

Ajankohtaista kiertotaloudesta ja jäteasioista

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SISÄLTÖ

1. Valmisteilla oleva lainsäädäntö
 - standardeista lyhyesti
2. Teknologiateollisuuden kiertotalousalusta
 - yritysesimerkkejä
3. Kiertotalouden ideointia meriteollisuudessa
 - palvelumallit, modulaarisuus ja uudelleen valmistus
4. Materiaalitehokkuuskatselmustoiminta (Motiva)

Teknologiateollisuuden kiertotaloustiimin yhteystiedot

1. Ajankohtaista kiertotaloudesta EU:ssa

- Komission kiertotalouspaketti 2.12.2015: tiedonanto, toimintaohjelma vuoteen 2018, jätedirektiiviesitykset, Ekodesign-työohjelma ja Waste to energy tulossa
- Tavoitteena resurssien arvon säilyminen mahdollisimman pitkään ja jätteen synnyn minimointi. Yhdistyy tavoitteeseen kestävästä taloudesta, vähähiilisydestä, resurssitehokkuudesta ja kilpailukyvästä.
- Kilpailukykytavoite: ehkäistään resurssiniukkuutta, hintojen epävakautta, luodaan uusia liiketoimintamahdollisuuksia ja innovatiivisempia tapoja tuottaa ja kuluttaa.
- Osa-alueet: 1. tuotanto ja tuotesuunnittelu, 2. kulutus, 3. Jätehuolto, 4. kierrätysmateriaalien markkinat ja 5. sektorikohtaiset toimet

Tuotanto ja tuotesuunnittelu

- Tavoitteena kestävämmät, korjattavat, uudelleen valmistettavat ja päivitettävät tuotteet
- Tuotesuunnittelu säästää arvokkaita resursseja ja mahdollistaa muunneltavuuden ja purkamisen, ml. arvokkaiden komponenttien talteenoton
- Välineenä ekosuunnitteludirektiivi ja tuotelainsäädäntö
- Tuottajavastuu organisoitava niin, että kustannuksissa huomioitu elinkaaren loppuvaihe
- Parhaiden käytäntöjen levittäminen, mm. Bref-asiakirjat, resurssitehokkuuden osaamiskeskus, EMASin ”revitalisointi”, ETV (ympäristöteknologian varmennusjärjestelmä) käyttöönotto
- Teollisten symbioosien edistäminen, jätelainsäädännön helpotukset

Kulutus

- Ympäristömerkintäjärjestelmien tehokkuus
- Ohjeistusta ympäristöväittämiin
- PEF-pilotoinnin jatko (Product Environment footprint)
- Julkiset hankinnat

Jätehuolto

- Yhdyskuntajätteen ja pakkausjätteen tavoitteet, kaatopaikkajätteen vähentäminen
- Määritelmien ja laskentamenetelmien yksinkertaistaminen
 - Uusi käsite final recycling
 - Backfilling
 - Laskennassa huomioon uusiokäyttö
- Nykyisen lainsäädön tehokas toimeenpano, ml. Jätteiden siirrot
- Jätteiden energiakäytön edistäminen

EU calls for compliant ship recyclers

ENDS Europe, 21st December 2015:

- Any facility wanting to scrap ships flying the flag of an EU member state will need to submit their application. The Commission plans to finalise the list by the end of 2016 in line with the requirements of the 2013 Ship Recycling Regulation.
- The regulation sets detailed rules on how ships should be recycled, including a requirement to list all hazardous substances. The Commission is also expected to publish guidelines on requirements for ship recyclers and for the independent verifiers certifying yards 'compliance with the EU rules.

Kierrätysmateriaalien markkinat

- Ehdotuksia milloin luokittelu jätteeksi päättyy (end of waste). Suomessa aloitettu selvityshanke.
- Valmistellaan EU-laajuisia laatustandardeja (mm. muovit)
- Tehdään analyysi kemikaali-, tuote- ja jätelainsäädännön rajapinnoista
- Veden uudelleen käyttöön sääntelyä (kastelu, pohjaveden muodostus)

Sektorikohtaiset toimet

- Laaditaan muovien käytön strategia
- Elintarvikejätteelle erityistoimia
- Kriittiset raaka-aineet: Kohdennetut ohjeet rakennusten purkualueille, parhaat käytännöt leviämään
- Biomassa ja bioenergia: biomassan kaskadikäyttö, biotalousstrategian päivitys

Johtopäätöksiä meriteollisuuden kannalta

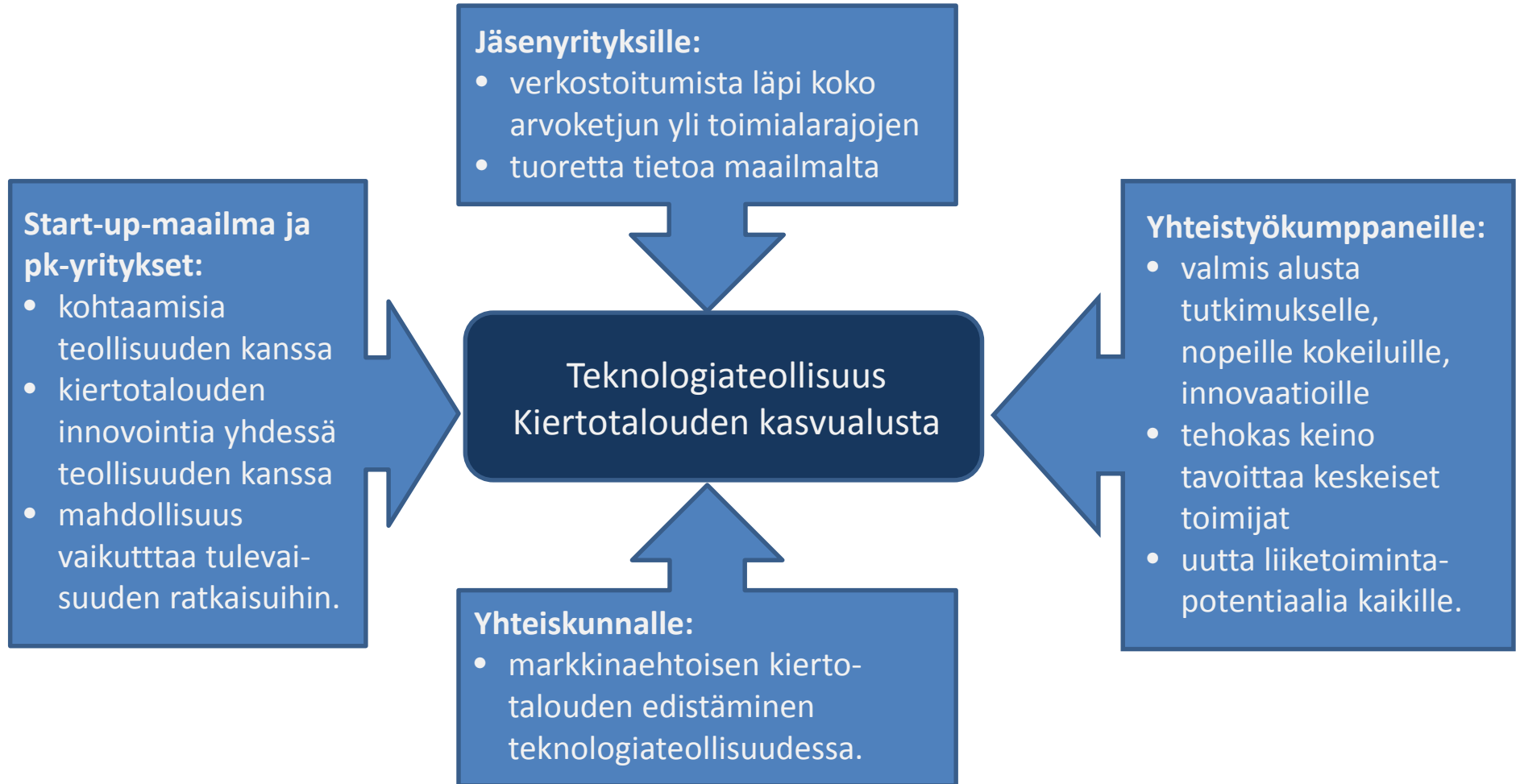
- Teollisuuden jätteet eivät ”scoupissa”. Materiaalien uusiokäyttöä halutaan edistää tuotepolitiikalla ja edistämistoiminnoilla.
- Teolliset symbioosit mahdollisuus materiaalivirtojen hyödyntämisessä, myös rahoitusta Horizon –ohjelman alla. Käytössä myös materiaalikatselmus.
- Kiertotalouden/kestävyyden arvoketjuissa ja brandaamisessa mahdollisuuksia, joihin myös rahoitusta. KASVAVAT MARKKINAT
- Kielletyt aineet esillä kemikaalipolitiikassa ja jäteasioissa.
 - Opas vaarallisten jätteiden käsittelyyn
 - Opas POP-yhdisteiden käsittelyyn (palonestoaineet)
- Paketti hyväksytty kesällä 2016 – jätelakeihin muutoksia seuraavina vuosina.
- Teknologiateollisuudella uusi lainsäädäntöseurantataulukko

Kierrätyksen standardit

- The European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CEN-ELEC) have agreed to the Commission's request that they develop material standards for eco-design by March 2019. The standards should cover:
 - Product life span
 - Re-use of components or recycling of material at end of life
 - Use of re-used components and/or recycled materials in products
 - Upgrade-ability
 - Ability to extract important components for reuse, repair, recycling and treatment
 - Calculation of recycled and re-used content in products

- The mandate from the Commission states that the standards will contribute to the implementation of the circular economy action plan and make it easier to consider material efficiency requirements in future product regulations under the Ecodesign Directive.
- In its circular economy action plan, the Commission is committed in developing future standards on product durability, reparability and recyclability as part of the eco-design work plan for 2015-2017.
- Setting out the criteria for the requested standards, the Commission said they should “provide reliable, accurate and reproducible measurement procedures, which are not prohibitively expensive or imply lengthy tests“. The Commission added that the standards could have a wider impact than products subject to eco-design requirements.

2. Teknolomiteollisuuden kiertotalouden kasvualusta



Grouping of the examples: The Circular Economy Framework

1	Circular supply-chain	Using renewable, recyclable or biodegradable materials and energy. Planning consecutive lifecycles. Using alternative materials.
2	Reduce	Reducing material and energy consumption throughout the lifecycle.
3a	Prolong – Design phase	Designing for durability, repairability etc. Modular designs.
3b	Prolong – Using the product	Service and maintenance of the product, availability of spare parts, modularity, extended warranty.
3c	Prolong – Product life-extension	Keeping things actively alive and relevant (modernization), capturing the value products hold, improving the products through repairing, remanufacturing, upgrading, remarketing and reusing. Re-X.
4	Recovery & recycling	Capturing and reusing valuable raw materials from waste, recycling and repurposing materials, waste management, zero-waste policies etc.
5	Sharing platform	Making use of idle goods, renting, sharing, swapping, collaborative consumption, cloud computing etc.
6	Product as a Service	Leasing-based business models, Pay-per-use, Service-based models.

Circular Economy focus areas in the case companies

	ABB	ABLOY	AGCO POWER	KONE-CRANES	NOKIA	SSAB	SUUNTO	UPONOR	VALTRA	WÄRTSILÄ
1. Circular Supply Chain	●	●	●	●	●	● C6	●●	●	●	●
2. Reduce	● C1	●	●●	●●	● C5	●	●●	●	●	●
3a. Prolong – Design Phase	●	●	●	●	●	●	● C7	●	●	●
3b. Prolong – Usage Phase	●	●	●	● C4	●	●	●	●	●	● C9
3c. Prolong – EOL Phase	●	●	● C3	●	●	●	●	●	● C8	●
4. Recovery & Recycling	●	● C2	●	●	●	●	●	●	●	●
5. Sharing Platform	●	●	●	●	●	●	●	●	●	●
6. Product as a Service	●	●	●	●●	●	●	●	●	●	●

ABB: Design for durability



At a conglomerate like ABB, the product assortment is extremely wide. Furthermore, various product lines are very different when it comes to the expected product lifecycles: remarkable part of products may be in use up to 40 years, for other product lines the lifecycle is considerably shorter. From Circular Economy's point of view it is important to understand the impact of expected product lifecycle on the selection of focus areas: For products with long expected lifecycle, the focus should be on the product design and manufacturing decisions, and on the use phase.

ABB energy efficient and energy saving products like motors and drives save energy and keep CO2 emissions out of our Earth's atmosphere throughout the lifecycle. It is estimated that motors consume 28 % of the world's electricity. The ABB's drives saved the globe in 2014, for example, energy consumption, which is equivalent to what 110 million households use in energy.

Service and maintenance are important elements of durability. ABB provides maintenance for products that have been in use up to 30 years. In general, lifecycles for all ABB products is long – close to 25 years for almost all the product.

Product development cycles are long especially for many products. Ecodesign can change materials used, but the Laws of Physics have not changed, so it is difficult to do any fundamental changes in their design. However, in other product lines, development work is active: For instance, ABB develops supercapacitors, has adopted permanent magnets in motors and generators, and is combining inverters and motors to the same unit.

Modularity has always been an essential part of ABB's product design. From durability point of view, modularity gives the customer option to choose an optimal configuration for the product.

In the future, ABB may have to consider whether lifespans of the products being produced are optimal. If the regulation changes, the company may have to change their design philosophy as some products may be "too good", i.e. last longer than the optimal lifecycle from the Circular Economy point of view.

ABB products are designed for durability, service and maintenance support to the long product lifecycle.

ABLOY: Zero landfill – what next?



Abloy is one of the leading manufacturers of locks and locking systems. The lock manufacturer has a mission to remove waste in their productions. This target is also in line with the company's LEAN philosophy, where the ultimate goal is to provide value to the customer through a perfect value creation process that has zero waste. The strict principle is to follow the waste hierarchy such way, that nothing ends up to landfill. If material is not suitable for recycling, it will be used as energy.

The manufacturing process of Abloy generates waste. However, thanks to the Taguchi and other methods used by the company, the process generates less scrap, and currently Abloy is optimizing also the amount of coating materials used in the process. The chemicals used in the process are changed in a planned manner, taking into consideration the strict quality requirements but also the environmental need of extending the life time of the chemicals. Certain amount of organic solvents and washing liquids are used in productions in a controlled way. Abloy is using final disposal solutions provided by Ekokem Ltd for the handling of hazardous waste, including the clear waste oil for purification into renewed lubricants.

The rinse water from electrochemical plating process is reused to minimize the amount of waste water.

Brass is widely used in locks. Locks manufactured using turning process means that material ends up waste chips. This brass scrap represents the biggest fraction in Abloy's total waste by weight. From recycling point of view, it is important to keep brass waste clean. Abloy sells the brass chips to a recycling operator.

In the end of life phase Abloy's customers can return the products to authorized lock smith shops. The products do not end up to Abloy directly, but the material is recycled by specialized recycling operators back to the raw material. The industry is meeting a challenge to further improve the parts recycling taken in consideration the extremely high security requirements of the products.

Abloy is a member of various producer association to meet the recycling requirements set by the authorities.

AGCO Power: 50 years of remanufacturing



AGCO Power has made diesel engines at its plant in Linnavuori in the town of Nokia for nearly 70 years. The company supplies the engines to many of the world's leading manufacturers of tractors, other farm machinery and other offroad machines, such as harvesters. Remanufacturing is in the DNA of AGCO Power: The factory has refurbished and modernized used engines for close to 50 years. After the Second World War, Finland was suffering from shortage of basically everything. Also in machine building one had to pay special attention to the durability and repairability of machines. It was essential that the engines could be repaired in very demanding conditions in the field, and without long breaks in the use.

Modularity and standardization have been key design principles at AGCO Power for decades. Common platforms thinking, with similar basic designs and shared parts reduce waste in the production and make the aftersales operations more efficient. In the 1990's the company made a decision that the majority of parts will be common to all engines.

The value proposition for choosing a remanufactured engine is clear. The customer can minimize the downtime due to the service, and get a remanufactured engine with the same guarantee as a new engine – at a lower price than buying a new engine. From AGCO Power's point of view, one benefit is getting used engines back from the market, instead of them ending up in the hands of competitors or resellers. Very high percentage of engines sold return to the manufacturer. For AGCO Power's resellers, remanufactured engine offers a low-risk option to provide their own customers with a fast and low-risk option to a traditional service and maintenance work.

AGCO Power's remanufacturing business covers currently mainly the European market. However, through OEM customers, products spread all around the world. In other markets, high transportation costs easily eat up the benefits of remanufacturing. Long distances also have a negative impact on customers' willingness to return their old engine to the factory. In some markets, trade policy and protectionism make remanufacturing a less attractive alternative.

Thanks to continuous product development, a remanufactured engine is better than the original one. Typically up to 15 – 20 % of the components have been improved during the time engine has been used. Many components, such as pistons / liners, bearing, gaskets, control units, sensors, cabling, are replaced with brand new ones.

As with all recycled materials, it is very important that all engines coming back from the field go through a very detailed inspection. Majority of engines coming back from the field are in a reasonably good shape. There are certain criteria for approving the engines for the rema process: The engine has to be in one piece, all parts have to be present, the engine can be broken but it needs to be in such a condition that it can be repaired.

Currently AGCO Power remanufactures approximately 1,000 engines per year and the business is growing. In the past decade, the volume of remanufactured units has doubled and the revenue tripled.

The company believes that there is still room for growth in the remanufacturing business.

Konecranes optimises with analytics

KONECRANES®

Konecranes is a world-leading provider of lifting equipment and services, serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals. Konecranes was formed in April 1994, when KONE Corporation sold the operations of its crane division.

Lifecycle Care represents Konecranes' comprehensive and systematic approach to maintenance of lifting equipment. The objective of the concept is to maximize the productivity of uptime and to minimize the cost of downtime. The company provides specialized maintenance services and spare parts for all types of industrial cranes, hoists, machine tools and port equipment.

In order to reach this goal, Konecranes has invested in the Industrial Internet of Things (IIoT) and Big data technologies, converting collected data into information, and using it for predictive maintenance. This solution provides data of the actual usage of Konecranes products. Today, there is enough data available for technology vendors like Konecranes to be able to analyse and predict, how the product is performing. Konecranes **TRUCONNECT® Remote Monitoring** provides visibility to crane usage and operating data, helping with decisions about maintenance investments and productivity. The data is utilized to estimate the remaining theoretical design working period (DWP) and service life of selected components.

Data reporting provided by the remote monitoring capability helps to optimize crane usage. Emergency stops, overloads and other safety issues are captured and reported. A variety of operating data regarding equipment usage is compiled periodically at the **Konecranes Remote Data Center**. Where Remote Monitoring is in place, a focused selection of critical status data, such as overloads and overheats, can be transmitted soon after the event occurs so the customer can take prompt action as necessary. In summary, remote monitoring provides detailed diagnostics of the usage and current condition of critical parts of the system (e.g. **RopeQ** and **RailQ** diagnostics services). This allows Konecranes to optimise their service operations so that a components are changed only when it is necessary: maintenance decisions are based on data, not calendar. The role of diagnostics is essential in this model.

In order to support this approach, Konecranes has develop special capabilities. Konecranes has own production for spare parts, both for their own and other manufacturers' equipment, using a reverse engineering process for obsolete crane parts. Additionally, Konecranes offers also **Rebuilt Parts**: urgent repairs of major parts or components can often be accomplished by rebuilding or refurbishing them in less time than it would take to order a new part or component.

The goal of Konecranes service and maintenance business is to extend the product lifecycle, and to help the customer to find an optimal equipment for their needs and to use this equipment in an optimal way. Remote monitoring and extensive analytics are key enablers of this.

At Konecranes, the Circular Economy has been business-as-usual already for a long time.

Nokia saves your energy



Most people recognise Nokia best for their world dominance in mobile phones in the past. Today, however, Nokia is a very different company. They are a market leader in the fields of network infrastructure and location-based technologies. Nokia's mobile devices business was sold to Microsoft in a transaction which was completed in April 2014.

A transformation of this magnitude in any enterprise has obviously also major impact on the focus of the company when it comes to topics such as product policy and the Circular Economy. Instead of having hundreds of millions of handset customers, the Finnish telecommunications company can now put all their focus on a few hundred business-to-business customers – e.g. telecom operators. Also the product portfolio looks today very different than a few years back: instead of having numerous handset products with reasonably short product lifecycle, the company now designs and manufactures investment goods with much longer expected lifespan.

But even the telecom network infrastructure business is going through major changes as the key technologies evolve. Modularity increases, and each module contains more and more functionality in a smaller and smaller space. The physical size of network elements is important for the telecom operators, as they have to pay rent for the device space (e.g. base stations). Smaller physical size means naturally also smaller consumption of materials. Another key trend is the increasing importance of software in the systems, which also has an impact on the hardware requirements. In general, software upgrades play a big role in Nokia's business. Approximately half of the company's revenue comes from services.

Another important driver helping to reduce material consumption is the current trend towards cloud computing. As bigger and bigger part of processing takes place in the cloud, i.e. in centralised computer centers, devices at the edge of the network do not need as much capacity and intelligence as in the past. However, this evolution has raised another question: how energy efficient are the computer centers powering the cloud computing solutions? Interestingly enough, the global energy consumption of the ICT industry is estimated to be almost as big as that of airline traffic.

When looking at telecom infrastructure from total cost of ownership (TCO) point of view, the importance of energy consumption becomes evident: Up to 80 percent of energy consumption of telecom network infrastructure products is generated during the use of the devices. The majority of energy consumption in Nokia's products is related to the various radio technologies. Albeit energy consumption in the middle-of-life phase is not directly a cost element for Nokia itself, it is something that is essential for Nokia's customers and therefore also a high priority for Nokia, too. The Finnish telecommunications giant is actively looking for novel ways to reduce energy consumption during the usage, for instance in joint-research projects with universities.

In the future, the importance of reducing energy consumption becomes even more important, as the data volumes are estimated to become approximately thousand times bigger than today.

The goal is to offer this increase in network performance without increasing the energy consumption.

SSAB: circular economy made of steel



SSAB is a leading producer on the global market for Advanced High Strength Steels (AHSS) and Quenched & Tempered Steels (Q&T), strip, plate and tubular products, as well as construction solutions. SSAB's steels help to make end products lighter and increase their strength and lifespan. The production plants are in Sweden, Finland and the US, with an annual capacity of 8.8 million tonnes.

The steel industry has always been living in a circular economy – even though it was called by other names. The very slogan of SSAB is in the core of the Circular Economy thinking: “Stronger, lighter and more sustainable world”. The concept of circular supply-chain is built into the process of steel production, as 20 – 100 % of the material used in production is recycled steel.

Industrial symbiosis is also a natural way of thinking in the steel industry. SSAB has evaluated, together with other members of the steel producing ecosystem, what kind of by-products are generated in each others' production, and if somebody else's waste could be used as raw material in some other place. However, in order this to be also economically viable, the by-product should be pretty much ready for use as such, and also the need for transportation should be reasonably limited.

Using secondary material requires strict quality controls and inspections. It is essential to know what you are buying when dealing with recycled materials. For instance, one has to pay special attention to radiation as there have been cases in the industry when radioactive material has entered the production process and caused major problems and production stoppages.

From the Circular Economy perspective, the steel industry in Finland has one special challenge: Practically all raw material is imported, and all finished products are exported. But this is something that SSAB and its predecessors have learned to live with. One just needs to look at things through a wider lens.

Wärtsilä: Conditions Based Maintenance keeps the engines going



Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximizes the environmental and economic performance of the vessels and power plants of its customers. Wärtsilä was established in 1834.

Increasingly, Power Plant and Ship Power customers focus their attention on equipment performance and predictive maintenance solutions as a way to optimise the availability and productivity of installations. With Wärtsilä's Condition Monitoring / Condition Based Maintenance (CM/CBM) services customers can fine-tune equipment operations parameters, taking into account all factors which can affect the lifecycle performance. CM/CBM also makes it possible to identify trends and changes in operating parameters well before they might compromise the operational availability of the installation – thus maintenance is performed only when needed and this optimizes the productivity. Behind Wärtsilä's CM/CBM services are years of experience coupled with the latest in diagnosing and analysing software and communications technology.

The analytics behind Wärtsilä's Condition Monitoring / Condition Based Maintenance services generates also valuable input to the product development process. These systems can already today collect and analyse numerous parameters (pressure, temperature etc.) from the systems, and the number of traceable parameters continues to increase.

As another way to prolong the lifecycle of their products and solutions, Wärtsilä provides also refitted engines. Sustainability can also be interpreted as the ability of equipment to reliably deliver performances required by design or regulations. As regulations change with time, fuel flexibility and engine upgrades will always be necessary to keep equipment up to date with legislation. There retrofits are made to improve both economic and environmental performance, as well as the safety and reliability of systems, throughout their life cycle. Modernization of engines can improve the performance of existing power plants, and help the customers to meet the new, more strict regulatory and performance requirements. Due to subsidies, customers often keep the power plants in production as long as technically possible.

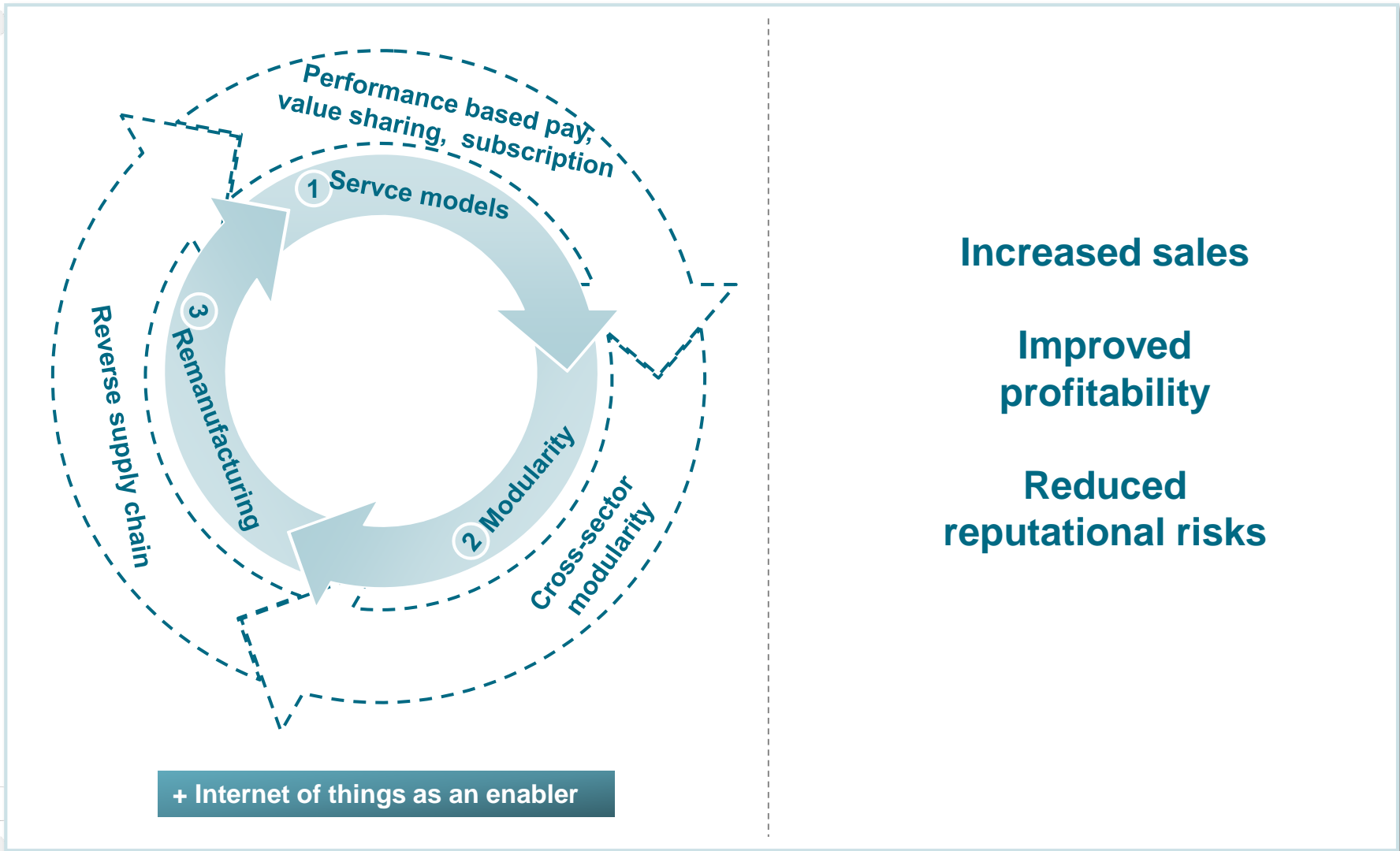
Wärtsilä is also a leading supplier of flexible power plants for the decentralised power generation market. One of the strenghts of Wärtsilä is the ability offer a modular approach where capacity can be added in smaller steps as the demand for capacity increases. This way a power plant can operate all the time close to the optimal level. Furthermore, also maintenance is easier to do unit by unit.

Since Wärtsilä's products have such a long operational life, identifying the life cycle impacts of the products is essential to understand their total environmental impact. Based on the results of life cycle assessments, the majority of the environmental impacts of a diesel engine arise during the operation of the engine: from exhaust emissions during engine operation, and from the fuel supply chain relating to its operations. Wärtsilä manages the life cycle of its products, among other things, through product desing, optimising maintenance and repair during the products' operational lifetime, and by training and advising customers.

3. Kiertotalouden ideointia meriteollisuudessa

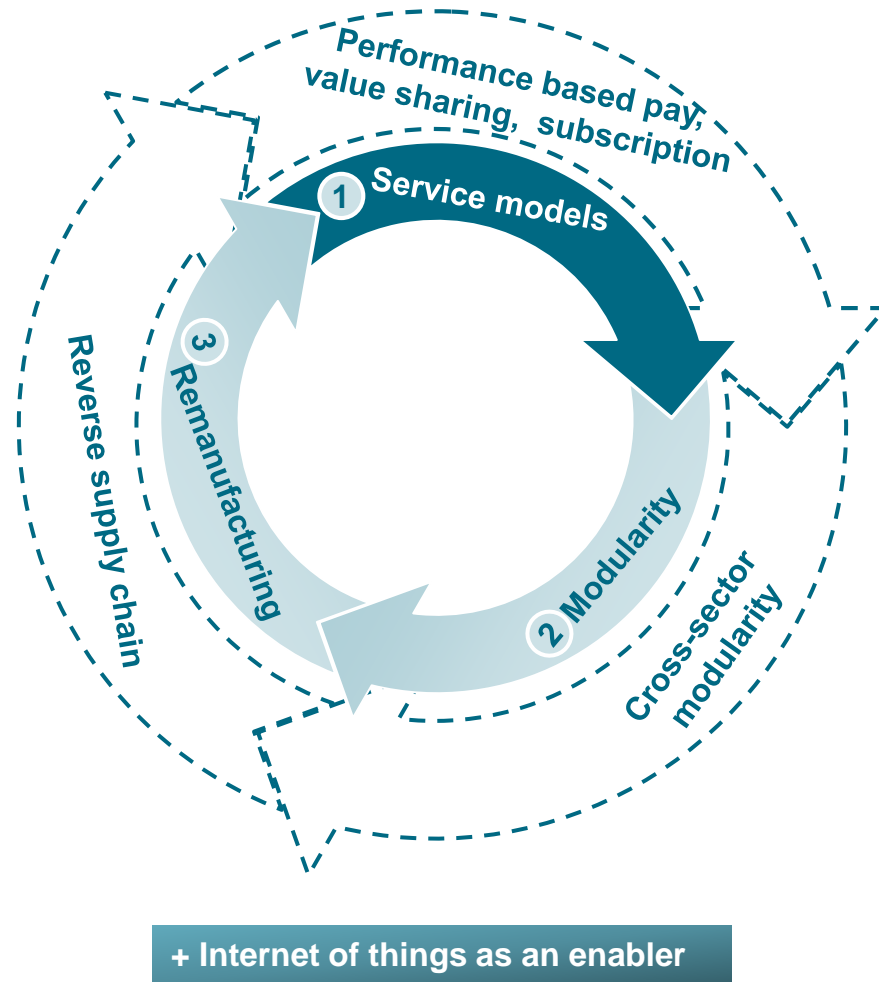
- Taustaa modulaarisuudelle ja uusille liiketoimintamalleille SITRAn Kiertotalouden mahdollisuudet Suomessa raportissa:
<http://www.sitra.fi/julkaisu/2014/kiertotalouden-mahdollisuudet-suomelle-0>
- Ja ravinnekierrätyksen osalta: <http://www.sitra.fi/julkaisu/2015/ravinteiden-kierron-taloudellinen-arvo-ja-mahdollisuudet-suomelle-0>
- Ellen MacArthur –säätiön julkaisu Intelligent assets – unlocking the circular economy potential:
http://www.ellenmacarthurfoundation.org/assets/downloads/publications/ElleMacArthurFoundation_Intelligent_Assets_080216.pdf
- Elinkaariajattelu ja –liiketoiminta Suomen meriteollisuudessa (Maria Elo ja Antti Saurama)

Circular economy in manufacturing – Service models, modularity and refurbishing create a self-enforcing, positive loop



1 Service leasing: maintenance included; after usage the machine is returned or sold forward in accordance with the producer

Leasing and other service model benefits include stronger customer relationships, improved customer performance and increased sales

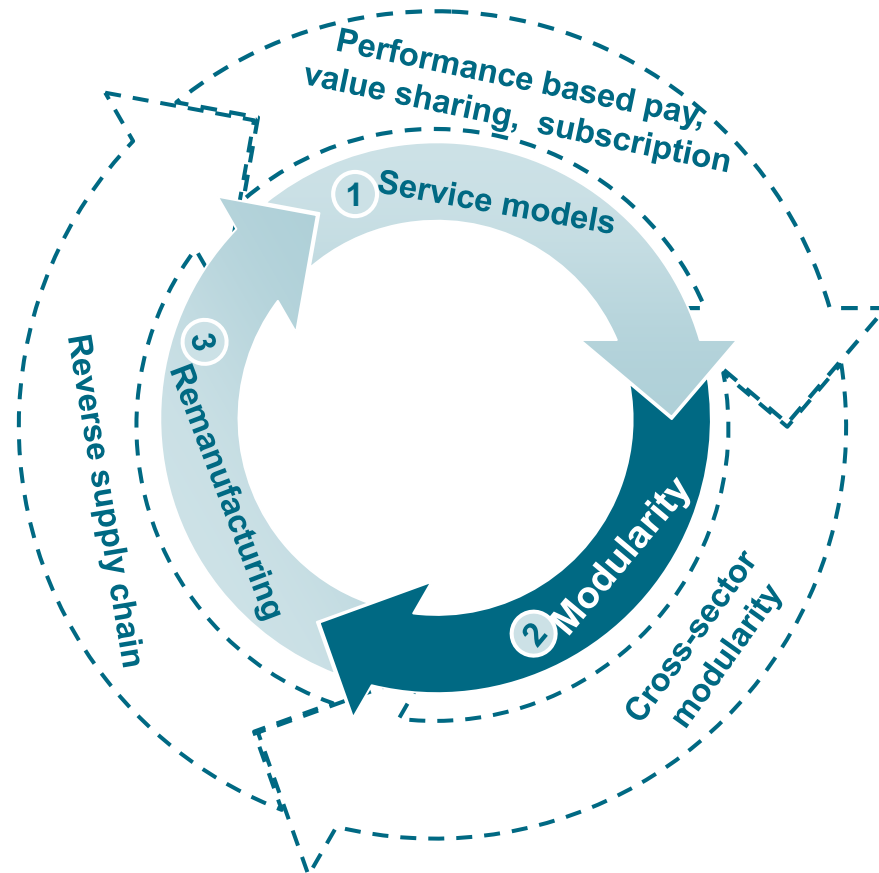


1. Leasing & other service models

- **Opportunity:** Securing access to products with contracts or with leasing model, enabling refurbishing
- **Industry leader practice:** Optimize revenue model through, e.g., performance-based pay, value sharing or subscription models
- **Benefits:** If leased, less investments required from clients → increased sales and stability for cash flow, Incentives to implement modularization further

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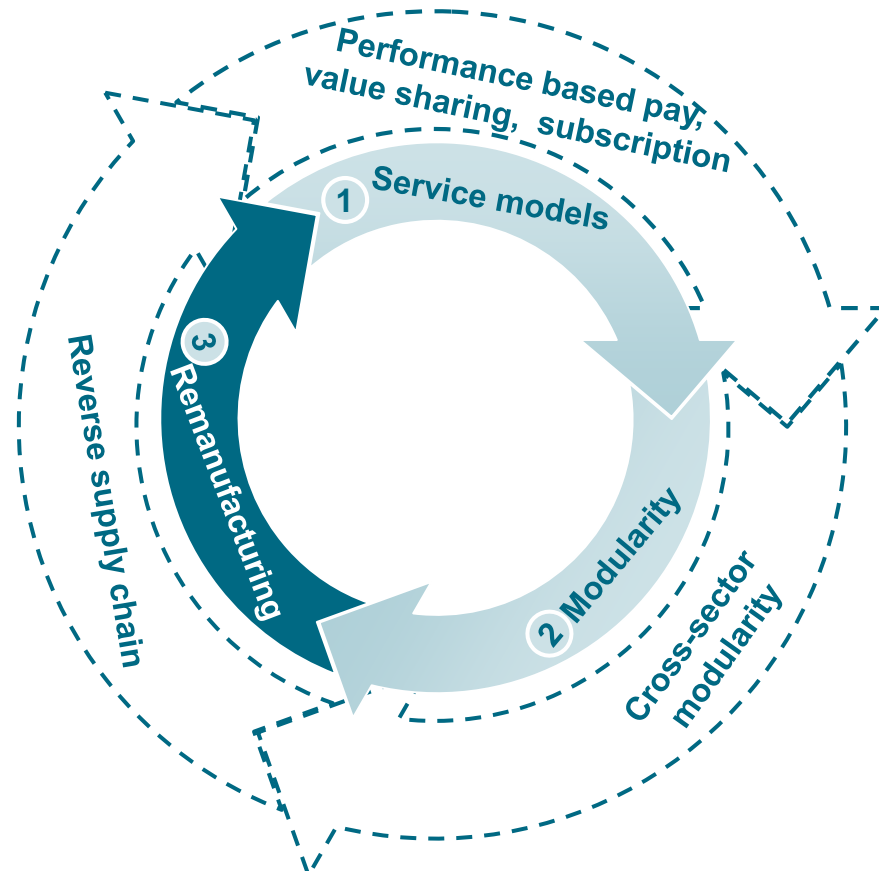
Modularity is known to reduce costs, but there are additional benefits in cross-sector modularity



2. Modularity

- **Opportunity:** Significant cost savings attainable in design, parts purchasing and assembly phases
- **Industry leader practice:** Stronger alignment and co-innovation with suppliers (cluster)
- **Benefits:** Helps reducing maintenance/service costs; Enables refurbishing with leasing

Remanufacturing is accelerated through leasing and modularity, challenges mainly in reverse logistics

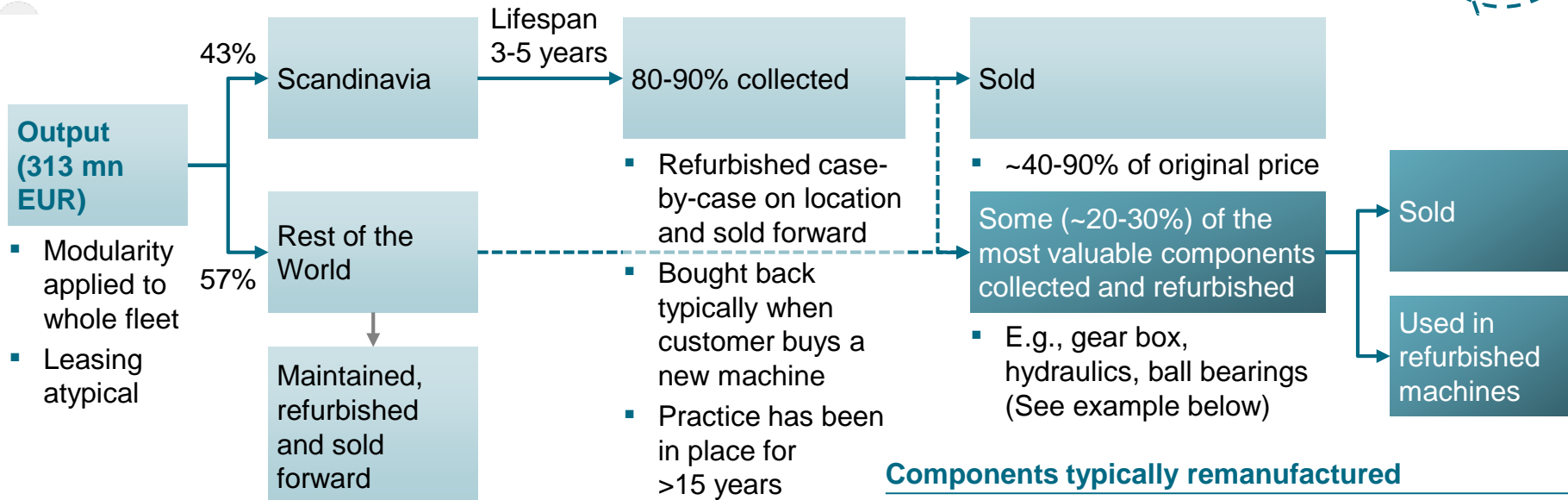


3. Remanufacturing & reverse supply chain

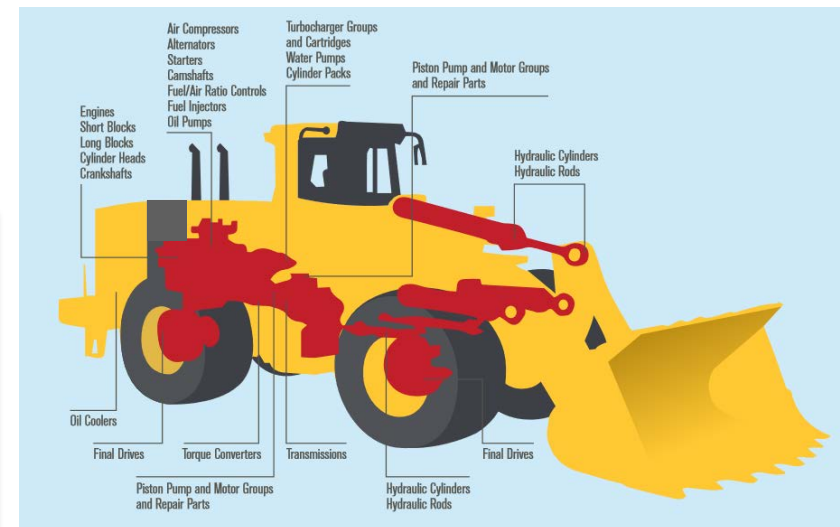
- **Opportunity:** Reputation risk could be mitigated, aftermarket exists anyhow, significant value added put into products, which could be captured; Cost-efficiency in re-selling once sold machine
- **Industry leader practice:** Reverse supply chains, products go through re-manufacturing process, significant value captured
- **Benefits:** Expand sales (new market segments); control reputation

Ponsse has implemented modularity throughout its fleet and has some refurbishing practices in place

ILLUSTRATIVE















Components typically remanufactured



- Modularity** – implemented in all new devices, design driven by performance. No benefits seen in cross-sector collaboration.
- Leasing** – not a typical practice, transactional business model
- Remanufacturing** – done effectively in Scandinavia, no standardized or centralized remanufacturing process, challenging logistically, high variation on the shape of the collected machine, no systematic analysis on profitability

The RESOLVE framework

Examples		
<p>REgenerate </p>	<ul style="list-style-type: none"> Shift to renewable energy and materials Reclaim, retain, and restore health of ecosystems Return recovered biological resources to the biosphere 	
<p>Share </p>	<ul style="list-style-type: none"> Share assets (e.g. cars, rooms, appliances) Reuse/secondhand Prolong life through maintenance, design for durability, upgradability, etc. 	
<p>Optimise </p>	<ul style="list-style-type: none"> Increase performance/efficiency of product Remove waste in production and supply chain Leverage big data, automation, remote sensing and steering 	
<p>Loop </p>	<ul style="list-style-type: none"> Remanufacture products or components Recycle materials Digest anaerobically Extract biochemicals from organic waste 	
<p>Virtualise </p>	<ul style="list-style-type: none"> Books, music, travel, online shopping, autonomous vehicles etc. 	
<p>Exchange </p>	<ul style="list-style-type: none"> Replace old with advanced non-renewable materials Apply new technologies (e.g. 3D printing) Choose new product/service (e.g. multimodal transport) 	

Palvelutoiminnasta liikevaihtoa

- Laivojen konvergenssipalvelut
- Huoltotoiminnan palvelut
 - Tehokas toiminta satamassa oloaikana - optimointi
 - Teollisen internetin hyödyntäminen, vrt. Kone
 - Tehdaskunnostus ja laitteiden kierrätys, ks. Valtran REMAN-konsepti:
<http://www.valtra.com/249.aspx>
- Purkutoiminta - onko arvopotentiaalia?
 - Tietopohja käytössä olevista laivoista
 - ARVOPOTENTIAALI -> MITÄ PROSESSEJA JA RESURSSEJA LIITTYY -> MITEN POTENTIAALI VOIDAAN LINKITTÄÄ OMAAN OSAAMISEEN JA TOIMINTAAN -> UUDET TUOTTEET, PALVELUT JA ARVOKETJUT

Kiertotaloudesta arvoketjua – esiintuonti

- SYKE auttaa elinkaarilaskennassa
- VTT on sertifiointi ETV-todistuksen antaja
- **ASIAKASLÄHTÖINEN TOIMINTATAPA**
 - LUT:ssa tehty tutkimusta, miten asiakkaiden toiveita voidaan kartoittaa ja miten palvelutoimintaa voidaan systemaattisesti rakentaa tuotetoimituksen päälle, mm. prof. Anne Jalkala, tutkijatohtori Joonas Keränen

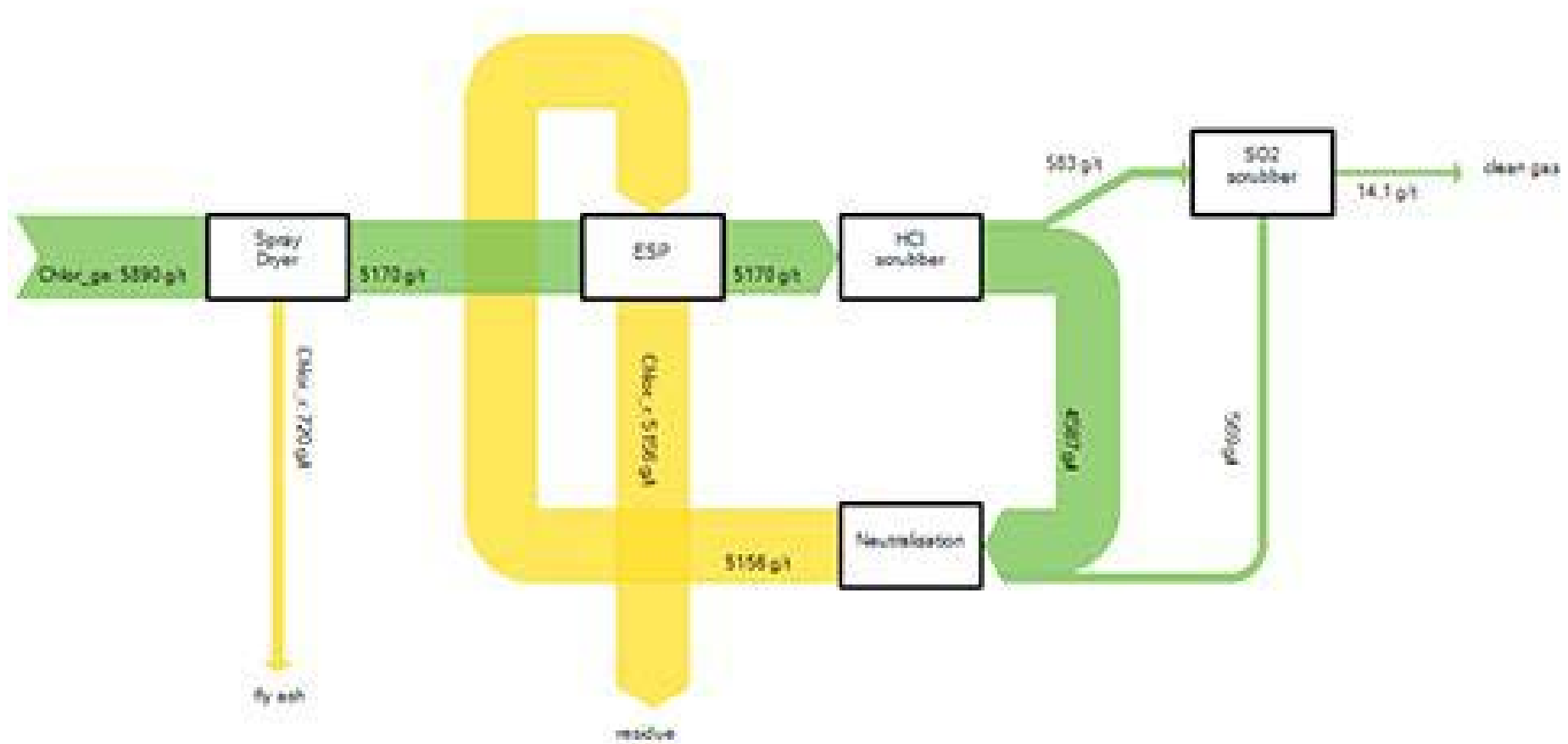
4. MATERIAALIKATSELMUSTOIMINTA

- Käytännön työväline yrityksen toiminnan tehostamiseen ja materiaalivirtojen hallintaan. Myös muut kustannukset kuten energia, työ, kierrätys ja jätehuolto lasketaan mukaan ja ne kohdistetaan materiaalivirtaan.
- Motiva
 - edistää ja kehittää materiaalikatselmustoimintaa
 - kouluttaa materiaalikatselmoijia (kts. linkki katselmuksia tekevät asiantuntijayritykset)
 - neuvoo katselmusten tilaajia ja katselmoijia
 - edistää ja valvoo materiaalikatselmustoiminnan laatua
- Vuosina 2014-2015 Suomessa tehtyjen materiaalikatselmusten säästöpotentiaali (ISO 14051) keskimäärin 1 M€/katselmus.
- Kokemuksia, ks. linkki case-kuvaukset
 - Vuonna 2016 tilaajayritykset saavat jopa 40%:n tuen katselmoijayrityksen kuluista (TEM myöntää tietyin ehdoin)

MATERIAALIKATSELMUKSEN ARVO YRITYKSELLE

- MATERIAALIKATSELMUKSEN ARVO YRITYKSELLE katselmuksen aikana löydettyjen säästöjen lisäksi
 - 'Euromääräiset' prosessin materiaalivirrat (ISO 14051 ml. sisäinen kierto ja hävikki)
 - Asiantuntijakonsultin vetämä työpaja sitouttaa ja tuo uusia näkökulmia
 - Priorisoitu toimenpiteiden listaus ja luokittelu antaa selkeän jatkon yrityksen toiminnalle

Tuotuksena materiaalivirta arvokaavio



Tuotoksena listaus toimenpiteistä

Yhteenveto tärkeimmistä käytännön materiaalisäästötoimenpiteistä sekä arviot niiden hyödyistä ja kannattavuudesta. Yhteenveto esitetään taulukkomuodossa taulukon A mukaisesti.

Tähän yhteenvetotaulukkoon poimitaan luvussa 6 esitetyistä toimenpide-ehdotuksista:

- kaikki kokonaistoteutettavuudeltaan kolmen plussan (++) ehdotukset
- kokonaistoteutettavuudeltaan kahden plussan (++) ehdotukset, jotka ovat yrityksen arvioiden mukaan toteutettuja, päätetty toteuttaa tai harkinnassa olevia toimenpiteitä (T,P tai H)

Taulukko A. Yhteenveto materiaalisäästöön liittyvistä toimenpiteistä

Toimenpide (Toimenpiteiden numerointi sama kuin luvussa 6.)	Säästö-potenti- aali	Investo- intti	Tokai- sin- maksu- aika	Toimen- pide- luokka*	Raaka- aineen käytön vähentä- minen (t/a)	Jätteen määrän vähentä- minen (t/a)	Veden käyt. ön vähe- nem. (m ³ /a)	Vaikutus- energian käyttöön (MWh/a)**	Ympä- ristö- hyö- dyt***	Yrityk- sen arvio toteutuk- sesta (T,P,H)	Ra- po- llin kohta
	(K)	(K)	(a)								
P1.1 Toimenpide a											
P1.2 Toimenpide b											
P2.4 Toimenpide x											
YHTEENSÄ											

* Luokitella ensisijaisen vaikutuksen suhteen (A-J)

Toimenpiteen luokitus tehdään sen tavoitteen mukaan. Toimenpideluokitus ilmoitetaan mihin ensisijaiseen vaikutukseen toimenpiteellä pyritään

- Raaka-aineiden käytön vähentäminen
- Häviön vähentäminen
- Kaatoaika/jätteen määrän vähentäminen
- Vääräisen jätteen muuttaminen kaatopaikajätteeksi
- Kaatopaikalle menevän jätteen suuntaaminen energianlähtöön
- Energiankäyttöön menevän jätteen suuntaaminen materiaalihyötykäyttöön/kierrätykseen
- Kaatopaikajätteen suuntaaminen materiaalihyötykäyttöön/kierrätykseen
- Tuotteen ylipainon vähentäminen
- Vedenkäytön vähentäminen
- Muuhyödyt

Teknolomiteollisuuden kiertotalousteimi

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