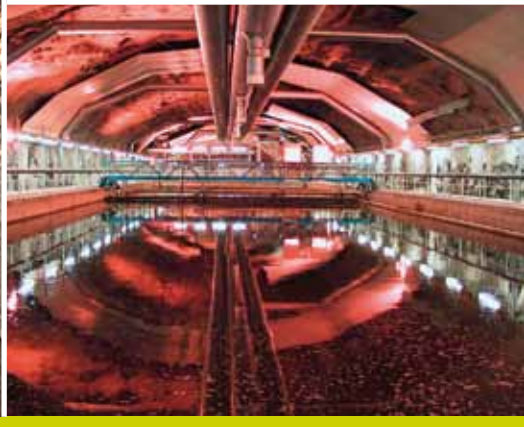
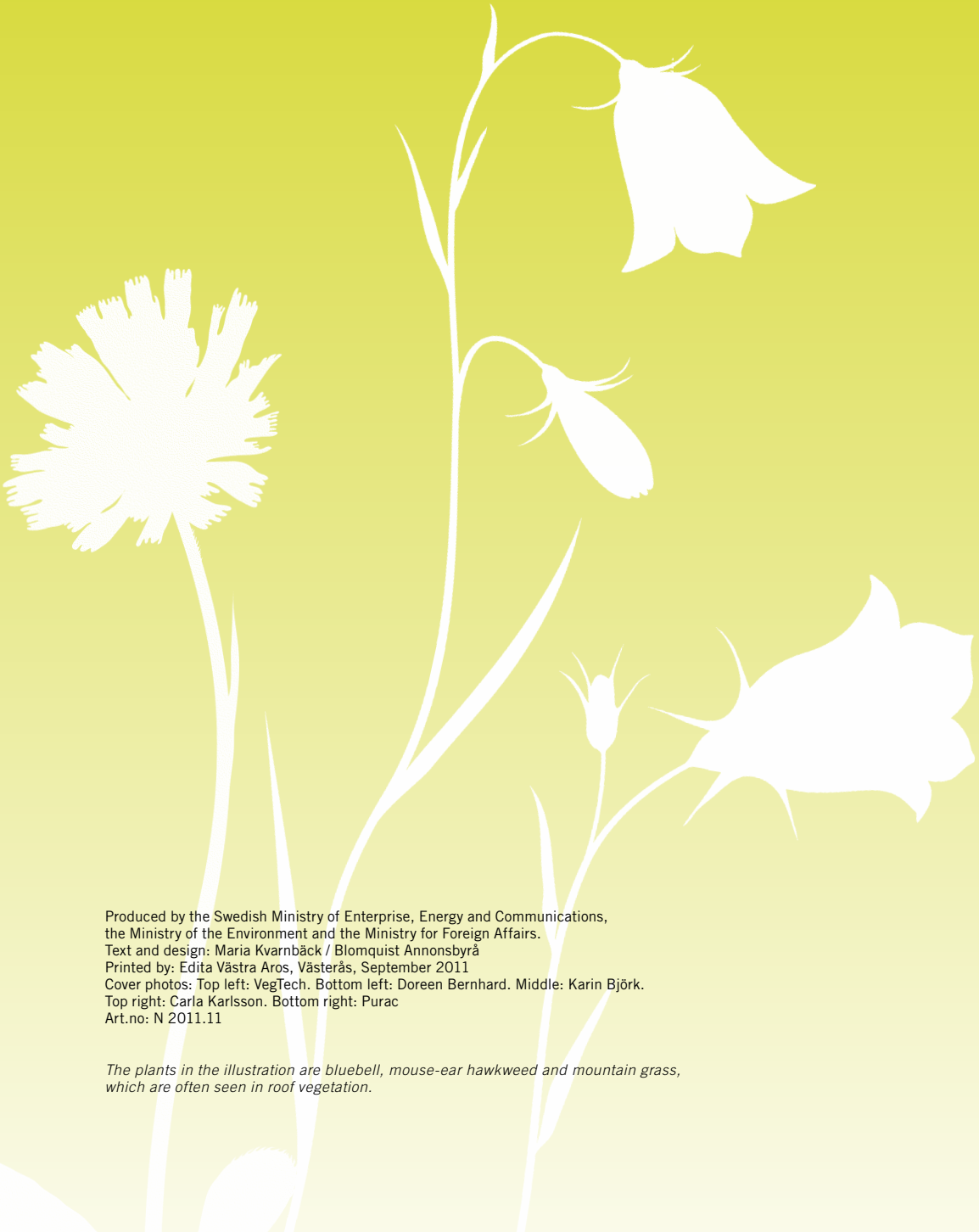
Environmental Technology

– 13 Swedish Solutions



REGERINGSKANSLIET

Government Offices of Sweden



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The plants in the illustration are bluebell, mouse-ear hawkweed and mountain grass, which are often seen in roof vegetation.

Preface

The Government's ambition is for Sweden to be a pioneer in the environmental and energy field. While climate change and environmental degradation may be viewed as the greatest threats of today, they also represent an opportunity. An opportunity to create new jobs and new businesses, to boost export revenue and to help improve the environment, both in Sweden and in the world around us.

Everywhere, countries are investing heavily in areas such as renewable energy, waste management, water purification and sustainable urban development. This is giving the Swedish business sector a golden opportunity to put forward Swedish solutions that match needs and demand for sustainable growth, development and job creation both in Sweden and globally.

The Government has now produced a broad-based national environmental technology strategy. It contains initiatives ranging from research and innovation to export promotion. The strategy builds further on the investments in environmental technology and the promotion of Swedish exports in this field undertaken by the Government in recent years. But it is also time for fresh advances that can give Sweden a leading position in the environmental technology field.

In Sweden there is a considerable knowledge and experience of sustainable urban development. This is an area that many countries have shown an interest in, for example the 'SymbioCity – Sustainability by Sweden' concept.

Increasing urbanisation in developing countries makes technological exchange and specially adapted measures and infrastructural investments of various kinds more vital than ever. Untied Swedish aid has contributed to the transfer of technology by for instance establishing reference sites and structures in Sweden's partner countries. Here, Swedish aid can act as a catalyst by encouraging institution- and capacity building, including the development of regulations and standards.

To enhance the overall impact of the various initiatives, the strategy also lists the tasks assigned to various government actors in the environmental technology field. By establishing a clear division of work that exploits the core skills of each actor, we can ensure that the greatest possible impact is achieved.

In order to reach the goals, more companies active in this sphere need to begin exporting or to increase their exports of environmental technology. Their participation is crucial to the achievement of the objectives. The Government can help establish the requisite conditions by setting out clearly defined ground rules for companies so that they may successfully enter the market, grow and export.

Ewa Björling

Andreas Carlgren

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Maud Olofsson

Summary

As a country, Sweden has everything to gain from becoming a pioneer in the field of sustainable development. Adaptation to environmental imperatives will necessitate new solutions, new ways of supplying energy, modern and environmentally sound technology, and future innovations that generate employment and development. If this is to be achieved, many different actors and policy areas will need to interact.

The aim of the Government's environmental technology strategy presented in 2011 is to facilitate the emergence and export of new, green Swedish solutions. Initiatives in both the short and the long term – targeting everything from research and innovation to exports – are to make Sweden a green-tech pioneer. The Government will therefore be investing SEK 400 million in environmental technologiy during the period 2011–2014.

The Government wants more Swedish companies to begin exporting green-tech solutions or to increase their exports of such solutions. This is in the interests both of Sweden and of other countries. This brochure offers a number of examples of Swedish technology designed to meet the challenges of climate change and environmental degradation.

Good can be better

In the following pages, we present both small and medium-sized Swedish companies and projects, all with their own areas of experience and business ideas. They have one thing in common – they boost employment, combine commercial and environmental benefit, and help promote growth, development and a better quality of life in various parts of the world.

The examples show that Sweden and Swedish companies are often at the forefront in developing and exporting environmental technology solutions. But we can become even better.

The demand for environment-friendly and climate-friendly solutions is growing and with it the potential for increasing both the number of employees and the level of turnover and exports in the Swedish environmental technology sector.

Strategy focus

Through the Strategy for Environmental Technology, the Government intends to make it easier to exploit potential in the Swedish environmental technology field. This sector is crucial to economic growth and higher export levels. The Government's role is to help create good conditions for the sector to grow.

The strategy outlines 12 proposed assignments, initiatives and measures designed to boost the Swedish environmental technology sector. These include steps to intensify research and innovation, initiatives aimed at facilitating financing and business development at an early commercial stage, support and assistance with market analyses/startups in export markets for small and medium-sized businesses, and measures to improve coordination among government agencies and other actors of relevance to development in the environment sector.

Read the Government's environmental technology strategy in full-text: www.sweden.gov/envtech

Strategy goals:

- To create good conditions for the emergence and development of environmental technology companies in Sweden.
- To promote exports of Swedish environmental technology and thereby contribute to sustainable economic growth in Sweden and globally.
- To promote research and innovation in the environmental technology field and facilitate the commercialisation of innovations.

Hammarby sjöstad – Swedish environment concept for export.

PHOTO: KAROLINA HEDENMO/MILJÖDEPARTEMENTET

Mobile telephony with sun and wind.

PHOTO: FLEXENCLOSURE

Plants on roofs clean air, save energy and reduce noice.

PHOTO: VEG TECH

Algae gives a new biofuel.

PHOTO: SWETREE TECHNOLOGIES

The sun purifies water in developing countries.

PHOTO: SOLVATTEN

Concentrated sunlight solves global energy challenge.

PHOTO: ABSOLICON

Bright future for new solar technology

By concentrating sunlight, solar energy can be made both cheaper and more efficient. The Swedish company Absolicon Solar Concentrator AB in Härnösand has developed new technology featuring concentrating reflectors that co-produce electricity, heat and hot water.

"A solution to the world's energy problem," says the company's CEO, Joakim Byström.

Via a silver mirror, the Absolicon X10 solar collector gathers sunlight into a narrow ray with the strength of 20 suns. This concentrated sunlight is focused onto photovoltaic cells, producing ten times more electricity than traditional solar panels. The power is converted into 230V and can be fed directly into the grid.

This new generation of solar collectors is considered particularly suitable for large buildings and industries using electricity, heat, cooling or steam in their processes. The technology also heats water efficiently. The heat loss in an Absolicon solar collector during conversion to hot water is just a quarter of that in a traditional flat solar collector.

Profitable investment

A typical installation might be in a hotel with 50 rooms in southern Spain. Ten solar collectors (100 m^2) would produce 5 000 litres of hot water – enough to meet the entire hotel's needs in terms of shower water and hot water for cooking and washing. It would also generate the equivalent of 20 kW of electricity, enough to power all the lighting, minibars and fans.

The repayment period for this investment, given current energy prices and Spanish conditions, would be 6–10 years. In Sweden, with its solar power subsidies, a similar installation replacing one powered by electricity and oil would have a repayment period of approximately 10 years. In a country such as India, the period would be considerably shorter. Here, this technology is deemed to have particularly high potential. Concentrating solar collectors in such countries use just a quarter of the energy and natural resources used by older technology, which means mass production is a feasible option.

> *The concentrated sunlight is focused onto photovoltaic cells, producing ten times more electricity than traditional solar panels.*

Multiple benefits

The manufacturing sector stands to benefit in a variety of ways. The solar cells can be exchanged for a thermal tube that produces temperatures of up to 200° C. This means the heat from the solar collector can be used directly in processes requiring steam, such as the textile and food industries.

Heat-powered cooling equipment represents a substantial area of application for water with temperatures of 140–160° C. Hitherto, this well-tested technology has used gas or oil for its energy supply. Now, with the aid of concentrating solar collectors, solar energy can be fully harnessed to cool buildings.

"Industry needs solar energy to lower its energy costs," says Joakim Byström. "Economic benefit and environmental benefit go hand in hand."

"Concentrated solar energy is the solution to the world's energy problems. Absolicon will not rest until our solar collectors have been installed in every country in the world."

In 2011, Absolicon won the prestigious Intersolar Award for the best solar heating product.

PHOTO: ABSOLICON

Absolicon Solar Concentrator AB

Established: 2007

Number of employees: 10

Development funding: Swedish Energy Agency, Swedish Agency for Innovation Systems, Stiftelsen för forskning om koncentrerad solenergi (Sparbankstiftelsen i Norrland), private financiers.

Markets/exports: Installations in Sweden, Spain, Italy, Greece and Chile. A manufacturing unit is planned in India.

Research contacts: Close collaboration with the Mid Sweden University. Pursues own research projects, usually together with students from Uppsala University or the Royal Institute of Technology, Stockholm.

Read more: www.absolicon.com

Above: District heating installation, Härnösand.

Below left: Solar cell.

Below right: Receivers – the sun panel heart.

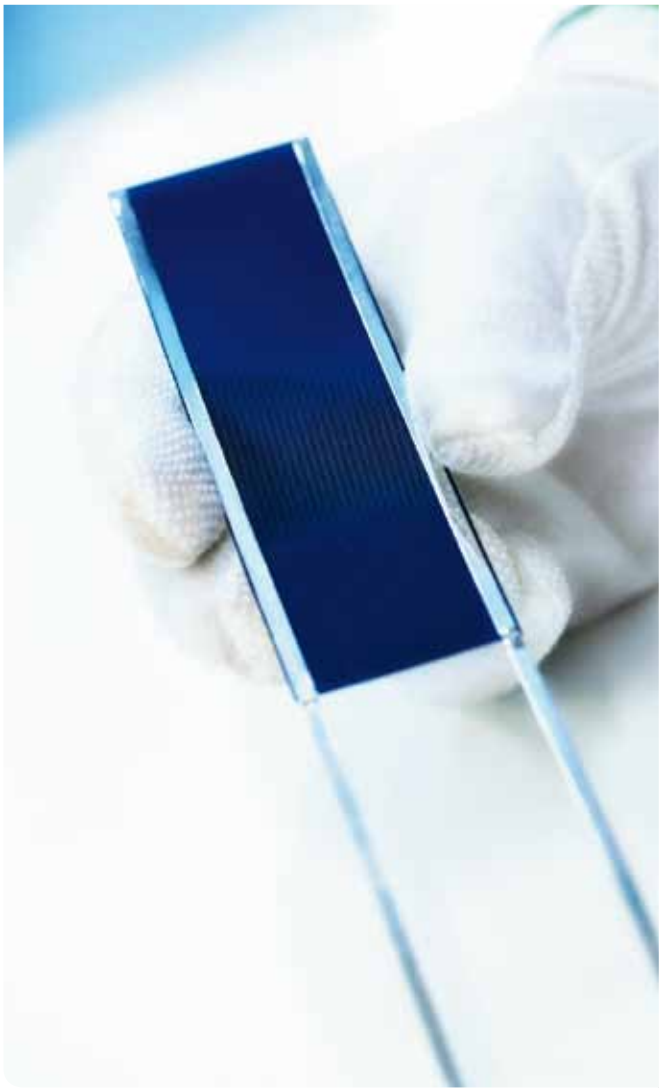

PHOTO: DOREEN BERNHARD

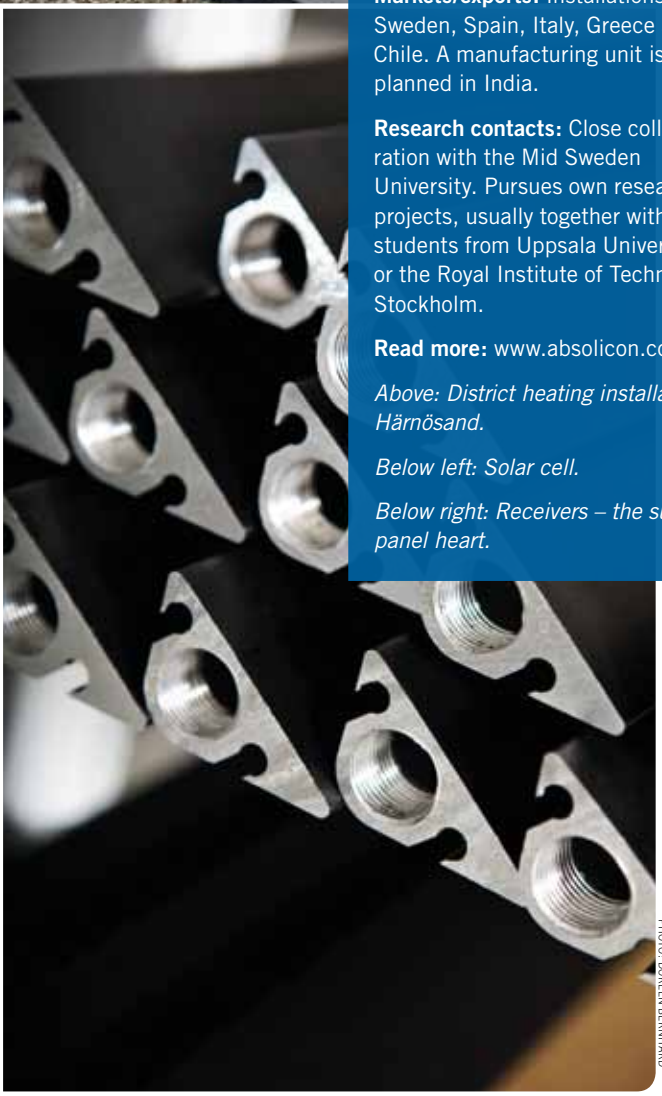

PHOTO: DOREEN BERNHARD

Exporting sustainable cities

Resource-efficient city areas such as Bo01 in Malmö and Hammarby Sjöstad in Stockholm have put Sweden on the world map. Sustainable urban planning has become a Swedish brand of acknowledged quality, and China is one of the countries in which Swedish urban development is now gaining ground.

> *Good planning is essential, and sustainable urban planning is largely about introducing the right skills early in the planning process.*

Today, over half of the global population are urban dwellers. China is one of the countries in which urbanisation is advancing most rapidly; something like 15 million Chinese per year are migrating to its towns and cities. This is placing a considerable strain on the urban environment.

"Efficient infrastructure and traffic, along with sustainable systems for waste management and water supply, are huge tasks for many urban areas experiencing growth," says Eva Nygren, CEO of Sweco Sweden.

Major potential

Sweco is one of the companies that have developed concepts and ideas for tackling the challenges posed by urbanisation. The company is clear about what is needed: good planning is essential, and sustainable urban planning is largely about

Symbiocity–A Swedish Concept

The Swedish 'SymbioCity' concept integrates community planning and urban development from an ecological, social, economic and spatial perspective. It involves adopting an eco-cyclic approach to energy, waste and water, community planning, transport and land use planning, and energy-efficient buildings. Caofeidian in China is one city to have applied this concept, which also underlies the development of the Hammarby Sjöstad suburb in Stockholm and has been implemented in other projects in China, Canada and Ireland etc.

SymbioCity is supported by a network of Swedish companies and organisations, and the concept has been developed in collaboration with the Swedish Trade Council. Read more: www.symbiocity.org

PHOTO: SWECO

Key Sweco players in Caofeidian

The Chinese eco-city of Caofeidian, 250 kilometres southeast of Beijing, is an example of Swedish expertise demonstrated on site (SE: svenskt kunnande omsatt i praktikten). Where there used to be fish farming ponds, salt production facilities, oil pumps and the seabed, a whole urban community is being developed. Housing, streets and roads have been established on reclaimed land comprising mud and sand dredged from the bottom of the Pacific.

A Sweco team has undertaken a sustainability analysis of the area, which in the future will have approximately a million residents. In addition to that, Sweco has also produced an urban plan. The first development stage will extend across 30 square kilometres and accommodate some 400 000 inhabitants. It is due for completion in 2020. Sweco has also produced a local development plan for 12 square kilometres of housing, workplaces, schools and a university, plus sports and recreation facilities.

The targets are ambitious. Besides not generating any carbon emissions at all, the new eco-city is designed to deliver a surplus of energy. In the plan it is proposed that 95 per cent of the energy use in Caofeidian should be renewable, and a highly sophisticated ecocyclic system will in principle enable everything in the city to be recycled. The city's water, waste and energy flows will be viewed as resources. Both treated sludge from sewage works and organic waste will be converted into biogas, for instance, and purified wastewater from dishwashing and clothes washing will be used to irrigate farmland. The eco-city will be based on a system of efficient ecocycles. In addition, a dense network of roads will facilitate public transport and it will be easy to walk and cycle in the city.

"Planning and environmental technology are not everything, however," says Eva Nygren, Sweco. "It's the way people live and behave that will determine whether the solutions we build into the city have the right impact." To raise environmental awareness, she notes, a sustainability centre is also being built where people can learn more about environment and sustainability issues.

introducing the right skills early in the planning process.

The work must be based on open, creative and constructive cooperation between decision-makers, experts and the general public. Here, Sweden has considerable expertise – and this in itself has become a successful export.

Given the growing number of urban dwellers, the importance of sustainable urban planning should not be underestimated.

"Sustainable urban development is vital if we wish to reduce greenhouse gas emissions and global warming," says Ulf Ranhagen, a senior architect at Sweco and a professor at Stockholm's Royal Institute of Technology. He adds:

"Using integrated planning and a holistic approach, it's possible to create climate-neutral city districts. This is true both with regards to new projects and the transformation of existing ones."

PHOTO: SWECO

Sketches of the future Caofeidian, Sweco.

The Sweco group

Established: Sweco has been focusing on sustainable community development and environmental technology for over 100 years.

Number of employees: 5 900

Development funding: Project exports are financed by private companies, foreign agencies, international banks, Sida, the EU and others.

Markets/exports: Operates in 11 countries. Extensive project exports, commissions in 80 countries.

Research contacts: Several professorships and two foundations associated with the operation. The foundations encourage R&D in the fields of environmental technology and architecture. They also award a regular energy prize.

Read more: www.sweco.se

A green power boost for developing countries

Flexenclosure uses the sun and wind to power base stations for telephony in developing countries lacking sufficient electricity. This low-energy technology reduces operating costs and carbon emissions while giving people in rural areas access to both mobile telephony and energy.

Flexenclosure is an environmental technology company based in Vara on the Västgöta plains, specialising in adapted energy solutions for global telecom companies. Its flagship, E-Site, is a system for powering base stations in places where no electricity is available.

E-site primarily uses renewable energy sources (sun and wind) to power the stations. The environmental and economic benefits are reduced diesel consumption, lower costs and a reduction of up to 90 per cent in carbon emissions compared with a diesel-driven generator.

The flagship sails on

Today, the product range includes everything from power solutions to complete computer halls. E-site technology is constantly developing. Its special feature is its 'brain', the Diriflex control system. Here, power generation is maximised using renewable energy sources, and the Diriflex also ensures that the battery bank is being used efficiently.

According to the company, base stations using E-site can push efficiency levels above 90 per cent, as opposed to maybe 60 per cent from wind turbines or solar panels plugged into a base station. Flexenclosure notes that a growing number of mobile operators are seeking green solutions for their rural base stations.

The beauty of it

"The economic beauty of it is that the reduced operating costs you get with E-site act as a strong incentive on mobile operators to install this green solution," says CEO Stefan Jern. He adds:

"No political pressure, law amendments or government subsidies are required. What's good for the customer – lower operating costs when renewable energy substitutes polluting diesel oil – is also good for the environment."

The company's calculations speak for themselves: a single base station run wholly on diesel oil can use 20 000 litres per year. This means a total annual operating cost of between USD 30 000 and 50 000. With E-site, the cost can be reduced by up to 90 per cent, which means a saving of almost USD 45 000 dollars per year/site. Reduced diesel dependence also reduces vulnerability to diesel price hikes.

> *In Nigeria alone, there are several thousand diesel-powered telecom stations. Here, the technology can reduce carbon emissions by over 100 000 tons per year.*

The environmental benefits are equally obvious. The reduced use of diesel for powering a base station corresponds to a reduction in carbon emissions of something like 50 tons per site/year. In Nigeria alone, there are several thousand diesel-powered telecom stations. Here, the technology can reduce carbon emissions by over 100 000 tons per year.

"While upgrading a diesel-powered site with solar panels and wind turbines to an E-site may seem like a relatively expensive move, such an investment is recouped in the space of about two years," says Stefan Jern. "Over five years, the mobile operator's return often exceeds 100 per cent."

Surplus energy for the community

A new and highly interesting feature developed in collaboration with Ericsson is Community Power, which enables mobile operators using E-site to distribute surplus energy from the base stations to local communities. In practice, it transforms the site into a power plant supplying the communities surrounding it. Places where electricity has never been available can now access it to charge mobile phones, to light streets and to run cold-storage rooms for medicines etc.

Community Power has aroused great interest in the telecom industry and won the industry's most prestigious prize, the Global Mobile Award, in the category Best Use of Mobile for Social & Economic Development.

PHOTO: CARLA KARLSSON

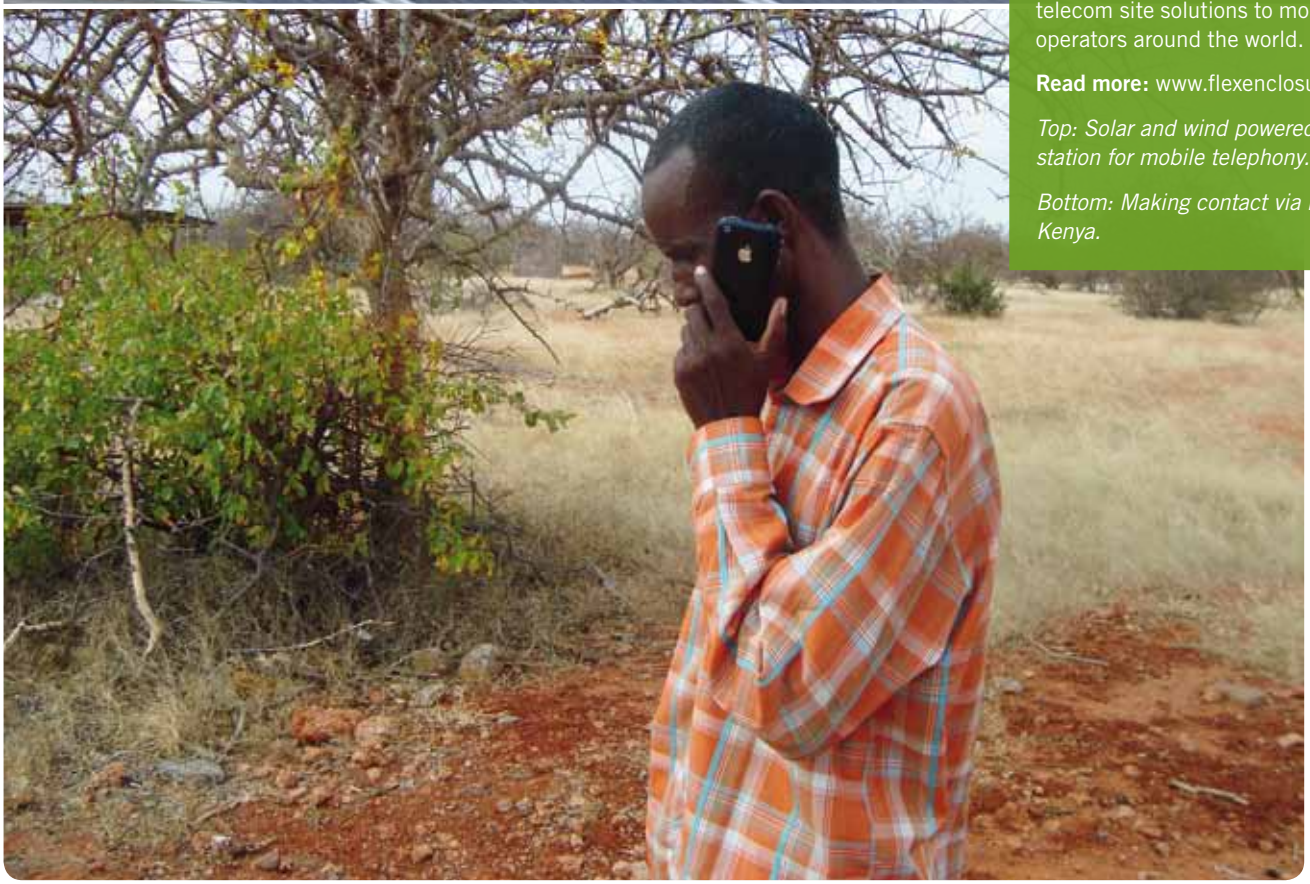

PHOTO: DAVID GUSTAVSSON

Flexenclosure AB

Established: 1989

Number of employees: 55

Development funding: Internal sources.

Markets/exports: Primarily Africa. Has so far delivered some 8 000 telecom site solutions to mobile operators around the world.

Read more: www.flexenclosure.com

Top: Solar and wind powered base station for mobile telephony.

Bottom: Making contact via E-site, Kenya.

A new biofuel derived from algae

A Swedish technique for cultivating microalgae in municipal and industrial wastewater by introducing flue gas is arousing considerable interest among both industrialists and researchers. The reason is its multiple environmental benefits: nutrients such as nitrogen and phosphorous are removed from the wastewater, carbon dioxide in the flue gas is fixed, and biomass suitable for use as biofuel is formed. The aim now is to commercialise this green idea.

The leading figure behind this innovation is Francesco Gentili, a researcher at the Swedish University of Agricultural Sciences (SLU) in Umeå. The technique is still at the project stage but ambitions are high: Francesco, together with the power company Umeå Energi, wants to produce biomass for biofuel production for transport while at the same time reducing carbon emissions in an economical and environmental sustainable way. The end product, biomass, can be used to produce bioethanol and biodiesel – or be used as fertiliser, fish feed or animal feed.

> *The biomass generated can be used to produce energy directly or as the raw material for biogas, bioethanol or fertiliser.*

The requisite technology is now being developed and scaled up in a special facility as a prelude to economically sustainable production. In the early stages of the project, artificial lighting was used to stimulate algae growth, but since February 2010 only sunlight has been used.

Climate gains

The project is deemed to be of major importance both for industry and for the achievement of climate objectives. The potential output from algal production in a full-scale plant using wastewater from the municipally owned utility Umeva and flue gas from Umeå Energi is estimated at between 18 000 and 20 000 tons of dry matter per year. The biomass generated can be used to produce energy directly or as the raw material for biogas, bioethanol or fertiliser. The algal technology can be used by industries in many different sectors.

"Results so far show that it works, and that producing algae using sunlight as the main source of energy in a northern climate yields both economic and climate-related benefits," says Francesco Gentili. He notes that there has been considerable interest in the project on the part of industries, research institutions and the general public. The aim is to set up a company to commercialise the results.

Viable in developing countries

Although CO_2 is a major threat to the global climate, the lack of it tends to be a limiting factor in algal production. Extracting the gas from industrial emissions can be an advantage from many environmental viewpoints. Francesco Gentili is optimistic:

"There is a very great need of good, cost-efficient environmental technology both in Sweden and abroad," he says. "Industry needs to reduce its emissions, and many marine areas, including the Baltic Sea, are hard hit by algal bloom. Our technique – which involves reducing levels of CO_2, nitrogen and phosphorous in flue gas while at the same time purifying water and producing biomass – is scalable in size and can easily be adapted to different activities."

The technique is not only of interest to Sweden. It is considered particularly suitable for developing countries, where the climate is often excellent for growing.

"Also the production system is cheap and simple to set up, while the technique solves a range of problems," says Francesco Gentili. The world needs solutions like this."

PHOTO: JOHAN GUNSEUS, SYNK BILDBYRÅ

PHOTO: JOHAN GUNSEUS, SYNK BILDBYRÅ

The algae project Umeå Energi

Established: 2007

Research contacts: The project is headed by Francesco Gentili, a researcher at the department of Wildlife, Fish and Environmental Studies, Swedish University of Agricultural Sciences (SLU), Umeå, in close cooperation with Umeå Energi, Umeva and Ragn-Sells.

Development funding: Swedish Energy Agency, Processum, Umeå Energi, Umeva, Ragn-Sells, Uminova Innovation.

Markets/exports: As yet, only at the experimental stage in Sweden. Cooperation established with the pulp and paper industry. New large facility for scaling up at the Dåva power plant outside Umeå.

Read more: www.umeaenergi.se

Top: Dried raw material.

Bottom: Pilot plant at the Dåva thermal power station, Umeå.

Water and wastewater solutions for the future

High-efficiency systems for water and wastewater treatment and for biogas production. Sweden's Purac is at the forefront of efforts to tackle two of the prime challenges faced by society today – clean water and energy for both people and industry. The company's installations are currently to be found in some 70 countries worldwide.

Purac is a part of the Läckeby Water Group, an independent, privately owned Swedish group. The company's core business idea is the treatment of municipal and industrial wastewater and the production of renewable energy through the conversion of waste and residual products into biogas.

The whole chain

Carefully developed process engineering adapted to the needs and overall economy of each individual site is what makes Purac a market leader in its field, the company says. Products and services extend throughout the chain from idea and planning to operation and maintenance of entire plants.

> *The industry norms and standards established early on in Sweden helped bring Swedish environmental technology well to the fore in the international arena.*

To date, Purac has completed more than 4 000 contracts, primarily in Europe and Asia. The contracting business unites the company's know-how regarding processes, design and contracting with its internally developed and licensed technologies for increased efficiency and more economical operation. Purac uses methods that it says are capable of reducing floorspace needs and operating costs by up to 50 per cent.

Success factors

Purac has long experience of systems for water and wastewater plant in both Sweden and the outside world. The industry norms and standards established early on in Sweden helped bring Swedish environmental technology well to the fore in the international arena.

Purac has for instance undertaken a number of projects in China, Sri Lanka and Russia, funded by Sida. The company has long been an established and successful actor in China, while India and Russia are viewed as interesting but challenging markets. Russia's relatively complicated business structure sets limits for what – by international standards – comparatively small companies like Purac can achieve. In India today, demand for water and wastewater treatment is still largely being met by domestic companies.

Expansion opportunities

The market may pose challenges, but growing needs suggest there is room for expansion. Demand for clean water and energy continues to rise all over the world.

"Even quite wealthy countries like Sweden and other developed nations face constant deterioration in their raw water quality, which means waterworks will have to be expanded," says Division Director Jonas Fack.

Given the rising pace of population growth and urbanisation, the need for wastewater treatment looks likely to increase dramatically. At the same time, global energy needs are perpetually increasing.

"The production of biogas from things like refuse and waste, sludge from treatment plants and industrial wastewater gives you green, renewable energy while at the same waste is being turned into something beneficial instead of being a burden on society," says Jonas Fack. "Here, Purac can help create a better world."

PHOTO: PURAC

PHOTO: PURAC

Purac (a division of the Läckeby Water Group)

Established: 1956

Number of employees: 118

Markets/exports: Established on three continents: Asia, North America and Europe. Has completed contracts in 70 countries.

Read more: www.purac.com

Top: GEWE XX for drinking water, Brisbane, Australia.

Bottom: Wastewater treatment plant, Oslo, Norway.

New timber dryer halves power bills

Timber drying kilns are the great energy guzzlers in sawmills. But that is about to change. A company in Luleå in northern Sweden, Alent Drying AB, has developed a new timber drying method. The result: drying times are shorter and electricity consumption has been halved.

> *The method can be applied in existing drying kilns by changing the control system and installing the new drying software, an investment that is recouped within a year.*

Timber is dried by blowing hot air through the timber batch. Efficiency is achieved by alternating between periods when the fans operate at full capacity and periods when they are switched off (rest and run mode). The water in the wood continues migrating out to the surface when the fans are off. The wood surface remains wetter than when traditional drying is used, which actually facilitates the transport of water out of the timber. Evaporation is 3–4 times as fast, which means shorter drying times – and less risk of cracking.

Rapidly profitable

The method can be applied in existing drying kilns by changing the control system and installing the new drying software – an investment that is recouped within a year.

Alent's drying method benefits both the environment and the economic situation in both industrialised and developing countries. In Sweden there are an estimated 1 500 chamber dryers, which, using the new technology, can each save 100 000 kWh per year. The EU zone has some 10 000 dryers, while there are perhaps a further 100 000 elsewhere in the world. Overall, the saving potential is huge: the company estimates that if all timber drying in the world were to use Alent's method the saving would correspond to the output from 25 coal-fired power plants.

Focus on volume

Alent's drying software is currently being developed for Microsoft's latest platform so that it can be used in standard PCs and in control units from the world's leading manufacturers. The focus is on boosting volume growth. For some time now, the company has had patents that save both the environment and energy when timber is dried, and it will shortly be ready to enter markets outside Sweden.

Its international business strategy involves selling program licences and know-how to an intermediary – timber dryers or companies working to improve energy utilisation in industry.

"We're hoping that Alent will be a good example of Swedish environmental technology exports emphasising what we're good at in Sweden," says the company CEO, Erik Björkman. "Swedish wood and drying technology is already internationally respected, both in research and in application. Our drying method opens up a new multidisciplinary area of application by combining wood physics and energy and environmental technology with modern control engineering. These are three areas in which Sweden is at the cutting edge."

PHOTO: ALENT DRYING

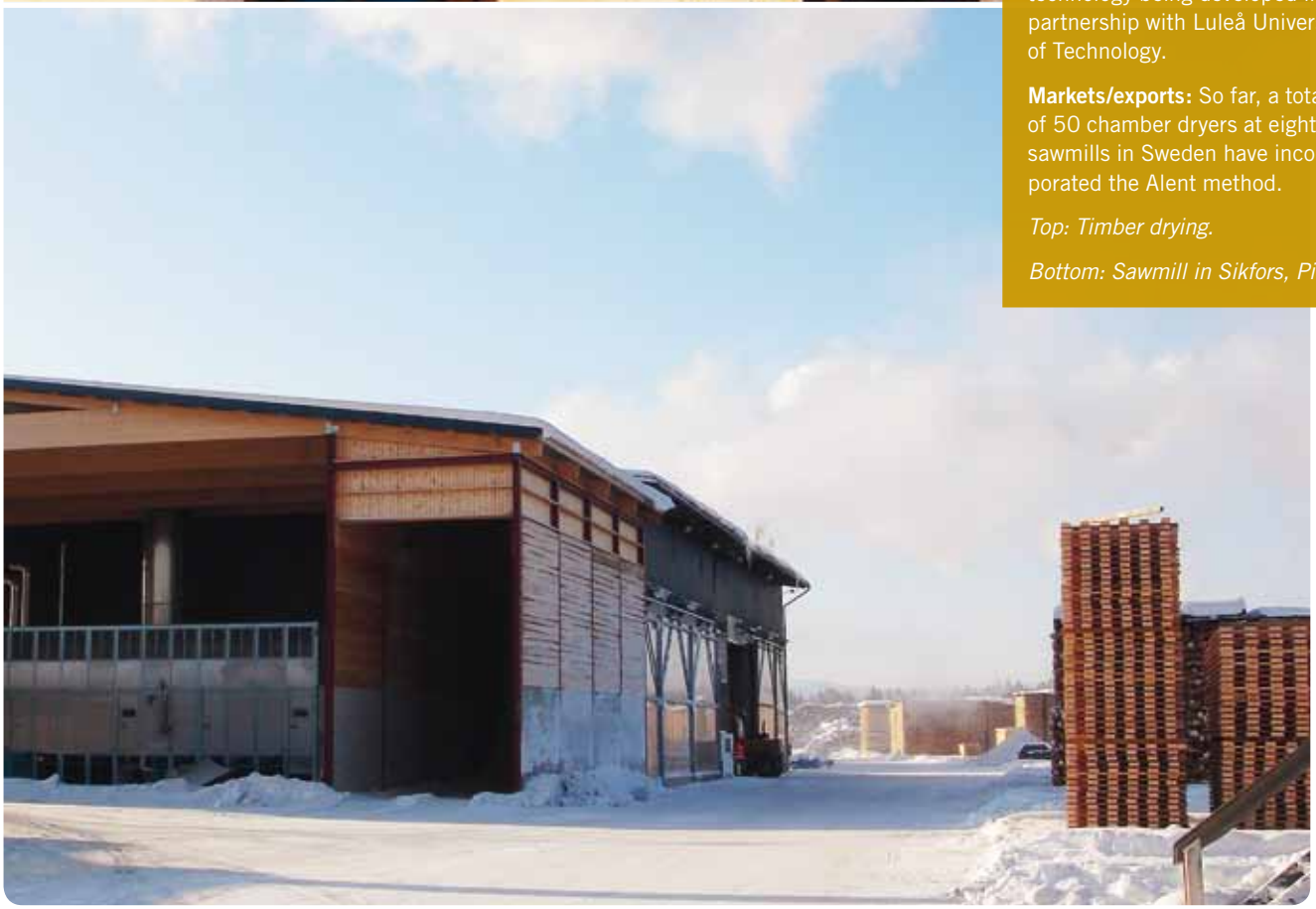

PHOTO: ALENT DRYING

Alent Drying AB

Established: 2005

Number of employees: Two. Nine people associated with the operation.

Development funding: Swedish Energy Agency (royalty loan), private financier (StenvallsTrä AB), Norrbotten County Administrative Board, Längmanska Företagarfonden.

Research contacts: Close cooperation with sawmills and wood researchers both in Sweden and abroad. Advanced control technology being developed in partnership with Luleå University of Technology.

Markets/exports: So far, a total of 50 chamber dryers at eight sawmills in Sweden have incorporated the Alent method.

Top: Timber drying.

Bottom: Sawmill in Sikfors, Piteå.

Drinkable water thanks to the sun

Solvatten is a Swedish innovation that purifies water with the aid of solar energy. The black container has already helped ensure thousands of households in developing countries of a decent, healthier existence.

Solvatten both heats and purifies water, which impacts favourably on energy use and the environment alike. It also improves the quality of life for individuals in the form of better health and better finances. This is crucial in a world where over a billion people or every seventh person lacks access to safe water.

In addition, due to its simple purifying method, Solvatten makes everyday life easier for many women who would otherwise have the arduous task of fetching fuel and purifying the household's water manually. Studies conducted in collaboration with two Swedish organisations, Kooperation utan Gränser and Vi-skogen, show that users save about three hours a day – time that can be used to educate their own children, for instance, or to increase the household's earnings.

Simple function

Fill it with water and Solvatten does the job itself. The container is placed in the sun for 2–6 hours, whereupon the water is pasteurised and made germ-free via UV radiation. Finally, a built-in filter cleanses the water from contaminating microorganisms. An indicator shows when it is fit to drink.

> *From a broader sustainability perspective, Solvatten can replace people's need of wood from forest areas that are already severely depleted.*

A container can produce 10–30 litres of hot, clean water per day. Prolonged handling in tough environments imposes heavy demands on the material, so the plastic is robust and is estimated to last for 5–10 years. The material is of food-grade quality and can withstand high temperatures. When the time comes to change containers, the old one is easily recycled.

Sustainable solution

The company's vision is to supply people in developing countries with the most cost-efficient and sustainable water treatment solution available at household level. The advantages of this simple water purifier, however, extend beyond individual benefit. From a broader sustainability perspective, Solvatten can replace people's need of wood from forest areas that are already severely depleted. Easing the pressure on forests may in turn reduce soil erosion and improve carbon uptake. The company estimates that during its lifecycle a single container can save 10–14 tons of carbon dioxide, corresponding to 50–70 trees (assuming that Solvatten is used 1.5 times a day for 330 days per year).

Not easy to reach users

Reaching those most in need of Solvatten is a major challenge. Today, the company cooperates with organisations such as Vi-Skogen, UN-Habitat and Världsnaturfonden WWF. Business partnerships and cooperation with NGOs makes it easier to reach users and enables Solvatten to be sold locally at a subsidised price.

The Solvatten containers are produced in Sweden. Petra Wadström is the inventor and the CEO of Solvatten AB:

"I created Solvatten after seeing with my own eyes how the lack of safe drinking water was causing enormous problems in Indonesia. It took many years and lots of different prototypes before I could put my idea into practice. My goal is – and will always be – to ensure that all those in need of clean, safe water are supplied with Solvatten.

PHOTO: SOLVATTEN

Solvatten AB

Established: 2006

Number of employees: 6

Development funding: Swedish Agency for Economic and Regional Growth, Swedish Agency for Innovation Systems.

Research contacts: Karolinska Institutet and Karolinska University Hospital, Stockholm, R&D Comair AB and VibraTech AB.

Markets/exports: Solvatten is used in Haiti, Kenya, Uganda, Tanzania, Pakistan, Timor and Nepal. Subsidiary in Kenya since 2011 (Solvatten Africa Ltd).

Read more:www.solvatten.com

Solvatten containers make daily life easier, Kenya.

Less nitrogen leaching with new plant fertiliser

SweTree Technologies is a company which, in close cooperation with Swedish universities, has developed a new type of fertiliser based on the amino acid arginine instead of ammonium and nitrate, which are normally used in plant fertiliser. The company's arginine-based product, arGrow, has been shown to have several environmental and biological advantages.

SweTree Technologies is a forestry biotech company that specialises in developing and commercialising products and technology to boost forestry production, tree processing, fibre modification and new materials based on cellulose.

ArGrow developed out of an environmental project at a nursery for forest trees in 2001. Studies at the nursery showed that arginine is effectively bound to the crop, which reduces the leaching of nitrogen by 40–95 per cent when it rains. This strong binding also means that the total fertiliser required for plant cultivation decreases by 25–30 per cent.

> *Reducing nitrogen leaching to groundwater and watercourses in connection with industrial cultivation is a global environmental issue and the environmental control requirements are getting stricter.*

Better plant quality

The first large-scale cultivation with arGrow was in 2006. During cultivation, differences in quality were found between plants cultivated with arGrow and plants cultivated with conventional fertiliser based on ammonium and nitrate.

"We discovered that the arginine stimulated the plants' root growth in a completely different way to traditional fertiliser. At the same time, it was easy to achieve a high nutritive content in the plant while retaining root quality," explains Jonas Öhlund, project manager at SweTree Technologies.

Root development and the quality of the root system are

extremely important for forest plants. After having been cultivated under optimum conditions with an abundance of water and nutrients, they are planted out in clearings where the water and nutrient supply is usually low. With arGrow, plants are shown to establish themselves and grow rapidly. This is important as mortality is highest during the initial period after the plant has been planted out.

"ArGrow produces a strong plant with adequate nutrients and resources," says Torgny Näsholm, Professor of Forest Ecology and Management at SLU, the Swedish University of Agricultural Sciences. "We believe that this is because arginine matches a plant's natural method for storing nitrogen. The plant can thus absorb nutrients easily and efficiently."

Global market

ArGrow's potential extends far beyond the Swedish market. Reducing nitrogen leaching to groundwater and watercourses in connection with industrial cultivation is a global environmental issue and the environmental control requirements are getting stricter. SweTree Technologies is seeing growing interest from both private companies and state institutions. Extensive commercial tests are currently in progress on species of tree other than Swedish pine and spruce in North America and Australia.

In another project, arGrow is being optimised for eucalyptus in countries including China and Uruguay. The production of eucalyptus is fertiliser-intensive. This is largely because eucalyptus is often cultivated in countries with daily precipitation. The environmental benefits of using a fertiliser that does not leach when it rains are, therefore, particularly high in such countries.

SweTree Technologies believes there is great potential for the expansion of its operations to include areas other than forestry. One example is golf courses. These require large quantities of nitrogen to fertilise the grass and are often located in or close to areas that are environmentally sensitive.

PHOTO: YVONNE HEDMAN

SweTree Technologies AB

Established: 1999

Number of employees: 30

Development funding: Swedish Agency for Innovation Systems (several projects) and EU subsidies.

Research contacts: Close cooperation with several universities, including Umeå University, SLU and KTH, the Royal Institute of Technology.

Markets/exports: Ongoing joint projects in the Nordic region, South America, the US, Canada and Asia.

Read more: www.swetree.com

Top: Fertilising with ramps, Gideå plant nursery, Örnsköldsvik.

Bottom left: Root of a forest plant.

Bottom right: Growing on free land.

PHOTO: YVONNE HEDMAN

PHOTO: SWETREE

Göteborg builds energy-efficient district

Sustainability is a key feature of Göteborg's fresh approach to the district of Kvillebäcken. Seven developers are working together to realise the architects' ambitions. Of six pioneering projects already given the go-ahead, one featuring energy-efficient buildings stands out.

The area of Kvillebäcken represents the first stage in the drive to build the new 'River City' in Göteborg. The vision is to create a sustainable district with the focus on human interaction and climate-smart living. The aim is a densely-built area with an inner city feel, and inspiration has been drawn from districts in central Copenhagen and London.

Collaboration the way forward

Göteborg is expanding across the river Göta. By developing and managing properties and areas, the municipal company Älvstranden Utveckling AB is helping to breathe life into the new heart of the city. A new consortium of seven developers is responsible for the development of Kvillebäcken. In partnership with the City Planning Office and other municipal administrations and companies, the consortium has formulated visions, set out objectives and planned the area.

> *In the 'Kvillebäcken Agreement' the developers undertake to transform Kvillebäcken into a socially, economically and ecologically sustainable district.*

The initiative is guided by a shared vision of sustainable urban development. In the 'Kvillebäcken Agreement', the developers undertake to transform Kvillebäcken into a socially, economically and ecologically sustainable district.

"To ensure that the Kvillebäcken Agreement is not just fine words, the consortium has prepared a 'Programme for sustainable development in Kvillebäcken'," explains Erica Bengtsson, environmental coordinator at Älvstranden Utveckling AB. "The programme gives the vision specific form and moves the sustainability issues to a level at which they are feasible in practice."

Six pioneering projects

Six separate pioneering projects have been granted state subsidies via the Delegation for Sustainable Cities. These include measures to develop energy-efficient buildings, a partnership between Älvstranden Utveckling and Göteborg Energi. This stretches the limits of the public systems for heating and power consumption for which Sweden is already well known. Minimising the emissions released by a district heated building at peak consumption times is one of the sub-objectives.

"Among other things, we're testing new technology that makes it possible to even out the 24-hour variation in district heating demand and thus reduce the proportion of fossil fuel that might otherwise be required at the morning and evening peaks, for example," explains Erica Bengtsson.

"This means that the structure of the building and the radiator system are used as short-term energy storages in the district heating network. The buildings will also be fitted with unique washing machines, tumble dryers and dishwashers that are powered by district heating. This will help reduce power consumption."

These solutions are estimated to have the potential to generate big financial and environmental gains when they are scaled up and distributed. According to a preliminary study, evening out the 24-hour variation throughout the district heating system in Göteborg means that the use of fossil fuel can be minimised and emissions of carbon dioxide be reduced by 15 000 tons per annum.

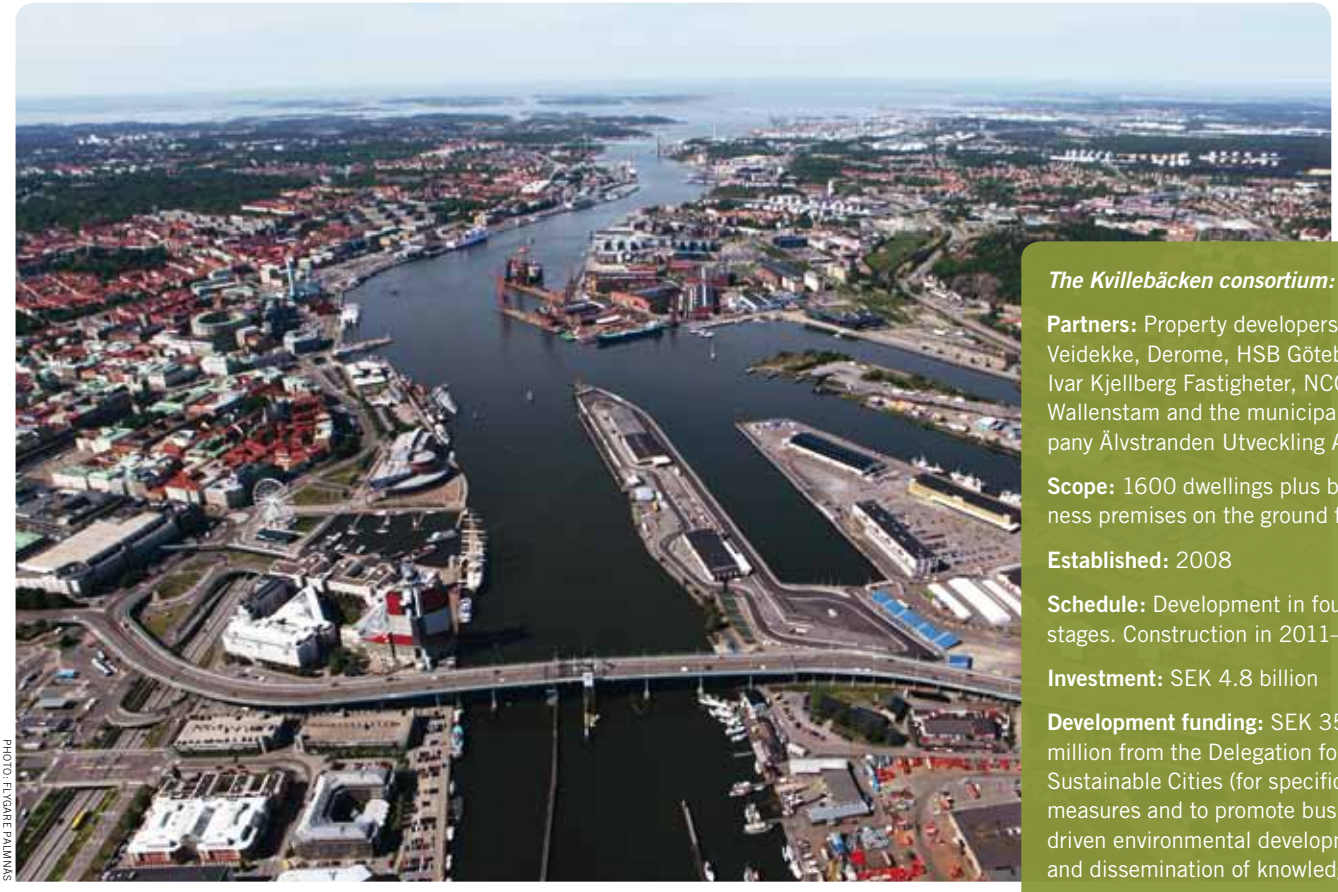

PHOTO: FLYGARE PALMNÄS

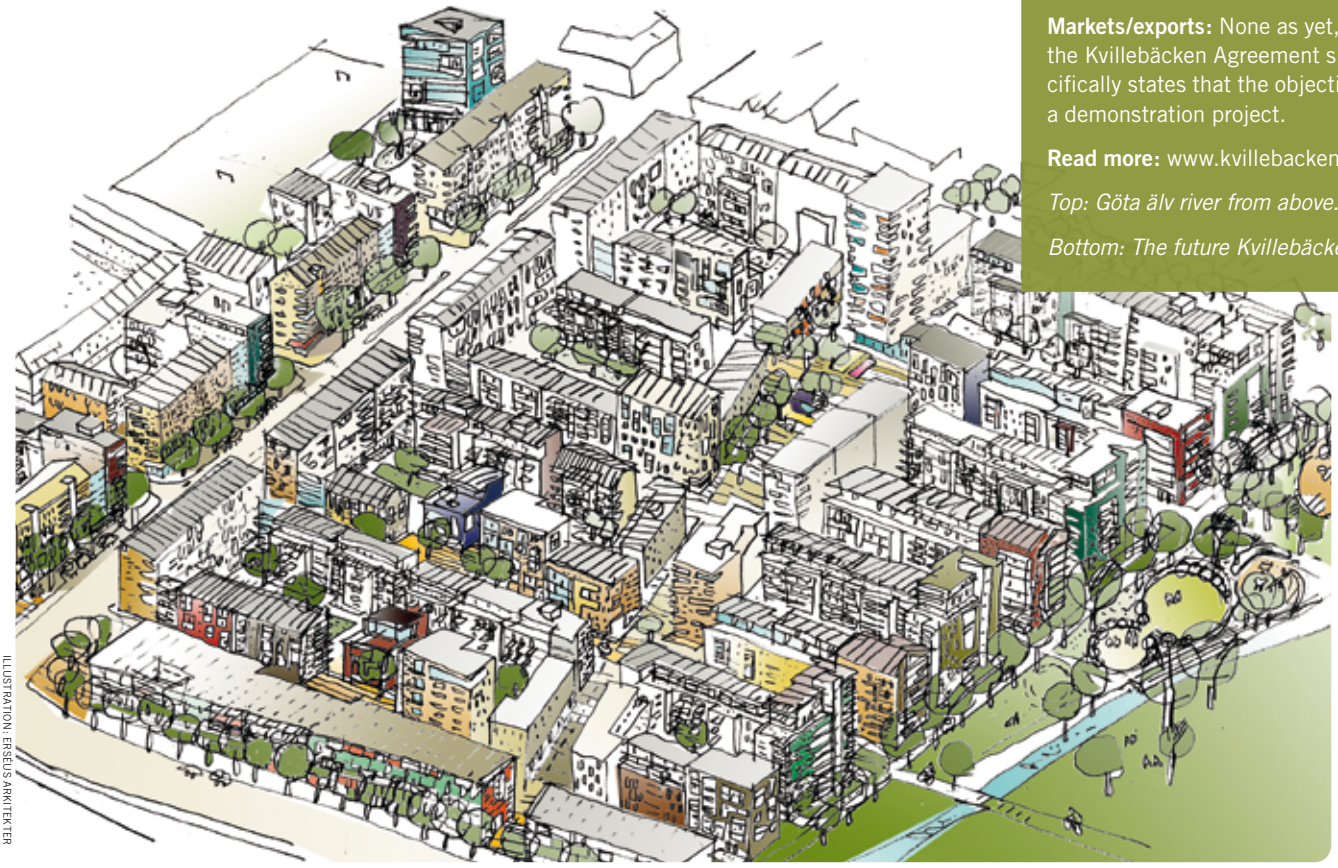

ILLUSTRATION: ERSEUS ARKITEKTER

The Kvillebäcken consortium:

Partners: Property developers Veidekke, Derome, HSB Göteborg, Ivar Kjellberg Fastigheter, NCC, Wallenstam and the municipal company Älvstranden Utveckling AB.

Scope: 1600 dwellings plus business premises on the ground floor.

Established: 2008

Schedule: Development in four stages. Construction in 2011–2018.

Investment: SEK 4.8 billion

Development funding: SEK 35 million from the Delegation for Sustainable Cities (for specific measures and to promote business-driven environmental development and dissemination of knowledge).

Markets/exports: None as yet, but the Kvillebäcken Agreement specifically states that the objective is a demonstration project.

Read more: www.kvillebacken.se

Top: Göta älv river from above.

Bottom: The future Kvillebäcken.

Purification of tap water and oceans

Advanced research for just over a decade lies behind Wallenius Water's water purifiers. Without the use of chemicals, the technology purifies the water in kitchen taps, swimming pools and oceans of harmful microorganisms and other undesirable substances.

Wallenius Water's story began in its fellow subsidiary, the shipping company Walleniusrederierna. A plan was presented in the mid-1990s to gradually reduce the environmental impact of vessels. One of the focus areas was to find a method of purifying their ballast water without creating new environmental problems.

> *As the technology makes it possible to recycle the water, it has a positive impact on both energy consumption and profitability.*

Shipping uses up to five billion tonnes of ballast water per year. This water is used to stabilise cargo vessels. The ballast water may contain contaminants and foreign species that risk multiplying and replacing natural ecosystems if the water is emptied without having been purified.

From ballast water…

Intensive work was begun to develop a purification method that met the tough requirements of the UN's International Maritime Organization, IMO. The project was implemented with one of the biggest suppliers in the maritime industry, Alfa Laval, and resulted in PureBallast, the first IMO-approved, chemical-free product for purifying ballast water.

The technology has since been installed in numerous vessels around the world. However, it has yet to enjoy a full international breakthrough. The reason for this is partly to be found in the regulations for international shipping.

"Although the IMO classifies unpurified ballast water as a major global threat to the environment, the convention that was supposed to force vessels to purify their ballast water has not been ratified by enough countries for it to enter into force," says Torkel Elgh, the Wallenius Water CEO.

… to purification on a broad front

In parallel with the development of technology for purifying ballast water, the Wallenius company developed a number of other products based on the same technology. This is Wallenius AOT (Advanced Oxidation Technology); patented, chemical-free technology inspired by the way in which nature itself purifies water. A light source and a catalytic surface are used to create free radicals that break down harmful microorganisms and other undesirable substances in the water without harmful residual products being produced.

The purification technology can be used for both small quantities of water and large volumes of thousands of cubic metres of water. As the technology makes it possible to recycle the water, it has a positive impact on both energy consumption and profitability. One of the beneficiaries is industry, where large volumes of water are often consumed.

In showers and swimming pools

Another area of application is the property sector, where chemicals or heat are frequently used to keep water free of microorganisms. The Legionella bacterium, which causes Legionnaires' disease and Pontiac fever, is a common problem in this connection. Bacteria can be spread via showers and similar installations where there is water mist. Wallenius AOT allows the temperature in the hot water system to be turned down, thus reducing the Legionella bacteria to a minimum.

A practical example of how the technology works can be seen at the swimming pool in Sundbyberg, which was able to reduce the use of chemicals and thus the bound chlorine by 70 per cent. At the same time, both water and energy consumption have decreased. Less chlorine consumption has also contributed to a better working environment for the staff.

PHOTO: SJÖFARTSVERKET/NICKLAS LILJEGREN

Wallenius Water AB

Established: 1996

Number of employees: 35

Markets/exports: Wallenius Water's water purifiers are sold worldwide via distributors and partners in four major segments: industry, energy, marine industries and properties.

Research contacts: Partnership with KTH, Stockholm, and others. Conducts its own research into photocatalysis.

Read more: www.walleniuswater.com

Cleaning ballast water has a major impact on the global ocean environment.

Technology to help reduce energy consumption

Saber is the name of a measurement system that allows users to keep track of how much power, heat and hot water they are using. Monitoring energy consumption gives people an incentive to manage it better. The company behind the technology is KYAB Sweden AB.

Easy monitoring of their power, heat and hot water usage helps households and workplaces get to grips with their energy consumption habits. Experience shows that it is possible to save around 20 per cent of energy consumption simply by changing user behaviour. This necessitates relating people's actions directly to their consumption of energy. Saber Pro and Saber Home from KYAB now make this eminently feasible by means of real-time measurement and educational visualisation of consumption.

> *Experience shows that it is possible to save around 20 per cent of energy consumption simply by changing user behaviour.*

In real time

Saber is essentially a system for real-time measurement of electricity and district heating. The system also has measurement technology that can divide up the consumption curve for district heating, for example, into heating and hot water without additional meters needing to be installed. The system is connected to the energy meter and the results are provided to the users via the Internet. Consumption is displayed in real time and allows users to be directly informed about and see the effects of changes in their use of hot water, power and heat.

Also for non-residential premises

Information on and visualisation of consumption is also possible in large properties, such as public buildings and companies.

"Studies show that companies and public institutions can save between 10 and 30 per cent of their costs for power and heat by knowing how they consume energy and changing their behaviour to reduce waste," says Kimmo Yliniemi, CEO of KYAB Sweden AB.

KYAB has recently begun to market and commercialise its measurement systems. The company has already sold systems to around 100 properties. Sales took off in 2010 and the system has been installed in schools and other public buildings.

Luleå Municipality has been using the Saber Pro system since 2009 and the Saber Visualizer system since 2010, as a result of which its power consumption has fallen. Premises where the measurement systems have been used include a culture centre, a restaurant and the Norrbottensmusiken premises. The system is also being used in schools and KYAB says that there are plans for it to be extended to cover the city hall and other properties. The company itself feels its prospects are good:

"We anticipate that KYAB will have sales of SEK 30 million within three years and that we will be operating in at least five countries within five years," says Kimmo Yliniemi.

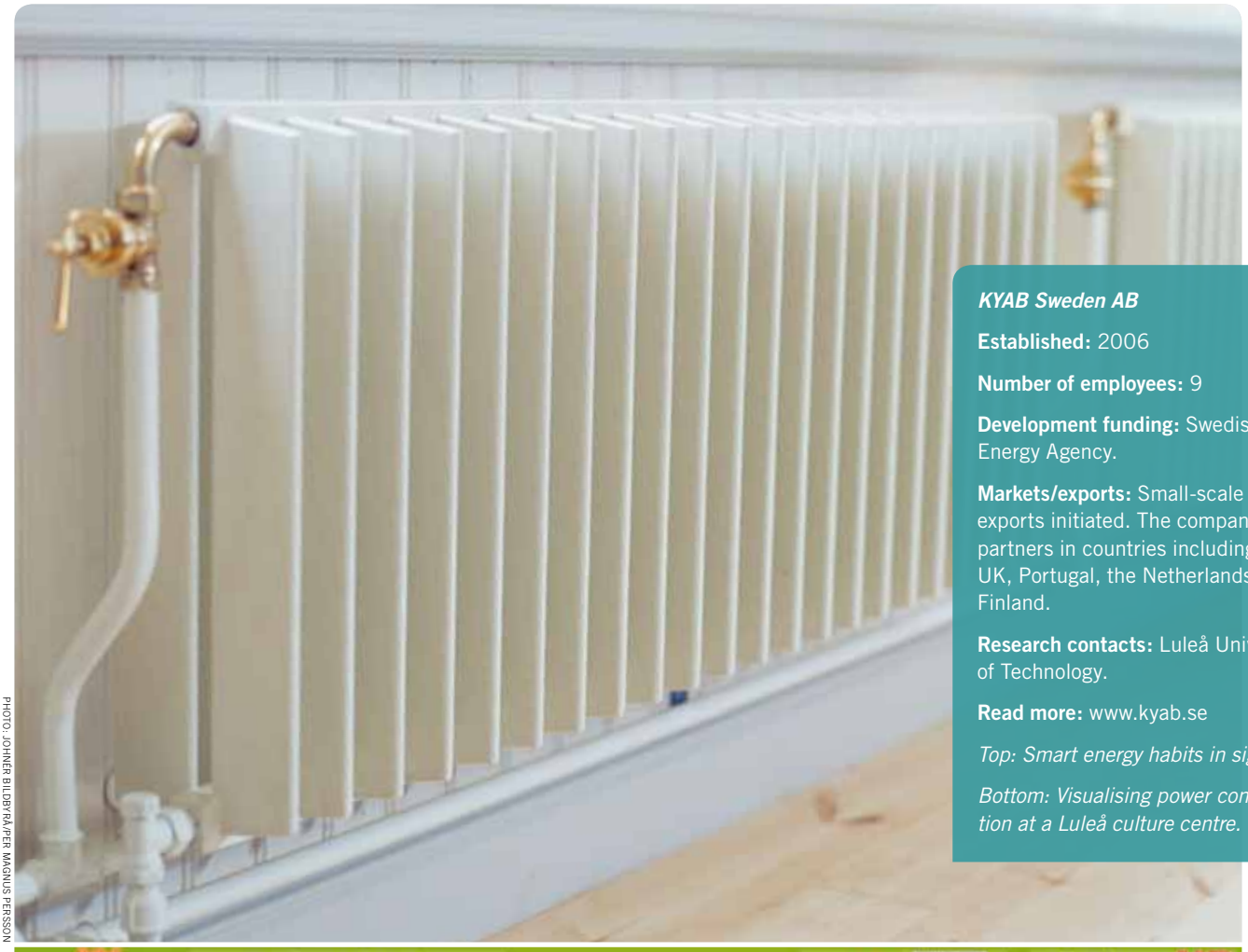

PHOTO: JOHNER BILDBYRÅ/PER MAGNUS PERSSON

KYAB Sweden AB

Established: 2006

Number of employees: 9

Development funding: Swedish Energy Agency.

Markets/exports: Small-scale exports initiated. The company has partners in countries including the UK, Portugal, the Netherlands and Finland.

Research contacts: Luleå University of Technology.

Read more: www.kyab.se

Top: Smart energy habits in sight.

Bottom: Visualising power consumption at a Luleå culture centre.

PHOTO: KYAB

Lifesaving toilet

Forty per cent of the world's population live without toilets. Faeces spreads disease and pollutes water. A green and white bag from Sweden solves the problem. The company behind the invention that can improve lives for billions of poor people is called Peepoople AB.

Peepoople's hygienic disposable toilet helps save lives and improve the health and quality of life of people who live in poverty. The need is huge. Some 2.6 billion people – 40 per cent of the world population – currently have no access to a toilet.

Simple home toilet

Hygiene and sanitation are essential to sustainable development. Slum areas in cities are growing fast and a lack of toilets can rapidly become a serious environmental and health problem when people live in close proximity to one another. Peepoople offers a hygienic, odourless home toilet that is always close at hand.

> *The bag uses a minimum of material and provides maximum hygiene.*

It is a user-friendly, cheap solution that requires no investment nor any fixed infrastructure and can thus easily be introduced on a large scale. Disaster response initiatives are another area of application. The Peepoo toilet was used after the earthquake in Haiti in 2010, for example.

Cleans itself

The Peepoo is, in fact, a biodegradable bag which uses urea to quickly neutralise bacteria, viruses and parasites that can cause disease and pollute the environment. At the latest one month after the disposable toilet has been sealed, all harmful contagious agents have been eliminated and the contents can be used as first-class fertiliser.

As the Peepoo is self-cleaning, it does not pollute the environment. The bag itself is converted into carbon dioxide, water and humus within a maximum of one year.

For weak economies

The inventor of the Peepoo is Anders Wilhelmson, an architect and professor at KTH in Stockholm. He conceived the idea of the mobile toilet in 2005 and was inspired by visits to slum areas around the world.

"The Peepoo toilet is a high-tech product for weak economies," explains Anders Wilhelmson. "The bag uses a minimum of material and provides maximum hygiene. It focuses on consumer reality and prioritises the user, in particular women and children, who often find it most difficult to go to the toilet in a dignified and safe manner."

Kenya first

The Peepoo toilet is easy and hygienic to use and simple and rational to produce. It should therefore be possible to sell it to groups with the least purchasing power. Kenya is the first country to introduce the Peepoo system.

"In October 2010, we launched the Peepoo toilet in the slum area of Kibera in Nairobi," says company CEO Karin Ruiz. "It's sold and distributed there by local female micro business owners and thus contributes to their day-to-day earnings. It's also used in several schools."

A successful collection system has been established with staffed collection points at which people can leave their used Peepoos for a fee. Marketing is now being gradually expanded and the present target is 20 000 users a day by 2012. In the long term, the bar will be set much higher.

"Our target is for five per cent of those who currently have no toilet, that's 150 million people, to use the Peepoo solution. This means 50 billion Peepoos per year and 300 production lines," says Karin Ruiz.

PHOTO: ASHLEY WHEATON

Peepoople AB

Established: 2006

Number of employees: 9

Markets/exports: Large-scale production in Sweden, starting in 2012. Office, production and sales on a small scale in Nairobi, Kenya. Launches in other slum areas in Africa and Asia under preparation.

Development funding: Private financiers. Subsidies from the Swedish Agency for Innovation Systems and the Dutch health organisation Simavi, among others.

Research contacts: Development in partnership with the Swedish University of Agricultural Sciences, SLU, and the Royal Institute of Technology, KTH.

Read more: www.peepoople.com

Indian girl with a Peepoo toilet.

Double benefit of plants in urban settings

The Swedish company Veg Tech is showing that trees, plants and bushes are much more than just a beautiful feature in an urban environment. Plants can actually be used to clean the air, save energy, reduce noise and manage surface water. The company's systems and products are contributing to greener construction throughout the Nordic region.

Vegetation technology involves using plants to solve technical problems. A better urban climate produced with the aid of green areas on building roofs and façades is one example of the advantages of the technology. The green areas result both in smaller temperature fluctuations and in natural air humidity. Plants can also be used to clean the air of harmful particles and reduce noise from traffic.

> *Green surfaces on roofs and façades are a smart solution for creating a greener urban environment without encroaching on the city's land, where competition for space is often tough.*

Many construction projects make use of the fact that plants on roof surfaces reduce runoff of surface water. A roof of pennywort (sedum) absorbs, stores and evaporates large quantities of precipitation. Risk of excess weight? No, a sedum roof from Veg Tech weighs only around 50 kg/m² when saturated with water. Special properties also guarantee the surface layer of the façade.

Saves energy

Veg Tech has many years' experience of vegetation technology. The company's main market is the Nordic region, where it offers everything from roof vegetation, roof gardens and green courtyards to systems for surface water management and façade vegetation.

Greater use of plants means advantages for the urban environment and for individual properties. Vegetation on roof surfaces and façades, for example, can insulate the building against both heat and cold, with reduced energy costs as a result. The insulating plant layer also makes the climate inside the premises more comfortable and the temperature more stable. With plants on the roof or in an inner courtyard, the property owner also benefits from a longer life for the weather-proofing layer of the surfaces. The protective vegetation shuts out harmful UV light from the sun and slows down the ageing of the surface layer.

Growing interest

Interest in greener urban environments is growing. Veg Tech is seeing increased demand for several plant products for urban environments such as roof vegetation and plants for surface water ponds.

The benefits of the technology and its ability to make use of surfaces that would otherwise be sterile and unused are thought to lie behind the growth in interest. Green surfaces on roofs and façades are a smart solution for creating a greener urban environment without encroaching on the city's land, where competition for space is often tough.

And, of course, plants on roofs, on terraces, in courtyards and on façades are beautiful. A green building, a green inner courtyard or a green district is usually well received.

Plants in water

Open areas of water, canals and systems for surface water represent another of Veg Tech's profile product areas. Vegetation plays an important role here too. The plants are actually essential to efficient purification of the water. A large proportion of contaminants in surface water are particle-bound and can be separated via sedimentation. Vegetation in the water slows the circulation time of the water and the contaminated particles have a chance to sink to the bottom or become stuck in the vegetation.

"Everyone benefits from a greener environment in our habitat. It gives rise to biodiversity, a better climate and, last but not least, better health for those of us who live there," says Bengt-Erik Karlberg, CEO.

PHOTO: VEG TECH

Veg Tech AB

Established: 1987

Number of employees: 28

Markets/exports: Veg Tech has a wholly-owned subsidiary in Denmark. The Norwegian market is managed from the head office in Sweden via a Norwegian sub-branch in Norway. Sales in Finland are via retailers.

Research contacts: The company mostly conducts its own research.

Read more: www.vegtech.se

Top: The roof of the Halmstad City Library.

Bottom left: Surface water management, Växjö.

Bottom right: Dam, Malmö.

PHOTO: VEG TECH

PHOTO: VEG TECH

The purpose of the Government's strategy for environmental technology from 2011 is to facilitate the emergence and export of new, green Swedish solutions. Initiatives in both the short and the long term – targeting everything from research and innovation to exports – are to make Sweden a pioneer in green-tech. This brochure describes a number of Swedish innovations designed to confront today's climate and environment challenges.

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