Umwelt Bundes Amt
Für Mensch und Umwelt

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Chemical Leasing -

Example for resource and material efficiency

BACKGROUND MATERIALS

for the workshop on

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in Berlin

BiPRO
Beratungsgesellschaft für
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1 Background on chemical leasing and objectives of the workshop

The chemical leasing concept

Chemical leasing is an innovative business model in which payments are no longer based on the amount of chemicals consumed, but on the function performed for the user (e.g. a certain area cleaned to a certain standard). This means that the consumption of chemicals becomes a cost factor for the producer rather than being a revenue factor. As a result, the producer has an economic interest in reducing the consumption of chemical products by means of process optimisation. The consequence is closer cooperation between the producer and the user of the chemicals. This offers economic benefits for both partners, and in particular, as a result of the lower consumption of chemicals, it can lead to resource conservation, energy savings, a reduction in the environmental impact, and avoidance/reduction of risks arising from the use of chemicals. Figure 1 shows how the service-oriented chemical leasing business model establishes a shared interest for the producers and suppliers of chemicals and their customers – the less the better.

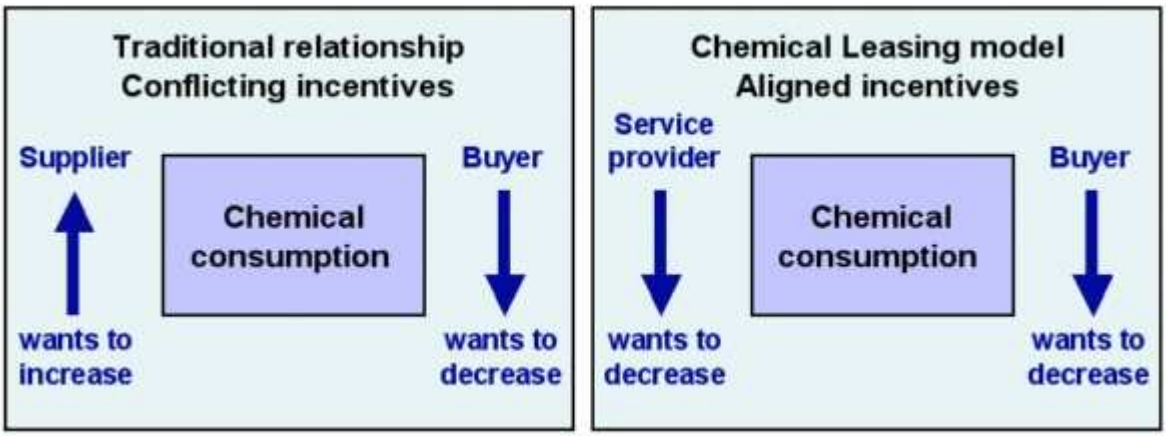


Figure 1: Chemical leasing models produce common interests

The historical development of chemical leasing

Chemical leasing has already been used by individual companies in various forms for many years. However, it has not established itself in any systematic fashion in industrial processes or sectors, nor has it received broad publicity or been the subject of scientific discourse. In 2002, the Austrian Environment Ministry launched an initiative to systematically present the economic aspects together with the environmental advantages. Pilot projects were successfully initiated and promoted and the term “chemical leasing” was established as a brand name. The Austrian initiative was adopted by UNIDO in 2004 and implemented in various sectors in three pilot countries (Egypt, Mexico, and Russia). By targeted publicity and further successful examples, chemical leasing was established as a promising activity within the framework of the Strategic Approach to International Chemicals' Management (SAICM). In the meantime several other countries such as Colombia, Serbia, Sri Lanka, Bra-

zil, Nicaragua, Ukraine, Croatia and Morocco were included as pilot countries. The participants and interested institutions met regularly to discuss their experience.

Germany has also started a chemical leasing initiative resulting in several pilot projects in different industry sectors. This initiative is supported by the German Federal Environment Agency (UBA) and by the Deutsche Bundesstiftung Umwelt (DBU). Within the project of UBA several quality criteria have been developed which are in the meantime internationally recognized and applied.

Sustainability Criteria for chemical leasing

Chemical leasing combines economic advantages for the involved partners with benefits for the environment. To achieve these added values sustainability criteria play a major role.

The following criteria have been developed:

a) Reduction of adverse impacts for environment, health, energy and resource consumption caused by chemicals and their application and production processes

   This criterion addresses a key element of the chemical leasing business model, namely the joint efforts of all participants to optimise the use of chemicals so that the desired output can be achieved with fewer chemicals. It is important for the implementation of the criterion that the reduced consumption of chemicals can be expressed in terms of environmental improvements. This frequently takes the form of a reduction in the amount of waste or lower emissions. The greater the environmental improvements the better fulfilled is the quality criterion. Reductions in energy consumption are achieved in most cases as a result of the reduction in material flows, and should be taken into consideration. In addition to the environmental impact of the chemicals, the impact of machines and equipment also has to be considered ("overall balance"). The analysis of the examples has shown that a material flow analysis before and after chemical leasing is a suitable way of initially registering the desired improvements.

   In additional to the environmental impact, the criterion also covers health and safety risks. The target is in particular a reduction in the exposure to chemicals, which can also be determined by the material flow analysis. The practical effects of the more intensive cooperation between producers and users are also of importance. While the exchange of information about the chemicals which are sold in a classic business model is concentrated on the safety data sheets, with chemical leasing there is much more intensive communication in many cases and the implementation of improvements.

b) Improved handling and storage of chemicals to prevent and minimize risks

   This extends the logic of criterion a) to cover potential impacts (risk dimension). The criterion is quantified in terms of the extent to which risks can be avoided or reduced. The case examples show that the criterion frequently plays little or no role, but in some cases this criterion is of central importance (e.g. sealing of windows).

In addition to the environmental and health-related dimension, the criterion also has an important economic component which plays a role in particular when there are changes in the liabilities of the participants.

c) No substitution of chemicals by substances with a higher risk

Chemical leasing aims to increase the efficiency of use of the chemicals. In some cases, this can be achieved by substituting chemicals, although this may conflict with sustainability objectives if the substitute chemicals pose higher risks for health and the environment. The case studies show that in many cases this criterion is not relevant because there is no intention of substituting chemicals.

If substitution is being considered, it is necessary first to establish whether this would present a greater risk for health and environment. This can be based on the classification in accordance with REACH / GHS and the exposure of environmental sectors and individuals.

d) 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

These aspects are essential for the long-term application of the business model. While commercial improvements are relatively easy to quantify in terms of the monetary value, the fair and transparent contract elaboration between the partners is a more complex matter.

e) Monitoring of the improvements needs to be possible

Monitoring measures are considered to be an essential element for the documentation of achievements and the identification of gaps and shortcoming that still need to be addressed by the partners.

Political dimensions of chemical leasing:

Environmental policy dimension

Chemical leasing leads to a more sustainable use of chemicals. It can be shown that environmental and health impacts are reduced in a quantifiable way, and existing risks are also reduced. By linking economic success and environmental advantages, the business model ensures long-term improvements. Against this background there is an interest from the side of environmental policy to support the business model. Promotion is done by funding and public relation activities; it is not foreseen to include chemical leasing in any prescriptive legislation.

Economic and political dimension

For all target groups, chemical leasing can offer improved competitiveness due to better knowledge on process requirements and performance of chemicals. Long term business relations enable techno-

logical developments that would not be feasible for partners acting alone. To this extent the business model contributes significantly to the objectives of economic policies.

International development dimension:

Chemical leasing allows the transfer of technology and expertise to emerging economies and developing countries and thus contributes to international development targets.

Research policy dimension:

An integral element of chemical leasing is the stimulation of further technological development. Applied research is clearly at the focus of the interest.

In addition to this research policy dimension, it should also be noted that new partners such as chemicals wholesalers could also be involved in research activities induced by chemical leasing.

Currently existing need for action

A broad implementation of chemical leasing did not happen so far, the business model is only applied in single pilot cases and limited to some chemicals suppliers. Therefore need for action exists as regards appropriate communication and information transfer to users and suppliers of chemicals. In particular providers of chemicals (manufacturers, traders, distributors) should be convinced to offer chemical leasing in a systematic way as part of their portfolio.

Objectives of the workshop

The main objective of the workshop is to foster the exchange of experiences between suppliers and users of chemicals and to support a broad Europe wide implementation of the business model.

2 Chemical leasing in Germany and international

2.1 Chemical leasing definition and comparison to similar business models

Chemical leasing definition

The principles of chemical leasing were described by UNIDO together with the international chemical leasing working group in the following definition:

> *Chemical leasing is a service-oriented business model that shifts the focus from increasing sales volume of chemicals towards a value-added approach.*
>
> *The producer mainly sells the functions performed by the chemical and functional units are the main basis for payment.*
>
> *Within chemical leasing business models the responsibility of the producer and service provider is extended and may include the management of the entire life cycle.*
>
> *Chemical leasing strives for a win-win situation and aims at increasing the efficient use of chemicals while reducing the risks of chemicals and protecting human health. It improves the economic and environmental performance of participating companies and enhances their access to new markets.*
>
> *Key elements of successful chemical leasing business models are proper benefit sharing, high quality standards and mutual trust between participating companies.*

Comparison and differentiation to similar business models

Chemical leasing shows similarities to other business models such as classical leasing, chemical management services, outsourcing, pay-on-production, contracting, single-source-supply and cost per unit business models. Common is in all these models the focus on the benefit and a correlated service. The transfer of property is not regarded as the main target.

The special approach of chemical leasing – different to the other models – is the element of process optimization achieved by common exchange of know how. This enables an increased economic efficiency as well as an improved environmental performance.

Variations of the business model of chemical leasing

In the basic model there are two involved partners: the supplier and the user. These partners combine their know-how and optimize processes following the common target of a reduced chemical consumption which is economically driven

Chemical leasing business models are not necessarily limited to these two partners. It might be advisable to integrate further partners with additional know how. This is in particular valid for equipment manufacturers. There contribution typically addresses the optimum interaction between machines/equipment and chemicals on the one hand side and to the final product on the other hand.

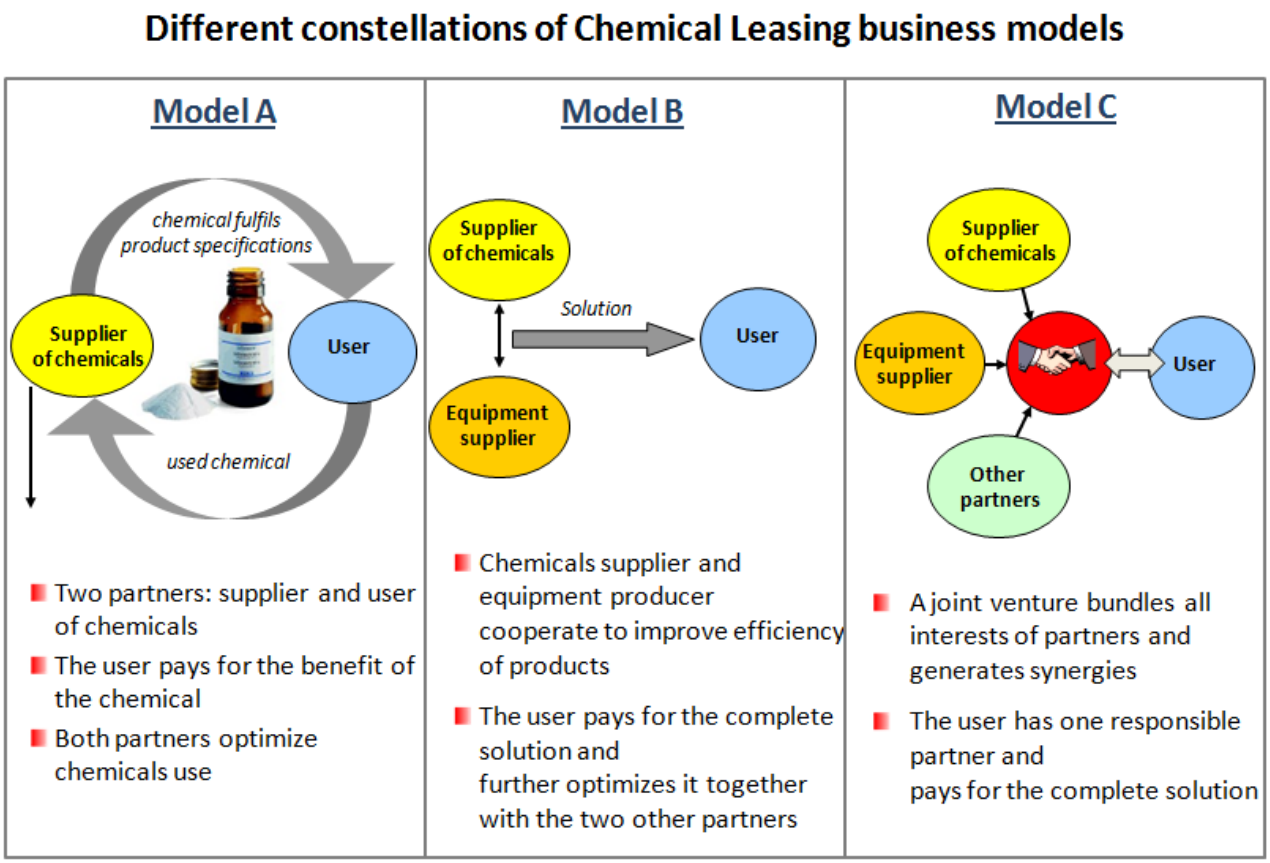


Figure 2: Overview on concrete business models of chemical leasing

In some practical cases the equipment manufacturer even plays the most important role as the main innovation comes from the machine side. Here a combination with classical leasing (no sales process for the machine) and chemical leasing (benefit oriented payments) might define the best approach.

2.2 Implementation chances and basic requirements to apply chemical leasing business models

2.2.1 Implementation chances in industry sectors and processes: no general limitation if chemicals are applied

The chemical leasing business model will as a rule function well in all industry sectors and processes if the certain pre-conditions are met.

Experiences from pilot cases show that some processes and industry sectors are in particular open to this new business model.

2.2.2 Necessary conditions for chemical leasing: optimization potential, willingness to cooperate, legal compliance

Relevant optimization potential

It is a characteristic element of chemical leasing business models that the supplier increases his earnings with a reduction of the amount of chemicals consumed. Participation in investments for process optimization is therefore in the supplier´s interest as long as an economic advantage can be gained. Without such potentials chemical leasing cannot be applied.

There is scope to reduce the amounts of chemicals used. Reduction must be possible in a way which does not have a negative effect on the quantity and quality of the end product.

Applications in which chemicals have to be used in fixed proportions, or where the consumption of chemicals is determined by specific chemical reactions are therefore not suitable chemical leasing business models.

Willingness to exchange know how

The supplier of the chemicals is willing and able to contribute relevant practical expertise to the process optimization.

If the producer or supplier of chemicals has no practical expertise then they cannot take part in the process optimisation. The switch from a quantity-oriented payment to a use-oriented payment will not generate any impulse to reduce consumption.

Chemicals are used according to legal requirements

If chemicals are being used in Germany or other European countries then among other conditions it is necessary that all REACH requirements are met in good time. In the case of hazardous chemicals the use must be an identified application for which an exposure scenario has been developed in the registration dossier.

2.2.3 Industry sectors, processes and substances that suit in particular well for chemical leasing

Good applicability to apply chemical leasing at non-core- processes or at auxiliary processes

Chemical leasing means intensified collaboration between suppliers and users based on an exchange of know-how. Therefore trust and confidentiality between the partners is a key success factor. In particular for processes that define a core competence of a company there are typically restrictions as regards the exchange of know how. Based on this it is expected to have better implementation chances if auxiliary or non-core processes such as cleaning, coating, water purification, gluing, disinfection, etc. are addressed. These expectations are confirmed so far by existing worldwide pilot cases. Correspondingly those industry sectors suit well where such processes are widely used, e.g. metal works, automotive industry and food industry.

2.3 Rough estimations for chemical leasing potentials in Germany, European Union and worldwide[1]

Estimating the potential of chemical leasing business models in Germany[2]

In Germany, more than 50 million tonnes of chemicals are used every year. The large majority of this is in the value-creation chain in the chemical industry involving reactions with fixed proportions of chemicals. As explained, such processes are not well suited for chemical leasing.

Probably in the order of 10 million t of chemicals per year are used in processes where there is a realistic prospect of implementing chemical leasing, particularly in the following sectors (rounded figures):

Solvents	7 000 000 t/y
Surface coatings	1 500 000 t/y
Adhesives	500 000 t/y
Pesticides	50 000 t/y
Disinfectant	50 000 t/y

A pre-condition for chemical leasing is that there is potential for optimisation and that this business model is also attractive for the producer. Precise assessments would require detailed market studies, which would be beyond the resources of this project. However, based on the experience of the pro-

[1] For all data mentioned here it should be considered that these are rough estimations and are not based on scientific detailed analyses

[2] Data is used from the German Statistical Office in combination with statements from industrial associations and experience in the implementation of chemical leasing projects.

ject team it is possible to estimate roughly that chemical leasing can result in an average reduction of 10-20% of chemicals used in about 1% of the possible application cases.

This would represent an overall annual reduction potential of 10 000 – 20 000 t in Germany.

For important chemicals this gives the following rough estimates for the reduction potential:

Solvents	7 000 – 14 000 t/y
Surface coatings	1 500 – 3 000 t/y
Adhesives	500 – 1 000 t/y
Pesticides	50 – 100 t/y
Disinfectant	50 – 100 t/y

It is expected that up to 20% of this potential will be realised over the next 5 years, which would represent an annual reduction of approx. 2 000 - 4 000 tonnes.

Export opportunities and potential

The figures given above reflect the situation in Germany, where production processes using chemicals are already relatively sophisticated in an international comparison. This means that there is less optimisation potential for chemical leasing than in other countries. Whereas an average reduction of 10 – 20 % could be expected in Germany, experience in emerging economies shows that reductions there could be twice as high.

The greater potential also makes the business model more attractive, from both an economic and environmental point of view.

It is therefore expected that the German chemical industry – which is strong in terms of both the export and the use of existing expertise – will use the opportunities offered by chemical leasing.

This will not lead a priori to a reduction in German exports of chemicals, because improved competitiveness could result in other chemicals producers being forced out of the market. In any case, the use of chemical leasing with German participation in emerging economies will mean lower emissions, less waste, and reduced health impacts and risks.

3 Potential obstacles and possibilities for solutions

Chemical leasing is for many industry sectors a new business model. Therefore incentives and constraints play a major role for implementation. Sometimes incentives and constraints work vice versa: an incentive for a supplier, e.g. higher dependency of a client, might define a constraint for a user of chemicals. Against this background the following table shows incentives and constraints from a broader perspective. Thereafter possibilities to overcome obstacles will be analyzed.

Overview of incentives and constraints

Incentives	Constraints
Chemicals' producer or supplier	
Improved customer ties	Lack of trust in methods of cost allocation, difficulty to control revenue parameters
Improved profitability	Several suppliers for the same chemical product
Revenue for previously unpaid services	Competition problems regarded the spread of know-how
Better and earlier identification of customer needs	Low perceived optimisation potential
Possible wider applications for new developments and product optimisation	High investments needed to achieve process optimisation
Positive, environmentally-friendly and innovative image	Problems calculating price fluctuations for raw materials
Better overview of disposal routes and improved product responsibility	estionable quality and reliability of the preparatory processes
	Training requirements
	Liability questions
	Worries about economically weak partners
User	
Cost benefits	Dependency due to close customer-supplier ties
Concentration on core competence	Reduced flexibility
Availability of chemical expertise	Flow of know-how via the plant constructor and/or chemicals producer to competitors
Improved security	Loss of jobs due to rationalisation effects
Avoidance of overcapacity	Uncertainty about meeting technical specifications with an external plant
	Technical and logistical problems for the transport of products to and from external plants
Plant constructor	
Closer customer ties	Increased capital requirements
Increased range of offers	Uncertainty with economically weak user companies
Revenue from existing know-how and previously unpaid services	Increased administrative overhead

Table 1: Overview of constraints and incentives for chemical leasing

Examples for solutions related to obstacles

Reduction of information gaps

A major obstacle for all involved partners might be missing or incomplete information. As successful projects often define a competitive advantage to the involved partners and due to confidentiality requirements information is not communicated. This deficit can be solved by public organizations that fund pilot projects and enable a proper communication.

Solutions concerning missing trust by quality criteria, independent monitoring and fair contracts

Missing trust towards other partners can define a major obstacle for successful implementation of chemical leasing. Inclusion of a third party for the control of process parameters, unit of payment or within the elaboration of a contract can reduce constraints. Another solution to build trust is the consequent application of quality and sustainability criteria.

Solutions concerning economic risk reduction by public funding and support

Chemical leasing is a business model what means that is based on economic advantages of partners and that therefore principally should work without public support. On the other hand practical experiences show that in particular a public promotion is a very valid tool to motivate companies to start the implementation of the business model.

4 Example of a pilot project and applied technologies

Cleaning pipes and containers in the food and pharmaceutical industries

Mode of operation and partners:

The classic business model envisages that chemicals for cleaning pipes, tanks, and containers are purchased on the basis of a price per unit volume or weight. This means that the more chemicals are used then the greater is the supplier's profit. With chemical leasing, payment is based on the amount of the final product obtained (e.g. kegs of beer or tonnes of chocolate), in compliance with strict purity specifications and hygiene regulations. This means that the profit of the chemicals' supplier increases with a lower consumption of chemicals. It is then in the interests of the supplier of the chemicals to help the user to optimise the production process by introducing expertise.

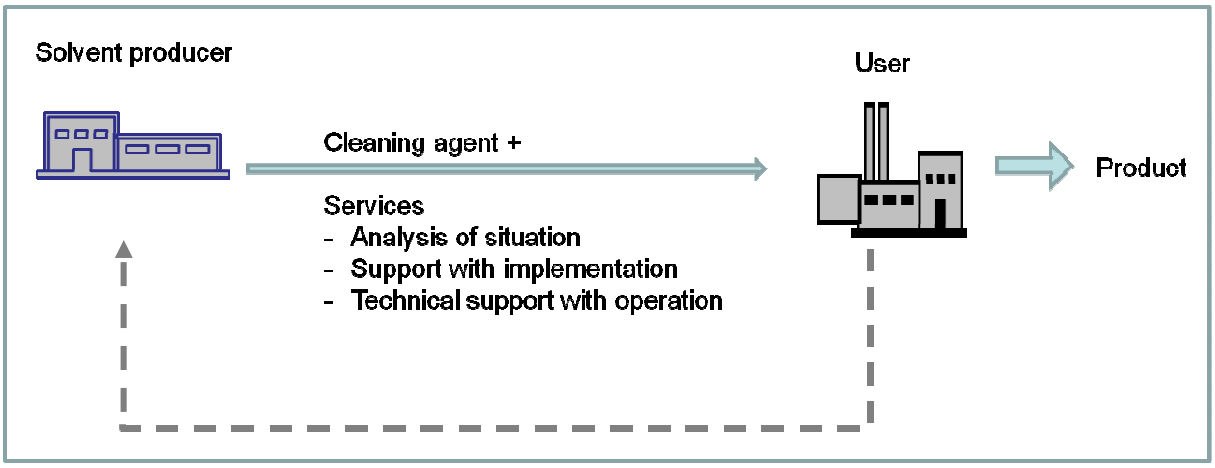


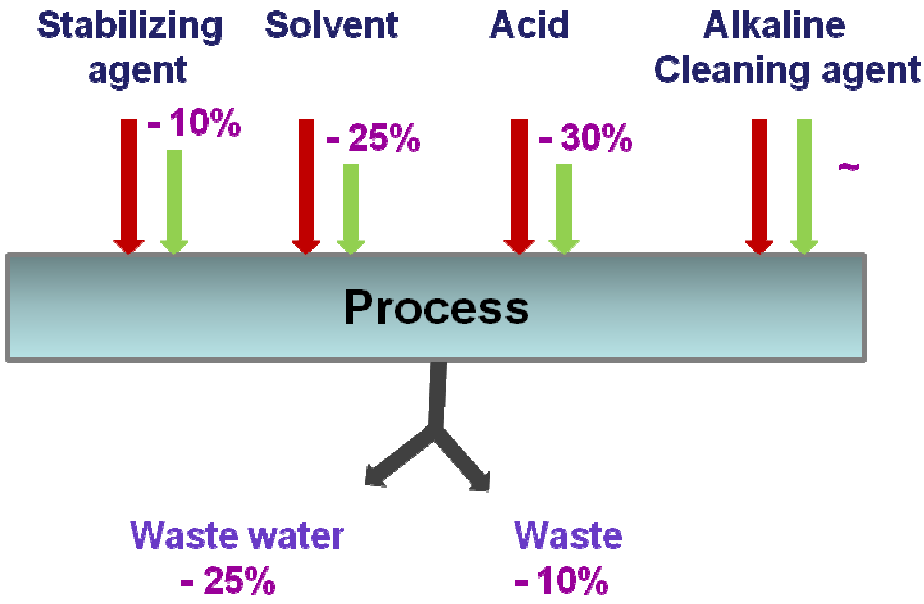
Figure 3: Participants in “Cleaning pipes and containers in the food and pharmaceutical industries”

Applied technologies for process optimization:

The supplier of the chemicals usually performs an analysis of the cleaning process with its own specialized measurement equipments. This is targeted among others to determine the efficiency of single cleaning steps. Based on the results of the measurements an optimization of the cleaning plant and its control circles – depending on the manufactured final product – takes place. Furthermore the usage time of cleaning chemicals is increased by adding certain stabilizers.

Environmental results:

The chemical leasing business model leads to a lower consumption of cleaning agents. These reductions are due to process optimisation and can be expected to be stable. The lower consumption leads to a reduction in waste and to reduced effluent load. Energy will also be conserved, both through direct effects (e.g. less heating and pumping due to fewer cleaning cycles), and indirect savings due to a reduced flow of materials.



Indirect energy conservation (lower materials flow): ~ 25%

Direct energy conservation (fewer cleaning cycles): ~ 10 %

Economic results:

The process optimisation initially leads to an increased burden for the supplier of the chemicals which is only gradually balanced out by the reduction in the amounts of chemicals supplied, until subsequently an economic benefit results. A certain minimum size of the plant and the initial level of consumption of chemicals is therefore a precondition if the business model is to be economically attractive. The break-even point for the supplier of the chemicals is set at less than one year. For the user, the business model will usually involve only a very short amortisation period, because in most cases no major investments are necessary.

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