning Up With Rent-a-Chemical" by Elizabeth Grossman 2014	<a href="http://ensia.com/features/cleaning-up-with-rent-a-chemical/?utm_content=buffer32b26&amp;utm_medium=social&amp;utm_source=twitter.com&amp;utm_campaign=buffer">http://ensia.com/features/cleaning-up-with-rent-a-chemical/?utm_content=buffer32b26&amp;utm_medium=social&amp;utm_source=twitter.com&amp;utm_campaign=buffer</a>

Meanwhile, also innovation networks and consulting companies have become aware of Chemical Leasing. For instance the innovation network 'ertermis', a Lower-Saxonian network of the universities Oldenburg, Lüneburg and Osnabrück, aims at improving the knowledge transfer between industry and science. The organisation supports the implementation of new business models such as Chemical Leasing (Universität Osnabrück 2012; p. 32).

## Research activities

The German chemical industry annually spends 5 % of its turnover on research for new products and processes (VCI 2014; p. 37). The business model Chemical Leasing presents a variety of possibilities for research that are explained below.

Basically, the business model contains a number of approaches for the promotion and integration of research projects due to its structure, i.e. the close collaboration of the participating companies and their shared interest in reducing chemicals. As outlined by the project team in chapter 5.2.1, the cooperation between supplier and user under the Chemical Leasing business model can lead to joint research activities on the substitution of hazardous chemicals with less hazardous alternatives.

Furthermore, Chemical Leasing is also about application-oriented research for the continuous technological development and optimisation of processes. This refers to technologies saving chemicals as well as to recycling technologies for discarded chemicals.

Another field for potential research activities is the development of monitoring technologies, measurement and control systems and IT solutions for the inspection and monitoring of the process optimisation and the economic parameters (fair and contract compliant distribution of the benefits among the partners).

A third possibility refers to economic analyses of the course of the business model and to types of funding with methods of economics and business administration. The role and impact of the financial sector on Chemical Leasing has been discussed in chapter 2.2.2.

The BiPRO GmbH had planned to conduct a research project about Chemical Leasing in the agricultural sector (fertilisers and plant protection products) in Serbia with support of the DBU and local partners. However, DBU rejected the research proposal because the evaluators did not expect further significant improvements in terms of fertiliser and plant protection products reduction as well as increase in resource efficiency when implementing Chemical Leasing, since a variety of measures for these purposes exist. In addition, the evaluators doubted that the business model could be successfully implemented in agriculture as the boundary conditions (soil and weather effects) vary strongly.



## 6 Revision of the national Chemical Leasing website

In order to make the national activities in the field of Chemical Leasing easily available to all interested parties, the project team maintains a national website which contains information about the business model Chemical Leasing<sup>16</sup>. Therefore, BiPRO has updated the content and the structure of this website several times during the project and has linked the latest outcomes on the page as downloads.

The national Chemical Leasing website is only available in German.

The page structure is as follows:

- Current issues
- Chemical Leasing
  - Background
  - Concept
  - Versions of the business model
  - Quality assurance and sustainability criteria
  - Potential partners
  - Advantages of the business model
  - Support on the national and international level
- Pilot projects
- National activities
  - Chemicals trade
  - National working group
- International activities
- Information
- Global Chemical Leasing Award
- FAQ
- Links

As can be obtained from the structure, the website provides encompassing background knowledge about Chemical Leasing and also offers information about pilot projects, current activities on the national and international level as well as references to further information, the Global Chemical Leasing Award and additional links.

Based on the structure presented above, the following figures exemplarily show screenshots of the website. The content and significant changes on some pages are described briefly as several adaptations and updates have been conducted on this national Chemical Leasing website by the project team during the project.

First, the homepage provides a rough overview of the aims of Chemical Leasing and shortly explains the business model. The page is presented in Figure 4.

Amongst others, the changes on the website include the structure of the *Current issues* page (*Aktuelles-Seite*). Instead of the former *Latest news and events* (*Neuste Nachrichten und Veranstaltungen*) and *Older news and events* (*Ältere Nachrichten und Veranstaltungen*), two new subheadings can be found: *Planned events* (*Geplante Veranstaltungen*) and *Further news* (*Weitere Nachrichten*), which is depicted in Figure 5.

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<sup>16</sup> [www.chemikalienleasing.de](http://www.chemikalienleasing.de)

Figure 4: Homepage of the website [www.chemikalienleasing.de](http://www.chemikalienleasing.de).

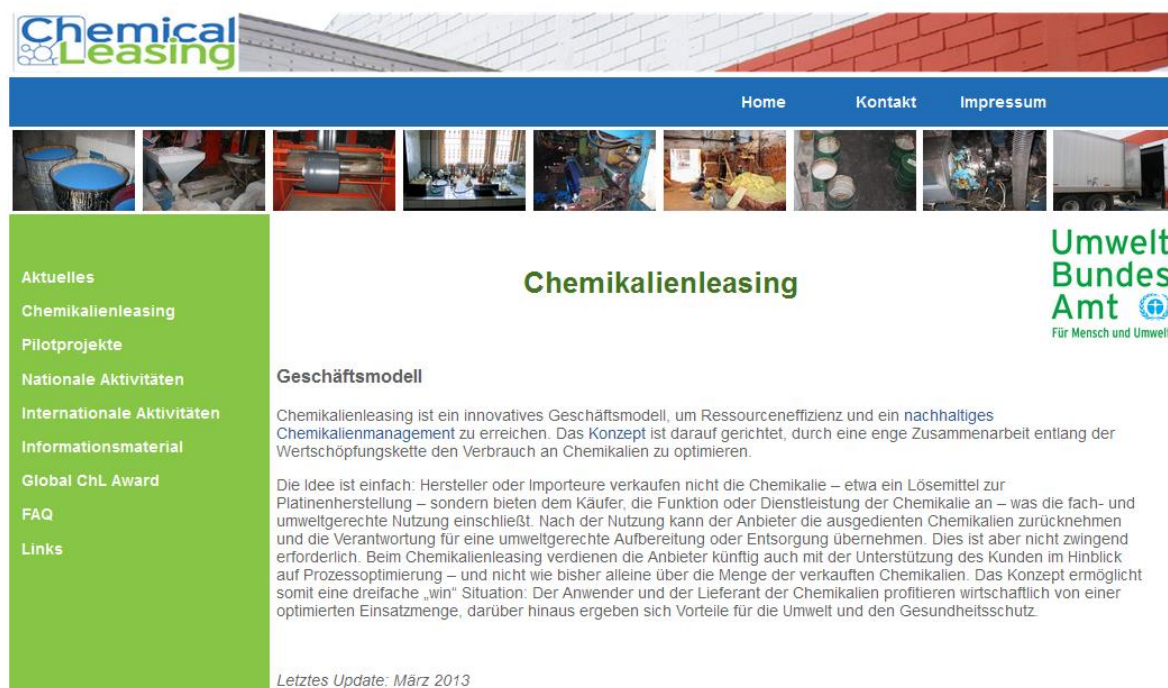


Figure 5: 'Current issues' page of the national Chemical Leasing website, July 2014.

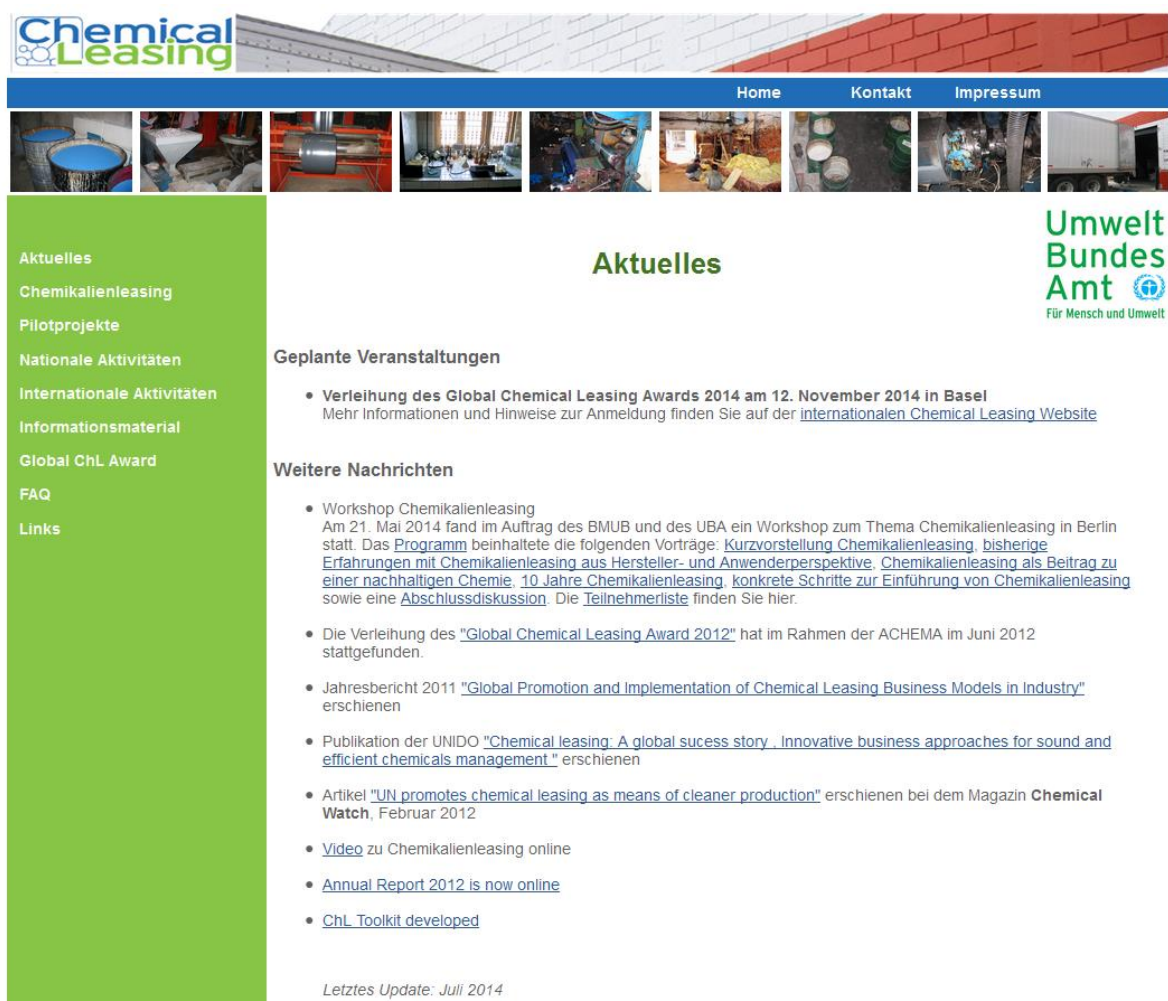


Figure 6 shows the subpage Chemical Leasing which is again referring to *background, concept, versions of the business model, quality assurance and sustainability criteria, potential partners, advantages of the business model* and the *support on the national and international level*. This page allows the reader to obtain numerous background information and details about Chemical Leasing.

In addition, the project team has created the completely new category *national activities*. Here, different Chemical Leasing activities from Germany are listed. Currently, the page contains the two sections *chemicals trade* and *national working group*. The page is presented in Figure 7.

Another update has been conducted on the *Global Chemical Leasing Award* page. The agenda of the last award presentation is provided as a download and readers find a reference to the 2014 award as shown in Figure 8.

Figure 6: Structure of the page ‘Chemical Leasing’ with detailed information about the business model.



Two further subpages of the German Chemical Leasing website provide information about frequently asked questions (FAQ) and list links to useful pages.

Questions answered in the category FAQ include the following:

- ▶ What is Chemical Leasing?
- ▶ What is the main use of Chemical Leasing?
- ▶ Which industrial sectors can apply Chemical Leasing?
- ▶ What are the differences between Chemical Leasing and the classical form of leasing?
- ▶ How does the business model Chemical Leasing differ from the Chemical Management Service (CMS) model?
- ▶ Are model contracts for Chemical Leasing provided?
- ▶ What do the new EU chemicals regulation (REACH) and Chemical Leasing have in common and how do they interact?

The links refer to pages of international activities and several websites of authorities: BMUB – chemicals, Federal Environment Agency – chemicals policy, UNIDO – Cleaner Production, Austrian Environment Ministry – environment, BiPRO and the Bavarian State Ministry of the Environment – Chemical Leasing.

Figure 7: Page about the national activities on Chemical Leasing.





Figure 8: Subpage about the Global Chemical Leasing Award of the national Chemical Leasing homepage.

**Chemical Leasing**

Home Kontakt Impressum

**Global Chemical Leasing Award**

**Umwelt Bundes Amt**  
Für Mensch und Umwelt

**Aktuelles**  
Chemikalienleasing  
Pilotprojekte  
Nationale Aktivitäten  
Internationale Aktivitäten  
Informationsmaterial  
Global ChL Award  
FAQ  
Links

**Neues Geschäftsmodell**

Um das Konzept und die Bedeutung des Chemikalienleasings weltweit stärker ins öffentliche Bewusstsein zu rücken, wurde in enger Zusammenarbeit zwischen der UNIDO, dem österreichischen Lebensministerium und dem deutschen Umweltministerium (BMU) die Verleihung des Global Chemical Leasing Award initiiert. Der Preis wird weltweit ausgeschrieben und in den Kategorien "Fallstudien", "Beratungsdienstleistungen", "wissenschaftliche Publikationen" und "PR" vergeben.

Die erste Verleihung des Global Chemical Leasing Award fand 2010 in Prag statt. 2012 wurde der Award zum zweiten Mal im Rahmen der ACHEMA in Frankfurt vergeben. Im Jahr 2014 ist die Verleihung des dritten Awards geplant.

**Global Chemical Leasing Award 2014**

Weitere Informationen folgen

[Global Chemical Leasing Award 2014 \(pdf\)](#)

**Global Chemical Leasing Award 2012**

[2012 Frankfurt \(ACHEMA\)](#)

**Global Chemical Leasing Award 2010**

[2010 Prag \(ChemCon\)](#)

## 7 Conclusions and recommendations

This paragraph summarises the possibilities for communication and for the reduction of the factors inhibiting the implementation of Chemical Leasing that have already been addressed in the report and it deduces opportunities how political and industrial actors could use the findings from the existing experiences in the future in order to further disseminate the Chemical Leasing business model in the German chemical industry.

The experiences, which the project team was able to collect in the course of the project as well as in the previous or in parallel projects within German and international Chemical Leasing activities, show that the targeted communication of the specific benefits induced by Chemical Leasing still needs to be improved. This significantly supports the reduction of the inhibiting factors, as e.g. doubts can be removed and trust can be build. Findings from international experiences and concepts can be transferred to the German chemical industry and initiatives and programmes can be combined more effectively.

Specifically, the following activities for the implementation of incentive systems and communicative measures are proposed:

1. **Strengthen or establish linkages and synergies to other chemical industry programmes with a focus on resource efficiency, such as Responsible Production, Global Product Strategy (GPS) and the Guide on sustainable chemicals**

Chemical Leasing can contribute significantly to the achievement of the aforementioned programmes. Thus, the business model should be implemented into these programmes as a sustainable possibility for companies. The specific contribution of Chemical Leasing to the respective programme should be emphasised in each case. Improved cooperation which may support the substitution of chemicals can be mentioned as a contribution to the Guide on sustainable chemicals and the sustainability criteria for Chemical Leasing explicitly prohibit a substitution with substances with higher risk. Contributions to Responsible Production include the increased safety at work during the handling of chemicals and the reduced adverse impacts on environment and health as well as the more intense cooperation among the business partners along the value chain.

2. **Integrate Chemical Leasing into the political activities for a sustainable chemistry**

Currently, BMUB and the Federal Environment Agency elaborate a guiding principle for Sustainable Chemistry with support of the Öko-Institut and BiPRO. The initiators have already presented this guiding principle to an international audience at the conference in December (chapter 5.1.4). Furthermore, the international conference “Sustainable Chemistry Conference 2015: the way forward” will be held in September 2015. Chemical Leasing should be highlighted as an important contribution and way towards a Sustainable Chemistry. BMBU’s and the Federal Environment Agency’s activities create international attention for the topic Sustainable Chemistry and Chemical Leasing can benefit from this regarding prominence and awareness.

### **3. Further support of the international Chemical Leasing initiatives by Germany**

Since Germany leads the global export of chemical products, German chemical suppliers who are selling their products abroad can introduce their know-how in the respective countries and consequently support the transition towards Sustainable Chemistry especially in developing and emerging countries. Thus, they can facilitate a sustainable economy and development in general.

In order to further promote this development the project team considers the continuous close collaboration between UNIDO, BMUB and the Federal Environment Agency as an important aspect to exchange national and international experiences in the field of Chemical Leasing and to be able to use synergies. Therefore, BMUB and the Federal Environment Agency should observe and support the developments on the international level and should foster the collaboration with UNIDO.

### **4. BMUB, UBA and UNIDO should jointly work towards increased transparency of existing Chemical Leasing projects and companies' engagement in a mandatory disclosure in return for the support they receive**

Many companies are being supported in their Chemical Leasing projects on the national and international level by UNIDO or BMUB and the Federal Environment Agency but, at a later stage, often are not willing to transfer concrete data on their projects' developments to the institutions. This however is important for both, the advancement and the validation of the functioning of Chemical Leasing. In return for the support they receive, companies could for instance be obliged via a contract to regularly disclose data on chemical quantities and the energy demand (e.g. at least one comparison prior and one year after the implementation of the business model).

### **5. Support of the integration of Chemical Leasing (and similar service-oriented business models) into public procurement, e.g. by integrating it into handbooks on green public procurement, like the 'Handbuch Umweltfreundliche Beschaffung' (Federal Environment Agency) or 'Buying Green!' (European Commission)**

Due to its share of 13 % of the German gross domestic product, public procurement can ensure that Chemical Leasing is applied more strongly in the industry; e.g. by explicitly asking for the business model in tenders. In addition, this generates more awareness for Chemical Leasing.

### **6. Governmental support of Chemical Leasing via marketing-effective measures, e.g. in the form of awards or prizes**

The project team considers voluntary and marketing-effective measures, e.g. a German sustainability award for Chemical Leasing for national projects only, to be more expedient than subsidies for the introduction of Chemical Leasing. For instance, awards could be presented for the different steps of production or in a company, such as cleaning, coating, printing, disinfection, lubrication, etc.



## **7. Improved examination of the fulfilment of the sustainability criteria for Chemical Leasing at the Global Chemical Leasing Award**

For a successful application for the Global Chemical Leasing Award, the submitted cases have to fulfil the sustainability criteria. The fulfilment of the criteria is often confirmed but no serious examination of the criteria is being conducted or provided (e.g. quantifications). Thus, the project team takes the view that the award criteria should increasingly demand the fulfilment of the sustainability criteria and should explicitly ask for the kind of fulfilment. To support the applicants, e.g. UNIDO could provide model examples of a successful examination of the sustainability criteria.

## **8. Expanded research in the field of Chemical Leasing in chemicals trade, including estimations of economic potentials and different chemicals and their application regarding the suitability for the business model**

In order to reduce deficits regarding specific issues such as opportunities and risks of Chemical Leasing in chemicals trade, information about improved market and revenue situations induced by Chemical Leasing and the suitability of different chemicals for the business model, more research is required in this area. Currently, these aspects can only be analysed for individual cases (particular company, process, chemical substance, etc.). In order to investigate and assess the entire branch's situation, comprehensive studies in the field of chemicals trade are necessary that should include economic estimations and an analysis of a number of chemicals or chemical substances and their applications. Afterwards, the information gained must be disseminated to the chemical distributors.

## **9. Promote Chemical Leasing as an element of the REACH authorisation process (e.g. via the targeted information through European Chemicals Agency (ECHA), the Committee for Risk Assessment (RAC) and the Committee for Socio-economic Analysis (SEAC))**

Authorisation procedures for Annex XIV-substances under REACH define the boundary conditions for the placing on the market and the application of a chemical substance. Manufacturers who request authorisation for such a substance have to ensure the compliance with those boundary conditions. For instance, this can be achieved by launching the substance solely in connection with Chemical Leasing. This would not only further disseminate the business model in the chemical industry but would also positively affect the authorisation prerequisites, as a closer cooperation and enhanced know-how transfer occur. Moreover, it should be considered to introduce Chemical Leasing into authorisation procedures as a condition under REACH (Article 60(8)). Also, an introduction into the respective guidance documents seems advisable and is being supported by the Austrian government, too.

## **10. Adaptation of the UNIDO Toolkit to the German circumstances; e.g., this includes additional contract examples, the adaptation of potential partner lists, or information about the German chemical policy**

After the finalisation of the revised version of the UNIDO Chemical Leasing toolkit, it should be examined whether single elements for of the toolkit for German companies or policy representatives should be adapted to the circumstances in Germany. This refers particularly to the

political boundary conditions or to the provision of German model contracts for Chemical Leasing.

#### **11. Support of the further development of Chemical Leasing in the agricultural sector and integration of the business model into international debates and guidelines on sustainable chemicals management in agriculture**

Due to the few existing pilot projects on Chemical Leasing in the agricultural sector to date, additional case studies are required that show the potential and better elaborate the special features of the business model in agriculture (impact of external factors). This includes also the development of suitable contracts that fulfil the Chemical Leasing criteria (amongst others the service-oriented payment) and simultaneously reflect the interests of the business partners (bearing the risk of harvest losses, etc.). The initiation of new pilot projects can take up the Austrian experiences.

In addition, the Federal Environment Agency should analyse the existing business models in agriculture and compare them to Chemical Leasing. In some cases, identical or similar models could be commonly used already. Synergies should be used and existing models could be complemented with important aspects of Chemical Leasing. Chemical Leasing, or similar models on which Chemical Leasing can tie on, should be examined regarding their transferability to developing and emerging countries.

Furthermore, the German policy should integrate the business model into international guidelines or discussions, e.g. at the FAO. Here, especially the contribution of Chemical Leasing to the solving of current challenges (necessity of high yields, agrochemicals in groundwater, etc.) should be underlined. Another possibility is the establishment of a German consultant system that globally supports Chemical Leasing projects in agriculture by introducing know-how.

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## 9 Appendix

Announcement of the German-Brazilian Economic Forum in Rio de Janeiro

Presentation of the Chemical Leasing business model by Ana Maria Oestreich.

Figure 9: Flyer announcing the German-Brazilian Economic Forum in 2012.

O SISTEMA FIRJAN CONVIDA:  
**SIMPÓSIO BRASIL-ALEMANHA:  
CONSTRUÇÃO SUSTENTÁVEL  
COM EFICIÊNCIA ENERGÉTICA.**

Participe do simpósio que apresenta soluções tecnológicas inovadoras, voltadas a sistemas construtivos e utilização de fontes de energias renováveis. Garanta sua vaga.

**Clique aqui** e confira a programação completa.

**22 DE NOVEMBRO, 8H30 ÀS 17H**  
**Sistema FIRJAN:** Av. Graça Aranha, 1 – Centro, Rio de Janeiro.

Evento gratuito. Vagas limitadas.  
Confirme sua presença:

**0800 0231 231**  
LIGAÇÕES GRATUITAS DE TELEFONE FIXO  
NO ESTADO DO RIO

**4002 0231**  
CUSTO DE LIGAÇÃO LOCAL

[faleconosco@firjan.org.br](mailto:faleconosco@firjan.org.br)  
[www.firjan.org.br](http://www.firjan.org.br)

APOIO

**SINDUSCON-RIO**  
Sindicato da Indústria da Construção Civil  
no Estado do Rio de Janeiro

**ABCP**  
CREF de Construção Civil  
Unidade Operacional Tijuca

 **SENAI**

 **Baden-Württemberg**  
VERBUNDUM FÜR INNOVATION UND WIRTSCHAFT

**Sistema FIRJAN**

 **INFORMA,  
FORMA,  
TRANSFORMA.**

Exemplary programme for workshops in the field of chemical distributing companies and Chemical Leasing in June in Switzerland.

Figure 10: Agenda of the CHEMAWARE Forum in June 2013 in Berlin.

CHEMAWARE™ Forum		
REACH und seine Auswirkungen auf die industrielle Teilereinigung in der Schweiz		
Agenda		
Präsentiert von SAFECEM Europe GmbH		
6. Juni 2013   Bern   Hotel Sternen Muri, Thunstrasse 80, 3074 Bern-Muri, Tel. +41 31 950 71 11		
9:15 h	Empfang	Referent
9:45 h	Grusswort	Manfred Holzleg (SAFECEM)
10:00 h	REACH und seine Auswirkungen auf die Teilereinigung in der Schweiz	
10:00 h	– Allgemeine Einführung zu REACH	Dr. Benedikt Fischer (BiPro)
10:30 h	– Übernahme des Annex XIV in die schweizerische Chemikalien-Risikoreduktions-Verordnung (ChemRRV) und Konsequenzen für die Verwendung von Trichlorethylen	Dr. Josef Tremp (Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation UVEK Bundesamt für Umwelt BAFU)
11:00 h	– Aktivitäten von Dow und SAFECEM zu Trichlorethylen unter REACH	Dr. Hans-Norbert Adams (3S ChemConsult)
11:20 h	Kaffeepause	
11:35 h	Chemical Leasing für den zukunftsorientierten Einsatz von Trichlorethylen	
11:35 h	– Chemical Leasing als Modell für den nachhaltigen Einsatz von Trichlorethylen	Dr. Benedikt Fischer (BiPro)
11:55 h	– COMPLEASE™ Chemical Leasing von SAFECEM	Steffen Säcker (SAFECEM)
12:15 h	Fragen und Antworten Teil 1	Alle, Moderation: Dr. Hans-Norbert Adams (3S ChemConsult)
13:00 h	Mittagspause	
14:00 h	Komplettlösung für den nachhaltigen Einsatz von chlorierten Lösemitteln	
14:00 h	– Geschlossene Reinigungsanlagen	Dieter Lukowski (SAFECEM)
14:30 h	– Portfolio und Spektrum von Lösemitteln	Adeline Ossola (Dow Europe)
15:10 h	Kaffeepause	
15:30 h	– Sichere Lieferung und Rücknahme von Lösemitteln – Optimierung des Reinigungsprozesses und der Reinigungsergebnisse – CHEMAWARE™ Lösemittelschulungen für den sicheren und optimierten Einsatz von Lösemitteln	Lionel Montémont (SAFECEM)
16:00 h	Fragen und Antworten Teil 2	Alle, Moderation: Dr. Hans-Norbert Adams (3S ChemConsult)
16:45 h	Zusammenfassung und Schlussworte	Manfred Holzleg (SAFECEM)
17:00 h	Ende des Forums	



## Chemical Leasing Workshop in Berlin (Mai 21, 2014)

### Programme

Figure 11: Front page of the flyer "Workshop Chemical Leasing".

### Programm

10.30	<b>Willkommen und Hintergrund</b> Dr. Vassilios Karavezyris
10.40	<b>Kurzvorstellung des Geschäftsmodells "Chemikalienleasing" (ChL)</b> Dr. Reinhard Joas
11.00	<b>REACH, Ressourceneffizienz, Rücknahme: Bisherige Erfahrungen mit Chemikalienleasing aus Hersteller- und Anwenderperspektive</b> Steffen Saecker
11.30	<b>Chemikalienleasing als Beitrag zu einer nachhaltigen Chemie</b> Dr. Christopher Blum
11.50	<b>10 Jahre Chemikalienleasing - Von den ersten Pilotprojekten bis zum Global Chemical Leasing Award 2014</b> Petra Schwager
12.20	<b>Von der Idee zur Umsetzung: Konkrete Schritte zur Einführung von Chemikalienleasing</b> Dr. Reinhard Joas
13.00	<b>Diskussion und Schlussworte</b> Dr. H.-C. Stolzenberg
13.30	<b>Mittagessen</b>
<b>- ENDE DES OFFIZIELLEN WORKSHOPS -</b>	
14.15-16.00	<b>Abstimmung Internationaler ChL Award (Organisation, Evaluierung, Koordination); Information über Chemikalienleasing Event in Alpbach</b>
16.00-16.30	<b>Besprechung Chemikalienleasing Toolkit</b>

### Referenten

Im Rahmen des Workshops erwarten Sie Vorträge hoch qualifizierter Experten, die ihre unmittelbaren Erfahrungen und detaillierte Sachkenntnisse mit Chemikalienleasing in den Workshop einbringen.

Folgende Personen werden referieren:

- **Herr Dr. Vassilios Karavezyris** – BMUB Experte für Nachhaltige Chemie
- **Frau Petra Schwager** – UNIDO Koordinatorin des globalen Chemikalien Leasing Programms
- **Herr Dr. Reinhard Joas** – BiPRO GmbH
- **Herr Steffen Saecker** – SAFECEM GmbH; Anbieter Chemikalienleasing
- **Herr Dr. Hans-Christian Stolzenberg** – UBA Fachgebietsleiter „Internationales Chemikalienmanagement“
- **Herr Dr. Christopher Blum** – UBA Experte für Nachhaltige Chemie

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Figure 12: Back page of the flyer "Workshop Chemical Leasing".

Ziele des Workshops	Hintergrund und Zielsetzung	Konferenzort, Teilnahmegebühr und Registrierung
<p>Das Geschäftsmodell Chemikalienleasing ist so konzipiert, dass es wirtschaftliche Vorteile sowohl für den Lieferanten als auch für den Anwender von Chemikalien generiert.</p> <p>Auf dem Workshop wird Chemikalienleasing aus Praxis-sicht vorgestellt. Sie erfahren wie Sie Chemikalienleasing in Ihrem Unternehmen umsetzen und dadurch Vorteile realisieren können. Außerdem erhalten Sie Informationen zum Internationalen Chemikalienleasing Award 2014 und dessen Teilnahmebedingungen.</p>	<p>Chemikalien spielen in der modernen Industriegesellschaft eine sehr wichtige Rolle. Allerdings stellt sich zunehmend die Frage, inwiefern Chemikalien Mensch und Umwelt unnötig belasten und wie schädliche Auswirkungen auf diese verringert werden können. Ein prioritäres Ziel der internationalen, europäischen und nationalen Nachhaltigkeitspolitiken ist es unter anderem, die Entwicklung und Einsetzung ressourcenschonender Produkte zu fördern, welche gleichzeitig ein Minimum an Emissionen und Umweltbelastungen verursachen. Nur durch solche nachhaltigen Ziele in der Chemiebranche können dauerhafte Wettbewerbsfähigkeit und Innovation, welche die Grundlage unseres Wohlstandes als Industrienation bilden, gewährleistet werden. Gleichzeitig können durch den sachgerechten Chemikalieneinsatz sowohl die menschliche Gesundheit, als auch die Umwelt geschützt werden.</p> <p>Chemikalienleasing ist ein innovatives Geschäftsmodell, welchem die Idee zu Grunde liegt, dass die klassische mengenbezogene Bezahlung (€/t) von Chemikalien durch eine nutzenorientierte Bezahlung (z.B. €/m<sup>2</sup> gereinigte Fläche) ersetzt wird. Dadurch ändert sich der Chemikalienverbrauch für den Chemikalienhersteller von einem Erlös- zu einem Kostenfaktor. Somit entsteht auch ein wirtschaftliches Interesse des Chemikalienherstellers den Verbrauch von chemischen Produkten beim Anwender durch Prozessoptimierung zu verringern. In Folge dessen kommt es zu einer intensivierte Zusammenarbeit zwischen Chemikalienhersteller und -anwender, die durch den verringerten Chemikalienverbrauch zu Ressourcenschonung, Verringerung von Umweltbelastungen, Energieeinsparung und zur Vermeidung bzw. Verringerung von Risiken aus der Anwendung von Chemikalien führt.</p>	<ul style="list-style-type: none"><li>• <b>Teilnahmegebühren:</b> Es werden keine Teilnahmegebühren von den Teilnehmern erhoben.</li><li>• <b>Veranstaltungsort:</b> Der Workshop Chemikalienleasing wird am 21. Mai 2014 in den Räumlichkeiten der Landesvertretung Hessen in den Ministergärten 5 in 10117 Berlin stattfinden.</li><li>• <b>Registrierung:</b> Da die Teilnehmerzahl begrenzt ist, melden Sie sich bitte bis zum 16. Mai 2014 über die Website <a href="http://www.chemikalienleasing.de">www.chemikalienleasing.de</a> an</li></ul>

## List of participants

Table 8: List of participants of the Chemical Leasing Workshop.

Name	Department/Organisation
Wolf-Uwe Kilian	Kilian Industrieschilder GmbH
Alexander Kilian	Kilian Industrieschilder GmbH
Stefanie Wieck	UBA (IV 1.2 Biozide)
Anja Behnke	UBA (III 2.1 Übergreifende Angelegenheiten, Chemische Industrie, Feuerungsanlagen)
Manfred Holzleg	SAFECEM Europe GmbH
Steffen Saecker	SAFECEM Europe GmbH
Markus Leube	CSC JÄKLECHEMIE GmbH & Co. KG
Sebastian Herzog	Grünenthal GmbH
Petra Schwager	UNIDO
Nils Decker	UNIDO
Dr. Gesine Bejeuhr	vfa (Verband Forschender Arzneimittelhersteller e.V.)
Ingrid Kaltenegger	JOANNEUM RESEARCH Forschungsgesellschaft mbH - Resources
Dr. Christopher Blum	UBA (IV1.1 Internationales Chemikalienmanagement)
Dr.-Ing. Hans-Christian Stolzenberg	UBA (IV1.1 Internationales Chemikalienmanagement)
Dr. Vassilios Karavezyris	BMUB (IG II 3, Internationale Chemikaliensicherheit, Nachhaltige Chemie)
Dr. Reinhard Joas	BiPRO GmbH
Veronika Abraham	BiPRO GmbH
Marvin Kant	TU Berlin
Dr. Rolf Buschmann	BUND für Umwelt und Naturschutz Deutschland (Technischer Umweltschutz)
Dr. Jutta Emig	BMUB (IG II 3, Internationale Chemikaliensicherheit, Nachhaltige Chemie)
Dr. Verena Ehold	Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW)

## Minutes (in German)

Begrüßung durch Herrn Dr. Blum (UBA), Herrn Dr. Karavezyris und Frau Dr. Emig (BMUB)

### Kernaussagen der Einführung:

UBA beschäftigt sich seit 2007 mit ChL, unterstützt die nationale und internationale Umsetzung sowie die weitere Verbreitung des Modells.

BMUB/UBA sehen einen signifikanten Beitrag von Chemikalienleasing zu einer nachhaltigen Chemie.

Verleihung des dritten Global Chemical Leasing Awards am 12. November 2014 in Basel im Rahmen der "Ecochem" (<http://ecochemex.com/>) wird durch BMUB und UBA unterstützt.

Vorträge Dr. Reinhard Joas (BiPRO GmbH), Steffen Saecker (SAFECEM GmbH), Dr. Christopher Blum (UBA) siehe Anhang

### Wesentliche Diskussionsergebnisse:

Herr Saecker betont die Unterscheidung zwischen Risiken und Gefahren durch Chemikalien (Risiko = Gefahr x Exposition) die durch die Nachhaltigkeitskriterien reflektiert wird. Herr Dr. Blum betont, dass durch ChL keine - im Vergleich zum IST-Zustand - Chemikalien mit höherem Risiko eingesetzt werden dürfen (siehe auch ChL Nachhaltigkeitskriterien), dass UBA sich darüber hinaus für einen Verzicht auf gefährliche Chemikalien einsetzt.

Frage von Herrn Dr. Buschmann: Müssen eigenständige Firmen gegründet werden, um ein erfolgreiches ChL Projekt zu implementieren? Antwort von Herrn Holzleg: Obwohl nicht zwingend nötig, ist es nach Erfahrungen von SAFECEM sicherlich von Vorteil, da durch ChL eine Neu-Ausrichtung in der Kundenorientierung eines Unternehmens erforderlich wird.

Herr Saecker und Herr Leube betonen, dass der Anbieter/Lieferant viel Know-how mitbringen muss, damit ChL Projekte gelingen, da Kernkompetenzen der Anwender meist nicht das Handling der Chemikalien umfassen.

Normung von ChL Projekten (Herr Dr. Blum, Herr Dr. Joas): eine Normung z. B. durch ISO Richtlinien ist nicht geplant oder nötig. Es zeichnet sich jedoch ab, dass ChL die gegenwärtig in Entwicklung befindlichen VDI Richtlinien zu Ressourceneffizienz erfüllt. Dies ist zumindest das Ergebnis erster beispielhafter Analysen, die im Rahmen eines Projektes von VDI-ZRE durchgeführt wurden.

Für die von Herrn Dr. Buschmann aufgeworfene Frage nach einer stärkeren Verankerung von ChL im Regelungsbereich werden als Ansätze erweiterte Berichtspflichten und der Einbau von ChL in „Beste verfügbare Techniken“ sowie „Zulassungsvoraussetzungen unter REACH“ diskutiert.

Vorträge Petra Schwager (UNIDO), Dr. Reinhard Joas (BiPRO GmbH) siehe Anhang

### Weitere Diskussionsbeiträge:

Herr Dr. Buschmann plädiert dafür, mehr Anreizsysteme für ChL (vgl. Ökoeffizienz-RL) und weitere Instrumente (ChL-Partnerbörse, Reporting von Unternehmen) zu entwickeln. Herr Dr. Blum skizziert kurz die Überlegungen des UBA, den Unternehmen eine Matrix zur Verfügung zu stellen, anhand derer die durch ChL erzielten Verbesserungen evaluiert werden können. Darauf aufbauend könnte auch eine öffentliche, anonymisierte Datenbank entwickelt werden, in der die durch ChL erzielten Verbesserungen dargestellt sind.

Anmerkung von Frau Dr. Bejeuhr: Die Zulassung und Dokumentation von neuen Verfahren/Prozessen etc. ist in der Pharmaindustrie teils sehr teuer, wäre aber bei der Einführung von ChL evtl. erforderlich. Die Motivation könnte daher gering sein bzw. der Aufwand zu hoch, das neue Geschäftsmodell einzuführen, wenn damit technische Veränderungen einhergehen. So ist z.B. die Reinigung von Anlagen in vielen Betrieben der Pharma-Industrie eine Kernkompetenz, die nicht an Dritte übertragen wird.

Auf die Frage von Frau Dr. Ehold nach Zertifikaten/Labels für ChL erläutert Frau Schwager: Obwohl dies ursprünglich geplant und auch vorbereitet wurde (Einbindung des TÜV-Süd), war letztlich von Industrieseiten aufgrund der damit verbundenen Kosten und der bereits gegebenen Vielzahl an Zertifikaten kein Interesse gegeben. Einen Ersatz kann ein Zertifikat über eine erfolgreiche Award-Teilnahme liefern, für die die Einhaltung der Nachhaltigkeitskriterien erforderlich ist.


Herr Holzleg unterstrich die Herausforderung v.a. für solche Unternehmen, in denen der Mengenverkauf von Chemikalien das Kerngeschäft darstellt, sich auf das Denkmmodell des ChL einzustellen.

ChL in der gesamten Wertschöpfungskette: Anmerkung von Herrn Decker: ChL sollte nicht nur zwischen Lieferant und Anwender stattfinden, sondern in der gesamten Wertschöpfungskette implementiert werden.

Verbreitung des ChL Modells: Herr Dr. Karavezyris schlägt verstärkte Einbringung von ChL in SAICM durch UNIDO vor, da ChL die Nachfrage von SAICM nach positiven Beispielen und Instrumenten erfüllen kann. Frau Schwager will diesen Vorschlag aufgreifen, um ChL global weiter zu verbreiten.

## Programme of the International Chemical Leasing Conference in December 2014 in Vienna

Table 9: Programme of the international Chemical Leasing Conference.


<b>International Conference on Sustainable Chemistry and Chemical Leasing: Paving the way for Inclusive and Sustainable Industrial Development</b>	
<b>Where: Vienna International Centre, Board Room D, C-Building, 4<sup>th</sup> floor</b> <b>When: 10 December 2014, 09:15am – 15:15pm</b> <i>Moderation by Mr. Paul Hohnen (Senior Sustainability Expert; Founder; Sustainability Strategies)</i>	
	
<b>Until 09:15</b>	<b>ARRIVAL OF PARTICIPANTS</b>
<b>9:30 – 9:50</b>	<b>Official Opening</b> by Mr. Taizo Nishikawa ( <i>Deputy to the Director General, UNIDO</i> ) and Mr. Thomas Jakl, <i>Deputy Director General (Austrian Ministry of Agriculture, Forestry, Environment and Water Management - BMLFUW)</i>
<b>9:50 – 10:20</b>	<b>Keynote Speech – Sustainable Chemistry, Green Chemistry and Chemical Leasing: Pioneering Approaches for ISID</b> , Mr. Paul Anastas ( <i>Director of the Center for Green Chemistry and Green Engineering, Yale University</i> )
<b>10:20 – 11:20</b>	<b>Chemical Leasing – An innovative business model across industrial and service sectors</b> - Taking stock of global Chemical Leasing applications, Mr. Reinhard Joas ( <i>Managing Director, Bipro GmbH, Germany</i> ) - Chemical Leasing in practice, presentations provided by the Chemical Leasing Award Winners 2014 and Award Winners from 2012 - Chemical Leasing in the health sector, Ms. Verena Ehold ( <i>Legal Officer, Chemicals Policy Unit, BMLFUW</i> )
<b>11:20 – 11:40</b>	<b>COFFEE BREAK</b>
<b>11:40 – 13:00</b>	<b>Panel Discussion: Up-scaling and mainstreaming of Chemical Leasing</b> Mr. Thomas Jakl ( <i>Deputy Director General, BMLFUW</i> ), Ms. Vojislavka Satric ( <i>International ChL Expert, National Cleaner Production Centre Serbia</i> ); Mr. Cesar Barahona ( <i>Director, National Cleaner Production Centre Nicaragua</i> ); Mr. Rodrigo Lozano ( <i>Professor, Copernicus Institute of Sustainable Development, Utrecht University</i> ), Mr. Jose Salinas ( <i>Director General, TENSID-CHEMIE S.A., Ecuador</i> ); Ms. Petra Schwager ( <i>Global Chemical Leasing Programme Coordinator, UNIDO</i> )
<b>13:00 – 14:00</b>	<b>LUNCH BREAK</b>
<b>14:00 – 14:40</b>	<b>Guiding Principle for sustainable chemistry:</b> Mr. Dirk Bunke ( <i>Professor, Öko-Institut Freiburg, Germany</i> ), Mr. Christopher Blum ( <i>Sustainable Chemistry Officer, German Federal Environment Agency</i> ); <b>Questions &amp; Answers</b>
<b>14:40 – 15:00</b>	<b>What comes next? Sustainable Chemistry, Chemical Leasing and ISID in 2020;</b> <i>Interactive Discussion with the audience</i>
<b>15:00 – 15:15</b>	<b>Conclusions and Closure of the conference</b> Ms. Petra Schwager ( <i>Global Chemical Leasing Programme Coordinator, UNIDO</i> )

*The conference will be followed by the Global Chemical Leasing Award Ceremony, taking place at the Hotel Park Royal Palace, Schlossallee 8, 1140 Vienna, Austria, starting at 18:45pm.*



## Agenda of the award presentation of the third UNIDO Global Chemical Leasing Award 2014

Table 10: Agenda of the award presentation of the Global Chemical Leasing Award.

 <b>The Global Chemical Leasing Award Ceremony</b> <b>WHERE:</b> <i>Hotel Park Royal Palace, Schlossallee 8, 1140 Vienna, Austria</i> <b>WHEN:</b> <i>10 December 2014, 18:45pm - 22:00pm</i>	
<b>Until 18:45</b>	<b>Arrival of Guests</b>
<b>19:00</b>	- <i>Drinks and starters will be served</i>
<b>19:00</b>	<b>Welcome Address</b> - <i>UNIDO: Mr. Stephan Sicars, Director, Programme Development and Technical Cooperation Division</i>
<b>19:05</b>	<b>Key Addresses by the Sponsoring Governments of Austria, Germany and Switzerland</b> - <i>Austria: Mr. Thomas Jakl, Director General, Austrian Ministry of Agriculture, Forestry, Environment and Water Management</i> - <i>Germany: Ms. Gertrud Sahler, Director General, German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety</i> - <i>Switzerland: Mr. Rolf Stalder, Ambassador, Permanent Representative from Switzerland to UNIDO</i>
<b>19:20</b>	<b>10 Years Chemical Leasing – Experience of UNIDO</b> - <i>Ms. Petra Schwager, Coordinator Global Chemical Leasing Programme, Environmental Management Branch, UNIDO</i>
<b>19:30</b>	<b>The Chemical Leasing Award and its winners</b> <b>(4 Categories: Companies, Consultants, PR, Scientific Papers)</b>
<b>20:30</b>	- <i>Drinks and food will be served</i>
<b>22:00</b>	<b>Official Closure</b>