

Developing a National Action Plan for Smart Grids: Lessons from Sweden

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Webinar Presenter

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Emily

Hello everyone! I'm Emily Evans with the National Renewable Energy Laboratory, and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with the International Smart Grid Action Network, also known as ISGAN. Today's webinar is focused on Developing a National Action Plan for Smart Grids: Lessons from Sweden.

One important note of mention before we begin our presentations is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center's resource library as one of the many best practices resources reviewed and selected by technical experts.

Before we begin, I'll quickly go over some of the webinar features. For audio, you have two options. You may either listen through your computer or over your telephone. If you choose to listen through your computer, please select the "mic and speakers" option in the audio pane. Doing so we will eliminate the possibility of feedback and echo. If you choose to dial in by phone please select the telephone option and a box on the right side will display the telephone number and audio PIN you should use to dial in. Panelists, we ask that you please mute your audio device while you are not presenting. If anyone is having technical difficulties with the webinar, you may contact the GoToWebinars Help Desk at 888.259.3826 for assistance.

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the presentations will be posted to the Solutions Center training page within a few of weeks and will be added to the [Solutions Center YouTube channel](#) where you will find other informative webinars, as well as video interviews with thought leaders on clean energy policy topics.

Today's webinar agenda is centered around the presentations from our guest panelist Karin Widegren. Karin has been kind enough to join us to provide an overview of the recommendations and proposals presented in the National Smart Grid Roadmap that was developed by the Swedish Information Council and the National Knowledge Council for Smart Grids. Lessons learned during the process that define key issues to address will also be discussed.

Before I have Karin begin her presentation I will provide a short informative overview of the Clean Energy Solutions Center Initiative. Then, following the presentation, we will have a Question and Answer session where the panelists will address questions submitted by the audience, closing remarks and a brief survey.

This slide provides a bit of background in terms of how the Solutions Center came to be. The Solutions Center is one of 13 initiatives of the Clean Energy Ministerial that was launched in April of 2011 and is primarily led by Australia, the United States, and other CEM partners. Outcomes of this unique initiative include support of developing countries and emerging economies through enhancement of resources on policies relating to energy access, no-cost policy assistance, and peer to peer learning and training tools, such as the webinar you are attending today.

The Solutions Center has four primary goals: It serves as a clearinghouse of clean energy policy resources. It also serves to share policy best practices, data, and analysis tools specific to clean energy policies and programs. The Solutions Center delivers dynamic services that enable expert assistance, learning, and peer to peer sharing of experiences and lastly, the Center fosters dialogue on emerging policy issues and innovation around the globe.

Our primary audience is energy policy makers and analysts from governments and technical organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

A marquee feature that the Solutions Center provides is the no-cost expert policy assistance known as "Ask-an-Expert." The Ask an Expert program has established a broad team of over 30 experts from around the globe who are available to provide remote policy advice and analysis to all countries at no cost. For example, in the area of Demand and Policy Evaluations we are pleased to have Bruno Lapillonne, the Vice President and Co-founder of Enerdata, serving as one of our experts. If you have a need for policy assistance in Demand and Policy Evaluation, or any other clean energy sector, we encourage you to use this valuable service. Again, the assistance is provided free of charge. If you have a question for one of our experts please submit through our simple online form at cleanenergysolutions.org/expert, or to find out more on how the Ask-an-Expert service can benefit your work, please contact Sean Ester directly at sean.esterly@nrel.gov or 303-384-7436.

We also invite you to spread the word about this service to those in your networks and organizations.

Now, I'd like to provide a brief introduction for today's panelists.

Our presenter today is Karin Widegren, the former Director of the National Coordination Council for Smart Grids in Sweden, which was formed by the Swedish Government in 2012. Before joining the council Karin Widegren served as Director of International Affairs at the Energy Markets Inspectorate, the Swedish energy regulator. With that I'd like to welcome Karin to start the presentation. Karin?

Karin

Thank you and thank you for giving me the opportunity to speak here today and inform you about our efforts to get an action plan in place in Sweden and about our work with the Swedish Coordination Council for Smart Grid. First of all I'd just like to mention that our assignment is finished last year in December, by Christmas, we delivered our action plan. It means that I personally am no longer the director of the National Coordination Council because it ceased its assignment so I'm back at the Swedish regulator, which was mentioned I was at when I we started this work, social information.

Before getting to the presentation I would like to just give you an outline of what I'm going to talk to you about today. So, next slide please.

To understand our action plan I think it's important for you to get some information about our overall mission and assignment and also our background to the interests of Smart Grid in Sweden, how the electricity market works, and other prerequisites that we have explained. Together these are the driving forces for a smart grid of a more national type. After that I will go over to the proposals itself and inform you about the different components in the action plan and how we've been working to come up with a result. Finally, some words about the way forward, what will happen next now when we have concluded our work.

This outline moves to the mission and assignment of the Coordination Council. The Council itself is a governmental body that is independent of the government and presents proposals to the government. This kind of committee is formed in Sweden when the government wants to focus and get input on such an issue. This kind of committee is commonly used. Next slide please.

So, the organization—the Council—the council itself consists of 15 members, the key positions within industry, academia, governmental authorities, and organizations. The council has been assisted by a secretariat, who has been running the daily work of the council where I have been head of that secretariat.

We started our work in 2012, in the autumn of 2012, and as I mentioned, we delivered our action plan in December. So we've been working on this about 2 1/2 years. The deliverables or our assignments, we can say, are two-fold. The first part has a lot to do about coordination to stimulate corporation

knowledge transfer and awareness of the possibilities of smart grid amongst stakeholders. One important instrument in this is the establishment of the knowledge platform, which is our website, for smart grid. There we also tried to stimulate dialogue on the website.

The other part of the assignment is more of a traditional type for a governmental commission. It is to deliver proposals to remove barriers and stimulate the development of smart grid and form a national action plan, which would cover 15 years—from this year up to 2030.

I also would like to mention that our name in Swedish is actually Smart Electricity Grid because we don't have that smart grid expression exactly the same in Swedish. So, we are focusing on electricity. That would be good for you to know if you probably have a large gas market or think gas is important. Next slide please.

In our assignment it important to say we have to have a very broad perspective when we are talking about smart grid. So we're not just talking about the utility business here. We have to account for all possibilities on the market from connect generation plans all the way to the residential customer and the smart home solutions on the customer side and all the technologies in between for transmission, distribution, and larger customers like industrial and services. This broad perspective, when we started our work, the council decided to formulate the main objective of the work. Next slide please.

These main objectives, you can say, it is divided into four parts. The first part is to contribute to clear and fair rules on the emerging smart grid market—market design, building influence from the new technology. This is an important part of our mission. Customer empowerment—the new technology customers may take a much more active role on the market but it's also a very important part. Then, the favorable conditions to develop a smart grid in Sweden that also make a smart grid a growing Swedish industry for global markets. This is an innovation and economic growth aspect.

All this has to be done through the means that is pointed out in our assignments about corporations, knowledge development, and dissemination and the national action plan. As a talking point for our work we will also state that smart grid is not an aim in itself but it offers a rational way to meet the future challenge we see in front of us. Next slide please.

So, with this perspective we started to identify focal areas significant for smart grid development in Sweden. In one area, the broadest area, the smart grid is part of the wider energy system. Here we have been looking at smart electricity grid is part of a sustainable city development possibilities to integrate smart grid, our energy carriers, also electrical passport, and so forth. So this is a really broad system perspective of smart grids.

The second focal area is electricity market design. Here we also include the customer empowerment aspects.

The third sector is about R&D knowledge provision where we have what is our strength and weaknesses, where should we put our priorities in R&D, or what kind of programs you need to develop knowledge in this area.

Security and privacy has also been defined as a specific focal area. We are stressing that these have to be integrated as a part of the action plan in all areas but to make sure that we don't forget about security and privacy issues we have to be sure that this is defined as an area of its own. The same is for standards and interoperability, which is also both integrated in an area. We also expect this to be a growing business in economic growth and business development. A global market is also a focal area. Finally, communication and dissemination of our results and analytical work on the way to reach our action plan. Next slide please.

When it comes to communication and dissemination I just want to put an emphasis, the importance, of stakeholder's involvement in the process. The action plan is not a product just made up of 15 members, we have around 100 persons involved in the process through expert groups, which have been established for each focal area and have delivered significant feedback to the council. The knowledge platform, which I have already mentioned—the website, swedishsmartgrid.se—and besides these expert groups and the knowledge platform we have also had numerous workshops, what we call dialog fora, on specific issues for stakeholders with specific interests. So the involvement and input from the border out has been very large. Next slide please.

This introduction into how we have been working and our priorities I will get through some slides about the electricity market characteristics and other prerequisites. In Sweden it's about the main features in our market design, production needs, consumer patterns, and so forth. So we'll go to the first of these. Next slide.

Here it's about initial supply and demand. Here are some figures. What is important to note here on the supply side is that our electricity production is almost fossil free, mainly hydropower and nuclear with a growing sector with wind and solar. Fossil fuels, like oil, are mainly used in the household sector. The natural gas market is very limited. We only have a gas map in the south of Sweden so we're talking about different energy solutions for customers. Natural gas is normally not a part of it.

On the consumption side, industry is a rather large sector because our industrial sector we have a lot of steel mines, pulp and paper, which is the traditional base of Swedish industry—which means we have a high consumption there. We also have national transport and services about 3/4 of the size. The consumption is actually decreasing due to what opposes to lower, or to increase energy efficiency and lower CO₂ emissions. So we have a long tradition of having CO₂ taxes and other energy taxes and other energy incentives. We have a green certificate system for renewable energy since 2003, which means this is really influencing the amount of new renewable energy coming to market and as a token, the result, is we have lower emissions per capita than anywhere else in Europe. Next slide please.

From a wider energy aspects electricity market, it's Sweden's electricity system, to a large extent, that's connected to the other Nordic countries—Denmark, Norway, Finland, and also to the Baltic Region. The production is in the north, primarily hydropower in the north and the consumption is in the south. So you have a rather strong grid taking the power from the north to the south. When we're talking about the market it's normally towards about the Nordic electricity market because we are so interconnected and we also have a common wholesale market. Next slide please.

We have liberalization of the Nordic countries' electricity market. It was primarily formed in the mid-90s and the Nordic wholesale market has been fully integrated since then. The power exchange, local in the Nordic area, plays a very important role. Compared to our power exchanges in Europe and other parts of the world we have a very high liquidity, which includes the trust of the power exchange—about 75% of the power generated in the Nordic region is traded on Nord Pool. It's a large keeper. Focus on the future of electricity markets is, in all countries, rather ambitious targets for renewables, the need for infrastructure development, and also to get demand flexibility into the market, and consumer empowerment.

The next part of the market that I want to mention is about electricity utilities—what the structure is. Next slide please.

On the distribution side we have a national grid, one Svenska company. We have regional companies—four operators, and on the local side it's more specific in the Swedish market. There are a lot of small network operators—170 operators per 5.3 million customers. That means we have small co-ops, small community utilities. If that is something which has to be considered then we look at our action plan.

On the supply side we believe that the competition is rather well developed, compared to a lot of other countries. Indicators of that are number of electricity suppliers and rate of switching, which are rather high in Sweden with more than 100 suppliers and more than 30% switching rate. Next slide please.

Finally, some words about the consumption side. If you look at average figures for electricity consumption in Sweden it's rather high. That is due to the cold climate and as I mentioned before the extensive energy intensive industries. Despite this high average consumption per capita we have rather high efficiency standards in buildings. We also have a high concentration of electrical heating, mainly in single family houses. In cities we have a well-developed district heating system in most middle sized towns. Various districts have district heating with CHP, based on bioenergy. Looking at the typical consumption per household, a single family building with electrical heating normally uses 25,000 kWh. An apartment, which is heated with district heating, has around 4,000 kWh of consumption. So, when we're looking at the possibilities for demand responding to customers' involvement, of course these families with electrical heating is a rather important customer segment. Next slide please.

When we talk about action plans or looking at other countries' action plan for smart grid roll-out of smart grid meters, it's normally a major ingredient in the action plan. In Sweden we're rather fortunate because this roll-out is more or less already done, though we still have some things to do.

Already in 2006 we have given mandatory hourly meter reading for customers above 63 hours, which is more or less industrial customers and service. From the 1st of July 2009, we have a new law stating that monthly meter reading for all customers should be mandatory and the customers should be billed according to actual consumption per month. This legal change made almost every utility decide to invest in remotely read electrical meters, which gave us a major roll-out of meters by the 1st of July 2009.

There was no legal requirement concerning functionalities or communication systems but surveys done show about 90% of the meters are capable of hourly meter reading. What is lacking is, of course, the data handling systems among a lot of utilities. Finally, in 2012 in October there was a new law stating that obligation for network companies to deliver hourly data at no extra costs for customers subscribing to an hourly-basis supply contract. So, with this new law there was an expectation to have a large interest from customers who have these hourly based contracts being able to adapt their consumption according to prices. The interest for these contracts is, however, rather low. So a part of our action plan is to see how we could get the higher interest from consumers. So, from this background of the electricity market and what has been done up till now, just a few words about the driving forces for smart grid in Sweden. Next slide please.

Of course driving forces for smart grid is primarily market based but you want to stress some important development, and I'm getting to this soon—of course the expansion of renewables incremental production and reduction of fossil fuels. We have rather ambitious objectives, both from European and Swedish governments, for renewables and for electric RE goals and to change electrical systems to a sustainable one. Another part of the challenge, the driving force, is of course ICT development. Technology development helps utilities to use new technologies and offer them to the consumer. So, the interests in renewables and the vision for sustainable electricity systems, using new technology, really give us some future challenges, which we have to face. Next slide please.

These challenges can be looked at in two perspectives. The first is from the electricity network perspective but we get a high degree of complexity and as demands change, as I mentioned, we have a large scale renewables—which have to be handled, and also demands, investment grid investments—which normally take a longer time than building renewable plants, integration of generation on the consumer side—which compared to a lot of other countries so far is not very big in Sweden but it's expected to increase electrical vehicle integration—which in cities raises some problems to the network. All this has to be done with enhanced quality and security of supply and also to handle it we have to develop forecasts and how to handle peak load and excess power balance.

On the electricity market side, on the other hand, we expect new business models, new services, and new market actors coming to the market and then they will influence, of course, the demand and the demand profile making business more difficult for suppliers. We can see also how energy storage with aggregators, energy efficiency services will change the demand patterns together with a more engaged and empowered cost and demand response. All these really are demanding much more flexibility in the electricity system and to promote this flexibility is really one key feature for our action plan. Next slide please.

Flexibility—I would like to stress that we are not only talking about technology here. Flexibility has a lot to do with understanding the customers' behaviors and customers' reactions to the market possibilities to be able to create incentives, which are attractive enough to get the early adopters on the market to receive experience. Because in the future, we are expecting much larger price differences in NP and balance compared to today. It's also important to stress that we should not only focus on the economic incentives but also other incentives like customers' need for simplicity, customers' environmental concerns and interests contribute to environmental protection, customers' interest of independence—and here comes the distribution of generations. And finally, when we get customers' interest, having demand response as getting experience, more and more customers involved in demand response, we have to look at the price formation and make sure that we get this right so that the flexible demand doesn't cause us more harm to the system. It should really help the system.

So, with this overview of the challenge we're facing we'll move to the actual proposal for our action plan. The proposal is the report, which is delivered to governments. It includes also a lot of political and background work, not only the plan. Unfortunately there is only a summary in English but the proposals and the plan itself we have made in English translation and that will be published in a couple of weeks on the website for those of you who are interested in getting more into the details.

First, I would like to mention some words about the process. The starting point is, of course, the objectives from the assignment but considering the long time frame of 15 years, we decided to develop future scenarios to see what would be needed in different situations. These scenarios are capturing main uncertainties, which derive these scenarios. One is the speed with which production is introduced on the market. The other is the customers' sense of the benefits of this marketing. So, depending on either policy, which are promoting much more production from renewables and then the customers' at the same time have a high acceptance level. Then you can expect a dramatic change during these 15 years. On the market in other scenarios the change would be much slower.

So with these scenarios we have identified the consequences that we need to handle for the electric systems and for the consumers. So from these consequences we have identified the key issues and need for measures and from these key issues we have formulated recommendations and proposals.

These recommendations and proposals are the key components of the action plan. Next slide please.

With our objective as a starting point we have divided our main, the main, areas of the action plan into three headings. The first is political framework and market conditions. Here we have rules on electricity market, the legal market design if you want to say so. The specific conditions of the electricity grid, the regulation is a part of that, but also other parts of that energy market the legal framework can both put barriers or promote to really have these corporations in the transport sector of the energy carriers and so forth. Finally, under this heading also—the long-term development of the policy framework—what we can do in short-term perspective or what we need to do in the short-term perspective is rather different to what is needed if you are looking 15 years ahead.

The second heading is customer participation enable societal aspects. Of course customers are also influenced by the political framework, but you have to decide to focus on customers specifically under this heading to make sure that the needs of the customers is an important part of an action plan. The first part is really about the customers' perspective and the second part is about the customers' access to measurement data and information. This is a lot of our regulation here but it's really to work out the customers' needs.

The third part is to permit synergies between smart grid and other areas in society, like community, planning, other products and services, how they are developing, and how they could be worked together with smart grid—like healthcare, e-health, and this kind of thing.

The third heading is really about promoting a growing industry for smart grids within Sweden and also in the global market. That is R&D, innovation and growth where we are dividing the action plan in knowledge and skill development, research priorities and innovation strategies, pilot and demonstration programs, and how to promote smart grid programs on a global market. So this is the main structure of our action plan. Next slide please.

Of course with this structure, with each main area, there is a large uncertainty. What will happen in future years? So to manage uncertainty, we have as a starting point the objective and recommendation. The objective and the recommendation are supposed to be valid for a long term period. So they are not a...the formation of the objective and recommendations are not really about what is needed to journey long term. All together we have 25 recommendations in that structure.

We also have motivation explaining why these recommendations are important and then from the motivations we chose to both proposals and assessments. The proposals are both concrete measures on short term and these measures are sometimes rather well elaborated. In other parts of the action plan further work is needed and the proposals have really to be detailed before they can get into port. They are also putting up proposals for further initiatives in the mid and long term.

Assessments, what we call assessments, are when we talk all about work or we are identifying important work, which is already in progress. Here we are, in an action plan, we are going to point out what we need to be done. In the next step we ask, well, work is already done but luckily the proposal is more like an assessment. For each recommendation proposal there is also an identified responsible party who should do this. Next slide please.

On this slide you are not supposed to read it. It is very, very difficult and it is also in Swedish. This is here to show you how we laid out the plan, starting with the recommendations and the different proposals. We are identifying which type of measures we have in the proposals—if these are legal measures, if they are economic incentives, or mainly about improving knowledge or destination of knowledge. So they are defined. The responsible party, which is normally an authority—a governmental authority, is also specified and finally the small arrows—that is the time frame. This is there to give you an overview and a picture of what it all looks like. It looks like a condensed version. As you have all these proposals and recommendations I can't go through them all so I will end with some examples of what our proposals look like. Next slide please.

These examples are from the three areas I mentioned—the green, blue, and yellow. The blue is about the political framework. The green is customers and the yellow is about innovation. We also have these four areas or types of measures. We are talking about legal measures and regulations, economic instruments, specific programs and strategies, and cooperation and knowledge dissemination. My first example is actually a proposal that has a legal development, amendment, to the electricity law, which we proposed to the government to introduce and that is a legal right for customers. To get access to hourly measurements without the requirement that we have today for an electricity contract and no extra cost for the consumer.

The reason for this legal amendment is the low interest in these types of contracts right now. So they believe that giving the customer the right to being able to compare and see what is in it for me and also to be able to get the higher interest for transmission tariffs, which are daily use tariffs. So we believe this is an important step on the way to get the consumers' interest for demand response to increase and doing this on a voluntary basis.

Another part, when we are looking at legal measures, is about storage. Energy storage is an important part of the smart grid and we believe that it could play an important role not only on the customer side or the production side but also on the production grid. The legal framework—we have identified some obstacles here and so what we are recommending is oversight and sees what could be done within the framework to remove these obstacles to get experience of storage solutions in distribution grids.

Moving to economic instruments—we have, and here we also talk about the distribution network and the network companies as they are regulated monopolies. They are interested in taking high risks and costs are very high so we believe we need a support scheme aimed at mitigating risk when investing in commercial but, as yet, partly unproven smart grid solutions. In

most programs there are a lot of things done to demonstrate, they have pilot demonstration programs, but we have identified the next commercial status that here is the main barrier. When you have little experiences you don't know how the new technology will influence your income and your income cap. Utilities tend to be conservative. This support scheme has to be elaborated in detail. We believe it should be not standard support, but more support with this specified for each case. So this is an important part that supports smart grid and we expect that...we are proposing that a research plan be further developed for that system in detail. We are also, when you're looking at innovation, when you look at funding for innovation and demonstration, you have also identified that there are some obstacles because more companies or certain demonstration programs. Here we want to further elaborate on supplementary forms of funding of the value chain of current innovation.

Coming to specific programs and strategies, we are proposing a thematic research plan that is supposed to be further developed and we propose that it be included in the national research bill coming up in the future. We are also proposing specific programs for information security and integrity protecting and to get that technology into electricity infrastructure. This is, of course, already an issue. What we are proposing is a concrete program involving results and to regulate the real estate that is needed to begin and do this on a streamline basis.

Finally, two examples of cooperation and knowledge dissemination. The first example is about the energy efficiency programs and demand response. The energy programs to promote efficiency among households and services are not considering the possibilities with demand response. We are proposing that you do go through all these programs and integrate with each other, and also to promote knowledge exchange when it comes to sustainable community planning and integrating possibilities of smart grid and knowledge sharing in the community.

So, this example, this has brought me to my final slide—the way forward. The action plan, as I mentioned, has been presented to the government and the government will send it out for consultation, which is the normal procedure. We have to be able to continue our work with the plan. We have proposed that, as a follow up to the council, that the government forms a national forum for smart grid. This proposal is with the government today and we hope that this forum will be formed in not too long a time because we need to...all along its 15 years that the plan is supposed to work. It has to be monitored and updated and there has to be responsible parties. So, for this forum we are proposing that all these stakeholders who have this assignment, or want to be a part of this, get specific assignments in the plan and should be part of the program. The mission of the forum should be to promote, continue to promote the dialogue. We think that has been very successful and that should continue. As I mentioned, to monitor and identify supplementary measures because the world is changing so we don't expect every detail of our plan to be the same for 15 years, and coordinating implementation, and also managing the knowledge platform.

So, we hope that right now it is the kind of hope in reverse but we hope that we will keep up the momentum and to work this action plan and having the action plan as a living document to fulfill the goals in the plan. With this I conclude my presentation. Thank you for listening.

Emily

Thank you Karin for that outstanding presentation. We have some great questions from the audience that we'll use the remaining time to answer and discuss.

The first question is a three part question on the electricity market. On average, how many electricity suppliers does each consumer have the option from choosing from—is the first part. The second part is—what is the business model driving the competition? Then finally—what are the primary factors associated with the consumer selection of suppliers? I can repeat any part of that for you Karin.

Karin

Okay, actually the consumers have a right to switch as often as they like and right now we have some dominate suppliers, of course. We have three big companies but there is a lot to choose among so actually there is, as I mentioned, about 100 different suppliers. Price difference between the suppliers is not very large, very small difference, and we have websites where you can compare the offering from these different suppliers. You can choose between having a fixed price for one year, two years, or five years or you can choose to have a price, which are...it's not an hourly basis but it's following the stock price. It's following the monthly average stock price. This is the most common types of contracts. A few suppliers are also offering these hourly based contracts and that is the stock price of the electrical change and you put some amount, a surplus, on the stock price and then you get it on an hourly basis. So we actually have all these offers. We have also seen that interests in prices, which follow the stock prices, have increased over time. Consumers are getting more and more interested in this monthly average instead of the fixed price.

Emily

Great...please continue.

Karin

What was the...I think I answered the first part of the question but forgot the last part.

Emily

No problem. The second part was, and I think you addressed this in part, what is the business model for driving competition. And the third part of the question was, the primary factors associated with consumer selection of supply, suppliers.

Karin

Yes, so the business model is actually really today a lot about prices; who can offer the best prices. But you can see now, there is a change in the market. The utilities, suppliers, are also offering equipment that can help you monitor your consumption, different equipment that you put on your meter or you get your data over the internet or on your iPhone to follow and see how you, how you can include energy efficiency in your home. There is also offers...some companies are offering to buy solar panels and these kinds of issues, also to

increase your customer relations. So it's moving slowly to more advanced business models compared to commodity market.

Emily

Great, let's go ahead and move on to our next question. This one is concerning the national action plan. The question is—what are the smart measures to be taken at low voltage and medium voltage level for those in the national action plan and to cope with the increased levels of renewables and changing load profiles.

Karin

We are not an action plan. We are trying not to address specific technologies. What we are talking about is to help utilities to make the right decision about investments. We have been, of course, looking at different technologies and I will give you one example about dynamic line reading. If there is a wind farm built in your area, you are obliged to connect to the wind farm that you have the one whole...are building the wind farm, he has to pay his own cost for connection. That is the utility that you are obliged to connect and sometimes you have to enforce the network to be able to connect to that wind farm and that is sometimes because cost is too high to get an interest in. So the interest in the investment is not there because the cost. The dynamic line rating, you could be able to connect a wind farm and solar, the thermal performance of your network, and you could have the one who built the wind farm agree to have a certain amount of curtailment with specific stipulations—the temperature of the lines when they go also to the limits. So this kind of solution has been used in an island of Sweden where we built a wind farm and we are using dynamic line reading instead of a very, very large investment for new transmission lines and reading a network line.

So this is one example and what we are looking at here is, if you do this, losses will increase in your network but for consumers and society as a whole this is a smarter investment than sometimes regulations focusing on losses. So with dynamic line reading, you probably need to look at the details and the regulation in these technical aspects to promote this kind of solution. Our solution, when you are looking at the system as a whole and the surveying of the smart grid technology, which means we will use more manpower and less investment, which is also influenced by the income cap or the multi-regulatory cap. So this is an important part. We are not saying these technologies need to be promoted. We are saying, in essence, that we have to monitor and follow how the income caps and the promotions of these new technologies are working together.

Emily

Great, thank you very much for that answer. Much appreciated. Our next question is about utility and the question is—is there a regulatory framework enabling utilities to stay on the smart grid? In particular, a funding mechanism related to the cost carried by the utility.

Karin

I'm not sure. What we have. We have a model for utility regulation is the income cap model and the income cap has a...it's the investment costs and you have the assets are valued, but the investment part—as most regulation systems—you have a VAC decided and you also have a model of how to evaluate your assets. Then you have the cost, which is not possible for a utility to influence, and then you have cost that is cost of labor and so forth.

So these are the three main elements in information of assets, the income cap, for the utility. The regulation doesn't say anything about the tariffs. The tariffs are decided by the utilities within the income cap.

Emily Got it. Thank you and I have a follow up utility question as well. Will utilities be allowed to install and operate and create services around storage? Under various regulatory regimes, storage is put at the same level as generation and therefore is not allowed to be installed by the DNSO.

Karin I actually...I did not get that one. You will have to repeat that. I'm sorry.

Emily Sure, oh, you would like me to repeat the question?

Karin Yes.

Emily Okay. Will the utilities be allowed to install, operate, and create services around storage? Then the question goes on to clarify. Under various regulatory regimes storage is put at the same level as generation and therefore is not allowed to be installed by the DNSO.

Karin Okay, I got it. So, today a DSO has the right to have storage but it has only to deliver on similar services in the network. If you own, if the distribution system operator owns the storage, you're not allowed to sell surplus on the market. You are not allowed to trade that electricity if you are a DSO. Then a solution could of course be to have a third party owning that storage facility, but then it has to be treated equal. The law says that all customers have to be treated equal. So when you are loading your storage, you are actually a consumer and you should have the same tariff as consumers have and you are also taxed because you are regarded as a consumer. When you unload your production it's regarded as, or storage...when you unload your storage you are a producer. That electricity that you have is the tariff for the users. So, for a third party it would not make sense to have storage to sell from your utility. What we really need is to define the storage—a kind of third party—not the producer, not the consumer. If you have storage capability you should, utilities should, be able to treat that storage differently if it gives you services, which are needed. This is the main tricky issue, which we are addressing in our action plan. We don't have elaborated on the final solution but the thing that we need to have is some kind of solution for a limited time frame to really promote storage and get experience for storage. So solutions could be linked to time to demonstrate technology also.

Emily Great, thank you very much for that answer. We have a couple more great questions that are coming in. I'd like to remind the audience that if you'd like to submit a question there is a questions box on control panel and feel free to keep the questions coming.

The next question is concerning smart grids. This participant would like to know—what is the perception of consumers of the smart grid and, more specifically, the smart grid meter installation. We have a big impact with health impact perceptions here in Quebec, Canada, as well as trust issues with regards to the pricing and information gathering and privacy.

Karin

Okay, thank you for that question. We are kind of lucky actually. When we installed the smart meters in 2009 it was very well received by consumers because there was a lot of criticism because you were billed not according to your actual consumption. You had the product billed and there were a lot of complaints around that. So, the customers got the information. We need these new meters for you to just pay what you consumed afterwards, not paying in advance. I think that really gives some good impression from the consumers when the meters were installed. We had very, very little protest and nobody, most people were happy to have these new meters. Now when we are talking about hourly contract and hourly rate there is some concern turning up what would happen if this meter...we have to be sure this data is not coming in the wrong hands and for risk of burglary and risk of probably commercial promotion, people selling at your front door knowing that you're home and so forth. These criticisms have been, but it is still rather small but in the action plan it says we have to be proactive. We know the problems in other countries. We have to consider and prepare for that in the action plan, although we are lucky to have very little criticism.

Emily

Thank you very much. I actually have another question here about the action plan. Let's see here. What is the realized peak demand reaction and percentage from demand response measures? Is there a target set by the action plan? If so, what is it?

Karin

No, we don't have any figures or targets. What we are saying is that we believe what we should start is really to get large consumers to be more flexible, a large consumer who has the possibility to be flexible, and react to the stock prices. We are starting with large consumers reacting to the stock prices. When it comes to households and small consumers, we think the strategy should be to start with the tariffs. Actually, the regulations today are promoting more...our new regulations starting in 2016 will promote utilities to lower losses. If you can get your customers to use time and use tariffs, that is a good starting point, and then also have small consumers reacting to the stock prices. Of course more consumers should be free to do that already now but we think this is a strategic approach—starting with the big consumers and then with tariffs moving to small consumers reacting to the stock price. The next step will be to get the using aggregate results to get small consumers flexibility to bid into the market, to influence the price itself. Because when you react, you have a free rider problem. A certain group will react to the stock price. They lower their consumption and that lowers the price so the gains getting smaller when they react. You're really getting this demand flexibility into the price formation and getting it into the market. That is the key issue and that is set as a mid-term goal here—getting that from that.

Emily

Thank you very much. Our next question is on distributive production model. The question is—what progress has been made with regard to the integration of the distributed production model? What are the main obstacles that you have anticipated?

Karin

When it comes to this right now, the interest in solar panels is increasing. We have just introduced tax reduction for [inaudible 1:06:22] net metering that

load. So we believe that we have more solar production. Looking at the distribution network the problem will be in upcoming years. The market will be very big with solar but with solar and electrical vehicles we can see problems on the distribution city networks. You can also, when it comes to electrical vehicles...it is also a probability that in certain areas with certain incomes you will get more electrical vehicles in certain areas. So there it is demand flexibility to handle these electrical vehicles. It would be important in specific areas but in the larger network we don't believe distributed integration can cause problems. Because of all the electrical heating, the network is rather strong and that helps.

Emily

Great, thank you very much. We have another question concerning smart grids, the smart grid. To which extent is there alignment between the Swedish smart grid initiative and other EU smart grid national initiatives, such as national platform? The participant goes on to clarify alignment could be information exchange on approach, lessons learned, identifying and understanding regional differences, and so on.

Karin

Yeah, I believe that is a very good proposal to...we do have some organizations and corporations within the European Union for knowledge sharing and sharing of best practice. Most of what is done, probably someone will say I'm wrong here but, I think we are very much focusing on pilot and demonstration programs where we do compare, do have coordinated activities, and follow-up. When it comes to national action plans, we don't have as much coordination as when it comes to demonstration programs—that is part of what you saw with the administration activities. We also have groups on the European level working on standards and interpretability and smart meter roll-out. There is focus on functionality of smart meters and there we are, very much, working together with other European countries with functionalities of the meters on an overall action plan, not so much on mass cooperation.

Emily

Great, thank you very much for that answer. We will go ahead and move on to a question on advanced demand side options. The question is—how big a problem will it be if consumers don't engage with more advanced demand side options? Is this a big risk in terms of long term networking, network balance—I'm sorry—network balancing, and what can be done to address it if it is a problem? Consumer engagement, or its absence, is seen as a big source of uncertainty in the UK.

Karin

Yeah, thank you. That is a very good question and we are lucky to have our hydropower. So, if you look at the situation today we are handling peak load and the situation is not acute but when simulation is done, when looking at a larger number proportion of wind energy in the system, you can see that the problem will increase and get larger and larger. With an energy-only market price, volatility will only increase dramatically. So, if you don't get demand or flexibility in the market prices will really be a big problem for the volatility, not the level in itself—the price volatility. With the price volatility, of course, there will be interest in demand response measures will increase. So the million dollar question for us is really to get these started before we

see these price volatilities and these problems on the market, to really get experience, get customers involved, and learn about customers preference and behavior in due time before the problem is really there, because we're going to see these problems in 10 years' time. So, this is really a critical issue.

Emily

We have another question concerning the smart grid action plan. Is the smart grid action plan targeted at a national level or do you consider the integration of local smart grid approaches, such as microgrids?

Karin

Actually the plan, it is a national plan, but we're trying to address local problems at the same time in the plan. The plan is focusing on the national legal framework, what we need to gain experience. Microgrid is something that hasn't been discussed a lot and we believe that it is an important development, which we have to follow. We don't have any specific proposals on microgrids. It's the proposal I mentioned about the long term, looking at the long term...no I did not mention. It is one of the headings we have—long term development of the policy framework and market conditions. In this long term perspective we are including microgrids, we are also including to look at the SME-zone with microgrids. There is a proposal or assessment saying that this really has to be considered by all involved to see what is needed on the national level to guarantee sustainability on more microgrids. So this is about how the microgrid issue has been handled so far in the action plan. As I mentioned before, this is—I mean—it's an action plan. Everything is not solved. There is...sometimes we are quite concrete and have a concrete solution and sometimes we are pointing at problems and say this has to be elaborated on. You have to get more knowledge. This is kind of the concept of a plan.

Emily

Great, thank you very much and again I would like to welcome the audience to make any additional question that they may have. Karin, the next question is—how important have your future scenarios been in the process to design key issues and need for measurements in the action plan, as it has a very long term perspective?

Karin

I think the scenario has really set the framework for the action plan and we can see with the rapid growth in incremental production, supported by policy measures in technology development, and the large successful consumer engagement. We will probably see an electricity market which is very, very different than the one we have today and that's also why we are saying we need to have a flexible action plan. It has to be updated. It has to be flexible, but it also has to be stable. You have to have a recommendation of the stable cost of the action plan. So really the situation did engage consumers a lot on the distributed production of the microgrids. It is something completely different to centralized solutions where the customers are more or less spectators, more or less looking at what's happening. So, this is the really difficult part to handle.

Emily

Thank you very much and that was our final question. I'd like to thank you again Karin for your excellent presentation and the wonderful Q&A. Now we would like to ask our audience to take a minute to answer a quick survey on the webinars that you viewed today. We have three short questions for you to

answer. Your feedback is very important for us as it allows us to know what we are doing well and where we can improve. Heather, can you display the first question please? The first question is—the webinar content provided me with useful insight and information. Thank you and the next question—the webinar's presenters were effective. Thank you and for our final question—overall, the webinar met my expectations.

Thank you for answering our survey. On behalf of the Clean Energy Solutions Center I'd like to send a thank you to our expert panelist and all of our attendees for participating in today's webinar. We've had a terrific audience with much, and we very much appreciate your time. I'd like to invite our attendees to view the Solutions Center's website if you'd like to view the slides and listen to a recording of today's presentation, as well as previously held webinars. Additionally, you will find information on upcoming webinars and other training events. We are now posting webinars to the [Clean Energy Solutions Center YouTube Channel](#). Please allow for about one week for the audio recordings to be posted. We also invite you to inform your colleagues and those in your networks about solution center resources and services, including the no cost policy support. Have a great rest of your day and we hope to see you again at a future Clean Energy Solutions Center event. This concludes our webinar.