

# *Advantage Environment*

Swedish companies contribute towards the Agenda 2030 targets everyday,  
all over the world - making the world better for everyone.



**INNOVATION  
FOR SUSTAINABILITY**

# TOWARDS THE SUSTAINABLE DE

## Swedish Initiatives for Agenda 2030 Innovation Fuels Sustainable Development Worldwide

In 2015, the 2030 Agenda for Sustainable Development was adopted, and in 2016, the Paris Agreement on climate change entered into force. The agenda calls upon businesses, governments and civil society to come together in a joint effort to achieve 17 Sustainable Development Goals to improve the lives and prospects of people around the world. Each goal has specific targets to be achieved over the next 15 years.

The Swedish project Advantage Environment is a Confederate of Swedish Enterprise initiative started in 2008. It provides information about existing and future products designed to reduce environmental impact. Within the project, new material is published every week on the website [advantageenvironment.com](http://advantageenvironment.com) - a showcase of Swedish companies with innovative solutions that are transforming the world.

Sweden is a small country, home to 0.13 percent of the global population. Yet it is a leading industrial nation, and a world leader in innovation; in the INSEAD Global Innovation Index 2016, Sweden ranked second. The industry has a high-technological profile, and is very climate efficient by international comparison; the country's share of global GDP is approximately one percent, but its share of the global carbon footprint is significantly smaller – approximately one part per thousand.

In 2016, the highly-specialized steel producer SSAB launched an initiative together with the iron-ore producer LKAB and the energy company Vattenfall to solve the carbon dioxide problem of the current steelmaking technology. The joint venture aims to develop a steel production process that uses hydrogen as a reducing agent instead of coal and coke, and has gained additional support from The Swedish Energy Agency. It is an ambitious

undertaking that will depend on a nationwide cooperative effort from the industry, the Swedish government, and research institutions, to hopefully have a full-scale demo plant up and running by 2035.

If the project succeeds, it will contribute significantly to global sustainability. But regardless of the outcome, it is not a coincidence that it is in Sweden this drive for carbon-dioxide-free ironmaking is happening; for a number of reasons, the country is in a unique position to pursue such endeavors.

The specialized, innovative steel industry is one factor; Swedish steel companies are world leaders within several market niches. The fact that Sweden has access to fossil-free electricity from hydroelectric and nuclear power is another; since the oil crisis of the 1970s, Sweden has invested heavily in new energy sources, and today 83 percent of Swedish electricity comes from nuclear and hydroelectric power. Sweden also has plenty of forest, producing bioenergy for industrial processes and district heating. Furthermore, Swedish iron ore is of the highest quality in Europe.

And this initiative is just one single example. Swedish industry is based on a wealth of natural assets and rests on strong traditions in forestry, metal industry, chemical industry, and engineering industry, with structural change towards knowledge-intensive production and increased process efficiency. The pesticide debate of the 1960s, triggered environmental engagement, ambition and awareness in all parts of society; since then, Sweden has been an environmental pioneer, leading the way towards sustainability and decoupling growth from emissions since the mid-1990s.

This structure, combined with the push-and-pull of collaboration and competition, high

# DEVELOPMENT GOALS

R&D expenditure, and public and private investment has fostered many global companies and resulted in countless transformational innovations, systems and solutions spread around the world. Today, the Swedish economy is diverse and competitive. Meanwhile, globalization is weaving diverse economies together, and value chains are being extended across the world. The world population is growing, and the centre of gravity is shifting towards Southern Asia and sub-Saharan Africa – the regions where extreme poverty is the most widespread and institutions are the most fragile. These regions are also where emissions are increasing the most – since the societies and economies there are in the midst of transformation.

The 17 Sustainable Development Goals can not be achieved or hardly even discussed in isolation from each other. They are overlapping and interconnected, because the global economy, the environment and the necessary solutions are all deeply intertwined. Emissions anywhere affect the environment everywhere. The actions of academia, industry, governments, the private sector, civil society and individuals all matter, and the cross-fertilization of ideas and practices between them and across different sectors are essential, both to foster innovation and to be able to adopt disrupting technologies and new ways of life when the world and the global society transforms.

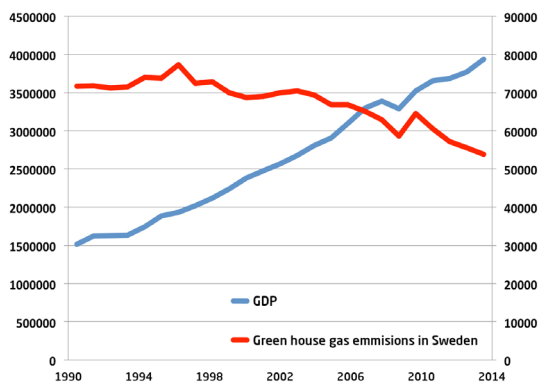
Perhaps the interconnectedness of the global challenges is manifested most clearly in the developing regions and emerging markets of the world: Health issues go hand in hand with sanitation and access to clean water; Food security offers key solutions for development; Energy poverty is a fundamental barrier to reducing hunger; Energy availability hinges on the development of infrastructure and institu-

tions, which requires investments, depending on the rule of law.

What we need to is to sustain economic growth and achieve higher levels of economic productivity through technology transfer, enhanced knowledge sharing and innovation. The developing regions have the opportunity to leap-frog to green technology; this can start positive feedback loops, powerful enough to disentangle this Gordian knot of development issues, ultimately allowing the entire world to rise out of poverty.

Sweden, already having achieved a high domestic efficiency, can best contribute to Agenda 2030 as a breeding-ground for innovation that exports its solutions to the global market, where they can provide a leverage way beyond the size of the country's economy. As we are about to see exemplified in the coming pages, that is already in the making: Swedish companies contribute towards the Agenda 2030 targets everyday, all over the world – making the world better for everyone.

## SWEDEN HAS MANAGED A DECOUPLING BETWEEN ECONOMIC GROWTH AND EMISSIONS



# INNOVATION FOR SUSTAINABILITY AROUND THE WORLD

The website [www.advantageenvironment.com](http://www.advantageenvironment.com) presents hundreds of examples of how Swedish companies contribute to sustainability all around the world. Here is a selection of a few such export solutions that originate in Sweden but make processes more efficient, save resources and benefit development wherever they are used.

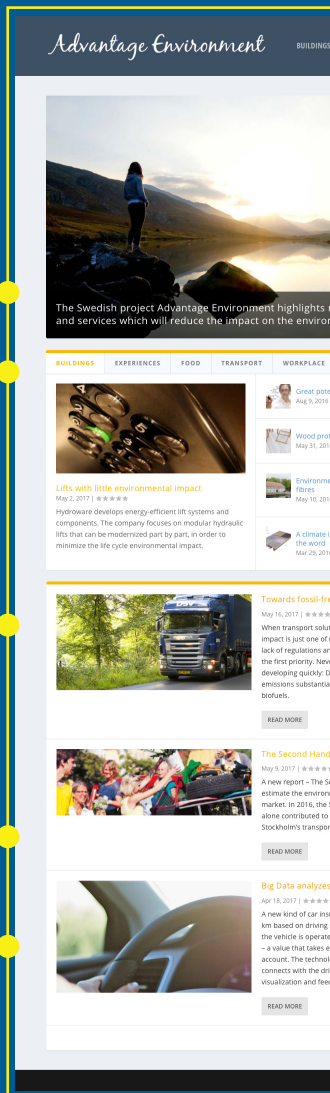
**LUDVIG SVENSSON'S** textile climate curtains replace heating and cooling systems in greenhouses and other facilities. The annual energy savings are equivalent to the output of four nuclear reactors.

**BILLERUD KORSNÄS** works with sustainability in the entire value chain, and creates fibre-based packaging and materials that challenge conventional packaging: a unique sealed paper bag for dry food that can replace glass, plastics and metal, a paper bottle for carbonated beverages, and dissolvable cement sacks that are thrown directly into the mixer, for instance.

Swedish advanced, light-weight, high-strength steels contribute to higher efficiency and reduced emissions in the applications where they are used. The specialized steel company **SSAB** has launched an initiative together with the iron-ore producer **LKAB** and the leading energy company **VATTENFALL** to develop a steel production process that uses hydrogen instead of coal and coke and thus emits water rather than carbon dioxide.

**SCANIA**, a world-leading provider of transport solutions, heavy trucks, buses and engines, exemplifies well how partnership and innovation becomes a driving force towards sustainability. Scania collaborates with business partners across the ecosystem, with projects such as truck platooning, electrified highways and autonomous transport solutions.

**ABB'S** electric propulsion system Azipod has saved more than 700 000 tonnes of marine fuel so far.



**OVAKO** manufactures a high-quality special steel, *Isotropic Quality*, unique in strength and purity. The steel is used in diesel engines that work at higher pressure, increasing fuel-efficiency. In 15 years, this has saved more than 120 million tonnes of CO<sub>2</sub> - twice Sweden's total annual emissions.

Determined to be well ahead of regulations, **TERN-TANK** is the first shipowner to order vessels within the project platform Zero Vision Tool (ZVT). The company operates the first LNG bunkering ships ever in the port of Gothenburg. They will trade European harbor without releasing sulfur and particles, also emitting 40 percent less CO<sub>2</sub> than conventional tankers.

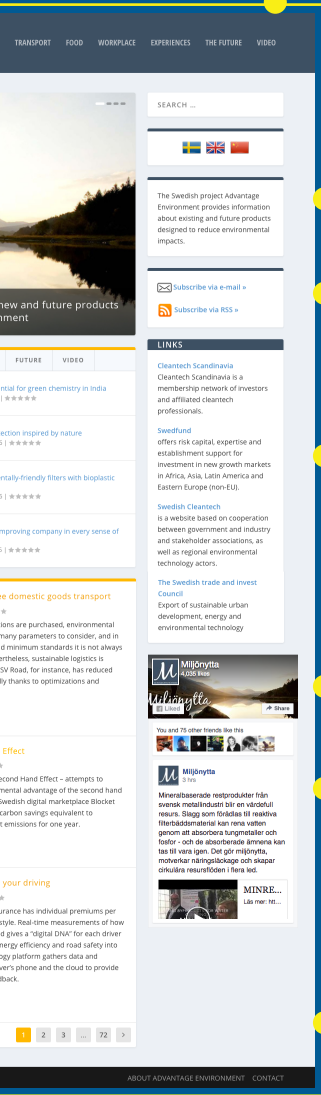
**NEXTSEAL'S** revolutionary sealing technology can eliminate 95 percent of natural gas leakage from pipelines. In the US market alone, this equates to more than half the carbon footprint of New York City.

**LINDEX**, one of Europe's leading fashion chains, operates close to 500 stores in 17 markets. The chain incorporates sustainability throughout the value chain, along with the customers, and with the entire lifecycle of the products in mind. Striving to be part of the circular economy, Lindex works with better cotton, clean shipping methods, and renewable energy - and offer customers to recycle clothing.

**ABB'S** variable speed drives have already saved more emissions globally than Sweden's total annual emissions. If the technology was universally adopted, the energy savings would be equivalent to the global nuclear energy output.

Almost every way of electricity production involves turbines. **SIEMENS INDUSTRIAL TURBOMACHINERY** manufactures steam and gas turbines with high efficiency and low environmental impact. Their export has saved more than seven million tonnes of CO<sub>2</sub> annually.

**OPCON** produces carbon-free electricity from waste heat at low temperatures. Applications include industrial and marine engines and power plants. Every percent of the potential market could save a quarter of Sweden's total annual emissions.



## INNOVATION FOR SUSTAINABILITY AROUND THE WORLD

A few pinpointed places where Swedish companies turn sustainable development into practice today.

**CORPOWER OCEAN** is conducting tests of their wave energy converters outside Scotland. The converters always oscillate in resonance with the incoming waves.

**MINESTO**, from "Deep Green produces electricity from low velocity currents", is preparing their first commercial underwater power plant outside Anglesey, UK.

**SANDVIK** is one of the key participants as the world's first fully electrified mining operation is developed in Borden Lake, Canada.

**BIORECRO**, from the article "Can we pull the carbon out of the air?", is participating in the world's first BECCS project, in Illinois, US.

**CASSANDRA OIL**, presented in the article "Oil out of waste" is opening a facility in Spain, to recycle the oil content of plastic waste.

**TRINE** maintains a crowdinvesting platform that funnels investments to solar energy projects in developing regions. Projects are underway in Kenya, Zambia, Tanzania, Senegal and Uganda.


**SEABASED**, with headquarters in Lysekil, is installing a complete, grid-connected wave park in Ada, Ghana - the largest in Africa.

**HÖGANÄS**, from "Water treatment with iron powder", is installing treatment facilities in the USA, Brazil and India.

**RIPASSO ENERGY** develops stirling engines that generate electricity from concentrated solar power. Their first commercial facility is located in Keetmanshoop, Namibia.

**GLOBHE** is coordinating drone-based medical deliveries in Rwanda - bypassing the lack of road transport infrastructure.





**ORBITAL SYSTEMS** specializes in water recycling technology. Their recirculating shower unit saves 90 percent of the water and 80 percent of the energy compared to a conventional shower. The first order outside Sweden went to Copenhagen, Denmark.

**KALMAR MOTOR**, from "Hybrid aircraft tractors", has delivered their TBL 800 to Frankfurt Airport, where it will tow the world's largest aircraft.

Zbee, **CLEAN MOTION'S** electric vehicle from the article "ectrification will reinvent the car", is already on the road in Delhi NCR, India.

Operating from Shanghai, China, Swedish **SPINDYE** is eliminating water-demanding and hazardous dyebaths by coloring the plastic solution prior to extrusion.

**CLIMEON** develops machines for converting low-temperature heat to electricity, with focus on the marine sector. The technology can save 5000 tonnes of CO2 from a single ship per year.

**ALELION**, from "Sustainable forklift batteries", has received orders for their Lithium-ion technology from Australia.

**AGAINITY** is converting waste heat into electric power. In Eldoret, Kenya, the heat source is municipal waste.

**IFOODBAG**, from "Innovative bag for online grocery shopping", has received an order for 20 million carrier bags from Nairobi, Kenya. They will be distributed throughout Africa to prevent food wastage and provide cooling for vaccines.

# Transports

Greenhouse gas emissions are driving climate change, and transports are a key component. According to estimates, the number of vehicles in the world is set to double in 40 years. With current technology, this would cause heavy burden on the environment - but technology is evolving: electrification is gaining traction, vehicles are getting lighter and more autonomous, and mobility is turning into a service. This development has bearing on, for example, SDG 9 (infrastructure), SDG 11 (sustainable cities) and SDG 13 (mitigate climate change).

## SAILING WITH THE CURRENT

HH Ferries' Aurora and Tycho Brahe will be among the first large ferries in the world to run on pure battery power on a high-frequency route. The company's ferry service across the Oresund between Sweden and Denmark transports more than 7.4 million passengers, 1.4 million cars and 410 000 buses and trucks on a yearly basis.

"Until now, diesel engines have been the only realistic solution, but we are now investing heavily in a conversion to pure battery power", says Henrik Rørbæk, CEO of HH Ferries: "The emissions will be cut in half. I am convinced that the project will inspire other shipping companies around the world to follow example".

A fully automatic laser-guided robotic arm connects the batteries to new shore-side electric grid installations every time the ferries are in port. They stay there for just 5 – 10 minutes at a time, so ground-breaking charging technology has been developed to maintain the timetable.

Since the conversion is a major investment, co-funding provided by INEA, the Innovation and Networks Executive Agency of the European Union, has been crucial for the project, as well as collaboration between a number of contractors. ABB Marine and Ports in Finland provide the custom-made systems.



"The emissions will be cut in half. I am convinced the project will inspire shipping companies around the world"

## BIOCOMPOSITES PROVIDE AN ENVIRONMENTAL ADVANTAGE

Trifilon is a Swedish developer and manufacturer of light and robust biocomposites, that save fuel and reduce emissions. The materials are reinforced with natural fibres, and can be used for volume production with regular injection and compression moulding machines. The company has recently begun a strategic collaboration with Plastal, one of Scandinavia's largest manufacturers of plastic parts for the automotive sector:



Södermanland flax fiber - a very local source for Trifilon biocomposites



”Our material contributes to lighter vehicles. The natural fibre content further reduces climate impact. By combining Plastal’s injection moulding know-how and Trifilon’s expertise in natural fibre composites, we hope to quickly launch a new biocomposite into high volume production.”, says Martin Lidstrand, CEO.

### ELECTRIFICATION WILL REINVENT THE CAR

Clean Motion, one of the winners of the WWF Climate Solvers award, develops an ultralight, electric three-wheeler: the Zbee. The vehicle is already on the streets in India. It is designed for short transports in urban environments, and seats up to three people. Thanks to the glass fibre composite body, the Zbee uses less than a tenth of the energy compared to a conventional car, and weighs only 270 kg.



Another company with ambitious plans for the future is Uniti, which originated in a research and innovation project at the University of Lund, where urban vehicle usage patterns were studied. Uniti is now using insights to develop an electric urban vehicle based on sustainability and creative solutions, closer to the world of robotics than the car industry.

### HYBRID FOR LONG HAUL TRANSPORTS

With support from the Swedish Energy Agency, Volvo Trucks has developed a new concept vehicle, the Volvo Concept Truck. It is the result of a five-year long research project aimed at creating more energy-efficient vehicles. The new concept truck, first unveiled in May 2016, cuts fuel consumption by more than 30 percent. The hybrid powertrain, partly based on knowledge and experience from Volvo Buses’ hybrid and electric buses, is one of the first of its kind for heavy-duty trucks in long haul transports:



”Our concept truck showcases the immense power of on-going technical advances”, says Claes Nilsson, President and CEO Volvo Trucks.

### ELECTRIC BUSES IMPROVE THE URBAN ENVIRONMENT

Several Swedish partners are involved in the ZeEUS project, which aims to electrify the urban bus networks of European cities; 35 bus technologies and a wide range of charging infrastructure solutions will be evaluated. In Härnösand, Sweden, the public transport system is already fossil-free, thanks to about 30 biofuel buses and two fully-electric buses.



”The biodiesel is produced from vegetable and animal oils and fats in slaughterhouses as well as fishery waste, reducing carbon emissions by 90 percent, says Tomas Byberg, CEO of the bus company Byberg & Nordin.

# Water

Water scarcity and lack of sanitation rank among the major global challenges. Among the Sustainable Development Goals, SDG 6 (to ensure access to water and sanitation), and SDG 14 (to conserve marine resources) explicitly address these issues. However, clean water is an essential basis for every endeavor towards sustainable development. More than 80 percent of wastewater from human activities is discharged into rivers or sea without pollution removal, and due to poor infrastructure and lack of sanitation, more than one billion people still do not have access to fresh water. A range of measures addressing pollution, water treatment and water-use efficiency will be required to meet the goals.

## PARTNERSHIP IN RESOURCE EFFICIENT WATER PURIFICATION

Mineral-based residuary products from Swedish metal industry are being turned into valuable resources. Slags that are processed into reactive filter-bed materials can purify water from heavy metals and make it possible to recover leached phosphorus. The results have direct bearing on several of the Sustainable Development Goals. Eutrophication is reduced. Across the value chain, more circular resource loops are established. By-products are utilized. Oceans and lakes are preserved. The recycling contributes to resource efficiency.

This example of industrial symbiosis involves for example the steel company Höganäs AB, the filtration systems supplier Alnarp Cleanwater AB and the road construction company NCC, as well as academia and government.



## EFFICIENT FLOATING FILTER FOR STORM WATER PURIFICATION

Storm water may be polluted by vehicle emissions, pollutants in the rain water, oil and heavy metals. The Helsingborg-based company Swedrop has developed a unique storm water filter that floats in the storm water drain, purifying both incoming and standing water from more than 30 pollutants.

"We want to treat the water cost-efficiently, as close to the source as possible", says Bengt Jäderberg, Chief Communications Officer, Swedrop.

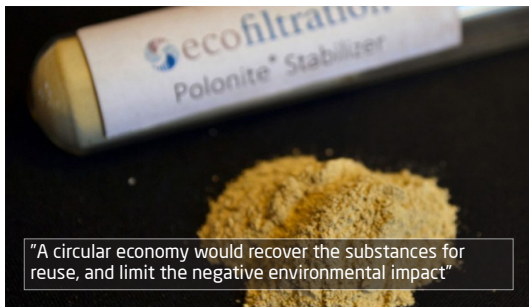


## NATURAL FILTER MEDIA FOR PHOSPHORUS RECOVERY

About 30 000 tonnes of phosphorus reach the Baltic annually, leaching from farmland and sewages. The global supply is limited, and a deficit would have a significant impact on future food production.

"A circular economy would both recover the substances for reuse, and limit the amount of chemicals being released to the environment", says Anders Berggren, interim CEO of Ecofiltration Nordic AB, a developer of silicate based filters. The natural filter material, Polonite, is a porous, reactive sorbent that absorbs the substance to be removed. It can filter phosphorus from sewage water and farmland runoff, and can also be used to restore eutrophic waters.

"After a brief period of drying, saturated Polonite can be used as an excellent fertilizer, releasing phosphorus at the same pace plants are able to absorb it", Anders Berggren says.

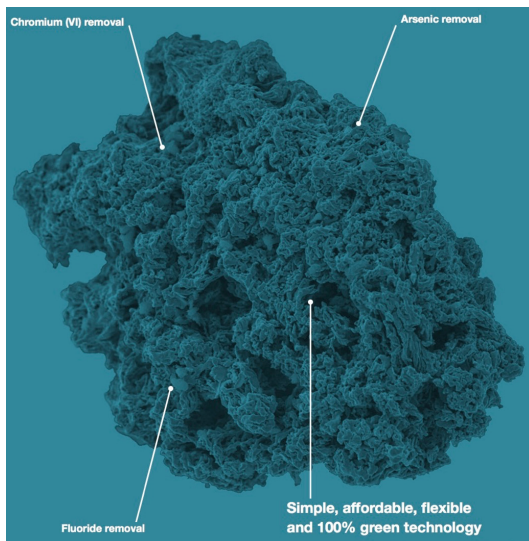


### WATER TREATMENT WITH IRON POWDER

Höganäs AB is the world's leading provider of metal powders. An emerging and very promising application is water treatment: porous iron powder is a functional high-tech material, capable of removing multiple contaminants from drinking water and industrial wastewater, and the company delivers complete solutions. The secret is the sponge-like geometry of the iron particles, which gives them a very large reactive surface area.

"Metal powder has a number of interesting environmental applications. It is able to absorb contaminants and heavy metals from soil and water, and it can reduce corrosion and extend the life of components", says Ulrika Rask-Lindholm, Vice President Communications of Höganäs AB.

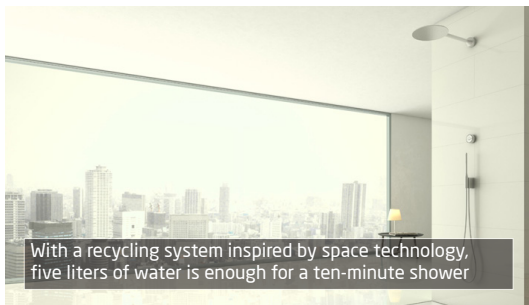
Cleanit® LC is capable of removing multiple contaminants from groundwater and drinking water, including hexavalent chromium, arsenic, selenium, phosphates, and radioactive isotopes. Once the medium has been spent it can be returned back to Höganäs for recycling. Cleanit® EC is an energy-efficient electrocoagulation technology for industrial wastewater treatment, that can handle heavy metals, organic substances, ammonia, nitrates, phosphates and various other contaminants.



### INNOVATIVE SHOWER SAVES WATER AND ENERGY

Orbital Systems has developed a recirculating shower system that can save 90 percent of the water used, compared to a conventional shower. An internal nano-filter removes particles, bacteria and viruses continuously.

"The water that flows into the floor drain is collected, purified and pumped back to the shower nozzle. Because the water is already heated the energy savings can amount to 80 percent," says Mehrdad Mahdjoubi, CEO.



# The circular economy

Sustainable consumption and production can manifest through the development of a circular economy, where waste is eliminated as a concept. In the circular economy, waste from one process becomes the feedstock for another, and growth comes from smarter and more efficient use of resources. It requires a systemic approach and cooperation among actors in the supply chain.

## SECOND HAND MARKETS FOR THE CIRCULAR ECONOMY

Godsinlösen, a company specializing in reuse and return logistics, has developed a circular concept to make sure that damaged or rejected products are repaired and brought to new use. The concept of circular damage cover is a collaboration with insurance companies, where damaged property is collected and repaired, and repaired products are offered as compensation. Damaged goods from transports and e-commerce are also given a second life. A recycled mobile translates to more than 80 kg of waste savings and more than 60 kg of carbon dioxide emission savings.

"Godsinlösen does not repair any phones in Staffanstorp, but relies on a global network of external partners such as Apple, Samsung and Sony", says Jens Thulin, Circular Business Developer at Godsinlösen, Staffanstorp: "The basis of our business model is to assist companies and organizations with turning the circular economy into practice. It turns out that it is profitable to find the link between waste and resources."



A circular concept makes sure that damaged or rejected products are brought to new use

## ENVIRONMENTAL RUBBER FOR THE WORLD MARKET

While rubber is in high demand, 14 million tonnes of tires are discarded annually. AnVa Polytech is the first company in the world to recycle carbon black from discarded rubber and turn it into new components. Their environmental rubber saves 60 percent of the carbon emissions.

"The rubber is used to make automotive components, which closes the circle and relieves environmental impact", says Bo Norlin, CEO.



A car may contain 70 rubber components. Recycled rubber from discarded tires closes the circle

### TROPICAL FISH THRIVING IN WASTE HEAT

The Bergsöe lead smelter is one of Europe's largest recyclers of used lead batteries. In addition, waste heat from the processes heats parts of the nearby town's heating network - and now also a tilapia aquaculture. Tilapia, considered to be one of the most sustainable fish to eat, thrives in the heated fish tanks, and the closed indoor systems prevent water pollution:

"To start a fish farm at a lead smelter might seem like a far-fetched idea, but it is actually a very good example of industrial symbiosis", says Peter Carlsson, CEO of Boliden Bergsöe.



One of the first tilapia aquacultures in Sweden is housed in a lead smelter, using heat from the process

### THE SECOND-HAND EFFECT

In spring 2017, Schibsted Media Group released their second annual international report on the environmental advantage of second hand marketplaces. The climate savings were calculated in collaboration with IVL The Swedish Environmental Research Institute. By buying used items instead of new ones, the users on Schibsted's marketplaces contributed to 16.3 million tonnes of greenhouse gas emission reductions in 2016.

"The Swedish digital marketplace Blocket alone contributed to carbon savings equivalent to Stockholm's transport emissions for one year", says Lena K Samuelsson, Schibsted Media Group.

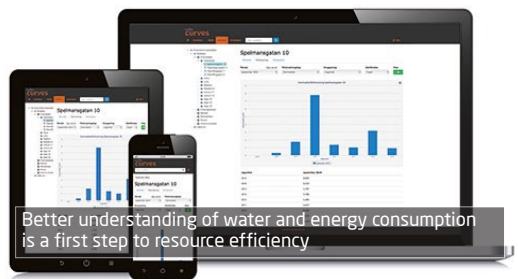


Second hand trade saves millions of tonnes of manufacturing and waste management emissions

### CLOUD SERVICES SAVE WATER AND ENERGY

Ecoguard develops measuring systems to check properties for leaking toilets and many other parameters. The company collaborates with many property owners, keeping track of 250 000 measurement points in Swedish real estate. The services are cloud based, and a web interface gives customers easy access to information on their usage of electricity, energy and hot water.

"80 million litres equals about half a million bathtubs. This is the amount of water saved during the first year in Hammarkullen, Gothenburg. In our experience, individual metering and charging typically results in usage reductions of up to 40 percent", says Per Ernedal, CEO.



Better understanding of water and energy consumption is a first step to resource efficiency

# The Bioeconomy

In the bioeconomy, all applications of fossil carbon resources are replaced with renewable, sustainable biomass. The development of a bioeconomy immediately addresses SDG 15 (deforestation); SDG 12 (consumption and production); SDG 7 (energy) and SDG 13 (climate change). The sustainable management of forests, halted deforestation and restoration of degraded land and soil are important development targets. The Swedish forest, doubled in size in the last 90 years, is a well managed resource, and the growing forests act as an important carbon sink.

## FUTURE PLASTIC BOTTLES CAN BE MADE OF BARK AND ROOTS

New innovations and emerging value chains are making use of increasingly refined forestry products. A recent Swedish project involving Tetra Pak, among others, proved that bioplastics developed from bark and roots is a viable packaging option.

"Finding ways to replace plastics is high on Tetra Pak's agenda", says Erik Lindroth, Environment Director.



10 million tonnes of logging residue from Swedish forestry is a sustainable source of raw materials

## HIGH-PERFORMANCE FUEL FROM RESIDUALS OF SWEDISH FORESTRY

In a recent initiative, the fuel company Preem, chemical and cleantech company Sekab, and forest company Sveaskog have joined forces to develop a high-quality bio-based gasoline for regular combustion engines, based entirely on forest biomass.

"Our assessment is that forest resources will play a crucial role in the green transition to a fossil-free society. The value chain developed here is of particular interest since it can use a range of forestry derived by-products", says Ann-Britt Edfast, R&D Manager at Sveaskog.



Sweden's 30 million hectares of forest land is a feedstock for fossil-free transport fuels

## PAPER-BASED PACKAGING SOLUTIONS REDUCE ENVIRONMENTAL IMPACT

Billerud Korsnäs creates packaging and materials from forest-based raw materials, and offers

sustainable solutions that challenge conventional packaging. The Axello ZAP is a renewable, recyclable, dust-tight and insect-proof paper packaging for dry food. It is the first of its kind in the world, and can replace glass, plastics and metal.

The D-Sack™ cement sack was developed together with the world's largest cement manufacturer, LafargeHolcim: the packaging is thrown directly into the concrete or mortar mixer, without being opened, and is dissolved upon use. Dust is eliminated, working conditions are improved and there is less environmental impact.

"To be truly innovative, we have to understand, measure and solve needs throughout the value chain of the packaging and the packed product", says Mikael Strömbäck, Business Segment Director, Sack Solutions at BillerudKorsnäs.

The company is currently developing a revolutionary paper bottle for carbonated beverages.



## NATURAL PROTECTION AGAINST WATER POLLUTANTS

Axon Environment Technique develops filter solutions for boat washing facilities and fuel filling stations, to prevent pollutants from reaching the ground water. The filters are based on peat, a natural filter material which efficiently absorbs oil, other organic pollutants and heavy metals.

"We are using peat from Northern Sweden. Peat that is formed north of the Arctic Circle has special properties and is especially good at absorbing contaminants from water", says Per Axelsson, CEO.

"One litre of granulated peat is capable of absorbing half a litre of oil. The peat has an additional advantage in that it can be combusted as a fuel when it is discarded".



## MICROFUNGI REPLACES FISHMEAL

The biotech company Cewatech, with headquarters in Gothenburg, has developed a technology to grow microfungi with agricultural and paper pulp sidestreams as feedstock. The nutrient-rich product can be used as fish feed, and is a good replacement for fish meal in fish aquaculture. Fish farming is set to overtake commercial fishing in production volume within the coming decade, and it is likely that aquaculture will remain one of the most important ways to supply the growing world population with high quality protein:

"Fish feed produced from such feedstocks would increase growth rate of fish, improve the environment, generate revenue for paper mills and save wild catch which would otherwise go into fish meal production", says Lars Edebo, Head of Research and Development at Cewatech.



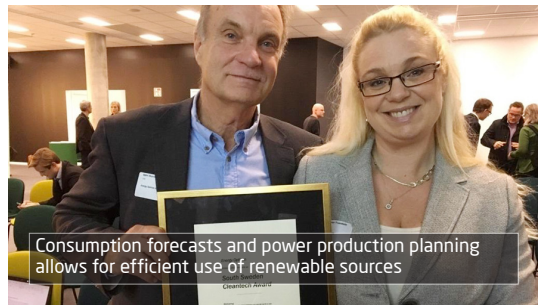
# Energy

One in five people still lacks access to electricity. SDG 7 is to achieve affordable, reliable and sustainable energy - but energy is central to nearly every major challenge and opportunity the world faces. It is also the dominant contributor to climate change. Sustainable energy is opportunity - it transforms lives, economies and the planet. To achieve the Sustainable Development Goals, access to clean energy technology, renewable energy, and energy efficiency has to be facilitated.

## A PRESTIGIOUS ENVIRONMENTAL AWARD FOR ENERGY OPTICON

Planning the energy production in district heating networks is a challenging task. Weather, consumption forecasting and market fluctuations – there are many variables to consider. Energy Opticon from Lund, Sweden, has developed a prize-winning software solution that automatically optimizes the management of the facilities.

"With our solution, investments in renewable energy can realize more of their potential", says Moa Dahlman Truesdale, CFO.



## LEAD-COOLED MINIREACTORS RECYCLE FUEL

In October 2016, the India-based investment company Essel Group signed a financing agreement with the Swedish research company LeadCold, which will allow LeadCold to license and construct the world's first privately funded lead-cooled nuclear power plant. This is a reactor type of the fourth generation, where fuel efficiency is improved over current nuclear power plants.

The first demonstration reactor will be built in Canada, where it will replace diesel-electric generators for off-grid electricity production.

LeadCold's concept is based on a small, modular reactor design called Sealer – Swedish Advanced Lead Reactor. By recycling the nuclear fuel, the fuel resources increase by two orders of magnitude compared to the nuclear power of today.

Corrosion and fretting from the lead has been the major technological hurdle. In a successful collaboration with the Swedish steel industry, LeadCold materials experts have developed a new corrosion proof aluminium alloy for the reactor.



## DEEP DRILLING FOR GREEN ENERGY

DHE Holding (Deep Hole Energy) is on its way to become a leading geothermal energy producer in Europe. A new, patented drilling method cuts through the bedrock ten times as fast as compe-



ting technologies, and can reach greater depths where the temperature is higher. This makes geothermal a viable and competitive energy source at new locations:

"We can reach more than 5 km below the earth's surface for geothermal energy, producing electricity, district heating and cooling at places where it was not possible before", says Petri Laukkanen, CEO.

### PRODUCING ZERO-EMISSION ELECTRICITY

Opcon's systems use excess heat from industrial processes, power plants or marine engines to produce electricity. The plant is able to use low- and high-grade waste heat with a temperature range of between 55-250°C.

"Today, a very small percentage of waste heat is recovered for energy production" says Rolf Hasselström, CEO.

### SOLAR STIRLING HYBRID WITH WORLD LEADING EFFICIENCY

Ripasso Energy builds on submarine Stirling engine technology developed by Kockums. Ripasso's Stirling engines generate electricity from concentrated solar power in a unique hybrid system with world leading efficiency, that complements with fuels such as biogas or ethanol when the sun is not available. Systems have been delivered to Italy and Africa.

"Interdisciplinary cross breeding of Stirling Engine technology has given us a feasible and robust solution for clean energy", says Gunnar Larsson, CEO.

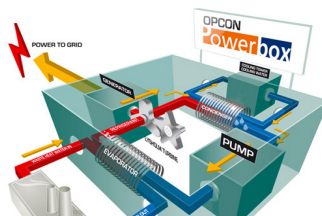
### RENEWABLE ENERGY FROM CLEANER SEAS

Ascidians are invertebrates, common along the Swedish west coast. Like clams, they feed by straining plankton and bacteria from the water, absorbing substantial amounts of nutrients. Marin Biogas is conducting a large-scale project where ascidians are cultured and harvested from the sea to produce biogas, at the same time removing nitrogen and phosphorus from the water.

"The organisms benefit the environment three times; they reduce eutrophication, produce renewable energy, and the waste product from their digestion becomes a valuable fertilizer for agriculture", says the founder Fredrik Norén.



With new methods, geothermal wells can be drilled faster and deeper than ever



By utilizing waste heat, electricity is produced from a source that would otherwise go to waste



Stirling Hybrids provide electricity continuously by combining the sun's power and available fuels



Soft-tissued ascidians grown on ropes can be harvested as an excellent biomass for biogas digestion

# The Developing Regions

Worldwide, three billion people cook in an open fireplace, using soot-producing wood or charcoal as a fuel. Scattered particles contribute to climate change, and the hunt for firewood is time-consuming and causes deforestation. Poverty, hunger, health, access to water, deforestation and growth - the challenges of developing regions are often deeply interconnected - but there are many examples of innovations able to contribute towards many of the Sustainable Development Goals at once, bridging humanitarian aid and development issues. They improve health and productivity, save money and time, and give people the means to lift themselves out of poverty.

## SOLAR-POWERED WATER PURIFICATION

Solvatten — literally, “solar water” — is a combined portable water treatment and water heater system that has been designed for off-grid households use in the developing world. The product has 240 000 users in 20 countries around the world, and the company is running 45 projects with different partners.

There are many different methods to clean drinking water, but many are based on large-scale plants and electricity. Solvatten uses only the sun's energy and a special container.

Each unit contains two five-litre containers joined together to a can that is folded open like a book to expose the transparent containers to the sun. The combination of heat and UV light kills pathogens and purifies the water in a couple of hours. A simple indicator tells the user when the treatment is complete. The treated water is hot, up to 75°C, and thus perfect for household and hygiene purposes such as cooking, hand washing, and cleaning.

“Before I had Solvatten, I used to boil water and fetch more fire-wood both for heating, cooking and drinking water”, says Wilhemina Akatapan. Her family is one of more than 20 000 in Northern Kenya reached by a Solvatten trial.

## A CLEANER WORLD WITH ENERGY EFFICIENT FIREPLACES

The Swedish-Zambian company Emerging Cooking Solutions has developed a system of fuel-efficient pellet-fired stoves for use in developing countries. The stoves help to save forests, reduce cooking time, and enhance health and household economies.

“We utilize forest residues, sawdust, peanut shells and other by-products to convert into wood pellets. In Sweden, we have long experience in producing pellets, and we are now transferring



these skills to Africa", says Per Löfberg, Marketing Manager, Emerging Cooking Solutions.

Emerging Cooking Solutions uses products available in the market for the stoves, but manufactures their own wood pellets in Kitwe, Zambia, and makes sure there is an infrastructure for the distribution through the French oil company Total's network of gas stations.

### ECO-TOILETS SAVE WATER, IMPROVE HEALTH

The toilet manufacturer Separett is participating in a program in Lima, Peru, where one and a half million people use holes in the ground instead of toilets. Because of the extremely arid climate, installing water closets is not an option. In the program, 650 families have received urine-diverting toilets; the composted waste is collected and sold as fertilizer.

"In countries like Peru and Alaska, our toilets provide improved sanitation in areas without clean water and proper sanitary systems", says Mikael Billsund, CEO at Separett AB.



Separating toilets reduce odor and improve hygiene compared to the makeshift solutions often used

### CROWD INVESTMENTS DEVELOP OFF-GRID SOLAR

TRINE has developed a crowdinvesting platform that funnels investments to solar energy projects, closing the gap between private capital in developed countries and local partners in emerging markets. Projects are underway in Kenya, Zambia, Tanzania, Senegal and Uganda, and more than 100 000 people have been empowered to escape energy poverty so far.

"By 2021, the goal is to have funded 1000 projects and provided 66 million people with clean energy", says Sam Manaberi, CEO.



TRINE's platform builds long-term partnerships between investors and local entrepreneurs

### INNOVATIVE BAG MITIGATES FOOD WASTAGE AND HEALTH ISSUES

iFoodbag is a new Swedish packaging company which has developed a unique paper bag to eliminate the need for expensive and polluting cold chain transports of food. The water-resistant bag consists of at least 80 percent cellulose, and can keep food items chilled and frozen for 24 hours. It can be re-used several times before being recycled as paper.

"We are working to improve food distribution in tropical climate countries. Temperature sensitive medical products is another possible use", says Karl Fallgren, CEO and founder.

In collaboration with a Kenyan partner, up to 20 million carrier bags will be distributed throughout Africa to help prevent food wastage, reduce hunger and guarantee that, for example, vaccines are distributed without compromising the cold chain.



The insulating paper composite and the air-tight sealing makes the iFoodbag a unique innovation



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