

INVEST IN cleantech

A MAGAZINE ON SWEDISH ENVIRONMENTAL TECHNOLOGY FROM THE SWEDISH ENERGY AGENCY | 2014



HOT POWER

Photovoltaics is making new progress

Pioneers Three companies with cutting-edge technology

Market Improvement in sight **Outlook** Five hot trends

Interview Niklas Zennström aims for green **Focus on** Sustainable companies

Business angels How they find high-potential companies

Join us on an exciting journey

THE CLIMATE DEBATE usually focuses on how climate change will affect us. How high sea levels will rise, for example, when the ice melts or whether Sweden is at risk of experiencing more extreme weather conditions.

The truth is that nobody knows exactly, but are these really the most important issues? Not many people doubt that we will encounter problems. Perhaps because this appears so obvious.

What we do know is that we are consuming more resources every year than the earth is able to produce. This is not sustainable. Just like you can't overdraw your bank account without being passed on to a debt-collection agency or receiving a debt-collection notice.

Do we really want to overdraw the earth's resource account?

We need solutions that optimize and reduce our use of the earth's resources and that help us solve this challenge. But the challenge we face is also an opportunity for Sweden's emerging cleantech companies.

THIS YEAR'S EDITION of Invest in cleantech will describe both potential opportunities and some success stories. You will read interviews with prominent individuals who focus on cleantech.

We can confirm two key points:

1. Future markets for cleantech will grow.
2. Swedish expertise in cleantech will offer major benefits to anyone who is well prepared.

So why not join us on this journey toward a sustainable energy system, where a host of new technological advances will be needed. This is the very area that constitutes a major strength in Sweden!



ANDREAS STUBELIUS
Project Manager,
the Swedish Energy
Agency

CONTENTS ▼



Sol Voltaics develops nanomaterials that boost the efficiency of solar cells. The company's Business Development Manager, Erik Olsson, is seen in the photo.



4 Pioneers
Meet three Swedish companies that are challenging traditional business logic – and have global aspirations.

11 Market improvement
Following an acid test, the trend for the cleantech market has once again turned slightly upward. What does the future hold?

14 Sustainable business
Two sisters, Karin Bodin and Anna Borgeryd, are running the Polarbröd bakery company with a green hand.

16 Theme: Solar
The photovoltaic market is advancing again. Where are the best business opportunities?

22 Find high-potential companies in the technology jungle
More business angels are interested in cleantech companies. They are now learning how to assess companies.

24 Five hot trends
Technological advancements are now moving fast. Read about these five hot trends that are here to stay.

26 Niklas Zennström invests in the environment
He changed the telecom market. Now Niklas Zennström is focused on the cleantech field.

32 Five questions for the analyst
Which areas attract most investors? Analyst Michele Parad provides answers.



KRISTOFER SAMUELSSON

NASA/SDO/IA/HANDOUT/CORBIS

HELIOSPECTRA



Energy-smart lighting controls plant growth.

Plant lighting successful on the stock market

GOTHENBURG-BASED company Heliospectra has developed energy-efficient and intelligent LED lighting for greenhouses. In global terms, the market is extensive: every year, between 5 and 10 million fittings are replaced worldwide with a market value of some SEK 38-77 billion, according to marketing analyst Redeye.

Against this background, it is not surprising that the company has made strong progress since it was listed on the NASDAQ OMX First North market in mid-June, 2014.

The share price at opening was SEK 8 and, at the time of writing (end of September), it was SEK 28.

Heliospectra's solution is both energy-efficient and intelligent:

"Our solution includes sensors that detect how the plants 'feel' on each occasion, and software that can control the light supply. This means that we can control plant growth based on the specific needs of each species," says Staffan Hillberg, CEO of Heliospectra.

214

USD BILLION

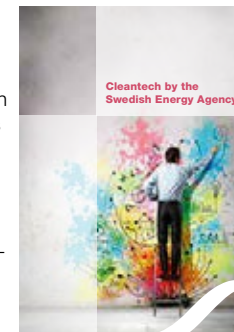
Global investments in renewable electricity and fuel in 2013.

SOURCE: RENEWABLES 2014 GLOBAL STATUS REPORT

WHERE TO FIND TOMORROW'S SMART TECHNOLOGY COMPANIES

EVERY YEAR, the Swedish Energy Agency invests about SEK 90 million in conditional loans to support various types of companies in early stages of development. The conditions for receiving the loans are that the companies have a unique technology, a strong team and a clear market.

In total, the Swedish Energy Agency has granted various types of conditional loans to more than 50 companies – all active in the energy sector, but at different stages of development toward a commercial product or solution. The business development process of the companies and the Swedish Energy Agency is described in the Cleantech document published by the Swedish Energy Agency.



Read the document: www.energimyndigheten.se under **Innovations, R&D/Business Development and Commercialization**

MINESTO



Minesto develops a new concept for tidal power.

SWEDISH CLEANTECH ON WORLD TOUR

FOR THE SECOND consecutive year, the Swedish Cleantech Tour has visited three cities around the world to present a number of Swedish cleantech companies to international investors.

"We began in London last spring, continued to Zurich in September and ended with Boston in October," says Magnus Rehn, business coach for the STING (Stockholm Innovation & Growth) business incubator and one of the initiators of the tour.

Over two days, the companies get to know the current market and investor climate through seminars and other meetings, and then present their technological solutions to a selected audience.

"Globally, interest in Swedish companies is great. The first year of the tour has led to a handful of new partnerships and investments for the companies," says Magnus Rehn.

The companies this year include Watty (energy-efficiency solutions), Minesto (electricity generation from tidal currents) and Chromafora (heavy metal extraction from wastewater).

Read more at www.swedishcleantechtour.com

CHALMERS INNOVATION SEVENTH IN THE WORLD

FROM RESEARCH findings to vibrant business concepts. Sweden's business incubators assist start-ups with business concepts, networks and investor contacts.

The international UBI Index has now been ranked best business incubator in the world, which gives Chalmers Innovation in Gothenburg a number seven rating in the world (and best in Sweden).

Since it was founded in 1999, Chalmers Innovation has started 115 companies. In 2011, the companies that were started in the business incubator had 406 employees and sales of SEK 558 million.

PIONEERS

Innovations and new technological advancements are required to address the world's major environmental challenges. Meet three Swedish pioneer companies – two new companies, and one with experience amounting to 50 years. All three have business concepts with potential to shake up global markets.

"Our nano solution can boost the efficiency of solar cells by 30%," says Erik Olsson, Business Development Manager at Sol Voltaics.

Giving more power to solar cells

IN TWO HOURS, the earth receives as much energy from the sun as the entire world population uses over a whole year. The question is how we can optimize our use of this energy?

Nanotechnology may provide the answer.

Lund-based company Sol Voltaics has developed solar cells in the form of a nanowire ink solution. The nanowires can boost efficiency individually or by being installed in today's solar cells.

"The efficiency of silicon solar cells, which currently dominate the market, is about 15-20%. Our solution can boost efficiency to 20-25%," says Erik Olsson, Business Development Manager at Sol Voltaics.

The technology is based on the world-leading nanotechnology research conducted in Lund for several decades, which Sol Voltaics has continued to develop since the company was founded in 2008. Sol Voltaics' solution enables considerably faster production of gallium arsenide nanowires than previous methods. The amount of material required is microscopic. It only takes one gram of nanowires (billions of nanowires) to cover one square meter of a solar cell panel.

"The challenge now is to integrate the solution with solar cell manufacturers, which we are doing together," says Erik Olsson.

MOST OF THE MAJOR panel manufacturers are located in China, Japan and the US, and Sol Voltaics is seeking prospective customers in these markets.

Despite overcapacity and price pressure throughout the industry in recent years, the global photovoltaic market is continuing to grow at a furious pace.

The major challenge for Sol Voltaics now is to move from lab-scale production to an industrial setting. In 2012, Sol Voltaics received just over SEK 100 million in investment capital – including a loan of SEK 41 million from the Swedish Energy Agency – to build a pilot plant and scale-up the company's production. The company maintains regular contact with investors to secure fresh capital for further development.

"We currently have five principal owners. But we are obviously looking for more sponsors and partners," says Erik Olsson.

JOHAN WICKSTRÖM

SOL VOLTAICS

BUSINESS CONCEPT: To produce and sell nanomaterials that boost the efficiency of solar panels.

STARTED: 2008.

NUMBER OF EMPLOYEES: 28.

Recycling shower water

IN A SPACE SHUTTLE, astronauts re-use water in a closed system. Why couldn't that work on earth as well?

This was the research topic that Mehrdad Mahdjoubi chose for his undergraduate project in industrial design at the Faculty of Engineering at Lund University in early 2011.

As a result of his research into a shower equipped with recycling technology, 25-year old Mehrdad is now CEO of Orbital Systems, based in the Rosengård Football Club's training facilities in Malmö.

"You have to dare to question existing solutions. Cleantech has endless potential," says Mehrdad Mahdjoubi, as he demonstrates the shower's features.

The system is based on filtering and purifying the water before pumping it back in to the showerhead again, where a heating coil keeps it warm. When the person has finished showering, the shower water is discarded.

"This shower uses five liters of water, instead of 150 liters, for a ten-minute shower. And saves 80% of the energy for heating the water."

THE PERSON SHOWERING cannot tell the difference. The pressure in the showerhead is always steady and the temperature is stable.

"Our potential customers are commercial facilities, such as hospitals, sports facilities and so forth. The more you shower, the more you save. Our business is driven by the need to save energy, but being able to purify the water could be important in some developing countries where bacterial risks are great."

In 2012, Orbital Systems won the Green Mentorship Awards competition and, at the same time, the co-founder of Skype, Niklas Zennström injected capital into the company (read more on page 26). Almi and Vinnova have also helped to support the company, which has been selling its products on the market since 2014.

The current focus is to make the organization more market-oriented, employ more salespeople and establish a network of partners.

"Sweden is a great country for cleantech, but the market is too small. Our long-term goal is to create a presence where we can generate the most value – where water supplies are limited and energy prices are high."

JOHAN WICKSTRÖM



ORBITAL SYSTEMS

BUSINESS CONCEPT: To produce showers that recycle water.

STARTED: 2012.

NUMBER OF EMPLOYEES: 15.



"This shower uses five liters instead of 150," says Mehrdad Mahdjoubi, CEO of Orbital Systems.

Joakim Karlsson, President of Envac's North Europe division, in front of Envac's self-emptying waste chute at Strömkajen in Stockholm. The system can handle 50 metric tons per week, including the waste collected from boats in the Stockholm Archipelago.

Sweeping the market clean

GUJARAT, SEOUL, Peking and New York.

Some of the most recent orders are listed on the flipchart in Envac's conference room. They say something about the market situation: managing waste efficiently has become a hygiene factor (in both senses) for all growing cities.

"A waste vacuum system has so many benefits," says Joakim Karlsson, President of Envac's North Europe division.

"It offers a cleaner environment, less transport and more security, and cities can use their spaces more efficiently.

The technology hasn't changed since it was introduced 50 years ago. You put your waste in a closed container, from where it is vacuumed into a container in a collection station, which may be located up to several kilometers away. The only thing that's changed is how the waste is sorted. Waste is usually sent to three different containers now – for combustible, food and paper waste.

THE FIRST CUSTOMER. Sollefteå Hospital, has had the same system since 1961. Although the hospital has received assistance with central vacuuming before, the waste has proved a greater problem. They wondered whether waste couldn't be vacuumed away as well.

No sooner said than done – Centralsug (Envac's former name) developed the world's first waste vacuum system.

The company was alone in its niche for several decades, but competition has intensified over the past ten years. About ten companies are now competing for the major contracts. A market exists for the product all over the world. Envac has 40 offices across 20 countries – and sales of some SEK 1 billion.

"Nordic countries are mature markets, and Spain has come a long way. But now the Asian market is growing," says Joakim Karlsson.

Although the waste sector was also impacted by the financial crisis, Envac's business concept holds major potential. Global urbanization continues at a rapid pace and cities are competing for attractiveness – while the imminent threat of climate change is always present.

"Demand is constantly growing," Joakim Karlsson says.

JOHAN WICKSTRÖM

ENVAC

BUSINESS CONCEPT: To deliver automated, environmentally friendly solutions for the collection of waste and recyclable products.

STARTED: 1961.

NUMBER OF EMPLOYEES: About 600.

New opportunities for Swedish cleantech in Germany

MUCH OF THE focus for new technology exports lies on China, India and the US. However, Sweden's key trading partner is actually Germany.

The country is now undergoing a major energy transition, Energiewende, which has opened opportunities for energy companies with smart solutions. As a result, the Swedish Energy Agency, in cooperation with the German-Swedish Chamber of Commerce, has initiated a two-year program to support Swedish cleantech companies in the German market.

"We will help companies analyze the market, establish networks and get in touch with customers," says Alexander Lidgren from the Swedish Energy Agency, which expects to include about a dozen companies from the Agency's company portfolio (companies that have received loans from the Swedish Energy Agency).

What solutions are most attractive for the German market?



Germany's energy transition could benefit Swedish cleantech. Pictured: Hamburg.

"The Germans have made a lot of progress on their own, but this is a major market. I think all companies that can reduce energy costs are highly attractive, such as Ecofective and Applied Nano Surface, to name just a few," says Alexander Lidgren.

144

The number of countries worldwide that have set targets for renewable energy generation.

SOURCE: RENEWABLES 2014 GLOBAL STATUS REPORT

TOP TEN CLEANTECH COUNTRIES

1. ISRAEL
2. FINLAND
3. US
4. SWEDEN
5. DENMARK
6. UNITED KINGDOM
7. CANADA
8. SWITZERLAND
9. GERMANY
10. IRELAND

SWEDEN is rated fourth on the Global Cleantech Innovation Index 2014 – a joint initiative between the Cleantech Group consultancy and the World Wide Fund for Nature (WWF). The survey measures the entire chain, from research and innovation to commercialization. (Refer also to the interview with Michele Parad, lead author of the report, on page 32.)



900,000 square meters of roofing covered with solar cells at Tesla's new plant.

RENEWABLE ONLY IN TESLA'S BATTERY PLANT

SALES OF TESLA'S electric vehicle continue to rise, but the supply of batteries has not met demand. In early September 2014, the company announced its intention to build the largest lithium-ion battery plant in the world in Reno, Nevada, in the US. The plant will largely be self-sufficient with energy generated by solar, geothermal and wind power. The roof of the plant, for example – about 900,000 square meters – is covered with solar panels. The total electricity generated by the three energy sources is an estimated 2,900 MWh per day, equivalent to the electricity use of about 95,000 households.

Construction costs for the plant will total SEK 30–35 billion and battery production will commence in 2017, if everything goes as planned. The plant will produce battery capacity equating to 35 GWh by 2020, which is sufficient for 500,000 electric vehicles.

TESLA



Toward a brighter future

The cleantech market has been through an acid test. But the trend has turned over the past year, albeit cautiously. At the same time, however, the focus has shifted to innovations with a lower price tag.

TEXT: FREDRIK WASS ILLUSTRATION: LADISLAV KOSA



Fredrika Gullfot described the background and start-up of her company, Simris Alg, in the 2012 issue of Invest in cleantech.

ALGAE FARMER IS NOW ON THE MARKET

HAVING SOLAR-POWERED factories that produce useful substances and new materials is how Fredrika Gullfot, the founder of Simris Alg, describes her unique biomass: algae. Algae can produce almost anything – from biofuels to food – using sun, CO₂ and nutrients.

This autumn, the company's first Omega 3 products will be launched in the market. (At present, 96% of all Omega 3 is extracted from wild fish.)

Simris Alg issued new shares in March, which secured SEK 13.6 million and 73 new partners, most of whom are private individuals.

"The share issue was highly successful and we are now preparing for expanded production. That will require additional capital at a later stage. But first of all, we want to start selling, since we are eager to show numbers in the revenue column," says Fredrika Gullfot.



Carl Hall from venture capital company Alder.

CAPITAL INFLOWS in the cleantech market rose 20% in 2013, and mainly came from private investors. This information was presented in the Nordic Cleantech Dealflow 2013 report from Cleantech Scandinavia, which has been monitoring the sector since 2007.

Much seems to indicate a similarity between today's market and the IT sector after the dot-com bubble – investment appetite is far more cautious than it was five or ten years ago. But there is no denying where technological development and society are headed.

In 2013, EUR 89.1 million was invested in Swedish cleantech companies. This is a marked improvement compared with 2012 when investments totaled EUR 46.2 million, which was a record low following steadily declining figures since 2009.

One of the hotbeds for investors is energy efficiency, exemplified by Flexenclosure, the Swedish company that received the largest investment in 2013, in terms of both private and public sources. The company, a supplier of green energy supply systems to the telecom industry, received EUR 18.1 million.

A RECOVERY seems imminent, but not in all areas simultaneously. What actually happened? "Many of the start-ups were said to have revolutionary technologies and they were expected to mature as fast as IT companies. As a result, many investors became disillusioned. It became clear that physical products should be created rather than bits and bytes," says Carl Hall, an investor at venture capital company Alder.

Carl Hall believes that the first cleantech bubble has burst and a new wave of more realistic expectations and investments has commenced.

"We are moving toward a world of shrinking resources, that is undeniable. In ten years, we will have a middle class comprising five billion individuals and be consuming a huge amount of resources. There may be temporary setbacks, but the market has an incredible future," Carl Hall explains.

MAGNUS AGERSTRÖM, CEO and founder of Cleantech Scandinavia, thinks the trend is difficult to interpret at the moment, which may indicate that we have reached a turning point.

"While the number of investments has reached the same level as several years ago, the amounts

There may be temporary setbacks, but the market has an incredible future.

CARL HALL, ALDER

are smaller. And that has a major impact on the total amount," says Magnus Agerström.

Cleantech Scandinavia monitors 800 cleantech companies across the Nordic region. According to Agerström, revenues of the companies that were hyped up five years ago have not been impressive. But development takes time and sometimes, both behavioral changes and political decisions are required before innovation can take hold.

ALTHOUGH AGERSTRÖM believes that more could be done, he is convinced that several Swedish cleantech companies have the potential to establish themselves in the future. He describes how market conditions could change radically if, for example, a new technology could double the efficiency of a solar energy facility.

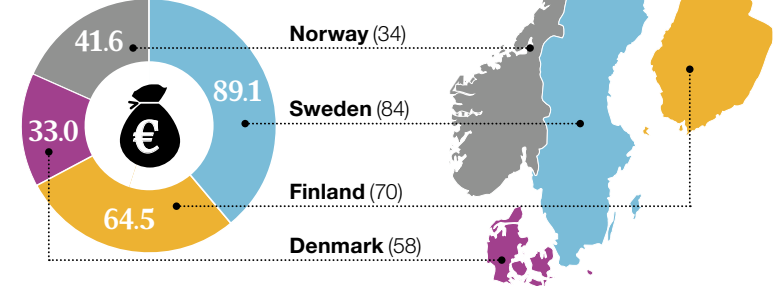
"There may be hiccups along the way, but a sudden overcapacity in solar power could bring prices down. At the same time, there are several Swedish companies with new technologies that have considerably higher efficiency as their potential. The economic calculations would suddenly become reasonable again," says Magnus Agerström.

HENRIK OLSÉN is a managing partner and founder of Environmental Technologies Fund (ETF), a London-based fund backed by some of the world's leading institutional investors. He sees a more cautious investment climate at the moment compared with five years ago, but not only in the cleantech industry. The exception is IT-related businesses with top rankings, not unlike the dot.com bubble.

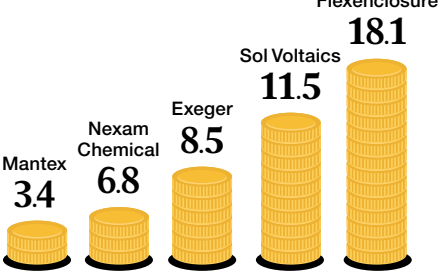
"Due to the slightly harsher environment, companies that are less capital-intensive and more service-oriented tend to receive financing easier. A major theme is efficiency enhancements in the IT field that are software-driven – green IT," says Henrik Olsén. ■

NORDIC CLEANTECH MARKET 2013 ▼

INVESTMENTS PER COUNTRY
EUR million (number)



FIVE LARGEST PRIVATE INVESTMENTS IN SWEDISH COMPANIES
EUR million



928

EUR THOUSAND
Average amount invested in the Nordic region.

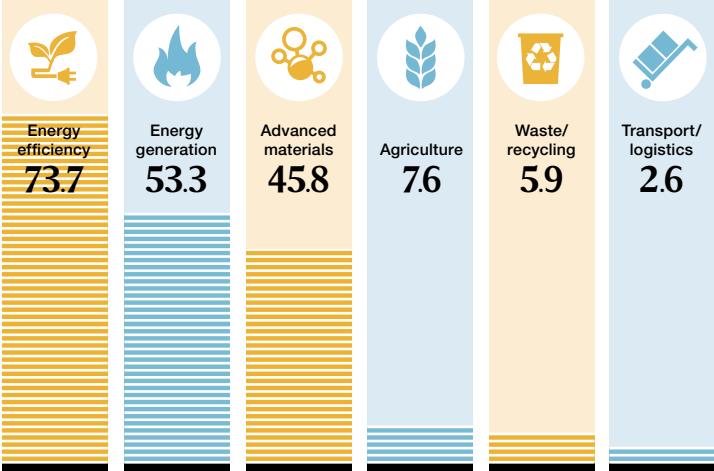
228.2

EUR MILLION
The amount that private and public players invested in Nordic companies in 2013. (EUR 202.1 million in 2012.)

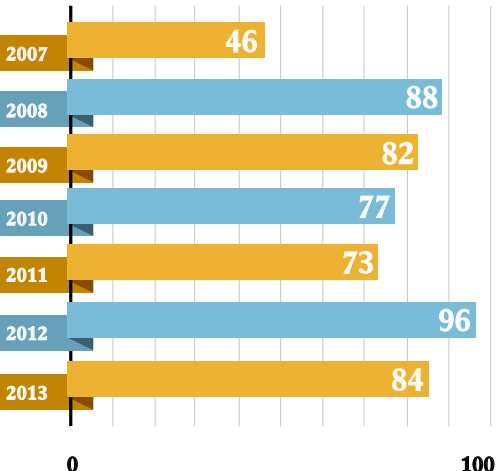
66.2

EUR MILLION
The amount that private investors invested in Swedish cleantech companies in 2013. (EUR 23 million in 2012.)

PRIVATE INVESTMENTS IN NORDIC COMPANIES PER AREA
EUR million



NUMBER OF INVESTMENTS IN SWEDISH COMPANIES 2007-2013



SOURCE: CLEANTECH SCANDINAVIA

SEEKING GREEN SOLUTIONS

More and more companies are including sustainability in their business plan. One example is the family-owned bakery Polarbröd. The company is headed by two sisters, Anna Borgeryd and Karin Bodin, who are constantly seeking green and resource-efficient solutions.

TEXT: VICTORIA GILLBERG PHOTO: ANDREAS NILSSON

SINCE 2006, sisters Anna Borgeryd and Karin Bodin have been firmly steering their family-owned business into the future with a clear objective: to convert to sustainable production and distribution. The company has 400 employees in Sweden, sales of SEK 800 million and a green approach permeates the entire operation. Through its sister company, Polarkraft, Polarbröd has built its own four wind turbines. The goal is to generate as much renewable energy as the company uses.

“Our need for green electricity will continue and if we can generate it ourselves, why not make the investment,” says Anna Borgeryd, Chairperson of Polarbröd.

In addition to wind power, they are also working to increase the proportion of organic bread and exploring possibilities for using 100% renewable packaging material.

“All long-term thinking, stable and successful companies are sustainable. Ignoring sustainability is not economically viable,” says Karin Bodin, CEO of Polarbröd and recipient of the 2014 Sustainable Leadership Award from the Swedish Association of Environmental Managers in August.

Her sister agrees. Their environmental commitment is obvious.

“Many people think that efforts to achieve sustainability are difficult and tedious, rather than seeing an opportunity to prepare for the future. Companies that choose not to convert will not survive in the long run,” says Anna Borgeryd.

THE SISTERS HAVE been members of the Polarbröd Board since they were 18. Karin Bodin has been CEO and Anna Borgeryd has chaired the Board since 2006. But the company’s journey began much further back.

MORE SWEDISH COMPANIES WITH A FOCUS ON SUSTAINABILITY

IKEA

Ikea has adopted a broad approach to sustainability, ranging from waste management to energy generation.

The company has 97 wind turbines and 550,000 solar cell panels. All home furnishings will also be made from recyclable materials by 2015.

ELECTROLUX

Electrolux is working actively to gradually reduce the energy consumption of its products. The company’s goal is to reduce CO₂ emissions by 50% in all areas by 2020.

H&M

H&M has adopted an eco-conscious approach to its entire production chain – from design to sales. The company uses a range of sustainable materials such as organic hemp and silk. The goal is that all cotton will come from sustainable sources by 2020.

ICA

ICA foodstores offers organic and locally sourced products to make climate-smart choices easier. Several projects are also ongoing to reduce the environmental impact of ICA stores through increased energy efficiency and transport optimization.

The first seed was sown back in 1879 when their forefather Johan Nilsson moved to Älvsbyn in northern Sweden and opened a bakery. When Anna and Karin’s grandparents discovered that traditional bread could be frozen to enable a longer distribution window, the business concept was created and the company that is now Polarbröd was founded.

“If you ask our grandmother, the purpose of Polarbröd is to show pride in the values of northern Sweden, like our bread culture. Our mother and father created job opportunities locally and were keen to continuously develop resource-efficient solutions. Polarbröd is a wholehearted company and we have kept that approach,” says Anna Borgeryd.

As they grew up in the 1980s, amid the acidification debate and the Chernobyl disaster, they received early insight into environmental issues. When they took over the company, they decided that Polarbröd would be their own contribution.

“After the Chernobyl disaster, even the soil in northern Sweden was impacted, and it became clear how everything is linked. It has become much clearer to me in recent years how this connects with Polarbröd and how we can work to reduce our environmental impact,” Karin says.

BUT THE SISTERS are not only driven by ideology and their love of nature. They may not refer to market share and economic forecasts, but business benefits are an obvious factor. And they do not see any conflict between positive financial results and environmental accountability.

The next step for Polarbröd is to eliminate distribution based on fossil fuels. Most transport takes place by rail, and the company also wants to see fossil-free delivery to stores. They are also investigating the possibility of installing solar cells to power their ovens and freezers.

But the most difficult nut to crack for Polarbröd is agriculture. They think that technological progress in this area should be faster and that joint solutions are required.

“Companies cannot achieve sustainable agriculture on their own. We need organic farming and have not achieved that today,” says Anna Borgeryd. ■

Polarbröd’s CEO, Karin Bodin (left), with her sister Anna Borgeryd, the company’s Chair.



POLARBRÖD

The company: Family-owned company founded in 1972. Third-largest bakery in Sweden.

Number of employees: 400.
Sales: SEK 800 million.



RED HOT

Photovoltaics is growing in all markets

Capacity has multiplied and prices have plummeted. More countries and players have now entered the photovoltaic market. Developments are moving at a furious pace in all areas of the value chain. What areas hold the greatest potential? And how are Swedish photovoltaic companies faring?

TEXT: JOHAN WICKSTRÖM PHOTO: NASA/SDO/AIA/HANDOUT/CORBIS

WHEN GERMANS sat down to lunch on June 9, 2014, a new record had been broken. On that beautiful summer's day, photovoltaic panels accounted for more than half of the country's total electricity generation, or a total of 23.1 GW (which is almost equivalent to the maximum power demand in Sweden on a cold winter's day).

Due to intensive price pressure, progress in the photovoltaic market has been explosive in recent years. In just five years, global photovoltaic capacity has increased almost six-fold, with Germany at the forefront. At the same time, prices have fallen by over 60%. While Japan, China and the US are driving the market, more and more countries are joining in.

And yet no technological revolution has taken place. Efficiency may have gradually improved, but silicon solar cells still dominate the market, despite intensive research into new materials.

This rapid market progress does not mean that money is easy to earn. Due to stiff competition, many photovoltaic producers – and investors – have lost money in recent years.

“The past few years have been tough and turbulent. And much of the module manufacturing has been relocated to China. But the situation has now begun to stabilize. We are still in the early days of this development,” says Björn Sandén, Associate Professor of Environmental Systems Analysis at Chalmers University of Technology in Gothenburg.

A new report from the Cleantech Group consultancy compares photo-

voltaic expansion with railroad development at the end of the 1800s – slow at first, followed by certain losses, until the arrival of a critical mass – after which progress accelerates and leads to the next wave of innovation.

PHOTOVOLTAIC plants can roughly be divided into three main segments: large solar power plants (either solar cells or thermal solar power via solar heating), solar panels on commercial properties and private installations on the rooftops of residential dwellings.

“All three segments are growing, but conditions vary from country to country,” says John Andersen, Board Chairman of solar energy company Scatec Solar.

He is a veteran in the solar power sector and helped to develop the Norwegian photovoltaic company, REC, ►

In two hours, the sun delivers more energy than the earth's population uses in a whole year.



Solelia's charging point generates about 1,000 kWh per year, offering about 20,000 kilometers of driving range.



CASE: SOLELIA GREENTECH

Charging electric vehicles with solar

TWO ELECTRIC vehicles are recharging under two solar panels outside the Royal Institute of Technology in Stockholm. This is one of Solelia Greentech's charging stations.

"They generate about 1,000 kWh per year per power outlet, which offers up to 20,000 kilometers of driving range," says Per Wickman, acting CEO of Solelia Greentech.

Each kWh generated is deposited in a "solar bank" with a guarantee of origin for the electricity.

The solar bank sends the information to the Swedish National Grid, which issues guarantees of origin for the photovoltaic power generation.

The station guarantees full recharging. On a cloudy day, the solar bank supplies electricity.

WHEN THE COMPANY started in 2011, Per Wickman, a former technology consultant, was one of the founders.

"I was fascinated by the connection between electricity generators and electricity consumers. This is a way to break down the barrier between them," he says.

The first prototype was completed in 2012. Today, the company has ten stations in operation. Customers can either purchase the entire station or rent it for about SEK 3,000 per month.

"Our biggest target groups are municipalities and property owners. But businesses and restaurant chains could also be interesting."

The challenge lies in developing a profitable business model.

"The electricity is more or less free right now. This will eventually change as the number of charging stations increases and additional services could also be included in the parking fee."

THE COMPANY now conducts joint marketing with Mobility Motors, a Nissan dealer, in which a charging station and electric vehicle are combined in a package offering.

However, the market for electric vehicles must continue to grow. There are currently more than 5,000 electric vehicles on Swedish roads and this figure is steadily growing. German vehicle giants Volkswagen, Audi and BMW also launched new electric vehicle models this year, which could stimulate the market.

What are your goals for the future?

"In five years from now, we will be seen in every municipality and have started to make international contact. The same guarantee-of-origin system that we use for electricity will exist throughout Europe. That will benefit us," says Per Wickman.

JOHAN WICKSTRÖM

which grew rapidly during the first half of 2000 until around 2010 when the market collapsed. REC later moved its production to Singapore and, over the past year, has begun to make strong progress again.

"The financial crisis and competition from Chinese producers made the going tough for REC. When we began, less than 10% of solar cell manufacturers were from China. That figure is probably 70% now."

JOHN ANDERSEN'S current company, Scatec, invests in large solar cell plants. "Our latest project is a 75-MW solar cell park in South Africa, equivalent to electricity for 30,000-40,000 households. We will build and operate the plant and sell the electricity to the government-owned electricity utility, which will pay a fixed fee for 20 years," he says.

Photovoltaics is a disruptive force in

SOLAR IN FIGURES

39%

Increase in installed photovoltaic capacity in 2013 – from 100 to 139 GW.

113.7

BILLION DOLLARS

Global investments in solar power in 2013.

36 GW

Germany's photovoltaic capacity – most photovoltaic power generation in the world.

SOURCE: RENEWABLE 2014 GLOBAL STATUS REPORT

the market: it is changing conditions for all players and reshaping business logic. Traditionally, electricity has been generated centrally in large plants and then distributed. Production is now becoming increasingly local, which presents new business opportunities.

IN THE US, the photovoltaic market has grown sharply in recent years due to a new business model in which third-party suppliers are responsible for the entire facility. Photovoltaic power generation increased 12 GW between 2006 and 2013. (In California alone, there are photovoltaic systems on more than 250,000 roofs.)

Eneo Solutions has now launched a similar business concept in Sweden and eventually throughout Europe.

"The idea is to sell photovoltaic systems and geo-energy as a service. We finance, install and operate, so the cus-

tomers don't need to worry about procurements or electricity price trends. They know beforehand what the cost will be," says Harald Överholm, who conducted research into photovoltaic development in the US before he helped to found Eneo Solutions.

SWEDEN IS lagging behind many countries when it comes to installing photovoltaic systems, but capacity is also growing here now.

The installation of solar cells doubled in 2013 in relation to 2012, amounting to 19 MW compared with 8.3 MW. However, this is merely a fraction in comparison with Germany, for example.

However, Sweden is far ahead in certain areas of research in solar energy, such as CIGS thin-film solar cells and dye-sensitized solar cells (Grätzel cells). Another example is the world-class nano

research conducted in Lund, which has led to the foundation of Sol Voltaics and its solution to boost the efficiency of solar cells (read more on page 4).

However, the photovoltaic market is not restricted to production, it also includes peripheral systems: integration, control, inverters and storage.

"We are ahead in this area, Sweden is good at system solutions," says Linus Palmblad, administrator at the Swedish Energy Agency.

LAST SPRING, the Agency funded five projects in the second round of its research program, *Electricity and Fuel from the Sun*. The aim is to develop technologies in solar cells, thermal photovoltaics and solar fuels. All of the findings from these research projects will lead to innovation and the commercialization of Swedish ideas.

"Photovoltaic technology may soon

be able to survive without assistance. The major challenges ahead are storage and electricity demand management, which are prerequisites for real large-scale development," explains Palmblad.

COMPANIES ARE already starting to emerge within this niche. In Germany, several thousand energy storage devices were sold to micro-producers in 2013.

"Storage is a prioritized area when developing new technology. Ultimately, it's about the total cost per kWh with storage potentially included," says John Andersen.

The new smart grid also offers new opportunities for storage – centrally, in a larger system solution or, for example, in an electric vehicle battery in the garage.

Another interesting trend is the various niche applications that are popping up, such as the integration of solar cells ►



Norwegian photovoltaic company REC was hit hard by the financial crisis and competition from China. The company has now moved its production to Singapore.



One of Scatec's solar parks in Germany.



Solar panel facility in Spain.

THEME PHOTOVOLTAICS ▼



CEO Linda Krondahl (left) and Kristina Linhardt from HiNation. They are holding the company's product, HiLight, which can provide light and charge mobile phones – with a focus on rural Africa.

with residential properties. Exeger is a company that manufactures Grätzel cells (solar cells that mimic photosynthesis in plants) in its pilot facility in Stockholm. The advantage is that these solar cells have higher capacity indoors, are thin and flexible and they can be integrated with all types of building components.

Exeger also targets the consumer market with products such as chargers for phones, tablets and network cameras, either embedded or as separate devices.

“The ‘Internet of things’ is a well-known concept. More and more things will be connected to the Internet, but their batteries won’t provide enough power,” says Giovanni Fili, CEO and founder of Exeger.

HiNATION IS A company that works with rural populations, mainly in Africa. It focuses on the large groups

The sun is an infinite resource. There is no reason why anything that’s built in the future shouldn’t be able to absorb energy.

BJÖRN SANDÉN



that live without electricity, beyond the reach of the infrastructure that is under development. The company’s product, HiLight, is based on solar cells and can provide light and charge mobile phones and other products via a USB outlet. The company has sold 3,000 HiLights to date, but there is a long journey ahead before it can become a real volume product.

“We have spent a lot of time in rural

Africa over the past few years. We have now signed a declaration of intent to develop a totally new solar cell lamp in collaboration with local players. This will entail an order for 40,000 lamps,” says Kristina Linhardt, HiNation’s Chairperson.

While Asia and the US are the major solar power regions today, development is starting to take off in Africa.

“Africa is still a minor player on the

DAN WALDEN/SOLAR ROADS



Solar Roadway’s business concept is to incorporate photovoltaic cells in future roads.

SOLAR CITY



Solar panels are an increasingly common sight on US rooftops. The market has grown sharply due to new business models.

global photovoltaic map. But African countries have all the prerequisites for becoming a major market – lots of sun, a huge need for electricity and large amounts of fossil fuels. Maybe they should skip the grid expansion and focus on distributed photovoltaics and local storage systems,” says John Andersen.

THIS IS OBVIOUSLY a market with great diversity that is now emerging on a global scale. In the spring of 2014, for example, US company Solar Roadways received more than USD 2 million in risk capital through a crowdfunding drive. Business concept: to build photovoltaic systems on all new roads. The company has developed solar panels that are so robust, they can handle weights of up to 100 metric tons. “There is no reason why anything

CASE: RIPASSO

Solar power with submarine technology

ON NOVEMBER 2012, a Swedish company broke a world record in Upton, in northwest South Africa. Malmö-based Ripasso achieved an efficiency level of 32% in its test facility for solar thermal power.

The technology differs from solar cells. In thermal solar power, the sun’s heat is converted into electricity via steam or an engine. Ripasso uses a Stirling engine that operates by cyclical heating and cooling of a gas. This produces compression and expansion, pushing the piston up and down and the engine, in turn, drives a generator.

“Our basic technique was developed for Kockums’ submarines. And compared with other Stirling engines, both power and efficiency is higher. We are the only player in the market,” says Gunnar Larsson who used to work at Kockums.

THERMAL SOLAR power has not reached the same stage of development as solar cells, and only accounts for a minor share of global photovoltaic power generation. The main benefits of



In 2012, Ripasso’s pilot facility in Upton, South Africa, broke the world record.

this technology is that the plants have higher efficiency than conventional solar cells, especially in deserts or other areas with high insolation.

“The efficiency of conventional solar cells is reduced when the sun is strong. Our facility is almost three times more efficient than conventional solar cells in such environments,” Gunnar Larsson explains.

This means that Ripasso’s future main markets are, for example, North Africa, Southern Europe and the Middle East.

There are lots of companies that sell thermal solar power, but most are based on steam driving the turbine, resulting in lower power.

TODAY, RIPASSO HAS a 120-KW plant, but the aim is to build a larger reference facility. In the future, plants will be built for about 50–100 MW.

“The technology exists. The major challenge now is to find customers, such as electricity companies, and initiate sales,” Larsson says.

JOHAN WICKSTRÖM

IKEA EXPANDS SALES OF SOLAR PANELS

IKEA WILL SOON be selling more than sofas, beds and other home furnishings. In autumn 2014, the furniture giant will expand its investment in solar panels.

In 2013, IKEA commenced sales of solar panels in the UK and, according to the company, sales have been successful.

IKEA customers in the Netherlands will be able to purchase panels in October, and Switzerland will follow suit in December. The solar cell package includes full installation and warranties.

“We want to start selling the package in Sweden too, but it has to be easier and more profitable for customers to generate photovoltaic power,” says Jonas Carlehed, Head of Sustainability at IKEA Sweden.

IKEA will also continue its own energy venture. The Group will invest about SEK 13 billion in solar and wind power by 2020.



Finding high-potential technology companies

Business angels play a key role in the growth phase of cleantech startups. Two-thirds of the angels in the Connect investor network are interested in cleantech. But how do they find the most interesting companies?

TEXT: SUSANNE ROSÉN
ILLUSTRATION: ANNE-LI KARLSSON

INVESTMENTS in cleantech – as in life science – are technology and capital-intensive, which makes them uncertain. But in a recent study, two thirds of the investor angels from the Connect network who were surveyed claim that they are interested in investing in Cleantech companies (see note).

In March, Connect Skåne held a highly appreciated half-day training course to raise the cleantech expertise of business angels.

“The advantage of this type of sector-specific

training is that both well-versed and completely new business angels can get to know each other. Transferring expertise and experience is important,” says Jeanette Andersson.

ONE OF THE SPEAKERS was investor Jan Tufvesson, who maintained that high-potential technology companies contribute to a sustainable future. He does not consider himself a business angel.

“Business doctor is probably more apt,” he says.

His interest in diagnosing and helping companies began when Jan Tufvesson, who has an MSc in Electrical Engineering, worked with organizational and technological development at Ericsson. He was involved in the foundation, and Chairman, of several Ericsson subsidiaries. He is currently involved in four young and promising companies: Heliospectra, Optistring Technologies, Mantex and Heatcore.

“In most cases, I was asked to chair, and subse-

quently invested in, the company,” he says.

However, the fact that they are all cleantech companies has not been decisive for his involvement, he claims. He chose them, because he thought they were interesting.

“If I like what I see, I invest. I prefer companies that are well-organized and profitable. But I obviously think it’s important to take full advantage of, and save, energy.”

Tufvesson also believes that a reason why the business angels’ are interested in cleantech is because this is a new area, and “where there could possibly be some high-potential candidates.”

THE KEY FACTOR before investing, he claims, is to gain confidence in the people and management of the company. He studies the business plan, how the company has assessed the market, and the timeframe for development of the company’s products. Whether they are over-optimistic or more or less realistic.

Tufvesson works about half-time with the companies he has invested in, including consultancy. Being retired is an advantage when you are a business angel or company doctor, he claims, especially for technology companies with long lead times.

“Then you’re not in such a hurry. You are probably more experienced and have some money to contribute.”

There are no ready answers for which companies or technologies that will prove the most profitable investments, or how much money a private investor should invest.

“You need a lot of luck and a long-term approach. Acquaint yourself properly with what the company is doing and whether they are equipped to deal with various problems. Finally, you should never invest more money than you can do without.”

IN ADDITION TO investing money, a business angel can contribute valuable expertise and contact networks to companies in the early stages of their development. Jeanette Andersson coordinates



The key factor is to gain confidence in the people and management of the company.

JAN TUFVESSON, BUSINESS ANGEL

financing issues at Connect and is responsible for business angels in Skåne.

“There are many reasons why business angels invest in new companies, ranging from very profit-oriented to almost philanthropic. The scale is broad. But all of them are keenly interested in developing new companies,” she says.

Connect also cooperates with the Swedish Energy Agency through Connect Green, which tours the country to market the cleantech field to investors and other stakeholders. During the autumn, newstarts in solar, forest, water and sustainable construction will have an opportunity to promote themselves. ■

CLEANTECH ATTRACTS BUSINESS ANGELS

Major growth potential, a scalable business concept and a driven team of entrepreneurs. These are the key factors behind business angel investments.

MORE THAN 200 business angels from Connect Sweden participated in a survey during summer 2013. Some 66% claimed they were interested in investing in cleantech. Equally as many were interested in life science and slightly more, 75%, were interested in investing in IT and communication companies.

The analysis of the survey shows that business angels are a heterogeneous group of private investors who take considerably greater risks than other investors, and that they have become more professional in recent years. The angels are still mostly men over 50 years, but the proportion of women is growing.

Business angels are specifically attracted to companies with major growth potential and a scalable business concept. However, a driven team of entrepreneurs behind the company is the key factor.

A BUSINESS ANGEL’S wish list includes venues where they can meet entrepreneurs and other investors, a steady deal flow of interesting investment offers and skills training. In order to facilitate meetings between entrepreneurs and investors, Connect Sweden is now producing a national, and eventually Nordic, web platform.

*The Business Angel Network and Investments Study was conducted by Connect Sweden and the Ratio Institute, sponsored by the Swedish Energy Agency and Vinnova.

Read the survey at connectsverige.se

5 hot trends

IN THE CLEANTECH MARKET

Technology is developing faster than ever, and this is also impacting the cleantech market. Here are five hot trends.



The Internet of Things 1

WHEN GOOGLE acquired Nest – a company that manufactures smart thermostats and smoke detectors – in 2014, the hottest area in cleantech became obvious. The search-engine giant had to pay USD 3.2 billion for the company which, according to many, is yet another example of how the Internet of Things is considered a serious field of development. The Internet of Things is the interconnection of physical devices and systems, which enables analysis and greater efficiency through data aggregations. Thermostats and other products for monitoring the use of resources may become key components in tomorrow's interconnected world. An interesting Swedish company is Watty, whose big data solution enables energy efficiency in buildings using simple components.

“Energy efficiency has been a pretty big theme for us. Despite the number of mature companies in this sector, they are still growing fast,” says Carl Hall, investor at Alder.

Photovoltaics

THE PHOTOVOLTAIC market is growing furiously in the US, China and Japan. In total, more than USD 113 billion was invested during the year, and the market has now stabilized after several years of falling prices. There are major opportunities here for finding companies with exciting niche applications and new system solutions – or financing systems. There are many companies in Sweden, including Sol Voltaics, Optistring and Exeger.

A great deal can happen, depending on other trends in the energy market, and there is no doubt that solar power has major potential.

“Solar is the future, but we need to see more stability in the market,” says Magnus Agerström at Cleantech Scandinavia.

(Read more about the solar market outlook on pages 16–21.)



Solar power plant in the Mojave Desert in Arizona.

Resource optimization 3



Industrial product wastage can be reduced by up to 50%, according to Magnus Norberg Olsson, CEO of Tomologic.

WHILE NEW methods for producing goods and services are certainly needed, there is much to be gained by optimizing existing systems and methods. Swedish company Tomologic is a good example. The company's algorithm, which calculates the most efficient method for cutting metal sheets and reduces waste dramatically, has made Tomologic one of the hottest new technology companies in Sweden. The steel market is valued at several thousand billion USD, and taking a small percent of this market will mean a lot of money.

“Resource optimization is what really drives our investment theme,” says Henrik Olsén at London-based Environmental Technologies Fund.



A carpool car replaces five vehicles and reduces environmental impact.

CleanWeb solutions 5

SMART DIGITAL services and solutions that help people save money and energy are becoming more popular. CleanWeb boosts the efficiency of existing infrastructure by harnessing the power of mobile technology, sensors, data analysis and other types of information technology. This may be various types of services that enable people to share vehicles (Sunfleet carpool) or accommodation (AirBnB booking service) with other users in a flexible and energy-efficient manner. It also involves completely new behaviors and the development of services that we have not seen yet.

“I think CleanWeb solutions will achieve the greatest success in the future. That is driving development,” says Magnus Agerström at Cleantech Scandinavia.



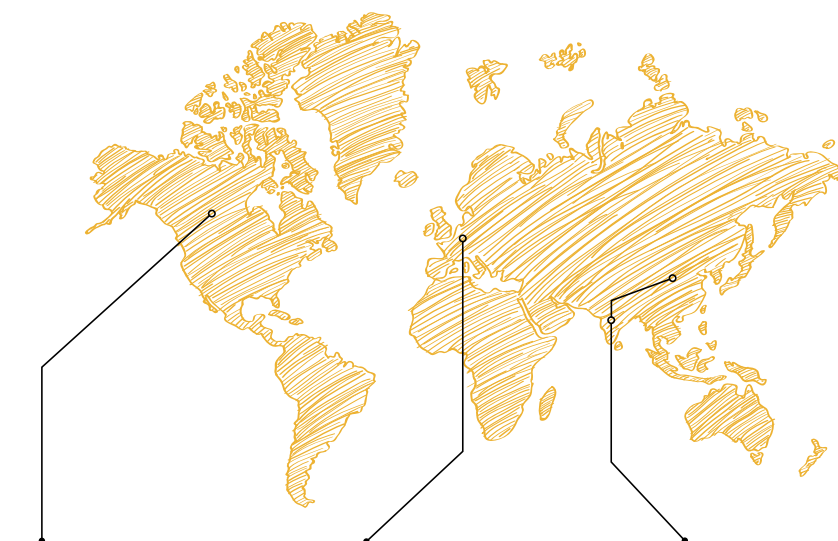
Sea salt-like material from Disruptive Materials has a range of applications.

Smart materials 4

NEW MATERIALS and fuels based on biological material are emerging in various fields. One exciting example is the company Disruptive Materials, which has developed a meso-porous material based on magnesium carbonate. Due to its unique properties, this material is suitable for a range of applications, particularly in the food and pharmaceutical industries. Last spring, the company won the Nordic Cleantech Open competition. Another company in this field, Cyclicor, from Skåne, develops new and sustainable polycarbonates that can be used in food products and medical devices, for example.

“This development is groundbreaking and the list of applications is growing. Various forms of bio-based material are replacing other types of material,” says Carl Hall from Alder.

The investment climate in cleantech's hottest areas



US
A few, but broad-based, themes with a strong focus on investment. Investments are more disposed to risk than in Europe. Companies are also usually better at marketing their solutions to investors, which attracts capital. The risk capital market is more mature with many highly-appraised companies.

EUROPE
High level of innovation in the Nordic countries, for example, as well as the Netherlands, Belgium and Germany. Developed industrial economies and programs that are driving development. Finland, Sweden and Denmark are all among the top five on the Global Cleantech Innovation Index 2014.

CHINA AND INDIA
Due to their large populations, China and India are major markets for both foreign and domestic companies. As urbanization continues, business opportunities are growing in such areas as urban planning, waste management and water and air purification. China's political system allows the country to quickly invest large amounts of capital in strategic areas such as cleantech.

SOURCES: DATA FROM CLEANTECH GROUP AND INTERVIEWS WITH CARL HALL, ALDER, MAGNUS AGERSTRÖM, CLEANTECH SCANDINAVIA, HENRIK OLSÉN, AND OTHERS.

THE PHILANTHROPIST

who wants to make a change

He has shaken up the telecom and music markets from the ground up. Niklas Zennström now has his sights set on IT and cleantech. The goal is to catalyze change and help new entrepreneurs.

TEXT: JOHAN WICKSTRÖM PHOTO: TOR JOHNSON

NINE YEARS AGO, he sold his company Skype for USD 2.6 billion and the following year, in 2006, he was selected as one of the world's most influential people by Time Magazine. Many people might have changed down a gear or two and taken it easy after that, but not Niklas Zennström.

"I would have been restless. I want to be involved and affect the outcome," he says on a hectic September day.

Today, he runs the international investment firm Atomico, with offices in five countries, in which focus is on new IT companies. In addition, together with his wife Catherine, he has started the organization Zennström Philanthropies, which works with human rights and the environment.

Zennström Philanthropies supports organizations that work with climate issues and furnishes them with, for example, tools to analyze the environmental impact of investments. Three years ago, the organization established the Green Mentorship Award, which is a competition aimed at new Swedish cleantech companies.

"The winner receives my personal mentorship for a period of one year. I help them to brainstorm strategies and ensure they gain access to my network," Zennström says.

In 2012, Orbital Systems won the competition with its water recycling shower technology (read more on page 6), and Niklas Zennström has also backed the project with his own money.

"It is an extremely interesting product that lowers both energy and water use."

Previous winners also include the company Clean Motion, which is developing the Zbee electric vehicle, and the ventilation company Rehact.

ZENNSTRÖM IS CONVINCED that cleantech as a prospect for investors has a bright future. He points out four fundamental drivers:

1. Fossil fuels are becoming increasingly expensive.
2. New cleantech is becoming cheaper and more efficient.
3. Consumers are setting ever increasing requirements for sustainable goods and services.

The greatest challenge is to find the right time for the investment.

4. Politicians will increase the cost of environmental emissions through taxes or fees.

"All of these factors are market drivers over time. The greatest challenge is timing; to find the right time for the investment."

Why doesn't Atomico work with cleantech investments?

"My colleagues and I have another background and different types of networks. But there are clear areas in common between the sectors. Many IT companies offer solutions to enhance the efficiency of resource utilization and to use energy in better ways," he says.

HOWEVER, DESPITE THE fundamental market drivers, there is a lack of capital when cleantech companies want to scale up operations.

"Yes, that is a major problem. Very few institutional investors are interested in companies between the seed and startup stage. I don't really understand why. Perhaps it is because they are more capital intensive."

What drives you today?

"I want to be involved and affect the outcome. It is fun to help entrepreneurs build a company from an idea to the end result. On the other hand, I can become quite angry that we haven't changed the way we live, despite all the knowledge in our possession."

On climate change, his views are rather pessimistic in the short-term but not for the long-term.

"So much interesting technology is being developed and there are so many skilled entrepreneurs that can change – and drive – consumers and politicians. So I am an optimist." ■

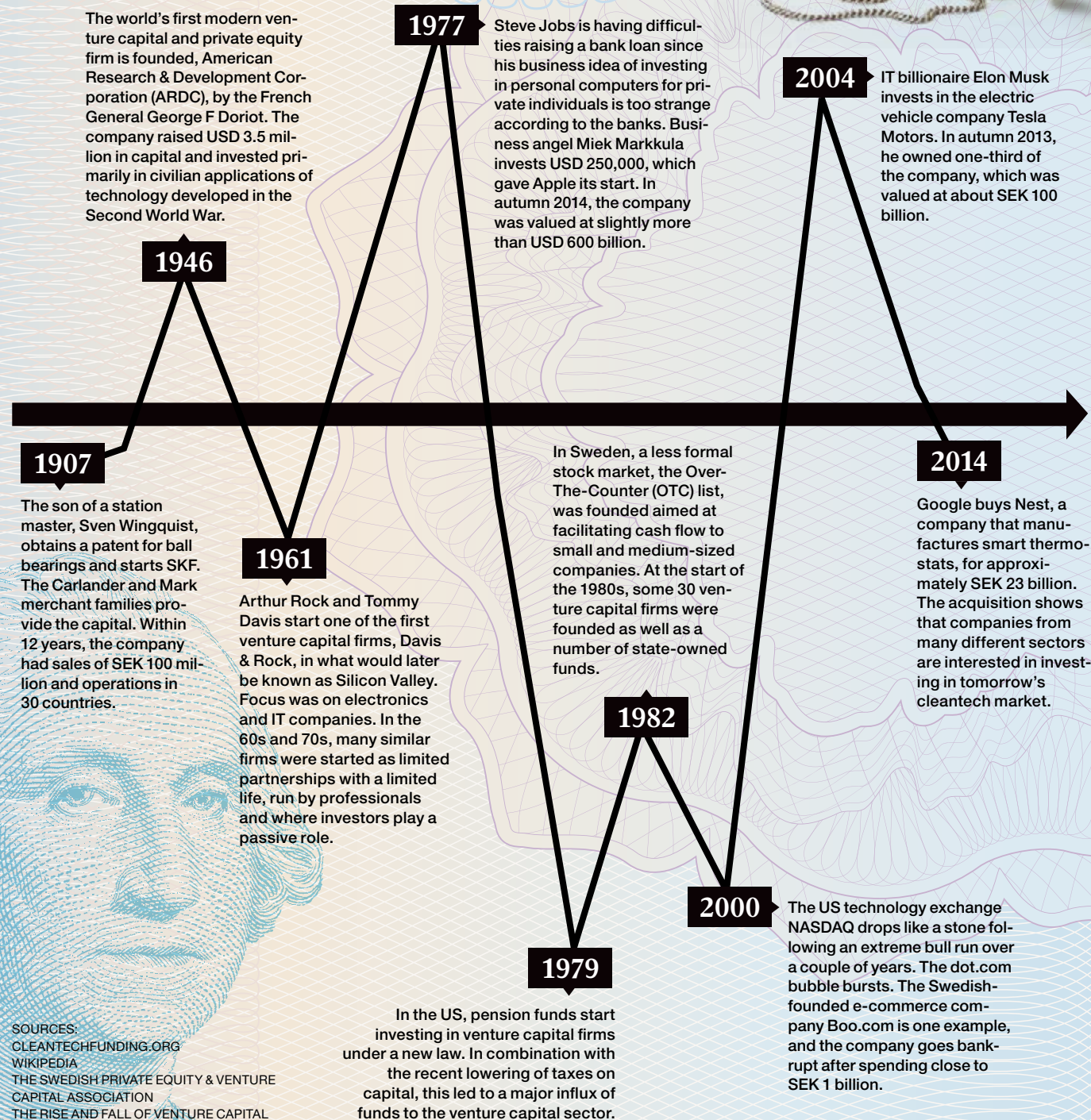
NIKLAS ZENNSTRÖM

Age: 48. **Lives in:** London.

Education: M.Sc. in Engineering Physics and M.Sc. in Business and Economics from Uppsala University.
Background: Started Kazaa in 2000 and Skype in 2003. Since 2006, he has run the international investment firm Atomico and the Zennström Philanthropies Foundation.

HISTORY OF VENTURE CAPITAL

Transforming new technological solutions into strong companies requires deep pockets. Over the course of time, venture capital has played a decisive role for a succession of major innovations. Here are nine years of this journey.



SOURCES:
CLEANTECHFUNDING.ORG
WIKIPEDIA
THE SWEDISH PRIVATE EQUITY & VENTURE
CAPITAL ASSOCIATION
THE RISE AND FALL OF VENTURE CAPITAL

The Swedish company Climeon generates electricity from residual heat – aiming for the shipping market. The product uses Alfa Laval heat exchangers.



Swedish cleantech companies helped along by Alfa Laval

The increase in interest in smart energy solutions fits ideally with industrial giant Alfa Laval. The company's components are used by many Swedish cleantech companies, for example in ships' engines.

IT ALL STARTED with a separator to remove milk from cream. Since the company was founded in 1883, the number of products has increased, even if separators are still in the line-up. However, they are now used for many more applications, for example, to clean gases or fuel onboard ships, to process vegetable oil or in the production of pharmaceuticals.

"A substantial part of our business is about the environment and energy solutions. We have worked with this for decades and cleantech is just another label," says Peter Torstensson, Senior Vice President, Corporate Communication at Alfa Laval.

One of Alfa Laval's main areas is heat exchangers, which transfer heat between hot and cold media in industrial processes. "Waste heat can be used more efficiently. Recently, we sold a heat exchanger to an oil refinery for SEK 100 million – the customer will save that amount in one year."

WITH SALES OF slightly more than SEK 30 billion and close to 18,000 employees, Alfa Laval is an industrial giant. The company also works with many smaller cleantech companies. A large proportion of the start-ups in the Swedish Energy Agency's portfolio use components from Alfa Laval.

One of them is Climeon, which has developed a highly efficient product for generating electricity from waste heat. The heat exchangers are sourced from Alfa Laval.

"Alfa Laval contributes a high level of competence and we talk with them on an almost daily basis. In addition, it is good to know they can deliver if volumes increase moving forward," says Thomas Öström, CEO of Climeon.

ONE OF CLIMEON'S target groups is the shipping lines. Climeon's product (two meters by three meters) can recover waste heat from the diesel engines of ships and generate electricity.

"Our modules have a capacity of 100 kW. One ship needs three such modules and there are 110,000 ships around the world. Initially, this is the market I have the greatest expectations for. But our technology can work in many instances, for example, manufacturing," says Thomas Öström.

Climeon is now building its first pilot facility, which is being partly funded by the Swedish Energy Agency in the form of a conditional loan of SEK 14 million. In 2015, the company expects to have come to market.

JOHAN WICKSTRÖM

SAVE THE CLIMATE AND INCREASE GROWTH

BUILD COMPACT cities, phase out subsidies for fossil fuels and set predictable carbon prices. These are some of the ten most important measures presented in the research report Better Growth, Better Climate: The New Climate Economy.

A key conclusion of the report is that there is no incompatibility between economic growth and climate measures.

The measures included a proposal for setting up new financial instruments that support new green technology, which should reduce financing costs by 20%. The research project was led by a global commission, which Sweden initiated in 2013.

Read more at newclimateeconomy.net

613 TWh

THE AMOUNT of electricity used by the world's 80 billion consumer electronic products (four times Sweden's total electricity use). Two-thirds should be savable through new technology. SOURCE: MORE DATA, LESS ENERGY, IEA



SOLAR-POWERED AIRCRAFT FLIES ROUND THE WORLD

IN SPRING 2015, the solar-powered aircraft Solar Impulse 2 starts its round-the-world journey. The solar aircraft is constructed from strong but ultralight carbon-fiber composites and more than 17,000 solar cells have been mounted on its wings (which are wider than those of a jumbo jet). The panels will deliver all the energy to the aircraft's four propeller motors. The energy is stored in lithium batteries in the wings thereby enabling the aircraft to fly both day and night. However, flying around the world will take time: the top speed is 140 kilometers per hour.

Read more at solarimpulse.com

Cleantech Forum attracted investors

The Internet of Things, solar energy and smart material. These were a few of the subjects addressed at the Cleantech Forum Europe in Stockholm at the end of May.

POWERFUL INVESTORS, smart entrepreneurs and potential buyers of new innovative solutions. About 450 people from across Europe were in place when Cleantech Forum Europe opened its doors on May 19, at the Brewery Conference Centre in Stockholm.

Under the heading “The future is really crazier than we ever think,” the Cleantech Group’s Managing Director Richard Youngman took the stage. He compared the growth of cleantech development with the expansion and significance of railways in Europe during the 1800s.

“The cleantech sector is developing in the same manner. Falling prices for solar cells and the success of Tesla are two examples of new technological paths that are successively making their mark.”

“THINGS HAVE BEEN a little shaky in the wake of the financial crisis, but if you look ahead, fantastic opportunities are waiting for investors,” asserted Youngman.

“The technology exists. The biggest challenge is perhaps identifying business models that can channel more capital to the cleantech sector.”

Erik Brandsma, Director General of the Swedish Energy Agency, agreed:

“There are far too few investors in this sector. Financial innovation and new methods of risk sharing are needed.”

FREDRIK WASS



Richard Youngman (above) from Cleantech Group opened the Cleantech Forum.



JOHAN JEPPESEN



Mattias Karls, CEO of Disruptive Materials.

WINNER OF THE NORDIC CLEANTECH OPEN

IT LOOKS LIKE salt flakes and contains 70% air – but it could revolutionize all dehumidification technology. Uppsala company Disruptive Materials won the Nordic Cleantech Open competition, which was decided at Cleantech Forum Europe.

“This was wonderful. We have actually been in existence for only nine months,” says CEO Mattias Karls after receiving the gold vase from the Minister for IT and Energy Anna-Karin Hatt.

The new material, Upsalite, comprises magnesium carbonate and can be used in dehumidification equipment, ventilation machinery and pharmaceutical manufacturing.

MIKAEL GUSTAVSEN



ÖRESUNDskraft INVESTS IN ELECTRIC VEHICLE CHARGER

THE MUNICIPAL energy company Öresundskraft plans a substantial expansion of electric vehicle (EV) chargers. In total, the company is investing SEK 25 million to build a network of EV charging stations in and around Helsingborg. The plans also include building a network of fast charging stations along a 1,600 kilometer national corridor.

GLOBAL INVESTMENTS INCLUDED IN RENEWABLE ENERGY

(USD billion)

Photovoltaics	113.7
Wind power	80.0
Biomass/waste	8.0
Hydropower (<50MW)	5.1
Biofuel	4.9
Geothermal, wave power, etc.	2.6

SOURCE: RENEWABLES 2014
GLOBAL STATUS REPORT

RESOURCE SHORTAGE COULD BE THE DEAL OF THE CENTURY



OVER THE next two decades, 2.5 billion people will join the global urban middle-class. This will create unprecedented pressure on the world’s resources. In a new report from consulting firm McKinsey “Resource revolution – How to capture the biggest business opportunity in a century,” this is highlighted as the business opportunity of the decade if we play our cards right.

The key is to utilize the world’s resources more efficiently. Smart IT solutions, new nanomaterials and biotechnology enable substantial leaps in development, according to the report.



How cleantech companies gain contact with customers

Are you looking for interesting technology companies? Then look at their collaboration with customers.

WHEN SCIENTIST Andreas Englund, on behalf of the Swedish Agency for Economic and Regional Growth, investigated the market for startups in 2010, he came to the conclusion that customer relationships were the largest market barrier. In other words: it was difficult to convince the intended customers to try new technology and take risks.

In a recent study, funded by the Swedish Energy Agency, he has now progressed and looked at the interface between small technology companies and their customers. Englund contacted 88 startups in the cleantech sector, of which 66 had collaboration with a customer. He thereby identified 20 customers that had collaborated with cleantech companies.

“It turned out that few of these customers had been in contact with cleantech companies prior to the collaboration. However, many had read about the companies in newsletters and the like. So a tip to companies is to be bold enough to take contact and, when doing so, aim efforts at the head of technology. Confidence can be built rapidly,” Englund explains.

The study details five different forms of collaboration between companies and customers.

“One example is testing prototypes, whereby the company can fund all or part of the prototype production.

Another common form is integrated collaboration, which is a closer collaboration on the development of a component in the customer’s products.

“Anyone investing in cleantech companies should look more closely at the types of customer collaboration the company has,” says Englund.

“I would rather invest in a company that collaborates with a customer. In this case, there is a greater chance that the product is one that is in demand in the market.”

IN PARALLEL, one should not let oneself be mesmerized by this.

“This could be a risk if the customer is too interested in technology. It is not certain that other companies are equally interested.”

What can the government do to increase demand?

“I believe more energy is needed to support customers and promote the testing of new technologies. For example, various support strategies could be put in place and guarantees given at the prototype phase.”

JOHAN WICKSTRÖM

PENSION FUND MONEY LEADS TO EMISSIONS

THE CONVERSION to a sustainable society requires rerouting of major capital streams to sustainable initiatives. Most of the world’s investments stem from pension fund investments, but only a small portion of these funds are invested in sustainable initiatives. This was shown in a survey conducted by the P80 Group Foundation – an initiative launched by Prince Charles, in which 80 of the largest global pension funds are gathered.

According to a survey carried out by accounting firm PwC on behalf of the Worldwide Fund for Nature (WWF), Swedish capital allocated to global energy investments, the Swedish pension funds also follow the same investment patterns. Pension savings in Sweden contribute to global emissions of 53 million metric tons of carbon emissions per



year, almost equal to Sweden’s emissions of 55.7 million metric tons in 2013.

Together with the WWF, the Swedish Energy Agency is now entering into dialog with Swedish banks and pension funds about how tomorrow’s capital flows can be mobilized toward sustainable investments.

At the end of

2012, Swedish pension funds’ investments were valued at about SEK 4 trillion, of which 9% was invested in energy-related companies.



GROWING MARKET FOR BATTERIES

THE MARKET FOR batteries will grow steadily over the next few years and is expected to reach sales of USD 50 billion by 2020. Growth is primarily driven by the increase in electric vehicles but also by batteries for consumer products such as smartphones, according to a report from the research and advisory firm Lux Research, writes news site www.Cleantechiq.com. Batteries for households with photovoltaic power is another growing market.



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Worth reading: "Ignore everybody: and 39 other keys to creativity", Hugh MacLeod

MICHELE PARAD CLEANTECH GROUP

"Look for companies in new fields"

TEXT: FREDRIK WASS PHOTO: MARK BLOWER

The annual report Global Cleantech Innovation Index takes the pulse of the cleantech market around the world. Michele Parad, lead author of the report, informs about some of the top trends.

How has the cleantech market developed over the past year?

"Stock listings in the European markets have increased in 2014. Even if many of these companies are listed on small alternative exchanges, we see this as a sign of a general recovery for the cleantech market."

How should cleantech investors think today compared with a few years ago, for example, with regard to the political conditions?

"Political decisions are always difficult to predict, and can change. Investors today are far more sensitive to such decisions than they were in 2007. But cleantech companies have also changed and the best companies make ends meet without subsidies. I think investors should be open to searching for investment opportunities in new fields."

What is the principal factor for innovations to break through both globally and locally?

"Funding is the key factor. Countries that have built a national network of investors often attract investment from overseas too. Silicon Valley companies and Israeli companies are obvious examples of strong local ecosystems."

How do Swedish cleantech companies fare in an international perspective?

"They have an excellent reputation. However, I have a feeling that the same companies are circulating on the local and international scenes. It would be healthy if more companies and other types of companies exposed themselves internationally."

Which areas will attract the most investors over the next few years?

"The areas that seem to need most attention are trendy concepts, such as the Internet of Things, robotics, big data and CleanWeb. You have an overriding concept in common – utilizing IT innovations to boost more sustainable development."

Read the top-ten list from the Global Cleantech Innovation Index 2014 on page 10.