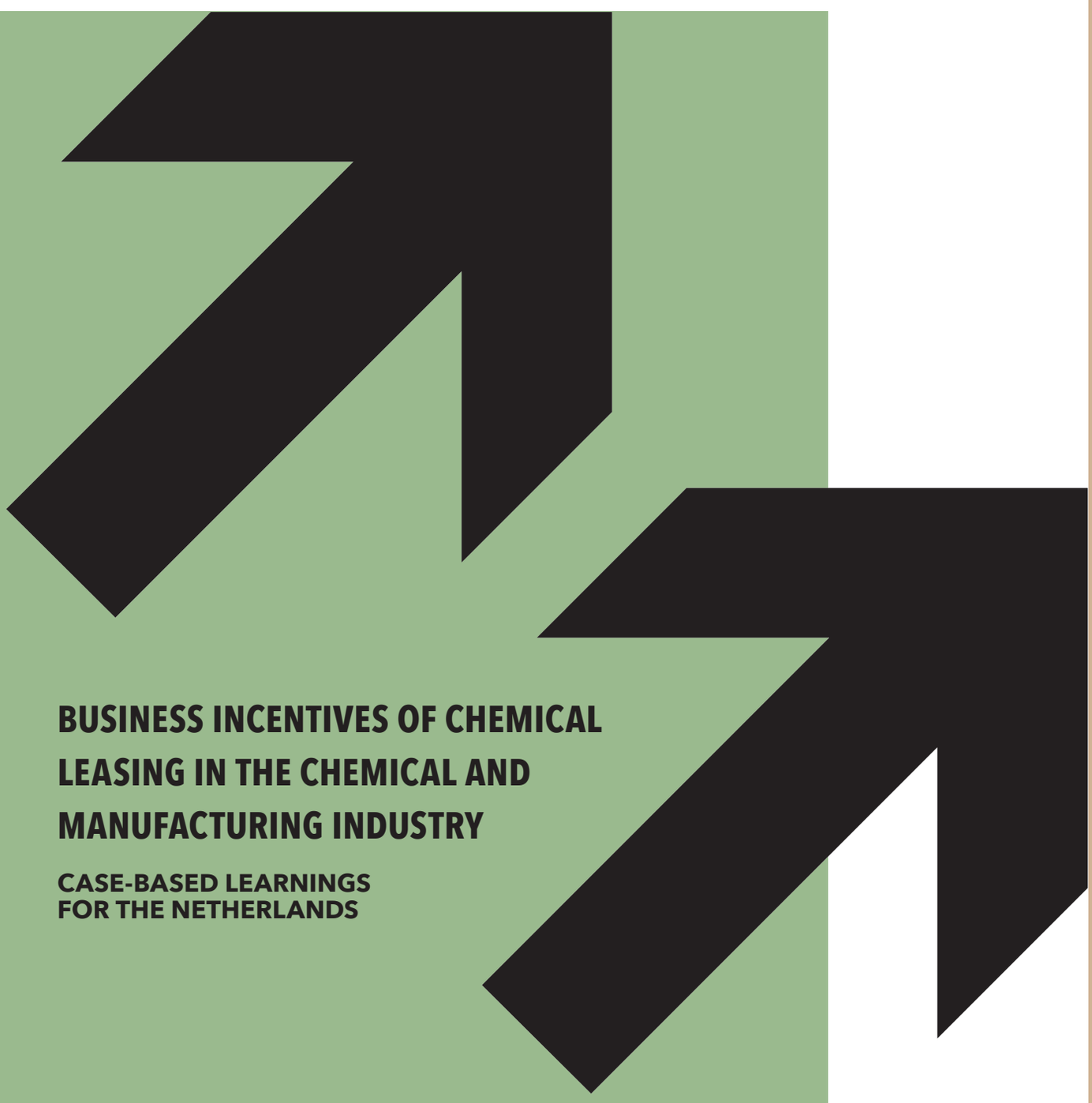
TAKE BACK CHEMICALS



BUSINESS INCENTIVES OF CHEMICAL LEASING IN THE CHEMICAL AND MANUFACTURING INDUSTRY

CASE-BASED LEARNINGS FOR THE NETHERLANDS

BUSINESS INCENTIVES OF CHEMICAL LEASING IN THE CHEMICAL AND MANUFACTURING INDUSTRY

CASE-BASED LEARNINGS FOR THE NETHERLANDS

White Paper, 1 March 2017

CONTENTS

ACKNOWLEDGEMENT

This white paper is, amongst others, based on studies executed with great support and in close collaboration with the Dutch Ministry of Infrastructure and the Environment, the Ministry of Economic Affairs and the Netherlands Enterprise Agency (RVO). The collaboration in these studies between public institutions, private organizations and research institutes has proven to be of great assistance in tackling several major issues requiring input from practice and from policy (e.g. concerning 'waste or non-waste'). Main thanks go to the Green Deal 'Take Back Chemicals' which formed the backbone of this collaboration.
Special thanks go to the people in the companies that were reviewed. Their openness and courage to be a frontrunner is highly valued.

INTRODUCTION

Sustainable production is increasingly receiving attention throughout Europe. It is pursued in many ways, generally concerned with energy and material consumption. While there are many technical initiatives tackling the reduction of material and energy consumption or reduction of waste production, such initiatives tend to be highly specific, i.e. having a limited scalability. The introduction of new business models forms a more widely applicable approach. Those new business models focus on the dematerialization of business or on closing material cycles, and are applied in the context of *Product Service Systems, Industrial Symbiosis or Circular Economy*. One such business model is called *Take Back Chemicals*.

The impact of Circular Economy on the Dutch and European landscape has been studied extensively, both from an economic and environmental point of view[1] [1,2,3]. New business models are thought to have a major contribution in the catalysis of Circular Economy and the environmental and economic gains it brings. By firstly implying an open and collaborative mindset and by secondly creating a demand for closed material loops, new business models are envisioned to open up a window of opportunity for many new, clean technologies [4,5].
Based on prospects related to the environmental and economic gains of Circular Economy, the EU has launched its Circular Economy Package late 2015, aiming to increase recycling and reduce material and energy consumption with targets set for 2030.

Though clearly not common practice in all industries today, some frontrunners have started Circular Economy initiatives. Specifically, some have initiated a move to optimize their business using the *Take Back Chemicals* business model. What is it that made them move? Based on finalized and on-going studies of business model optimization using the *Take Back Chemicals* concept, this paper displays key learnings on the business side of circular cases found in a diversity of industries in Belgium and the Netherlands.
It shows that progress is booked where efforts are made. In addition to disclosing *Take Back Chemicals'* business potential, this whitepaper therefore concludes with an advice to both private and (semi) public organizations concerning which efforts are needed to foster and grow these developments.

[1] Waste prevention, ecodesign, re-use and similar measures could bring net savings of €600 billion, or 8% of annual turnover, for businesses in the EU, while reducing total annual greenhouse gas emissions by 2-4 %.

The name *Take Back Chemicals* may trigger especially those embedded in the chemical industry itself, yet we stress the relevance of this concept to many other manufacturing industries. Chemicals are used in a wide variety of industries, ranging from food to automotive and electronics, assuring the relevance of this topic for these sectors. This paper briefly touches on the applicability of the concept of *Take Back Chemicals* to the different kind of industries, products and processes.

A lot has been written and can still be written about the overall concept of *Take Back Chemicals* or the related *Chemical Leasing* (e.g. environmental, economic, legal or financial aspects). The focus of this white paper is clearly on the economic incentives: the triggers that make organizations move. For further reading on other related topics, please see the references throughout this paper.

CONCEPT OF TAKE BACK CHEMICALS

Take Back Chemicals is a business model aimed to increase the effect of the chemicals used. Traditional business models are based on sales per volume. Opposite to this, applying *Take Back Chemicals*, a supplier introduces a service supporting the *effect* of the materials rather than selling the material itself. Hence, the supplier is paid for the service delivered rather than the amount of substance used, and the type of payment changes from volume-driven (€/ton chemical supplied) to a result-driven, measurable metric (e.g. €/ton treated product). Moreover, the supplier retains ownership of the material it supplies, and takes it back after use: the material is 'leased' to the customer (see Figure 1).
At least two actors are present in a Take Back Chemical set-up: a supplier and a customer of the chemicals. For the sake of clarity, this paper discusses mainly the 'classic' manufacturer-user relation, but other variants may exist including for example distributors, blenders or technology providers.

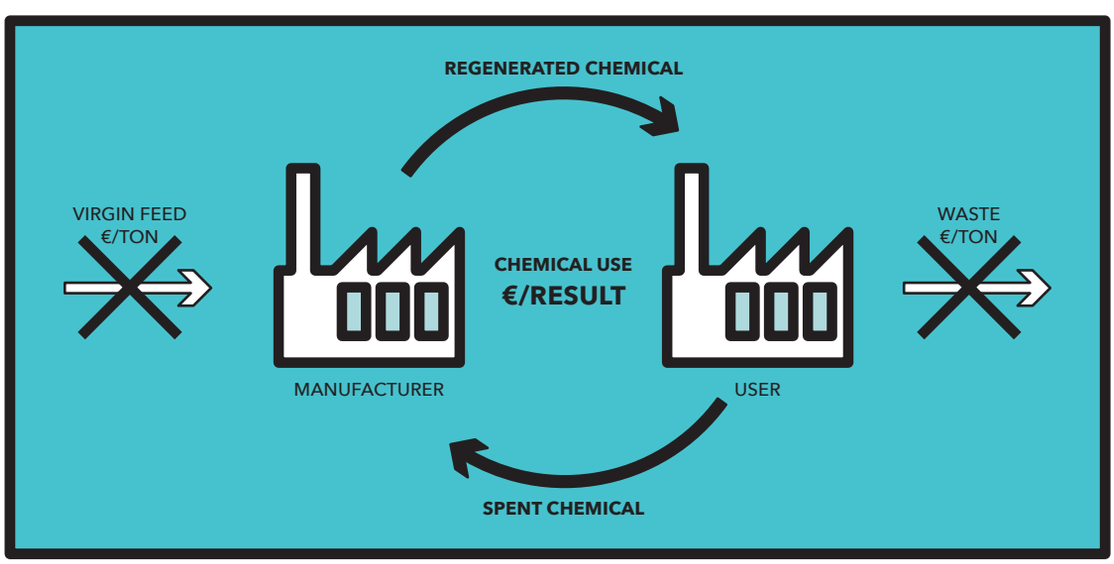


Figure 1. Example of a Take Back Chemicals model in a classic manufacturer-user variant. It is the take back of the spent chemical and the result-driven pricing that eliminates the traditional linear model based on €/volume. Other variants of a Take Back Chemicals model may include for example distributors, blenders and technology providers.

Being paid for and being co-responsible for the effect of the substance rather than the delivery of a certain volume, the supplier is stimulated to assist in optimizing the effect of the substance and to use it most economically. See Figure 2: opposite to traditional manufacturer-user relationships, the incentives related to the use of material in a situation are aligned. Whereas the user in each case is seeking for most efficient use of its chemicals, the manufacturer is traditionally driven to sell per volume, not necessarily minding the efficiency of use. In a Take Back Chemicals relationship, the manufacturer is included in the use stage, and the efficiency of use impacts the profits of the manufacturer. The traditional principle "the more you sell, the more you earn" is no longer valid. The result is that the interests of the manufacturer and the user are aligned: both aim to continuously incease the efficiency of use of the chemical. This is a major change compared to the traditional economic relationship between a chemical supplier and his customer.

This alignment opens doors to extensive cooperation between the supplier and customer in the development and operation of production processes. In terms of business models, it is the cooperative character and the typical price setting (€/result rather than €/volume) that differentiates *Take Back Chemicals* from simple business integration (the inclusion of upstream or downstream business processes) or outsourcing (the handing of over full responsibility of business processes).
Take Back Chemicals can be seen as a variant of *Chemical Leasing*. For further reading on the generic concept *Take Back Chemicals* or *Chemical Leasing* we refer to earlier reports [6,7,8,9].

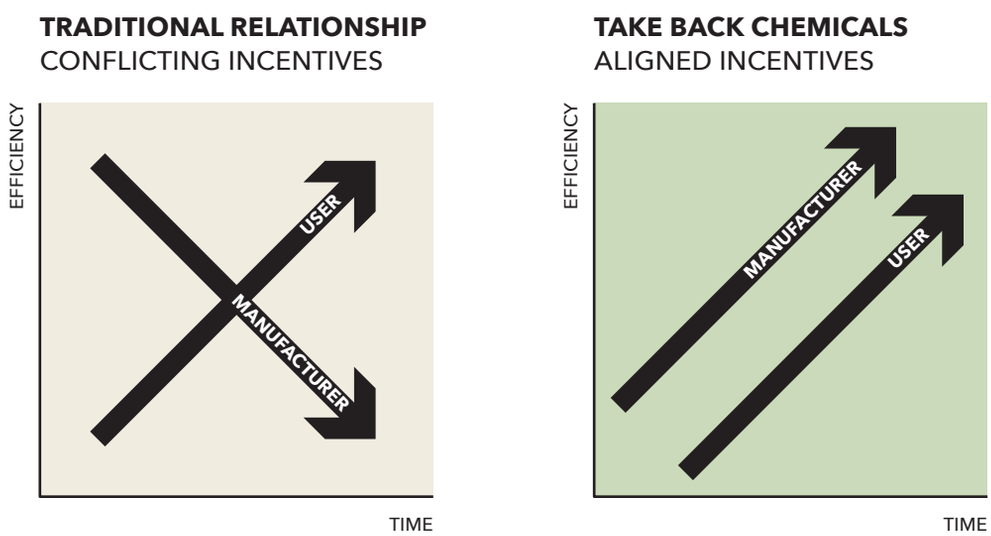


Figure 2. *Take Back Chemicals* shows aligned incentives of the manufacturer/supplier and the user. The figure on the left shows a traditional relationship: the user is seeking constant optimization of its chemical use, while the manufacturer – paid per volume – is primarily interested to sell more volumes over time, not necessarily minding about process efficiency. The figure on the right shows the situation where the manufacturer is paid per result – now being triggered to think along with the user to increase the process of use of the chemical over time: the incentives are aligned.

Take Back Chemicals is depicted as a generic concept, enforcing different business goals for different businesses. One size fits all.
Yet, this concept is not brought forward as a wonder method, miraculously improving each and every process. Rather, it is another way to continue the ongoing search for process optimization, client focus and societal well doing. And though the concept itself may be regarded as a 'one size fits all', the implementation and operation requires tailoring to exactly fit the needs of the involved companies.
Furthermore, the concept implies a certain openness to change for any organization wanting to benefit from it. It requires the ability to step away from the paved way of thinking and doing. And as business returns may not be huge in direct financial terms, indirect benefits must be valued by the organizations involved. For many, these indirect benefits may bring just that extra needed to consolidate its position and outcompete inland and overseas production. *Take Back Chemicals* has shown to bring new answers to those who manage to apply it right.

REVIEWED CASES

This whitepaper presents the findings of a study on the feasibility and benefits of *Take Back Chemicals* in the Netherlands and Belgium. The study was designed to assess the concept in its most broad form by examining the implementation process of the *Take Back Chemicals* business model from start to feasibility, and covering a wide range of industries and business incentives. Being distant yet involved in the implementation process, the research team was able to distill learnings from practice.
The examined cases include the sectors of chemicals, pharma, food, automotive, metal surface treatment, plastics and textiles. A brief description of successful cases is given below.

TEXTILE
A textile producer is faced with a European ban on one of its additives (TCE) used in the dyeing of textiles. Alternatives provided by the TCE industry do not entail a successful substitute. By applying *Take Back Chemicals* the innovation pressure was transferred to the supplier of other chemical products. By doing so, the textile producer has been able to more than double its innovation capacity for finding an alternative, TCE-free production process resulting in new routes for investigation.

COMMODITY CHEMICALS: SALT
Salt (NaCl) is a common feed in the chlorinated hydrocarbon commodity industry. It may also result as side stream of a process in the same industry. Having such 'waste stream', a polymer producer reduced operational expenses and emissions in effluent by separating, purifying and valorizing the salt. The salt is either valorized in a *Take Back Chemicals* model by having it taken back by the 'supplier' - the manufacturer of a chlorinated hydrocarbon intermediate - or by reselling the salt locally to other chlorinated hydrocarbon industries.

PLASTICS
Having moved away from mercury-cell based chlorine production, a PVC producer found itself left with non-contaminated and thus valuable side streams, a.o. spent sulphuric acid. Sulphuric acid is used by the PVC producer as a drying agent for chlorine. Applying *Take Back Chemicals*, the spent acid is no longer sent to waste water treatment but sent back to the producer for regeneration, where it is consumed as feedstock in the existing acid production process. The result is a firm reduction of total processing costs and the creation of space within the environmental permit for increased production.

PHARMACEUTICALS

Seeking to constantly optimize its assets, a pharmaceutical company was aiming to free one of its distillation towers from the sub-optimal recovery of a (commodity) solvent and making it available for other, more flexible and costly purposes. By applying *Take Back Chemicals*, it was able to involve a third party (a distiller) to execute the distillation at lower operational expenses yet with the same high level of control required in the pharma industry. The pharmaceutical company retained ownership of its solvent, and the high quality of the product was assured by amongst others track and trace, dedicated treatment and mutual contractual agreements based on purity specifications.

METAL SURFACE TREATMENT

The pre-treatment of steel in the galvanization industry results in large costs of waste treatment of spent acids (HCl). Applying *Take Back Chemicals*, the galvanizer, often a small or medium sized enterprise, was able to involve knowledge and monitoring expertise from the HCl manufacturer into its pretreatment process. By doing so, the reusability of ferrous-rich spent HCl was optimized, reducing overall waste handling costs, and being of interest for the HCl manufacturer as this material stream was taken back and valorized as a coagulant (e.g. $FeCl_3$).

FOUR MAIN BUSINESS GOALS REACHED

This white paper focuses on the business incentives of the business model Take Back Chemicals. Four main business goals realized with Take Back Chemicals in the examined cases are identified. These business goals formed the core drivers from an economic view to apply the concept.
When considering these goals one should keep in mind that there are two main perspectives: the supplier/ manufacturer and the customer/user of the chemical. Each perspective sheds its own light on the outlined business goals. For the sake of clarity and focus, auxiliary services and related business goals by third parties are not considered in this report.
The four business goals are *Operational excellence, Service expansion & market consolidation, Lean innovation,* and *Debottlenecking*. Operational excellence and Lean innovation appeal to both the perspective of the manufacturer and the user, as both can take benefit from a faster and less costly innovation process. Market expansion & consolidation appeals more to the perspective of the manufacturer: it relates to the services it can deliver to its clients. Debottlenecking finally appeals more to the perspective of the user: reducing the environmental/ administrative/financial burden and increasing process quality may increase its production.

1 OPERATIONAL EXCELLENCE: COST REDUCTION, RISK REDUCTION, QUALITY IMPROVEMENT

Operational excellence is a first and most obvious economic incentive for all partners involved in a Take Back Chemicals project. Operational excellence here is described by three main pillars: cost reduction, risk reduction and quality improvement.

Cost reduction is created by the savings inherent to the introduction of Take Back Chemicals. Cases show significant operational cost reductions with positive environmental impact, including savings of energy, water, and material consumption of up to 90%[2] and the elimination of (hazardous) waste and the use of hazardous materials (Substances of Very High Concern). Depending on the scale of change (highly radical to incremental), investments differ from significant to only requiring rather minor adjustments to existing infrastructure. Payback periods of down to one or two years or even several months were reported [8]. This shows that seeking for cost reductions through the opportunities brought forward by circular thinking, one reaches both economic and environmental goals simultaneously.

Risk reduction relates to the security of supply and the mitigation of cost fluctuations. As in a Take Back Chemicals situation all material is kept within a closed loop rather than being processed in a linear model, risks related to the supply of feedstock are minimized if not eliminated. This is highly relevant for chemicals produced from increasingly scarce resources, from sources in geopolitically sensitive areas or from resources that are subject to high price fluctuations (due to e.g. rapid changes in demand, production or market conditions).

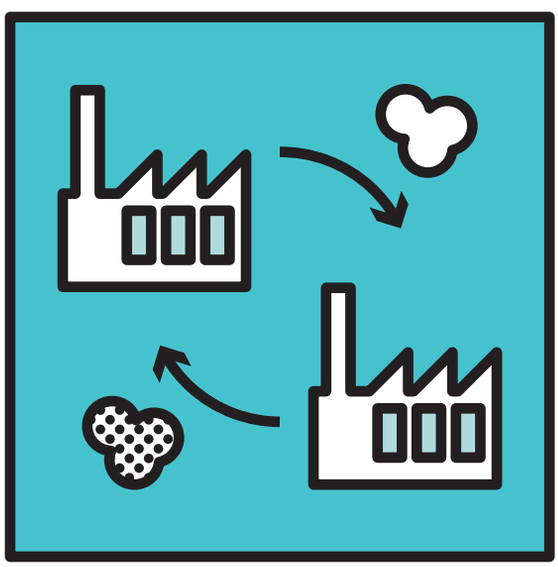
[2] Based on comparative life cycle assessment (delta-LCA) of the subjected production process.

"THE MOST EXCITING THING ABOUT THIS PROJECT IS THE NEW COLLABORATION WITH OUR SUPPLIER. WE USED TO BE OPERATING VERY SEPARATELY, BUT IN THE END WE'RE ALIGNED TO IMPROVE TOGETHER."

Sabine Thabert
Quality Manager, Inovyn *(joint venture Ineos and Solvay)*

Quality improvement is primarily reached by increased knowledge of use of the chemical and the decoupling of material consumption in the pricing model (€/result rather than €/volume). For example, in one of the cases a user (a producer of chlorine) involved the manufacturer of a drying agent (sulfuric acid) in the drying of chlorine. This drying used to be done up to or sometimes above saturation levels of the drying agent, resulting in suboptimal removal of water. Introducing a result-driven rather than a volume-driven pricing model (i.e. €/ton dried chlorine) allowed for sulfuric acid renewal (far) below saturation levels, improving not only the quality of drying but also that of reuse of the spent acid.

2 SERVICE EXPANSION & MARKET CONSOLIDATION



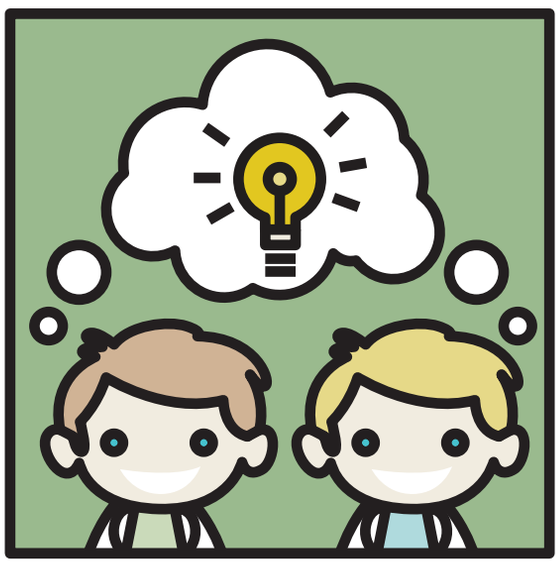
Manufacturing – be it of automobiles, food or electronics – requires many supporting processes, such as cleaning, purifying or drying. Many of these are crucial for the quality of the final product, yet are not considered core business. And as they are non-core, the chemicals and waste management related to these processes is often found to be suboptimal.

Applying Take Back Chemicals, a manufacturer expands its servicing towards users by supporting the chemicals and waste management, ideally taking back the spent chemicals. Such extended operations generally fit the manufacturer well, as the manufactured chemical often is the core business of the manufacturer, implying extensive product knowledge and likely existing infrastructure for take back and possible regeneration.

This servicing can be a differentiating factor especially for local suppliers, and allows users to keep its focus on its core activities. For example, in one of the cases the manufacturer of an acid (HCl) was involved in the pre-treatment of iron objects before galvanization (removal of grease, rust and zinc). By introducing expertise of both use and monitoring, the manufacturer was able to optimize the pre-treatment process in terms of the quality of pre-treatment but also that of reuse of the spent acid. This way it could consolidate its relation with its client and its position in the market.

For this to happen, the supplier/manufacturer is required to have extensive knowledge of the production, use and regeneration of its chemical. A second condition is that the customer/user is open for long-term commitments, including shifting responsibilities.

3 LEAN INNOVATION



Innovation is generally regarded as a business necessity, yet not necessarily as an easy process. It is often costly, time consuming and results are uncertain beforehand – impeding any innovation process. Specific for innovation related to chemical use, one may find that this process is at risk when:

a) The chemical use is considered non-core. This issue relates mainly to the user of a chemical.
b) There is a lack of knowledge about the exact behavior and functioning of the used chemical. This issue relates mainly to the user of a chemical.
c) There is a lack of knowledge about the use and purpose of the used chemical. This issue relates mainly to the manufacturer of a chemical.
d) The company tends to have a tunnel vision on its existing processes. This issue relates to both users and manufacturers.
e) There are financial challenges: investments are considered too large, or pay-back times too long. This issue relates to both users and manufacturers.

In each of these cases, it may prove to require relatively high amounts of resources to assure a desired outcome when trying to fulfill the innovation process as a stand-alone company.

Applying Take Back Chemicals, lean innovation can be reached. Lean innovation refers to innovation with the least amount of resources possible. By sharing and combining knowledge, assets or financial capacity, the innovation process is speeded up, results are improved and actual implementation is made possible. Also, as the focus of both involved parties now is on the result rather than the volumes (due to dematerialization in the business model), each of these parties can feel free to suggest new processing methods or even new chemicals.

For example, in one case the combined knowledge of the user and the manufacturer has led to new insights and fruitful directions in a substitution issue. In another case, the use of another's existing, under-utilized assets, has proven to be a way to cut costs. In a third example, the allocation of investment was shifted to another party for whom the investment is acceptable – obviously accounting for all related production costs, financial costs and profits between the involved partners.
This lean innovation obviously benefits the chemical user in terms of process optimization, but also has its benefits for the manufacturer, in terms of servicing and enforced client knowledge and relation.

The setting in which this takes place is crucial. Trust is of high importance and a key pre-requisite for any fruitful collaboration: inherent to any Take Back Chemicals project, the user and manufacturer do not invent everything by themselves, but rather do so collaboratively (minding intellectual property throughout the project is important). This applies directly from the start-up and explorative phase of a Take Back Chemicals project. And while trust and collaboration remain key throughout the entire process, contractual agreements and pricing (i.e. €/result rather than €/volume) can be introduced in a later stage to create a continuous innovation pressure, stimulating the supplier to keep innovating.
[The kind of innovation the concept applies to is open. The induced innovation can be either incremental, referring to operational excellence (e.g. reduced consumption or quality improvement), or rather radical (e.g. answering to substitution issues).

"THE CLOSE COLLABORATION WITH OUR SUPPLIER HAS OPENED OUR EYES TO NEW WAYS OF INNOVATING OUR PRODUCTION PROCESS, AND SO HAS LED TO THE SHARED CREATION OF NEW, FEASIBLE IDEAS."

Frits Wijsmuller
Sourcing Manager, Vlisco

4 DEBOTTLENECKING

A plant's environmental impact is limited by its environmental permit and other legislation. Such existing limits can form a bottleneck when planning to increase or change production. Moreover, for every new activity or permit renewal, companies are faced with continuously intensifying legislation while governments are aiming to push companies to pollute less. To retain a position in the EU, companies are driven to create more value within existing limits.

Applying Take Back Chemicals, overall environmental impact is reduced due to process optimization (also see *Operational excellence and Lean Innovation*). Cases show significant operational cost reductions with positive environmental impact, including savings of energy, water, and material and the elimination of (hazardous) waste and the use of hazardous materials (Substances of Very High Concern). These waste reductions are to be seen from both an environmental and a legal perspective, as the legal status of material has significant consequences for handling. Different legal solutions are seen in the reviewed cases, including the use of *by-product* and *end-of-waste* status (article 5 and 6 of the waste framework directive) but also avoiding waste. The latter is exemplified by reasoning of the Dutch government adopted in one of the cases that, in a controlled mechanism such as Take Back Chemicals, spent chemicals that are taken back do not necessarily pass through the waste stage. In this case, the material is regarded as down-stream use[3] of the product throughout use, recovery and reuse (as is to be defined in its REACH dossier).
Such process optimizations can have a large impact on for example emissions to air, discharge to surface water or sewage, and obviously waste production itself. And while impacts are reduced, space within the environmental permit or enhanced license to operate is created to intensify or modify activities.

> **"BY VALORIZING ONE OF OUR SIDE STREAMS, WE HAVE SIGNIFICANTLY REDUCED THE IMPACT ON THE SITE'S WASTE WATER TREATMENT PLANT, BRINGING US FLEXIBILITY FOR ANY FUTURE ACTIVITY."**
>
> **Kees Biesheuvel**
> Technology Innovation Manager, DOW

[2] *Downstream use* is the use of chemicals under REACH and CLP. Examples of downstream users include formulators, who produce mixtures which are usually supplied further downstream, and end-users, who use substances or mixtures but do not supply them further downstream.

APPLICABILITY

The applicability of the Take Back Chemicals concept is defined by the type of chemical, type of process and type of industry. Examples of these are given in Table 1 at the end of this section.

TYPE OF CHEMICAL

The applicability of the Take Back Chemicals concept firstly relates to the use of chemicals. Two generic uses are distinguished:

> Use with consumption (e.g. feedstock, fuels)
> Use without consumption (e.g. catalyst, detergent, solvent)

As Take Back Chemicals is about retaining ownership and reuse or recovery of chemicals, the concept works best for chemicals which are used without being consumed (or irreversibly modified). This means the spent chemical should be able to be separated on-site, be sent to purification and be reused.
Secondly, the concept works best for chemicals with a relatively high value.
As the spent chemical is reused or recovered, requiring certain processing, this value is defined by:

a) the value of virgin production,
b) the degree of contamination in the spent chemical and
c) the cost of purification.

Thirdly, the chemical needs to come in not too small volumes to attain a minimum absolute value. On the other hand, larger volumes tend to be considered part of core business (e.g. feed of the process rather than auxiliary chemicals) and are therefore a less obvious (first) option. Certainly in the case of a first exploration, the concept works best for chemicals with a, relative to the company, medium volume. Successful cases have reported volumes of 200 to 50,000 ton/a.

TYPE OF PROCESS

The processes most suitable for applying the Take Back Chemical concept for chemical users are those in the periphery of the user's core process. The chemical use should be necessary for the proper execution of the core activities, but not entails its focus and added value. Such processes include the cleaning of tanks, purification, dissolving, catalysis, dewatering, etc.
At the same time, the manufacturing of the chemical, including downstream use to a certain extent, generally is considered the core process of the manufacturer. Hence, the manufacturer has great knowledge of its chemical, and potential interest to extend its servicing around its production.

TYPE OF INDUSTRY

The suitability of the lease-based models to the European (chemical) industry has previously been researched on a wider level [9] and specifically for *Take Back Chemicals* in the Benelux [7,8]. It is applicable to generally all manufacturing subsectors, including the manufacturing of food and beverages, machinery and equipment, textiles, basic pharmaceutical products and pharmaceutical preparations, rubber and plastic products, basic metals, motor vehicles and electronic and optical products.

Companies are required to have a certain minimum size. Earlier studies [7,8] found that companies with less than 20 employees are less suitable for implementing the model due to organizational lay-out of the company (e.g. allocation of time of employees and assets can be an issue for smaller firms).

Finally, companies need to have extensive knowledge about their process and possibly that of their partner, i.e. they should be able to work on specifications. This requires (chemical) expertise, measuring equipment and resources to execute pilots.

Table 1: Examples of industries, processes and chemicals to which Take Back Chemicals may apply, sorted to applicable industrial processes. This table is based on underlying and earlier research [8,9].

INDUSTRIAL PROCESS	INDUSTRIAL SECTORS	SUBSTANCES	UNIT OF PAYMENT
Purification of chemicals (incl. drying)	petrochemical industry, pharmaceutical industry, cosmetic industry, …	(a)polar solvents, acids, organic and inorganic compounds, …	€/kg treated product or monomer, €/unit removed compound
Wastewater treatment	Broad spectrum of industries	Organic and inorganic compounds	€/m^3 treated water €/unit removed compound
Cleaning of working areas and installations	Food industry, cosmetic industry, pharmaceutical industry, electronics industry, …	Detergents, (a)polar solvents, acids, …	€/m^2 cleaned surface
Surface treatment: Greasing/degreasing, powder coating, wet painting, galvanization, thermal zinc galvanization, electroplating	Automotive industry, metal industry, electronic & optical products, machinery and equipment manufacturer	(a)polar solvents, paints, abrasives, acids, lubricants	€/number of pieces €/m^2, €/kg
Pre- and post-treatment of articles	Textile industry, health care industry, workwear industry, …	Paints, fire retardant, antibacterial and water resistant products, solvents, …	€/m^2 treated textile, €/unit treated product

RECOMMENDATIONS

This paper summarizes the economic gains from the concept of Take Back Chemicals. We show that progress is booked where efforts are made. In addition to disclosing *Take Back Chemicals'* business potential, this whitepaper therefore concludes with an advice to both private and (semi) public organizations concerning the efforts needed to foster and grow these developments.

BUSINESS/COMPANY INTERVENTION

Take Back Chemicals is a concrete, feasible approach for implementing circular economy in the existing European industry. It is a generic approach, as this study reveals applicability to a wide range of industries and reached business and environmental goals. Yet, final solutions will be tailor made. Guarantees or exclusions for applicability for plants - let alone sectors - can therefore not be given beforehand, and needs to be looked into case by case.
It is recommended for each company triggered by the given business goals to investigate the applicability of the concept to their situation and the feasibility of the envisioned goals. Several tools to do so have been made available [8,9] and more is to be expected published by the Ministry of Economic Affairs in the Netherlands later this year.

INDUSTRY SECTOR INTERVENTION

Growth in the application of Take Back Chemicals model in the chemical and manufacturing industry is possible by stimulating and promoting pilot- (feasibility) and demonstration (implementation) projects at plant level and with the full support of the upper management of the involved organizations. Industry sectors are recommended to assess the relevance of the concept for their sector, and, if deemed relevant, to promote the topic by active conversation with at least upper management of key organizations and by stimulating pilot/demonstration projects.

(SEMI) PUBLIC-SECTOR INTERVENTION

The role of (semi)public actors is crucial in enlarging the momentum of the Take Back Chemicals concept. Several supporting actions are envisioned, such as:

- Providing training and information
- Promotion of research, scientific publications and academic support
- Participation at international events
- Support to pilot/demonstration projects
- Support to spreading the successes of Take Back Chemicals (environmental and economic benefits) to the manufacturers and users of chemicals

Furthermore, the (semi)public actors are strongly advised to stimulate and facilitate circular economy in general or Take Back Chemicals specifically through clear a policy and legal framework. While the environmental and economic benefits of Take Back Chemicals seem to be beyond dispute, the legal implications need further thorough consideration. Whatever the actions taken by industry or (semi)public actors, businesses

should be able to rely on consistent regional, national and international policy, showing a coherent and clear ambition translated in clear and applicable legislation.

Two main routes are prospected: clarity on the existing 'End of Waste' and 'Byproduct' status as defined in the waste framework directive 2008/98/EC, and development of the possibilities of 'Avoiding waste': material not passing through the waste stage at all. The legal framework that follows from this is to be checked on national and international (EU or regional) level, to not impede national or cross-border business. Several instruments are at place to test and discuss such legal framework in an international context (e.g. the North Sea Resources Roundabout).

DEFINING CRITERIA FOR 'END OF WASTE' OR 'AVOIDING WASTE'

To ensure that a material stream receives an end-of-waste status or keeps its original status as resource (avoiding waste), specific criteria should be defined to support the conditions laid down in the articles 5 and 6 of the waste framework directive 2008/98/EC. The same criteria can be used to support the avoidance of waste.

These criteria should be defined together with the inspection, the permitting and policy authorities and the relevant industry sector. The criteria can be included in the permits to facilitate the work of the inspection (enforcement authority) and reduce situations in which the inspection has to make its own interpretation. Bringing a certain level of confidentiality in the preparation of the permit would be needed to protect the involved companies (e.g. sensitive information on the supply chain cannot be made public).

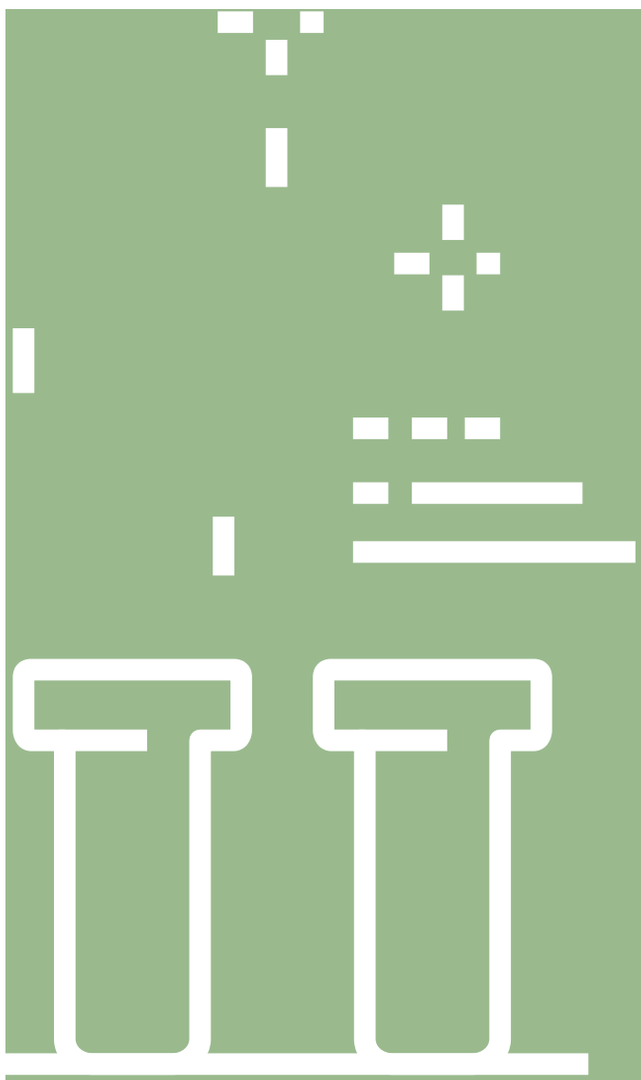
Once the criteria are defined and agreed at the industry sector level, they should be shared with other member state competent authorities in order to create an understanding and clear expectations for certain material flows. This approach would be needed especially for the flows that are not currently being considered at the community level. Again, protecting the confidentiality of the businesses involved would be necessary. Launching pilot projects to test the above recommendation would help to better understand the methodology and the best practices.

OTHER LEGAL MEASURES FOSTERING 'AVOIDING WASTE'

A way to deal with 'avoiding waste' is seen in the Dutch context, in the use of legal views ('rechtsoordelen'). A legal view is the view of the Dutch national government on a specific case. Some cases have started the process to attain a legal view on 'avoiding waste': the legal view describes the case where the Take Back Chemicals model is used to frame the conditions for a chemical to not necessarily pass through the waste stage when taken back after use for recovery, i.e. 'avoiding waste'. The publication of such case specific legal views can provide further guidance and potentially more certainty in this matter, fundamental for any entrepreneurship.
This initiative should be taken further: involving more governmental organizations, and creating an even more powerful instrument, applicable in a more generic form, e.g. incorporation in a national waste management plan, or material specific rather than case specific regulations by the Ministry ('ministeriële regelingen'). Regional organizations are advised to take notice of this development, and to make sure to be aware of recent perspectives when companies are seeking for circular opportunities (e.g. in permits).

LITERATURE

1. TNO; 2013; *Kansen voor de circulaire economie in Nederland*
2. Ellen MacArthur Fountation; 2012; *Towards the circular economy*
3. Ellen MacArthur Fountation; 2015; *Growth within – A circular economy vision for a competitive Europe*
4. Jonker, J.; Stegeman, H.; Faber, N.; 2016; *De Circulaire Economie - Achtergronden, ontwikkelingen en de zoektocht naar aansluitende business modellen*
5. European Commission; 2016; *A European agenda for the collaborative economy*; Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions
6. Vander Velpen, B.P.A.; Hoppenbrouwers, M.; 2012; *Implementing service-based chemical supply relationship – Chemical Leasing – potential in EU; Green Chemistry*; Wiley
7. RVO (AgentschapNL); 2014; *Take Back Chemcials in Nederland: bewustmaking en identificatie*
8. MIP Vlaanderen; 2014; *Take Back Chemicals: Upgraden van een traditioneel verkoopsmodel van chemieproducten naar een lease-sale model*
9. United Nations Development Organization (UNIDO); 2011; *Chemical leasing: a global success story - Innovative business approaches for sound and efficient chemicals management*
10. Port of Rotterdam, ISPT, VNCI; 2015; *Chemical Industry: Case studies on the application of the waste legislations in the Netherlands and neighboring countries; Regions for Resource*



For information about this paper
please feel free to contact:
Bart Vander Velpen
+31 88 3486756
bart.vander.velpen@rhdhv.com