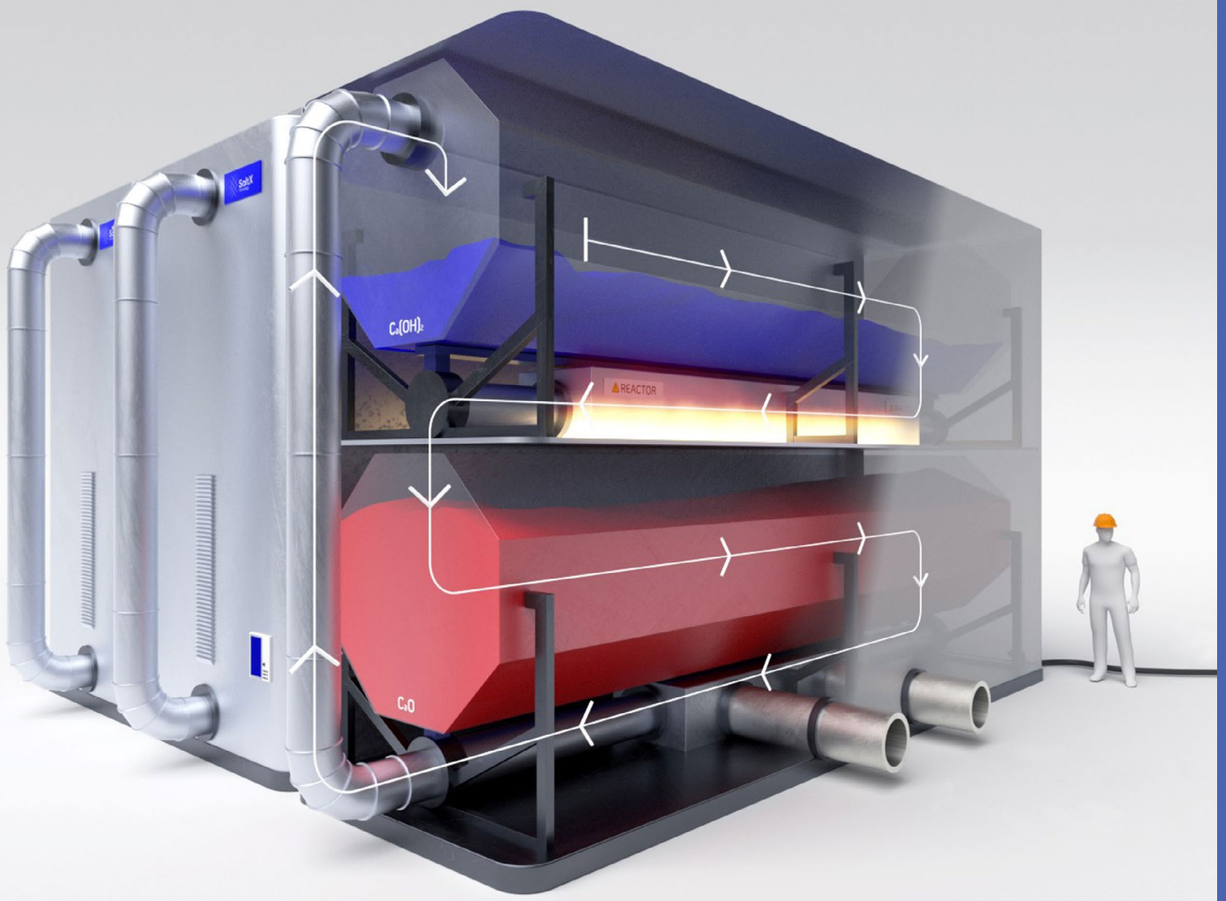
SaltX Technology

INFORMATION LINKED TO THE RIGHTS ISSUE OF SALTX

SaltX Technology carries out a rights issue of no more than SEK 80.6 million at a subscription price of SEK 5.50 per Unit.



CONTENT

The CEO's address	4
Focus on EnerStore	6
Partner interview	9
How the funds will be used	10
Business model for EnerStore	12
SaltX Labs	16
How SaltX technology works	18
Nano Coated Salt (NCS)	20
This is how production will be scaled	22
Market overview	24
Priority markets	26
Competitor analysis — heat	28
Competitor analysis — electricity	30
Information and sources	32

IMPORTANT INFORMATION

This information leaflet is not and should not be regarded as a prospectus in accordance with applicable laws and regulations. Invitation to shareholders and the public to subscribe for Units is only through the prospectus that the company has drawn up ("the Prospectus") which contains a presentation of SaltX, the rights issue and the risks associated with an investment in SaltX and participation in the offer. The Information Folder is not intended to replace the Prospectus as a basis for the decision to subscribe for Units in SaltX and does not constitute a recommendation to subscribe for Units in SaltX. Investors who wish to or are considering investing in SaltX are encouraged to study the Prospectus. The Prospectus has been published and is available at SaltX's website and at Eminova Fondkommission AB's website, www.saltxtechnology.com and www.eminova.se respectively. The Prospectus and application forms can also be obtained free of charge from the issuing house, Eminova Fondkommission AB.

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RISK FACTORS AND REFERENCE TO THE PROSPECTUS

This Information Folder is an introduction to the SaltX rights issue. The information in this folder shall be considered marketing material. For full information about the rights issue, the company and potential risks, please refer to the Prospectus.

THE CEO'S ADDRESS

The interest for large-scale energy storage is gaining momentum. When the world switches to renewable energy production, other forms of energy storage than those that are available today will need to be developed and sold. SaltX provides a solution that is effective both in terms of storage capacity and cost. These are important advantages that cause us to believe that there is a significant underlying demand for our EnerStore solution.

With this in mind, there are two reasons why SaltX is now going to the stock market to raise additional capital:

Firstly, it has taken longer than originally thought to gain sales momentum for our nano-coated salt, although the underlying interest is high, and secondly that we wish to take advantage of the time window currently in the market and which means that we want to increase the pace further in order to build as strong a market position as possible. Overall, we see great opportunities to create value for our shareholders, but this requires additional capital to fully utilise our position.

We will focus on two segments within EnerStore: The first priority is the solution we have in the pilot project with Vattenfall in Berlin, where we save surplus energy from wind power in the form of thermal energy, which can then be used for district heating. We will use this reference facility to market the solution actively in our three target markets — Germany, the USA and China. In these markets, we are convinced that there is a great demand for this kind of solution.

As the second priority, we will further develop this concept to show how EnerStore can store heat and then convert it into steam for heat or to power a turbine that generates electricity.

We see that the biggest commercial potential is within large-scale energy storage. We therefore estimate that our future revenue will come primarily from EnerStore.

With major, reputable partners, worldwide-patented technology and a strong team, we have good prospects of being a successful player in the global energy storage market.

Stockholm, November 2018
Karl Bohman

"WE WANT TO INCREASE THE PACE FURTHER IN ORDER TO BUILD AS STRONG A MARKET POSITION AS POSSIBLE."

"WITH MAJOR, REPUTABLE PARTNERS, WORLDWIDE-PATENTED TECHNOLOGY AND A STRONG TEAM, WE HAVE GOOD PROSPECTS OF BEING A SUCCESSFUL PLAYER IN THE GLOBAL ENERGY STORAGE MARKET."

KARL BOHMAN
CEO

FOCUS ON ENERSTORE

SaltX's new strategy is to focus on the application area for large-scale energy storage – EnerStore. There are several reasons for the new strategy

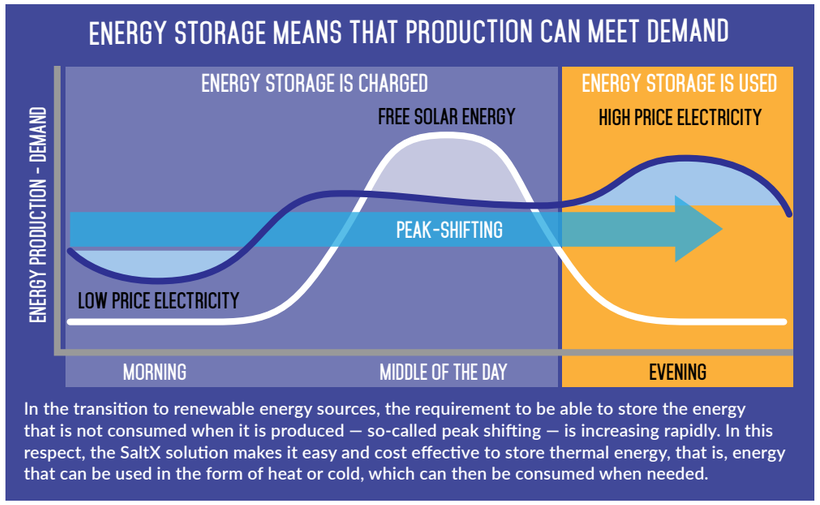
- **Market dynamics:** It is estimated that the market for energy storage will see a six-fold increase by 2030[1]. SaltX must build a market position already now in order to be able to compete in this market.
- **Tested and protected technology:** SaltX has strong patent protection worldwide for its nano-coated salt. The technology has been tested and proven by independent parties such as Stockholm University[2] and the German DLR (the German Aerospace Center).
- **Reference project soon completed:** The pilot project with Vattenfall is an excellent first reference project that can be used to sell large projects to other energy companies and customers with similar requirements.
- **Competitive:** Compared to other alternatives for thermal energy storage such as molten salt or concrete, EnerStore is considerably cheaper and requires significantly less volume
- **Supplement to batteries:** SaltX solution should not be seen as a direct competitor to batteries that store electrical energy. It is instead a complement because the heat from SaltX can be converted to steam, which drives a common steam turbine that in turn generates electricity.
- **Supply chain in place:** With the agreements with Nordkalk and Wacker, SaltX has secured the partners needed for large-scale production and to meet expected and greater demand next year.

ENERSTORE COMPARED WITH OTHER ALTERNATIVES... IS CONSIDERABLY CHEAPER AND REQUIRES SIGNIFICANTLY LESS VOLUME

As solar and wind power is being expanded, more and more cheap electricity is generated at certain times of the day. Unfortunately, this does not happen when demand is high. Therefore, the demand is growing rapidly for so-called peak-shifting[3], which makes it possible to store electricity in a way that makes it easy to consume when demand is greater.

The new strategy is to focus on two segments within peak shifting, which is also based on the same solution and principle as the pilot project being carried out in conjunction with Vattenfall:

1. **Wind power for district heating:** The target customers here are often energy companies such as Vattenfall. District heating companies in Europe, especially in Germany, have expressed great interest in EnerStore and are following the pilot project with Vattenfall closely.
2. **Renewable electricity for steam:** The target customers here are often large companies and industries that consume large amounts of steam in their processes. They have often already installed solar or wind power that generates surpluses.



In the transition to renewable energy sources, the requirement to be able to store the energy that is not consumed when it is produced — so-called peak shifting — is increasing rapidly. In this respect, the SaltX solution makes it easy and cost effective to store thermal energy, that is, energy that can be used in the form of heat or cold, which can then be consumed when needed.

SaltX sees a lot of investment in Germany, the United States and China in the above-mentioned areas. In these areas, renewable energy is rapidly expanding and governments often provide support and invest significantly in energy storage, mostly in batteries.[1,4,5,6] Therefore, it is natural that SaltX focuses primarily on these markets.

As we believe that a major part of our future revenue will come from EnerStore and the lesser part from our other application areas, the consequence of the new strategy will be that the work in other application areas — SunCool, HeatBoost and VerdAcc — will change. These applications are being moved to SaltX Labs where they have a more natural home.

At SaltX Labs, our partners and customers are in charge of development while SaltX provides support and, above all, salt materials, which is in line with the company's business model. In all of these application areas, development has progressed so far that the remaining work up to commercialization and beyond is best done by our partners.

With the new strategy, SaltX is well positioned in the energy storage market and has good opportunities to build a large market share.

SALTX ON TOUR
WORLD PREMIERE FOR SALTX ENERSTORE

Stockholm was the first stop on the world tour where SaltX technology is scheduled to be demonstrated in cities including Milan, Boston and Shanghai.

On 23 October 2018, EnerStore was presented outside SaltX's headquarters in Stockholm for partners, investors, press and other stakeholders.

The demonstration facility is a copy, just in a smaller version, of the pilot plant that SaltX operates with Vattenfall in Berlin, Germany.

The facility, which can be transported in a freight container, marks the start of the SaltX global tour to market EnerStore in key markets.

PARTNER INTERVIEW:

MARCUS WITT

PROJECT SPONSOR & VICE PRESIDENT ASSET MANAGEMENT, VATTENFALL

What is your impression of the project so far?
I think the project is a milestone and demonstrates that major steps have been taken over the past year. There is now a storage solution that works and that we will carry out testing on a larger scale in Berlin.

If the project in Berlin is successful, what is the next step?
Of course, we will test and see how the energy storage works in Berlin. It is important to review all the test data in order to make further calculations. With the facts we have from the demo plant, the calculation looks good for the Berlin project, and if the project succeeds, there is a good opportunity to install this type of storage in our district heating network, and also in our electricity generation. At Vattenfall, we view energy storage as a new feature that we can implement in several places in our energy system.

What does the timetable look like?
In the next six months, we will be able to know if it works on a larger scale, which I'm sure it will do. After that, we want to further scale up the energy storage and this will take one to two years.

This is an excerpt from a video interview with Marcus Witt, made on 23 October 2018 at the SaltX office in Stockholm when EnerStore was demonstrated.
See the full interview here:

AT VATTENFALL WE VIEW ENERGY STORAGE AS A NEW FEATURE THAT WE CAN IMPLEMENT IN SEVERAL PLACES IN OUR ENERGY SYSTEM.

HOW THE FUNDS WILL BE USED

In order to take advantage of the strong market situation for large-scale energy storage, and to have sufficient financial resources to implement the determined strategy to focus on EnerStore, SaltX is now raising capital through a rights issue for approximately SEK 80 million.

The capital raised by the company will mainly finance the increased investment in EnerStore. Over the past year, SaltX's organization has been strengthened and increased in terms of the number of employees, especially on the commercial side. This means that SaltX currently has sufficient resources and the right skills, and thus does not need to make any significant new recruitments.

Other application areas — SunCool, HeatBoost and VerdAcc — that are being moved to SaltX Labs will be funded through customer revenues and through public funding, such as EU H2020 and InnoEnergy.

As SaltX's business model is based on selling the company's patented nano-coated salt and not on selling, manufacturing and delivering complete systems or products, no substantial investment is required in either product certification, production equipment or distribution channels. This is done by SaltX customers and partners, which enables SaltX to operate a capital-efficient business.

Instead, SaltX invests in further development, testing, verification of, and quality assurance of the SaltX material. This mainly concerns new compounds and optimization of the nano-coated salt. This is done in SaltX's own laboratory and workshop and on a smaller scale. All manufacturing and logistics of larger volumes of the nano-coated salt will be carried out by partners such as Nordkalk and Wacker.

Hand in hand with physical tests in the laboratory, SaltX is investing in the patent portfolio by developing new patent applications with the help of SaltX's patent agents.

SaltX has a well-developed and defined strategy for managing the company's intangible assets — an IP strategy where patents are linked to empirical results, which provides strong protection for SaltX's intangible assets.

In addition to the above investments, the bulk of the funds from the rights issue will be allocated to the following areas and activities:

IN ESSENCE, NO INVESTMENTS ARE REQUIRED IN EITHER PRODUCT CERTIFICATION, PRODUCTION EQUIPMENT OR DISTRIBUTION CHANNELS.

GREATER FOCUS ON SALES AND BUSINESS DEVELOPMENT FOR ENERSTORE

In the last six months, the number of procurement processes for energy storage projects has increased significantly. New invitations to tender are being announced on a regular basis in SaltX's target markets — Germany, USA and China.

If SaltX, as a small and still relatively unknown company, shall be able to compete and respond to these inquiries, we must allocate sufficient time and resources, and ensure that we have the right skills to respond to inquiries. In addition, we must identify, attract and work with partners who build the system and components of SaltX patented saline solutions.

For this sales and business development work, we will strengthen the EnerStore commercial organization and reallocate certain existing commercial and technical resources within SaltX.

GLOBAL MARKETING CAMPAIGN FOR ENERSTORE

A demonstration facility of the pilot plant that SaltX operates with Vattenfall in Berlin was presented for the first time at the end of October this year. This marked the start of the global marketing campaign launched by SaltX. The demonstration facility will be transported in a freight container to key markets where potential customers have shown an interest in the company's solution.

Stockholm was the first stop and in January next year the SaltX demo container will be shipped to Milan where SaltX partner NOKA will show it to potential customers. Other planned stops are Glasgow, Boston, San Francisco, Peking and Shanghai.

SUPPORT FOR SUPPLIERS AND PARTNERS

Although SaltX does not manufacture the nano-coated salt itself and relies instead on strategic suppliers such as Nordkalk and Wacker, the company must allocate the necessary resources to support them when they start up volume production. This primarily concerns technical resources from SaltX, but also business development resources as well.

With the capital from the rights issue, SaltX will be well equipped for the future: with a unique, world-patented and cost-effective solution for storing thermal energy in a market that is currently gaining momentum.

TARGET MARKETS

In China, the largest solar and wind farms are being constructed while coal power plants are being closed. In northern China, in particular, it can get very cold and today cities are reliant on district heating from coal power plants. Solutions are needed there that enable a rapid energy conversion. Germany has relied on coal power until now but definitive political decisions have been taken to stop this quickly.[1,7] Energy companies are therefore looking for solutions that can quickly fill this gap.

The US East Coast, like Germany, has chosen to reduce the dependence on coal power, which also makes the East Coast an interesting market for SaltX.[8]

TARGET CUSTOMERS

With SaltX energy storage it is possible to store excess energy and then use it in periods when it is needed, and then in the form of heat.

Large district heating networks require 180 to 200 °C degree heat at the power plant in order to be able to deliver the right temperature to households.

Today, a large majority of industries use large quantities of steam. Demand for storage is high, but has not been economically viable, as the storage of steam requires expensive pressure tanks.

Two major advantages of storing thermal energy in salt are the high energy density and the ability to consume the energy at high temperatures. It also enables storage of energy in small-scale solutions, so-called micro-grids.

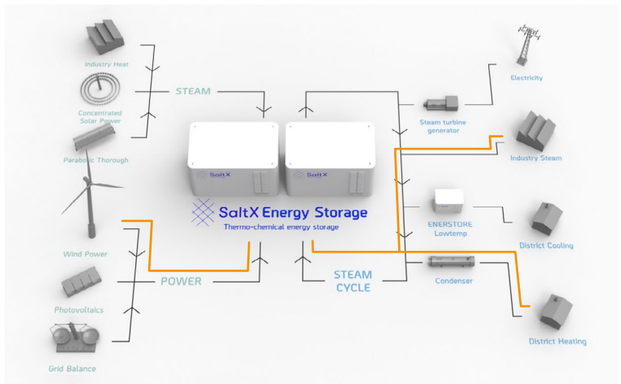
BUSINESS MODEL FOR ENERSTORE

THEREFORE CUSTOMERS WILL BUY

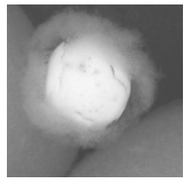
SaltX Technology is focusing heavily on the large-scale storage of thermal energy. The company's solution, EnerStore, can handle several of the challenges that the transition to renewable energy sources entails. By storing thermal energy in the company's patented nano-coated salt, SaltX can help solve the big challenge with storage, which is one of the keys to managing a fast and necessary transition. This is a development that the energy companies around the world are aware of, but which they have not been able to solve yet. This is why SaltX is experiencing great interest in EnerStore.

ENERGY STORAGE – THE KEY TO THE TRANSITION

The background is essentially that a change in energy production from oil, gas, coal and nuclear power creates new and major challenges if energy is to be consumed in the same manner as before — and in the way on which modern societies are based. Common to these non-renewable energy sources is that they have a steady production rate. Unlike the production of energy from renewable sources such as solar and wind power which instead have an uneven production rate, for example, when the sun is shining or when the wind is blowing. This situation requires the energy to be stored in order to be able to consume it whenever you want. In turn, this is necessary if the switch to renewable energy sources will not be too painful. In technical terms, one says that the fluctuations in the network must be able to be managed, and this is where large-scale storage becomes a necessity.



In the future, SaltX energy storage will offer the opportunity to store several different energy types and produce several different types of energy.



SaltX patented nano-coated salt is capable of being charged with thermal energy an almost unlimited number of times thus making it very cost-effective.

CURRENT OPTIONS – EXPENSIVE AND COMPLICATED

Large-scale storage is complex and no one has yet found a complete solution to this difficult challenge. Common to large-scale storage solutions that exist today is that they are expensive and complicated.[9]

Another solution that has been tested is called “pumped hydro”, which in slightly simplified terms means that water is pumped up to a high height and stored in reservoirs and then hydropower is subsequently generated by releasing water. This option relies on the fact that there are both mountains and room for reservoirs in the region.

There are some other solutions, but what they have in common is that they are seen at best as complementary forms of storage.

Large-scale storage of thermal energy of the type offered by EnerStore solves some of the major problems with the other storage formats, as it does not require huge investment and its ongoing use is cost-effective. The solution can also be introduced in the near future — that is within the next few years, not decades away.

The major energy companies around Europe and the rest of the world are currently struggling with this storage problem because they rely on energy production from coal, oil and gas. Sweden is something of an exception, as the problems are relatively limited because we have significant production of energy from water and nuclear power. There is also a large supply of biofuels from Sweden’s extensive forests.

NANO COATED SALT - CHEAPER AND BETTER

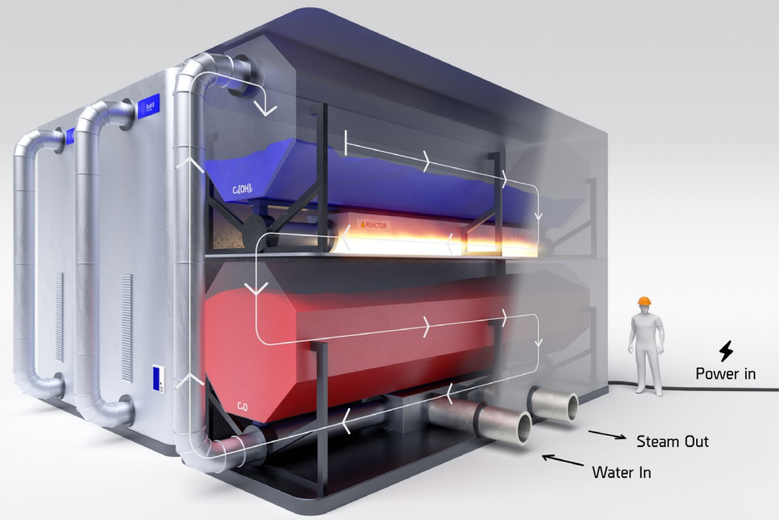
Storing thermal energy in salt is not new, but in practice, there have been problems with life expectancy. This is mainly because the metal corrodes due to the salt and that the salt crystals turn into clumps when being charged and discharged. This causes the chemical reaction to deteriorate and deteriorate over time. SaltX nano-coating prevents both these problems.

GREAT INTEREST FROM ENERGY COMPANIES

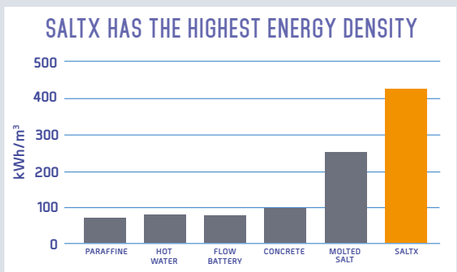
Energy companies are very interested in the opportunities for cost-effective storage that EnerStore makes possible. We are receiving a large number of unsolicited contacts with requests for more detailed demonstrations of EnerStore. The pilot plant in Berlin, which SaltX has developed in conjunction with Vattenfall and a number of other power companies, has a key role for this.

A more complete evaluation of this facility where surplus energy from wind power is stored and then used in Berlin's district heating network is expected to begin at 2018/19 year-end. To scale up the marketing process, SaltX has

ENERSTORE MODULES FOR THE INDUSTRY



EnerStore is planned to be available for both modular and larger customized systems. On the image above you can see a 3D image of how a module may look. These systems are best suited for the industry and smaller “smart grid” systems, where both one and several modules can be linked together.
The Process industry, food industry and several other industries need steam in their production. Today there are no good options for storing the steam, especially as it requires tanks that can handle high pressure which is both costly and requires high safety precaution. With SaltX storage solution it is possible to save energy efficiently at low electricity prices, which can then be used as steam.



developed a demonstration facility (read more about this here), which clearly shows the potential of EnerStore. Structured marketing will be carried out with the aid of this demonstration facility.

A global market tour is being planned for the autumn and spring in the priority markets, such as Germany, USA and China. In this way, there is a systematic way to approach these markets and there is great interest ahead of this tour.

ENERSTORE IS EXPANDING THE MARKET

A strong trend in the energy market with the transition to renewable energy sources is towards smaller local energy production units. The EnerStore solution is suitable not only for large-scale solutions, but also for so-called micro-grids, that is, smaller systems for energy production. This, for example, could be when a company or property owner who wants to develop local energy production by means of solar cells or wind power and thus has the need to be able to store the energy locally. An increasing number of companies express an ambition to introduce micro-grids. SaltX is building an organization to create the opportunity to handle interest from this fast-growing market.

An advantage of the market for micro-grid production is that the decision-making process is estimated to be significantly faster compared with energy companies. As far as energy companies are concerned, their evaluation processes are for obvious reasons longer and more extensive, while at the same time each individual business deal with energy companies is significantly greater in terms of value.

FOUR QUESTIONS
SIMON AHLIN
SALES MANAGER, SALTX

What are the most important current trends in the energy market?
The strong and rapid transition to renewable energy production. A transition which is being driven by both greatly increased environmental awareness, and because the costs for producing renewable energy are rapidly decreasing.

It is now actually the cheapest means of producing new energy. However, because the production of all renewable energy is uneven, that is to say that production takes place when the sun is brightest in the middle of the day or when the wind is blowing at night, saving energy becomes crucial if we are to maintain the way in which we have become used to living.

As energy storage is becoming increasingly important, how is this affecting the opportunities to market and sell EnerStore solutions?
In a very positive manner. We receive many unsolicited contacts from energy companies who want to talk to us. Moreover, if we contact them, the response is positive without exception — you could say that all doors are open.

I recently made a marketing trip to Spain — one of the first countries in the world to build large plants with large-scale energy storage. There I was able to meet all the leading players in the field and essentially everyone was positive about our solution. We are in discussions with most of these on how we can develop our relationship. It is most likely that many of these will want to do business with us.

How important is the pilot facility with Vattenfall in Berlin?
It is important so that we have an opportunity to show that EnerStore really can handle large-scale storage.

What happens if Vattenfall decides not to continue?
The crucial thing is that we obtain a clear so-called proof-of-concept that shows that we can scale up our energy storage into large-scale solutions. We will of course continue to develop and implement EnerStore at Vattenfall because we are convinced that the solution will create great value for Vattenfall and for Berlin. Ultimately, it is important that we can demonstrate how well the solution works. However, we will not stand or fall on Vattenfall's decision.

"STORAGE OF ENERGY WILL BE KEY IF WE ARE WE ARE TO MAINTAIN THE WAY IN WHICH WE HAVE BECOME USED TO LIVING"

SALTX RECEIVED BLOOMBERG AWARD

SaltX was named along with nine other companies as the winner of The New Energy Pioneers when the news and information company Bloomberg selected these as the world's most interesting clean-tech companies in April this year.

"Innovative companies around the world who stand out for their leadership in clean energy and business transformation technologies," states Bloomberg at the announcement of the winners.

An independent panel of industry experts, assisted by Bloomberg's analysts and technology specialists, selected the ten winners from over 160 entries from nearly 50 countries around the world.

SALTX WAS SELECTED AS ONE OF THE WORLD'S TEN MOST INTERESTING "CLEAN-TECH" COMPANIES BY A JURY APPOINTED BY BLOOMBERG.

SaltX's CEO Karl Bohman receives the award from Bloomberg's jury.

SaltX was selected as one of the world's ten most interesting energy companies. The ten companies are presented here at a ceremony in New York.

SALTX LABS

INTERVIEW WITH ERIC JACOBSON – HEAD OF GROWTH AND RESPONSIBLE FOR SALTX LABS

In a few words, how would you describe SaltX Labs?
SaltX Labs is the company's collaboration platform for development projects run by customers. It is also at SaltX Labs that open innovation is driven forward. The company's long-term vision above all is to deliver the patented nano-coated salt and the knowledge around it. SaltX Labs manages this vision in practice, yet so far on a small scale. Customer projects such as SunCool, VerdAcc and Heatboost will now be located in the SaltX Labs structure.

Where does Labs stand today?
Since the launch six months ago, valuable contacts have

been already been made all over the world and new collaborations have started — far better than expected. We select new partners and collaboration projects carefully in Labs based among other criteria on how quickly the projects can be developed into full integrations of the salt. If we exclude projects within SunCool, HeatBoost and VerdAcc, we currently have eight projects running. These include both smaller start-up companies and entrepreneurs who have come via our former so-called Hackathons and larger, established companies, such as the South Korean company DYECO.

SALTX LABS IS THE COMPANY'S COLLABORATION PLATFORM FOR DEVELOPMENT PROJECTS RUN BY CUSTOMERS.

ERIC JACOBSON

What can we expect from the development in Labs?
In short, we expect some of the projects to become commercial products that integrate SaltX nano-coated salt and technology, thus generating revenue for SaltX.

Internally, we have long had a strong belief that our technology can be integrated into many more products than those we have worked with. SaltX Labs has proven to be the right format for realizing this belief. I believe the fact that we now have projects in widely differing areas, such as moisture-generating paint, thermal batteries for electric cars and water production, proves the potential. I think this is the beginning of something really big!

Will we see commercial solutions taking form here?
Yes, I am convinced of this. Just the current eight projects look very promising and we are following them with great interest. It would surprise me if one or more of them do not become successful. However, as usual it is uncertain when this might happen, as it is the customers who decide how quickly they can and wish to proceed to commercialization.

In that case, when will the first commercial product emerge from Labs?
We have seen that the time for the development cycle of SaltX has decreased significantly in recent years. We hope that the innovation culture within Labs will be able to accelerate this rate further.

We have set up a web shop for SaltX Labs where we sell demo-tubes that can be used to learn more about the technology. A number of tubes were manufactured to test the market, they sold out after a couple of months and new ones are now on the way.

SunCool tubes can also be ordered from China for those who want to develop products based on these components. The companies that work with SaltX Labs can buy SaltX material, which a handful of customers have already done.

How do you support the companies that are part of Labs?
SaltX's focus is primarily on helping companies to understand our technology and how they can best utilize it. Of course, they get access to our nano-coated salt.

Within SunCool, HeatBoost and VerdAcc, work is progressing as before with the difference that it is becoming clearer and more explicit that it is the customer, not SaltX, who drives development to commercialization and beyond.

Is Labs downgraded in priority now as SaltX is investing so much in EnerStore?
No, however EnerStore is what we are focusing most on. The idea behind Labs is that we will use SaltX's resources and knowledge in the best and most efficient way. It should be remembered that in Labs our customers and partners ultimately determine the rate of development, which differs from EnerStore. Innovation and development is something that will always be part of SaltX's core business, and SaltX Labs is a tool for making the most of this.

Why do your other applications fit in here?
SunCool, HeatBoost and VerdAcc are good examples of customer-driven projects. Partners like Rheem (HeatBoost) and MCC (VerdAcc) are those who demand product development and we do this for them.

One example of new collaborations is DYECO, which is a well-established South Korean company and one of the customers who has bought nano-coated salt through SaltX Labs.

SUNCOOL, HEATBOOST AND VERDACC ARE GOOD EXAMPLES OF CUSTOMER-DRIVEN PROJECTS. PARTNERS SUCH AS RHEEM ARE THOSE THAT ARE DEMANDING PRODUCT DEVELOPMENT.

The company works with material handling processes and industrial chemicals and is now focusing on renewable energy. They want to develop their own version of large-scale energy storage using their own systems and processes incorporating SaltX nano-coated salt.

In addition to demo-tubes, the company has purchased both SaltX nano-coated salt and SunCool tubes to better understand the technology and is now building a test facility that they intend to scale up.

NOKA is an Italian company that operates within renewable energy and energy efficiency. The company became aware of SaltX through Labs and became a member. Today, NOKA is SaltX's EnerStore partner in Italy.

THIS IS SALTX LABS

SaltX Labs is the company's collaboration platform where both customer-driven development projects and open innovation are carried on. The platform's beta version was launched twelve months ago and SaltX Labs has been operating since February 2018. During this period, two so-called Hackathons have been organized and a number of new development cooperations have been started. The company's long-term vision is primarily to deliver the patented nano-coated salt and the knowledge around it. SaltX Labs stands for this vision in practice, but so far on a smaller scale.

HACKATHONS

SaltX Labs has organized two Hackathons in the last six months. A competition where entrepreneurs are challenged to solve energy problems using SaltX technology. The winners become part of SaltX Lab's accelerator program, and in this way get the best support for realizing and commercializing their ideas. The accelerator program includes, for example, office space in Stockholm, mentoring, IP strategy coaching and technical support from SaltX. The winning team is currently working to build the first prototypes and is now looking for funding.

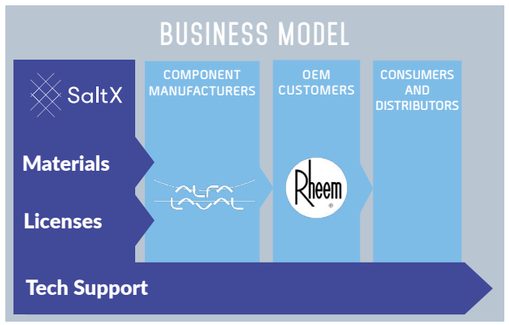
SALTX LIBRARY

Over the years, the company has built up a "library" of various salt formulas known as the SaltX Library. The library houses a unique knowledge of properties and how they can be utilized to store, make efficient and convert thermal energy from minus 10 to over 500 degrees Celsius.

SELECTION PROCESS

Companies and entrepreneurs contact SaltX on a daily basis to start up new cooperation. Therefore, it is paramount that we choose the right partners. Companies go through an evaluation process where SaltX carefully reviews the application idea and the team. It is important that time to market is relatively short, that the salt technology is close in temperature and power with what we are doing today and that it is clear that the partner will drive the project forward.

BUSINESS MODEL



HOW SALTX TECHNOLOGY WORKS

SaltX technology is as powerful as it is simple. The solution can be said to consist of two parts. On the one hand the properties of the salt, and on the other hand, the way in which energy is stored in the salt and then obtained for heating or cooling.

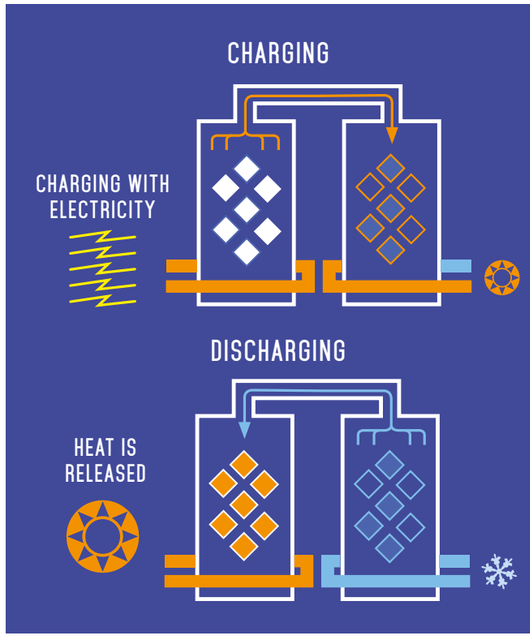
It has long been known that you can store heat or other forms of energy in salt. This is achieved when the energy is stored chemically by separating salt from water and then mixing them together again.

The problem previously was that the process of mixing and separating salt could only be repeated a few times. After that, the salt would have turned from independent salt grains into clumps. SaltX technology prevents this by means of a special surface layer — so-called nano-coating — and the salt thus retains its original form as individual salt crystals.

LONG-TERM AND COST-EFFECTIVE SOLUTION

The advantages of this are that you can charge and discharge energy tens of thousands of times without losing the salt's properties or its performance. The salt that is treated with nano-coating also possesses the property of being non-corrosive — that is to say, it does not create rust — unlike ordinary salt. This provides a long-term and cost-effective solution. Thus, the material in which the salt is stored does not rust. In addition, salt is environmentally sustainable and can be recycled.

...CAN CHARGE AND DISCHARGE ENERGY TENS OF THOUSANDS OF TIMES WITHOUT LOSING THE SALT'S PROPERTIES OR ITS PERFORMANCE.



SALTX FOR BEGINNERS

Can be compared with a battery, but SaltX stores thermal energy (heat/cold) instead of electrical energy.

1. A special salt is treated with nanoparticles and mixed with liquid.
2. When the salt is heated, for example by solar heat, the liquid is boiled away and part of the energy is chemically bound in the salt crystals.
3. If the fluid is re-added, the energy is released in the form of heat and/or cold. The technology can release temperatures of up to 500 degrees.

NANO COATED SALT (NCS)

– FROM NEW PATENT TO LARGE-SCALE ENERGY STORAGE

Following a breakthrough in the SaltX laboratory in 2012, the company succeeded in patenting nano-coated salt in 2013. The patent applies to virtually all different groups of salts, including certain other related materials such as lime, and all kinds of nano-coating of them.

The material used in SaltX's large-scale energy storage is CaO^{NCS} (nano-coated salt, in this instance lime). The properties of the product are characterized by high energy density, good water absorption, high temperature discharge, non-corrosive property and that it has the ability to not turn into clumps over time.

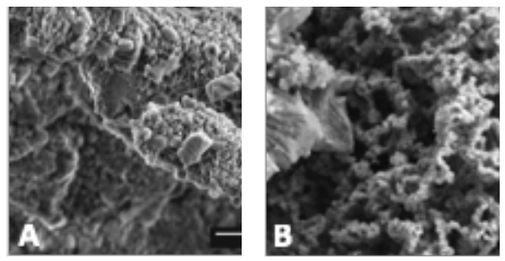
STOCKHOLM UNIVERSITY –2012

During and after the time the nano-coating was patented, CaO^{NCS} qualities were tested and verified at Stockholm University. The report from the university is titled: "Assessment of nano-coated CaO as a heat storage sorbent" and was written by Niklas Hedin and Eva Björkman, both professors.

EXTRACT FROM THE REPORT

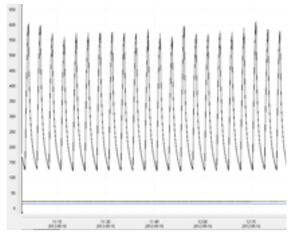
What was tested
Thermal energy storage based on the chemical reaction between calcium hydroxide ($Ca(OH)^2$ and calcium oxide (CaO) for different types of chemical heat pump application areas. The calcium oxide was nano-coated to prevent crystal growth and degradation during cycles (hydration-dehydration). 8,000 cycles were performed, where both stability, water absorption and peak temperatures were measured. The test was compared with normal calcium oxide.

Results
Using Scanning Electron Microscopy (SEM), there was a clear difference between nano-coated and non-nano-coated calcium oxide. See the two microscope images below, the left (A) shows clear crystal formation, while the right (B) shows that the salt has a completely new surface. The more cycles performed, the more porous and stable the nano-coated material became.



THE MORE CYCLES PERFORMED, THE MORE POROUS AND STABLE THE NANO-COATED MATERIAL BECAME.

The temperature during the 8,000 cycles was stable; an extract from the temperature logging is shown at the top of the next column.

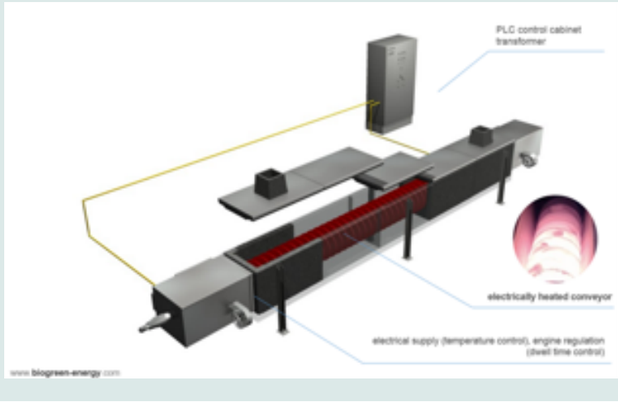


GENERAL ELECTRIC – 2013 – COMMERCIAL PROTOTYPE

Soon after the patent was submitted, SaltX won the GEImagination Award, resulting in a project where the companies together would develop a high-temperature oven that would raise the temperature rapidly. The market was primarily restaurant kitchens. The prototype, based on CaO^{NCS} and SaltX, met the technical requirements of the project, which were primarily to obtain high temperature quickly and with a high degree of certainty.

From the final report
"The result from the test shows that the requirements stated by GE can be met by an integrated and industrialized design."

The nano-coated salt is transported by means of a screw through the heat exchanger.



The heat exchanger is a French invention that both heats the salt material to 5,000 degrees Celsius and transports it at the same time.

DLR – 2017

Deutsches Centrum für Luft- und Raumfahrt (DLR) (the German Aerospace Center), Germany's equivalent of NASA, carried out verifications for SaltX in 2017 in a small reactor system of 5 kW. What was tested was that the thermo-chemical reactions were not degraded by nano-coating, and that it did not agglomerate (that it did not turn into clumps).

The results were positive and SaltX had now verified that NCS technology also worked in larger volumes than those used in the laboratory environment. Read more here.

ETIA – 2018

SaltX was asked to further scale the energy storage to test it on a real scale. A project led by SaltX and Vattenfall in Berlin took shape. Until then, CaO^{NCS} had been proven to work on a smaller scale and in prototypes. The next stage was a significant step up with 60kg of salt and an effective power output of 20 kW. This was to test the industrial process before the large-scale project in Berlin. The French company, ETIA, was chosen as the partner for constructing reactors where the salt would be charged and discharged.

Tests were carried out in spring and summer 2018 and the nano-coated salt worked as expected.

NEXT STEP – LARGE-SCALE TEST IN BERLIN

During the autumn, SaltX has built a large-scale pilot plant that will store 10 MWh and thus is filled with 25 tons of salt. The installation is based on the same technology and salt as used in previous tests.

SaltX technology has been proven to work on a smaller scale and in prototypes. The next stage is a very significant step up — a large-scale pilot project that will store 10 MWh and which will be filled with 25 cubic meters of salt.

THIS IS HOW PRODUCTION WILL BE SCALED

The salt used in EnerStore consists of calcium oxide and calcium hydroxide, or in more everyday terms “burnt and slaked lime". The salt is then coated with nanoparticles. The chemical designation of the nano-coated salt is CaO^{NCS}.

SaltX has built the delivery chain for large-scale production of the nano-coated salt through two key partners: Nordkalk and Wacker. Below is a description of the manufacturing process.

1. Nordkalk breaks up the lime and ensures that the salt is of the correct quality and has the correct sized salt particles.
2. Wacker then produces the nanoparticles and sends them to Nordkalk.
3. Nordkalk prepares and coats the salt with Wacker's nanoparticles in its production facility according to the SaltX formula. This process is called nano-coating.
4. Nordkalk controls the quality of the nano-coated salt according to the SaltX specification, whereupon it is packaged in the desired volume and shipped to SaltX customers.

MANUFACTURING PARTNERS

For the large-scale production of SaltX nano-coated salt, partners need both the raw material (salt) and the manufacturing process — the nano-coating of the salt. SaltX is ready, with the help of Nordkalk and Wacker, to scale up the delivery capability. In order to meet future demand and be able to deliver thousands of tons of salt to global customers, SaltX needs to have capacity for the volume and be able to deliver sufficiently high-quality salt.

Nordkalk, who SaltX has chosen as a salt supplier and preparation partner, is Northern Europe's leading supplier of lime with its headquarters in Pargas, Finland. The company was founded in 1898 and today employs 1,000 employees with customers mainly in the paper and cellulose industry, as well as the steel and mining industries.

Wacker Chemie, who SaltX has chosen as a chemical partner, is a global chemical company with approximately 14,000 employees. The company was founded in Germany in 1914 and is based in Burghausen near Munich.

NEXT STEP – GRAPHENE

SaltX is working continuously to develop its material and its formulas. In order to achieve even better performance and cost-effectiveness, the next step is to integrate the nano-coated salt with the super material graphene. A development project is in progress with the manufacturer of specialty paper, Ahlstrom-Munksjö.

THE NANO-COATED SALT HAS AMAZING PROPERTIES AND CAN STORE LARGE AMOUNTS OF ENERGY TODAY.

The objective of the project — next generation energy storage — will consist of graphene paper coated with the nano-coated salt. This process can be done entirely industrially, so-called roll-in-roll, just like in a conventional paper machine. In this way, it is estimated that the system cost of SaltX energy storage is reduced by up to 80 percent.

GRAPHENE PARTNER

Ahlstrom Munksjö is the company that SaltX has chosen as a development and future manufacturing partner for next-generation salt storage technology. Ahlstrom Munksjö is based in Stockholm and was formed by a merger of Ahlström and Munksjö in April 2017.

MARKET OVERVIEW

As solar and wind power is being expanded, the need for peak shifting is increasing. More and more cheap electricity and/or surplus electricity is generated at certain specific times of the day, often when the need is at its lowest.

Germany, the US and China are building wind and solar power at a high pace.[7] Market forces and initiatives from states are prioritizing the development of energy storage.

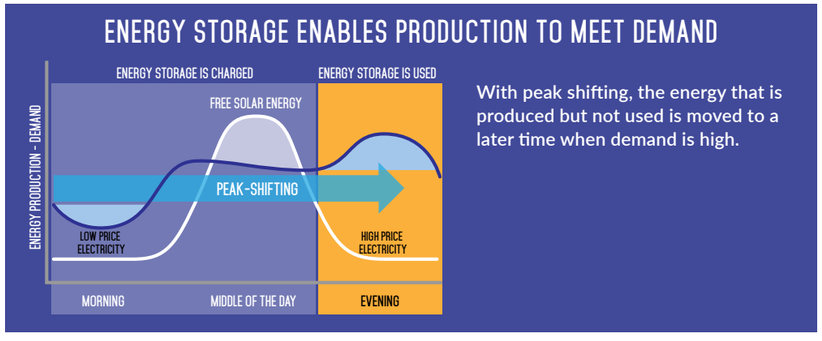
According to Bloomberg, energy storage will significantly affect the industry.[1] The cost of renewable energy has fallen sharply in recent years. There are thus great opportunities to store surplus energy and then to utilize later. This is backed up by a report from IFC and ESMAP that shows an expected 40% growth in

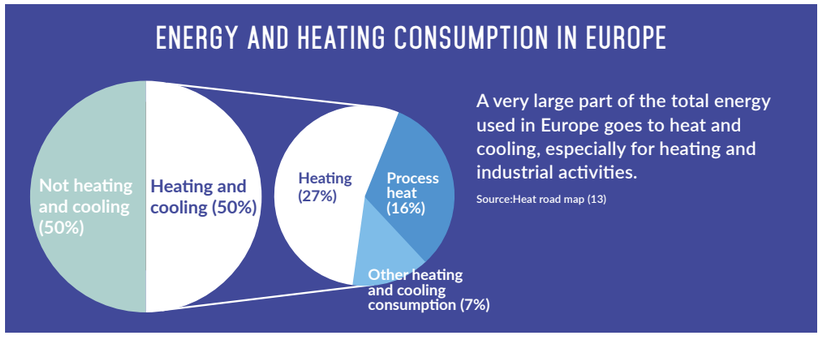
"ENERGY STORAGE WILL BE THE NEXT BIG MARKET"

BLOOMBERG

development markets in the coming decade, which would result in 80 GW in new energy storage.[10] The change is already happening — European Energy Storage Capacity reported that in 2017 the market for energy storage in Europe grew by 49%.[11]

Bloomberg New Energy Finance estimates that $ 103 billion will be invested in energy storage up to 2030. This corresponds to a six-fold increase in twelve years.[1]





CUSTOMER 1: WIND POWER FOR DISTRICT HEATING

Store energy during price lows and use it at high demand

Germany is one of the countries most introducing renewable energy, mainly in the form of solar and wind power. This means the supply of electricity varies greatly within the country. Attempts have been made to solve this in several ways, but a long-term solution has not yet been found.

Today, wind power is either turned off, or wind power energy is sold at very low prices to neighboring countries such as Switzerland when domestic demand is lower than the supply.

Energy companies in Germany are under a great deal of pressure to stop using coal, but it is still one of the main sources of generating heat. This, coupled with the increase in electricity generation from solar and wind power plants, creates an imbalance between when the energy is produced and when it is required. 50 percent of Europe's energy consumption is for heat and cooling.[13]

With SaltX energy storage, it is possible to store surplus energy when there is strong wind and then use it during periods when it is required the most (peak hours), and then in the form of heat for district heating networks that need heat at around 180 to 200 °C degrees at the power plant in order to be able to deliver the right temperature to households. China is another example of wind power expansion and where district heating is part of the heating system.[12]

"ENERGY STORAGE IS CRUCIAL TO ENABLE THE EFFECTIVE INTEGRATION OF RENEWABLE ENERGY, WHICH RELEASES THE BENEFITS OF SOLAR AND WIND ENERGY FOR GROWTH MARKETS"

ENERGY SECOT MANAGEMENT ASSISTANCE PROGRAM (ESMAP)

CUSTOMER 2: RENEWABLE ENERGY FOR STEAM

WHO IS THE CUSTOMER?

Today, many industries use large quantities of steam. Demand for storage has been high, but it has not been economically viable, as the storage of steam requires expensive pressure tanks.

Two major advantages of storing thermal energy in salt are the high energy density and the ability to consume energy at high temperatures. This enables storage of energy in small-scale solutions, so-called micro-grids, which can be charged at low demand for energy, then used to heat commercial properties or as steam in factories when the need is greater.

INDUSTRY

The process industry, the food industry and a number of other industries need steam in their production processes. At present, there are no good options for storing steam, especially as it requires high-pressure tanks, which are both costly and require high levels of safety. With SaltX storage solution, it is possible to store energy efficiently at low electricity prices, which can then be used as steam when demand is greater. SaltX energy storage can be charged using wind power and produces steam at temperatures of 180 to 2,50O °C.

CITIES AND URBAN AREAS

The City of New York has the world's largest steam network, which supplies thousands of commercial properties.[8] The city has big ambitions to become an environmentally adapted city with renewable energy and is rapidly developing the production of electricity from offshore wind farms.[5] The energy must be produced locally as regulations prevent the sale of energy between states. Therefore, storage is required in order to be able to provide steam from renewable sources. At present, there are no good options for storing steam, especially as it requires high-pressure tanks that are both costly and require high levels of safety. One alternative is SaltX energy storage that can be charged by wind power and when required then steam is produced at between 180° C to 250° C.

PRIORITY MARKETS

SaltX has carried out an analysis in order to prioritize its target markets in the coming years. Factors that have been decisive are how far the markets have come in terms of the introduction of renewable energy sources, the extent to which district heating is used, policy instruments and where installed capacity is available today.

THE INTEGRATION OF RENEWABLE ENERGY INCREASES VOLATILITY

Increased integration of wind and solar power increases volatility in the networks. This means that energy is not being produced in line with demand.

The interest in siting local energy stores at, for example, factories or properties is increasing, but there is also an increased interest in larger energy stores that can store heat for entire cities. These can take advantage of cheap electricity prices during the night and use the heat when the factory or the city is running for full.

HEAT IS OFTEN THE TYPE OF ENERGY IN MOST DEMAND

In Europe, 50% of energy consumption consists of heat and cooling (see the graph on the right), which corresponds to a proportion that is larger than both the transport and electricity sectors together. The global trend to convert to carbon dioxide-free manufacturing industries and greenhouse cultivation is also increasing the demand for thermal energy storage.

Prior to the commercial launch of EnerStore, SaltX has carried out a comprehensive analysis of the market and has identified three geographical key markets based on the technology solution closest to hand — charging with electricity and generating steam and heat whenever it is needed most. The countries chosen by the company have the largest integration of renewable electricity generation, the most mature energy storage market and a huge need for heat.

THERE IS GROWING INTEREST FOR SITING LOCAL ENERGY STORAGE AT, FOR EXAMPLE, FACTORIES OR PROPERTIES.

GERMANY

Germany is one of the leading countries in terms of the introduction of renewable energy. Both private solar production and wind power have a very good rate of growth. The challenge is that when production does not happen when demand is greatest, the energy has to be sold at a low price, for example to neighboring countries such as Switzerland.

Up to the present time, Germany has relied on coal power and the infrastructure has been built for this. Political decisions mean that coal power will be phased out quickly. Energy companies are therefore looking for solutions that can fill the gap between production and demand.

MARKET CHARACTERISTICS

Energy generated by renewables: 78 GW (wind and solar)
Current storage capacity: 610 MW
District heating installed: 71 TWh
Price fluctuations: ~50 %
Government grants/targets: 65% renewables by 2030, 2,500 MW storage installed by 2022

USA

The USA is high on the list of countries that integrate renewable energy. This is mainly in California and along the East Coast states (New York State and Massachusetts). The State of New York is now increasing the integration of offshore wind power at a high rate, while the state is demanding and procuring large-scale energy storage. The East Coast, like Germany, has a history of coal power plants and is used to both heating and steam systems. The world's largest steam system is located in New York and supplies thousands of commercial buildings and industrial companies.

MARKET CHARACTERISTICS

Energy generated by renewables: 98 GW (wind and solar)
Current storage capacity: 2,400 MW
District heating installed: in universities and hospitals, not large numbers
Price fluctuations: ~120 %
Government grants/targets: 20 % renewables by 2030, 9,000 MW storage installed by 2022

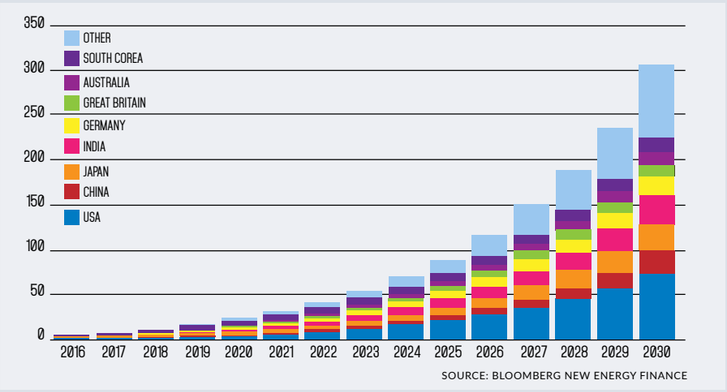
CHINA

China is at the forefront of the world when it comes to switching to renewable energy. The largest solar and wind farms are being constructed while coal power plants are being closed. In northern China, in particular, it can get very cold and cities are reliant on district heating from coal power plants as their heating source. Therefore, they need to quickly find solutions that make it possible to continue this energy conversion.

MARKET CHARACTERISTICS

Energy generated by renewables: 295 GW (wind and solar)
Current storage capacity: 75 MW
District heating installed: 890 TWh
Price fluctuations: high
Government grants/targets: 20 % renewables by 2030, 4,000 MW storage installed by 2022.

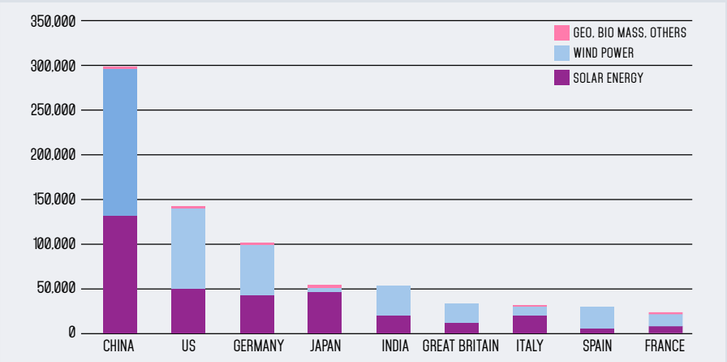
SIGNIFICANT INCREASE IN ENERGY STORAGE



SOURCE: BLOOMBERG NEW ENERGY FINANCE

According to Bloomberg, it is expected that large amounts of energy storage will be installed, and some of the top-rated countries for this are the US, China and Germany.

RENEWABLE ENERGY INSTALLED, MW, 2018



SOURCE: BP [7]

The installation of renewable energy is increasing throughout the world. Today, several countries have already installed a lot of wind and solar power, of which the US, China and Germany are at the forefront.

COMPETITOR ANALYSIS

FOR HEAT PRODUCTION

SaltX's large-scale energy storage supplies high temperatures at a consistent level. Temperatures can vary from 160 to 400 degrees Competitive technologies are usually sensitive storage materials such as concrete, metals, oil or water.

SALTX

Type of energy storage: Thermochemical
How it works: By heating, for example, $Ca(OH)_2$ to 500 degrees Celsius, the water will evaporate and CaO and OH_2 will be separated into two different storage units/containers. By combining the two substances again, a chemical reaction will occur and a high level of heat will be radiated.
Installed capacity: Installation is in progress of a 10MWh pilot project.
Locational requirements: That there is a high level of heat or cheap electricity

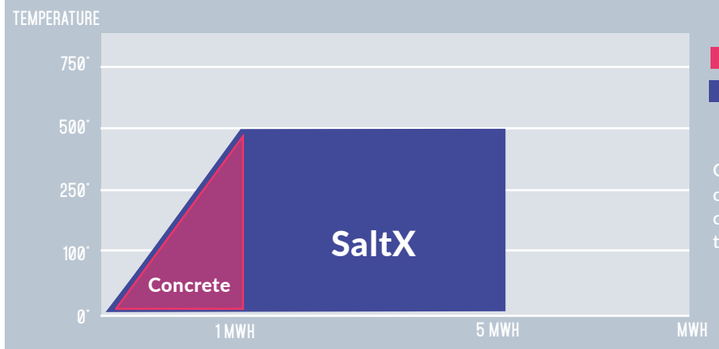
TECHNICAL DATA

LCOS*: ~ USD 15 cents/kWh
Energy installation cost: USD 200 per kWh
Energy density: 380 – 500 Wh/liter
Power capacity: n/a
Efficiency: 90 % (thermal), 33 % (electrical)
Lifetime: 20 years
Response time: 15 minutes
Discharge time: 4 – 36 hours

ADVANTAGES AND DISADVANTAGES OF SALTX

1. Low LCOS compared with comparative technologies
SaltX has the lowest LCOS among its closest competitors
2. High energy density
High energy density in relation to investment cost
3. Special usage
The SaltX solution is not as flexible and generally accepted as ion batteries.

ENERGY STORED PER CUBIC METRE



One advantage of SaltX storage compared to other sensitive heat storage is that more energy can be stored in the same volume due to the thermo-chemical component.

WATER

Hot water can be a competitor if the customer needs to store heat at a temperature below 100 degrees Celsius.

However, SaltX is aimed at customers who need higher temperatures on discharge (180 — 250 degrees Celsius), or at customers who need steam.

CONCRETE

Type of energy storage: Sensitive thermal heat storage
How it works: Hot heat transfer fluid (HTF) flows through steel pipes that transfer heat to the concrete. The heat is then stored in the concrete (with little heat loss). When it is released by means of liquid cold HTF through steel pipes, the HTF becomes hot.
Installed capacity: No info
Locational requirements: Requires access to cheap electricity and long storage time to be economically feasible. Otherwise, location is flexible.
Active companies: EnergyNest, TeraSolar

TECHNICAL DATA

LCOS: USD 40 cents per kWh
Energy installation cost: USD 151 per kWh
Energy density: 110 Wh/liter
Efficiency: 90%
Lifetime: up to 50 years
Discharge time: no info

ADVANTAGES AND DISADVANTAGES OF CONCRETE

1. Difficult to get the right temperature and power from the system
Because the concrete is sensitive heat storage, the concrete becomes colder when heat is released. Thus, heat can be extracted at 400 degrees Celsius in the beginning, but later in the process only low temperature heat can be extracted.
2. Short lifetime (depends on the material used)
Concrete storage in China has a short estimated lifetime. Heating and cooling of concrete can lead to cracks in the material

KEY RATIOS FOR COMPETING TECHNOLOGY (HEAT PRODUCTION) TABLE A

	CONCRETE	MOLTEN SALT	SALTX
LCOS (CENT/KWH)	14–28[7]	30–98[6]	2–5[3]
ENERGY DENSITY (WH/L)	110[8]	70–120[1]	400
POWER (MW)	MEDIUM	HIGH	HIGH
LIFETIME (YEARS)	30[5]	30[1]	40
ENVIRONMENTAL IMPACT	MEDIUM	MEDIUM	LOW
FLEXIBILITY	MEDIUM	LOW[10]	HIGH
INSTALLATION COST (USD/KWH) TERMISK	151	25–70[4]	25–90[3]

** LCOS= Levelised Cost of Storage, a key ratio that is often used when comparing different types of energy storage.*

There are a number of key ratios that are used when comparing different types of energy storage, of which LCOS is one of them. The strengths of SaltX are the low cost as well as the high energy density.

COMPETITOR ANALYSIS

FOR ELECTRICITY PRODUCTION

There are several conventional ways to store electricity for large volumes, and some of them stand out. The most common way is to pump water to a higher altitude, however, this technology is dependent on there being natural high height differences in the area.

PUMPED HYDRO

Type of energy storage: Gravitational potential energy, mechanical
How it works: Pumped water storage uses two vertically separated water reservoirs, with low cost electricity to pump water from the lower to the higher reservoir.
Installed capacity: —164 GW (96 % of the world's energy storage capacity).
Locational requirements: Requires both geographical height and access to water.
Other: This technology is the only one considered mature in terms of energy storage.

TECHNICAL DATA

LCOS: USD 15–20 cents per kWh
Energy installation cost: USD 300 per kWh
Energy density: 0.2 – 2 Wh/liter
Power capacity: 100 – 2,500 MW
Efficiency: 70 – 80 %
Lifetime: 30 – 60 years
Response time: 10 s – min
Discharge time: 4 – 16 hours

ADVANTAGES AND DISADVANTAGES OF PUMPED HYDRO

1. Low energy density
Pumped water storage has amongst the lowest energy density and thus takes the largest storage space.
2. Capital intensive
Initial capital costs are an obstacle to entry.
3. Geographic sensitivity
Limited to specific geographic locations where there is a natural height difference and access to water.

KEY RATIOS FOR COMPETING TECHNOLOGY (ELECTRICITY PRODUCTION) TABLE B

	PUMPED HYDRO	MOLTEN SALT	CONCRETE	HYDROGEN STORAGE	LITIUM-ION	REDOX FLOW BATTERY	SALTX
LCOS (CENT/KWH)	5-15[1]	55-80[1]	40[5]	30-40[1]	30-80[1]	25-75[1]	15-35[3]
ENERGY DENSITY (WH/L)	0.2-2[1]	70-210[1]	110	600[1] (200 BAR)	200-400[1]	20-70[1]	400
POWER (MW)	HIGH	MEDIUM	LOW	MEDIUM	MEDIUM	LOW	MEDIUM
LIFETIME (YEAR)	30-60[1]	30[1]	30[5]	5-30[1]	7-10	10	20-40
ENVIRONMENTAL IMPACT	MEDIUM	(USD/KWH) EL MEDIUM	LOW	HIGH	LOW	MEDIUM	LOW
FLEXIBILITY	LOW	MEDIUM	MEDIUM	LOW	HIGH	MEDIUM	MEDIUM
INSTALLATION COST (USD/KWH) EL	300[2]	–	–	1 800[2]	400[6]	1,300[2]	270-600[3]

** LCOS= Levelised Cost of Storage, a key ratio that is often used when comparing different types of energy storage.*

MOLTEN SALT

Type of energy storage: Thermal
How it works: Molten salt can be used to store heat until needed. If electrical energy is to be extracted, the molten salt is pumped through a steam generator that converts the thermal energy into electrical energy.
Installed capacity: ~ 2 GW
Locational requirements: Thermal storage container, heat source
Competitors: Abeinsa EPC, Sener, Areva,

TECHNICAL DATA

LCOS: USD 55 — 80 cents per kWh
Energy installation cost: USD 25 – 70 per KW
Energy density: 70 – 210 Wh/liter
Power capacity: 1 – 150 MW
Efficiency: 80 –90 %
Lifetime: 30 years
Response time: minutes
Discharge time: hours

ADVANTAGES AND DISADVANTAGES OF MOLTEN SALT

1. Stored energy is lost
The storage is sensitive and therefore the temperature drops over time, so there are limitations on how long the energy can be stored
2. Complex solar park
Normally, the molten salt plants are built with a tower in the middle, a so-called heliostat, to which a large number of mirrors concentrate the light, which requires a very complicated technology and the minimum installation of storage is 50 MW.
3. Major risks
If the salt is not kept liquid, the system will be damaged. In addition, the salt is corrosive, which also risks damaging the system.

LITHIUM-ION

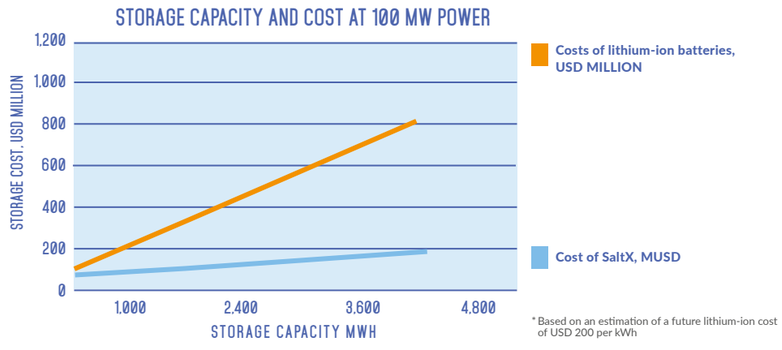
Type of energy storage: Electrochemical, electrical storage
How it works: A lithium-ion battery is a type of rechargeable battery where lithium ions move from the negative electrode to the positive electrode during discharge and in the opposite direction when charging.
Installed capacity: ~ 1 GW
Locational requirements: average temperature climate
Competitors: LG Chem, Samsung, Panasonic, BYD
Other: The technology is considered to be in development for large-scale storage

TECHNICAL DATA

LCOS: USD 25 – 40 USD cents per kWh
Energy installation cost: USD 400 per kWh
Energy density: 200 – 400 Wh/liter
Power capacity: 0.05 – 100 MW
Efficiency: 85 – 90 %
Lifetime: 1,000 – 10,000 cycles
Response time: seconds
Discharge time: 1 min – 8 hours

ADVANTAGES AND DISADVANTAGES OF LITHIUM-ION

1. High cost
Batteries are built in modules and on a large scale they do not fall in price, see graph below.
2. Safety risks
The battery can overheat when exposed to vibrations, high heat or charging at minus temperatures.
3. Complicated production
Requires advanced production processes to achieve high performance.



* Based on an estimation of a future lithium-ion cost of USD 200 per kWh

ADDRESSES

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7. Lifetime: 20 years. SiC: 2.8 – 5.6 USDm/MWth, WACC: 15%, Capacity: 6 MWhth, Cycles/year: 365, Efficiencythl: 95%, DoD: 95%.
8. Transan installation. Lifetime: 20 years, investment cost: USD 9.2m, WACC: 15%, Capacity: 60.6 MWhth, Cycles/year: 365, Efficiencythl: 95%, DoD: 80%.

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