

# Research and Innovation Needs for Smart Grid Transition

—Transcript of a webinar offered by the Clean Energy Solutions Center on 29 March 2017—  
For more information, see the [clean energy policy trainings](#) offered by the Solutions Center.

## Webinar Panelists

**Eric Peirano** Technofi  
**Klaus Kubeczko** Center for Innovation Systems and Policy (CrISP)

**This Transcript** Because this transcript was created using transcription software, the content it contains might not represent precisely the audio content of the webinar. If you have questions about the content of the transcript, please [contact us](#) or refer to the actual webinar recording.

---

## Stephanie

Hello, everyone. I'm Stephanie Bechler with the National Renewable Energy Laboratory, and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with International Smart Grid Action Network. Today's webinar is focused on the research and innovation needs for Smart Grid transition.

Before we begin, I'll quickly go over some of the webinar's feature. For audio, we—you have two options. You can either listen through your computer or over the telephone. If you choose to listen through the computer, please select the "mic and speakers" option in the audio pane. If you choose to dial in by phone, please select the "telephone" option and a box on the right-hand side will display the telephone number and audio PIN you should use to dial in. If anyone is having difficulty with the webinar, you can contact the GoToWebinar's Help Desk at 888-259-3826 for assistance. The number is also on the screen.

If you'd like to ask a question during the webinar—and we encourage that you do—please use the "Questions" pane in the webinar toolbar. If you're having difficulty viewing any of the material through the webinar portal, you'll find PDF copies of the presentations at <https://cleanenergysolutions.org/training>, and you can follow along as the speakers present.

Also, the audio recording and presentations will be posted to the Solutions Center training page within a few days of the broadcast 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.

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 many best practices resources reviewed and selected by technical experts.

Today's webinar is centered around presentations from our guest panelists, Eric Peirano and Klaus Kubeczko, who have joined us to discuss good practice cases of how to identify research and innovation needs for the transition towards future smart grids. Before we jump into the presentations, I'll provide a quick overview of the Clean Energy Solutions Center, and then following the presentations, we'll have a question and answer session, where the panelists will address questions submitted by the audience. AT the end of the webinar, you'll automatically be prompted to fill out a brief survey as well, so we thank you in advance for taking a moment to respond.

The Solutions Center was launched in 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial is a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Twenty-four countries and the European Commission are members, covering 90 percent of clean energy investment and 75 percent of the global greenhouse gas emissions.

This webinar is provided by the Clean Energy Solutions Center, which focuses on helping government policymakers design and adopt policies and programs with the support, the development of clean energy technologies. This is accomplished through support in crafting and implementing policies relating to energy access, no-cost expert policy assistance, and peer-to-peer learning and training tools such as this webinar. The Clean Energy Solutions Center is co-sponsored by the governments of Australia, Sweden, the United States, with in-kind support from the government of Mexico. The Solutions Center provides several clean energy policies and programs.

Next slide, please. These policies and programs include a team of over 60 global experts that can provide remote and in-person technical assistance to governments and government-supported institutions, no-cost virtual webinar trainings on a variety of clean energy policy topics, partnership building and development agencies, and regional and global organizations to deliver support, an online library containing over 5,500 clean energy policy-related publications, tools, videos, and other resources. Our primary audience is made up of energy policymakers and analysts from governments and tactical organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

The Solutions Center is an international initiative that works with more than 35 international partners across a suite of different programs. Several of the partners are listed above and include research organizations like IRENA and

IEA, programs like SE4ALL, and regionally-focused entities such as ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature that the Solutions Center provides is no-cost expert policy assistance, known as "Ask an Expert." The [Ask an Expert service](#) matches policymakers with one or—of the more than 50 global experts selected as authoritative leaders on a variety of clean energy finance and policy topics. For example, in the area of grid integration or off-grid solutions, we are pleased to have Hugo Lucas from Factor CO2 serving as one of our experts. If you have a need for policy assistance in any clean energy sector, we encourage you to use this valuable service. Again, the assistance is provided free of charge, and if you have any questions for our experts, please submit it through our simple online form at <https://cleanenergysolutions.org/training>. We also invite you to spread the word about this service to those in your networks and organizations.

Now, I'd like to provide brief introductions for today's panelists. First up is Klaus Kubeczko, who's a senior expert advisor and scientist at the Center for Innovation Systems and Policy at the Austrian Institute of Technology. He has an industry background as an electrical engineer and holds a Ph.D. in socioeconomics. Following Klaus, we'll hear from Eric Peirano, who is Executive Vice-President at Technofi, where he currently develops a commercial offer in the fields of low-carbon electricity, smart buildings and cities, and eco-manufacturing.

And with those quick introductions, I would like to welcome Klaus to the webinar.

**Klaus**

Yeah, thanks, Emily and Stephanie. Good morning, good afternoon, good evening to all of you. First of all, thank you to the Clean Energy Solutions Center for the possibility to hold this webinar. And before starting with the two presentations, let me briefly inform you about the ISGAN Annex 7 activities—what it is, what it does, and how this webinar is part of the Annex 7 activities. Annex 7 is part of ISGAN, and ISGAN was launched as the International Smart Grid Action Network at the first clean energy ministerial. Its participants report periodically on progress and projects to the ministers of the Clean Energy Ministerial. It is organized as one of the technology collaboration programs of International Energy Agency and creates a mechanism to advance the deployment of smart electric grids, technology as practices and systems, systems meaning, here, the physical grid as well as the system of incumbent and new actors, emerging actors, markets, and of those institutions, which provide the framework for an intelligent energy system.

ISGAN facilitates dynamic knowledge sharing, technical assistance, and project coordination. ISGAN Annex 7 is a working group within ISGAN which deals with the transition from centralized systems of energy with external energy supply towards decentralized systems with internal energy supply, so coming from hierarchical systems towards decentralized systems and local grid solutions.

The main objective of this annex is to investigate institutional issues in the wider sense associated with Smart Grid deployment. Annex 7 aims at sparking often international coordinated trans-disciplinary research activity in the social sciences, supporting and complementing technology-oriented Smart Grid activities. Further aims and scopes are to establish an inter- and trans-disciplinary network of social science humanities researchers and practitioners, to support policy development in the field of research, technology, and innovation, and last but not least, to bring up-to-date knowledge to the attention of the Clean Energy Ministerial and Mission Innovation.

The focus of Annex 7 lies on shaping the local grids, taking into account, most importantly, the socioeconomic complexity of energy systems and the links between technological and social components of energy system. Second, institutional change and orchestration processes, coordination processes related to Smart Grid Development and the transformation towards new energy systems. And third, the focus is on strategic long-term thinking in alternative transformative pathways. Not for everybody it might be clear what the term social science humanities, SSH, means, so social science and humanities covers basically all research disciplines which are not part of natural science or engineering. It includes social science, economics, psychology, political science, history, as well as marketing and law.

For the League of European Research Universities, Sir Llewellyn Smith from Oxford University and colleagues from European Research Universities have outlined the essential SSH research for secure, clean, and energy—and efficient energy—in a position paper. In Europe, this is relevant, as this is one of the societal challenges for which Horizon 2020, the European research program, is providing substantial research funding. Let me cite from this paper to explain, also, what are the rationale involved \_\_\_\_\_ for research in SSH to work on energy issues. And it brings me also to the reason of this webinar "Meeting the world's future energy needs in an environmentally responsible but affordable manner is an enormous technical challenge. However, devising the policies, institutions, legislation and economic tools that will enable this to be done in an effective and politically, socially, culturally and ethically acceptable manner is at least as great if not a greater challenge. Research in social sciences and humanities is essential to probe these deeper issues and develop the tools for tackling them."

So the reason for this webinar is to highlight the importance of social science humanities research for energy transition. Today's webinar is part of the process toward an Annex 7 white paper on the strategic research agenda for Smart Grid transition. The aim of the white paper will be to promote social science humanities and socioeconomic research and bring it to the attention of the Clean Energy Ministerial at the Annual CEM, Clean Energy Ministerial, Conferences, as well as to the attention of Mission Innovation, the rather new initiative of 22 countries with the aim to double investment on clean energy R&D within five years.

The steps in formulating the—this SRA so far have been screening of foresights, survey with national policymakers of ISGAN and ISGAN workshop in Shanghai dealing with these topics and the results of the survey; the Austrian SRA process, which I'm presenting later on, is also part of these activities and provides valuable inputs to this white paper; Annex 7 workshop has been taking place at the Austrian Smart Grid Week in 2016; and international workshop also discussing broader range of international and national strategic research agendas including, for example, from the Netherlands. Yeah, and finally, now with this webinar, we want to discuss with you, the stakeholders from different world regions, two of the processes of strategic research agenda development—the first, which was coordinated by Eric Peirano, who will present a European roadmap on research innovation needs regarding Smart Grid and the integration of energy storage, and the second process, an Austrian strategy coordinated by AIT \_\_\_\_\_ . It was a national strategy process which dealt with an intelligent and integrated energy system.

Okay, before the floor is given to Eric, I'd like to inform you of the possibility to join the Annex 7 LinkedIn discussion group on Smart Grid transition. If you want to join, please send me an email. The discussion group will be the platform to further discuss the issues of the white paper in its draft version as well as its final version.

Okay, and now, let me give the floor to Eric for the first presentation of an SRA.

**Eric**

Thank you, Klaus. So good morning, good afternoon, and good evening to everyone, and I would like to thank, also, \_\_\_\_\_ Klaus, the Clean Energy Solutions Center for giving me the opportunity to present this European roadmap for Smart Grids and integration of energy storage.

First, a short introduction before we go into the content of the presentation. So this roadmap is a ten-year roadmap covering the next decade. So when we say it's a ten-year roadmap, we mean that it is the list of research and innovation activities which must be launched in the decade to come so as to reach the ambitious targets set by the European Union, European Commission, for its energy policies.

So this roadmap was written in the framework of a project. This is the Grid+Storage project; it's the logo that you see at the left bottom corner of the slide. It was a service contract, consultancy contract, with the EC. The partners were Technofi, my company, which is a consultancy company specialized, among others, in the energy field; EASE, the European Association for Storage of Energy, so the Association gathers manufacturers, but also, major energy players in Europe; EDSO, which is the European association for Distribution System Operators, so it is the companies, the \_\_\_\_\_ energy companies in Europe operating the distribution grids; ENTSOE, which is the European association for TSOs, transmission system operators, so gathering companies operating the transmission networks in European countries; RSE, which is a national research center in Italy in

electrical engineering; and VITO, which is also a consultancy company with competencies in the energy field.

So this roadmap is very broad. It covers many technologies, technical issues, but it also covers socioeconomic issues, so that's what we are going to focus on today, and we will focus at the distribution level, meaning that we will address only R&I activities related to distribution grids. We will explain why.

Let's look at the content. So first, I would like to spend some time to explain the European policy framework because it has a strong implication for this roadmap. Then I will go through the stakeholder landscape—I will explain what the ETIP-SNET is. Then I will quickly go through the process, so that's the next three points, to explain the new structure of the roadmap, the structure of this roadmap, and then we'll spend some time on the socioeconomic R&I activities, so I will explain what are the major challenges in terms of socioeconomic research innovation activities for distribution grids in Europe.

So let's start with the EU policy framework. There are three main drivers for the energy policies in Europe. The first one is to reduce greenhouse gas emissions, so decarbonize European economy. So I would say this one is really the main driver. The second one is the security of supply—so this is mainly related to natural gas supply in Europe—and the third one is economic growth, which speaks for itself.

Important point: in Europe, we have 27 countries after the Brexit. Each country has a different energy system. For example, if we think about distribution grids, in France, there is only, I would say, one company operating almost all distribution grids, so 90 percent of the end users of France, so \_\_\_\_\_; whereas in Austria, in the country of Klaus, there are over 100 companies operating local distribution grids. So this has strong implications in terms of energy policy.

What about the regulatory framework at European level? So it is defined by what is called energy packages, and these energy packages, they contain directives and regulations. So regulation is something that is put forward by the European Parliament and which is mandatory. All of the member states, European countries, members of the European Union, have to adopt these texts, whereas directives are texts which has—which have, sorry, to be adopted, which have to be enacted at the parliaments of the different countries, but with a time delay.

So there were several packages during the two last decades in Europe which shaped and defined the European policies. So the first directive in the '90s was about the unbundling of the energy sector. So historically, the energy companies in Europe, they were vertically integrated. They were dealing with production, transport, distribution, and retail. So this first directive was to unbundle these companies so to—as to have separated competencies.

Second set of directive in the early 2000 was about the promotion of renewables. So I would say this is the main driver for our roadmap today: the

promotion of renewables, especially the \_\_\_\_\_ share of renewable electricity in electricity grids, which challenges the people operating these grids.

Third set of directive was about the internal market in electricity and gas. So in Europe, the European Commission tries to have a system or energy strategy that, without borders, was through \_\_\_\_\_ competition. And more recently, so we had a major recast of these existing directives and regulations so as to speed up, I would say, the three directives, which were put forward during the last two decades. So we will go back to this last package, which is called the Clean Energy for all European package.

So these directives have deeply changed the energy system. So as I said, now there are new market players with clear competencies, so generators, traders, retailers, service providers, and so on. There are regulated market makers, so it is regulated companies, so it is the system operators for transmission and distribution; and there are national regulatory authorities in each member state, so which call the act—which checks, sorry, the activity of the regulated players. And there is a European regulator, ACER.

We have an integrated European energy market, so we are trying to make sure that electricity is traded without borders. This is already the case today with \_\_\_\_\_ market with what we call the market coupling. So all sport markets in Europe are coupled.

So all these changes create intensive research and innovation needs for the power system, so—due mainly to the organization solutions that have to be put forward to operate electricity grids within the stability limits, of course, and at affordable costs.

What about the roadmaps of the European Commissions? So the European Commission, in 2008, published a broad roadmap, so addressing all energy topics, all energy technologies, so as to meet the 2020 targets that you see here, so reduction in greenhouse gases emissions, penetration of renewables, and energy efficiency. In 2014, this roadmap was renewed. It was an integrated roadmap where the European Commission went from individual technologies to the energy system, meaning to a system approach, with new targets for 2030, so that's the targets that you see here. And finally, so very important point, in 2015, the member states agreed on common energy policies in Europe with five main points. So the first point, energy security—we spoke about it—it's about the natural gas supply; about integrated energy market; energy efficiency, so the moderation of demand; transition to a low-carbon society; and research, innovation, and competitiveness. So that's where we are, our roadmap, today, in terms of policies.

So if we look at this integrated SET Plan, so this Strategic Energy Technology Plan, and its integrated roadmap, which was published in 2014, you'll see that there are ten key actions. So we are in Key Action 4: resilience and security of energy system. So this large integrated roadmap is supplemented with specific roadmap in each of these topics. So we are here at Key Action 4 and there are other actions, which is—are also relevant, so the

renewable energy technologies, the service for consumers, and e-mobility, meaning batteries that could provide \_\_\_\_\_ to \_\_\_\_\_ applications.

So now let's go quickly to the ETIP-SNET. So I would like to give you just some info about the landscape of the—this European roadmapping exercise for small grids. So we started from an existing roadmap, which was dealing with the integration of renewables, which was published in 2013, covering a decade, up to 2022. It was put forward by what was called the EEGI, the European Electricity Grid Initiative, \_\_\_\_\_ an association gathering all stakeholders of the power systems, so mainly research institutes and companies. This roadmap was supplemented every year by implementation plans. So implementation plans are publications—recommendations for the European Commission every year to draft the call for proposals in the H2020, for example, Horizon 2020, calls.

Our roadmap—this roadmap today—is an update of this roadmap, which extended the scope of the previous roadmap, so meaning not only the integration of renewables, but also, the integration of all flexibilities. So you can have flexibilities from renewable generation, but also, from storage, which was the focus, and from the network, from active demand, and so on. And we also had the assignment to link with the other energy networks, meaning gas and heat grids.

The main point in terms of stakeholder consultation was the merging of this EEGI and another technology platform, which was gathering research institute in—under the umbrella, what is called today the ETIP-SNET, so it is the European Technology Innovation Platform for Smart Networks for the Energy Transition, meaning that today, the European Commission has succeeded in gathering, under the same umbrella, all the stakeholder of the energy system, which is quite convenient when you do consultations. Just for your information, there is a new roadmap, which will be published in three—four years from now, which addresses the energy system as a whole. It is a new project and my company is a member of this project.

Just to clarify what we mean with flexibility, so in our exercise, the electricity network is the backbone of the energy system. So there is flexibility at the grid level, so you can have flexibility with, for example, phase shifters in the \_\_\_\_\_ or FACTDs, flexible A/C transmission devices. You can have flexibility from demand. You can modulate demand. You have flexibility from generation, of course, flexibility from energy storage, flexibility from the interaction with other energy networks, and flexibility provided by information and commission technologies. So that's the flexibilities we address in this fun mapping exercise.

Let's go through the monitoring and consultation process. So just a few words to tell you that to \_\_\_\_\_ this roadmap, we did many consultations, so through the ETIP-SNET, and also, through regional workshops. So the purpose of these regional workshops to—was—were to make—was to make sure that not only we consulted players at European level, but also at member state level. So we were at the assignment to hear about what was done in each member state, meaning that the European Commission wanted to make sure



that double funding was avoided, meaning that we would not specify R&I activities which were already covered in some European countries. We also did an extensive monitoring, meaning we scanned projects, both in European projects, national projects in European countries, and at international level so as to make sure that we will not specify R&I activities in the roadmap that were already covered by a research institute by—at national or international level.

The main inputs that we gathered from the—these regional workshops, two main messages for socioeconomics was this Number 2, multiservice business model. So for storage today in Europe, there is no business case for storage operators relying on a single service, for example, frequency containment reserves. So this is an important point and—which has been stressed, and which is there, too, actually, in the new energy package.

Another point was Point Number 4, market players, so there were—they made clear that they lacked a clear regulatory framework. And the most interesting point, at least according to me, was Point Number 5, which is a regulatory point issue. It's about ownership of storage devices and operation. So in Europe, some of the network operators, they want to own and operate storage devices, and they have entered into, I would say, a fight with market players which do not see it this way. They want to own and operate and provide, of course, services to the regulated players. So this is also something which is dealt with in the new energy package.

Let's go to the roadmap structure. So this is just one slice to explain quickly that the roadmap is really mapping the energy policies. So, what we did when we built this roadmap, so for those of you that will read the roadmap, we looked at the Energy Union policies and we made a forecast of the most probable evolutions of the power systems. From these evolutions—so that's Block 2—we deducted future challenges for the stakeholders of the power system, and this allowed us on those future challenges—Block 3—to map the knowledge domain into a tree-like structure with clusters and functional objectives. So we'll see shortly what the clusters are.

So, what are these clusters? So let's look at the right-hand side of the screen. So this is the clusters for the distribution system, so the challenges. So we have six different groups, so upgrading of the network, it means how to better operate the network with the existing asset. Power system reliability, power system flexibility, so how to have a system which is more reliable and flexible. ICT and digitalization, so try to find flexibility with ICT and digitalization. Market design and regulatory environment. So we will focus on these two last challenges, these two last clusters.

So let's go through some examples of R&I activities which are specified in the roadmap, which are of high importance for the future of the European power system, and especially distribution grids. The first one is active demand response. So active demands response is implemented in many electricity systems in Europe, especially at transmission level, with big industrial \_\_\_\_\_. So people or industries that are connected at transmission

level. There is still a major challenge to have massive active demand response for—from end users.

So we can take, for example, this Activity Number 3, so, "Study the rebound and deferral effects and provide reliable models to predict them so as to provide DSOs with methods to anticipate their impacts on the network operations." So this is something which is a major issue. Today, some operators are reluctant to rely on active demand response from end users because there is a high uncertainty which is related to it. So there is a strong need from social sciences to understand what we call rebound effects, meaning that people could participate in active response—active demand response schemes one day, and the other day, they could—they would not participate when you most need it in the system. From the regulatory point of view, there are still barriers in Europe, in most European countries, so has to have schemes which allow an aggregator, or I would say, a market player to bid on the whole sales market with a portfolio of, let's say, 10,000 end users. So this is still something which has to be fixed.

Next point, which is interesting, is the integration of energy efficiency, so these smart homes and smart buildings. Today, there is a major issue—that's Point Number 3, for instance—on customer acceptance and involvement in these energy efficiency schemes. So we are \_\_\_\_\_ social sciences, as Klaus was saying, so we have to work on ergonomics and market on price signals and behavior—we'll go back to these rebound effects—so as to make sure that we can make European customers participate in energy efficiency schemes.

So for the regulated players, there is a major issue. It's that we tell these guys that they have to sell, more or less, less electricity. For them, there is a need for a clear regulatory framework so as they can make sure that they will still make money, they would make a living, even if the electricity consumption goes down or decreases in—as the results of strong energy efficiency policies.

Another interesting point, which is a major issue right now, which is a hot potato, but which is also dealt with in the new energy package—this \_\_\_\_\_ energy package that was published in 2016—is how to use renewables, especially at low-voltage level PV, to have ancillary services. PV not only from, I would say, generators, but for example, from prosumers. So we are in the same scheme as for active demand. We want end users, so prosumers, to participate in producing electricity with the PV roofs to participate in the energy market. So this is still something which is under evaluation and which is also dealt with in the directive.

For the DSO, so there is a major issue on how to interact with these prosumers because DSO wants to know what is going on on their network, and this is also something which has to be dwelt upon. The second part, so the regulatory framework for temporary use of distributed DER, so distributed energy resources for grid management purposes, so this is really something which is also discussed. So some network operators would like to have an emergency situation, the possibility to take over some generation unit, \_\_\_\_\_

\_\_\_\_\_ generation units, and this is something that was discussed also, and it would take some time, I would say, to have a clear regulatory framework, so it needs research work.

For the system integration of what you call medium DER, so it is the same. So it's at medium voltage level. So here, I would say that the landscape maybe is clearer because most of the big distribution system operators in Europe, they have equipped the grids already with monitoring and control devices, which allow them to host more renewables and to procure this type of services. So the main issue in terms of regulatory problems, it's—is network codes, which have to be defined. Today in Europe, there are network codes for transmission but not for distribution, so it is something which has to be fixed, also.

For the integration of storage, I would say that today, the main issue is really to have the tools to simulate and to value storage in an integrated point of view, so in the energy system. And from the regulatory point of view—so we already spoke about it, so there is a major issue to know how to, I would say, to share ownership and operation of storage devices between market players and here, DSOs, so regulated players. So this is something, actually, which is clearly mentioned in the new recast of the directive, so this forced energy package.

Let's continue with another important point. So for distribution grids, it is the electrification of transport. So in terms of market design, there is a strong need to find the right incentives to encourage electric vehicle users to provide services through vehicle-to-grid applications. So this is something which is experimented in some countries, for example, in the country of \_\_\_\_\_ in Australia, I think they have already experimented quite far, but still, it lacks a regulatory environment at the European level. So this is also something to be dealt with.

Let's finish with the integration with other energy networks, so the coupling between energy networks, especially at the distribution level. So for Europe, it would mean how to couple electricity and heat. It's also still something which has to be understood, and there is need for simulation from market design to understand what is the added value of this coupling. Today, in terms of regulations—so I put "none" because the regulation is far from being clear and there are no specific activities foreseen.

Let's conclude. So we presented a roadmap, and this roadmap has allowed—it was a Step 4 because it has allowed all energy stakeholders—so not only the electricity power system, so the power system stakeholders to participate, but all the energy stakeholders from the energy system in Europe, and we were able to enlarge the scope to all flexibility means. We were able, in this roadmap, to consider, at the same time, but with an emphasis on storage, all means that can provide the necessary flexibility for the power systems for us to operate with very high shares of renewable energies, so non-dispatchable renewable energy sources.

In terms of research \_\_\_\_\_ activities related to energy storage, which was the main focus of this roadmap, we draw two main conclusions regarding socioeconomics. So the first one is about the regulatory frameworks and the market mechanisms which are needed to speed up the integration of storage in the power system, and of course, storage investments from market players. And from regulated players, there is still a major issue on how they could own and operate storage devices, let's say, electrochemical devices, to provide ancillary services, so let's say to provide frequency containment reserves and frequency restoration reserves, for instance. So I will end by saying that this is something which is dealt with—which is proposed, actually, in the existing directive, the \_\_\_\_\_ directive, which has to be adopted in—by the member states, and I'm pretty sure it is going to be discussed for a while.

I thank you for your attention. So just some more information, it is about the ETIP-SNET roadmap, so you can download it at the link, which is here on the slide. And the last link, the GridInnovation on-line, I encourage to visit these website, which is a database which contains all—I'm sorry, \_\_\_\_\_ . So the—this database contains all the projects which were scanned, so if you want to have an idea of what's going on in Europe in terms of research, here, we find that all projects have the different research activities, which country \_\_\_\_\_ results of these projects. Thank you for your attention. I'm done.

Klaus Okay. Thank you, Eric. After we have heard about the European-level definition of research needs, let's come to a national SRA process example for research for research organizations and universities as a focus. And yeah, before starting, maybe Eric also mentioned some specificities of Austria. Let me add, apart from this federal state issue with mixed, large, and small energy companies, distribution system operators, providers, et cetera, we have quite a complex issue. With respect to the situation of the integration renewable energy sources, we have quite different constellations in the western part of Austria and in the eastern part of Austria. In the western part, it's mainly small-scale hydropower and we have large capacities for storage there for hydro storage as well. In the east, we have wind and PV, and in one province, we even have a net energy production of one of the provinces so they can also feed into the larger grid of the provinces into the transmission grid.

So given this complexity of Europe, and also, of national, federal state, for countries with such federal state structures, this agenda-setting process can be of interest when you have to deal with complex coordination processes and to get innovation processes going, which are necessary for the Smart Grid transition.

In the following presentation, you will hear about the goals and the embedding of the strategic research and the process, the participatory process leading to the final document, the content of the SRA, and at the end of the presentation, I will tell you more about the impact of the SRA, that it had on

policymaking at the national level, and also, other levels, and concluding with the main learning experiences we can derive from that.

The goal of the intelligent energy system SRA is closely related to energy policy goals as well as to energy research and innovation policy goals. In Austria, this is also handled by different ministries. So on the one side, of course, there is security of supply and the provision of energy infrastructure as public services as the main goal; there is the new focus on the integration of renewable energy sources compared to earlier strategy processes; and there is also need to guarantee resilience of infrastructure systems in the light of the integration of these renewable resources and challenges related to digitalization of the energy grid.

From the point of view of energy research and innovation policy, the owners of the process in Austria, the BMVIT, the Ministry for Transport, Innovation, and Technology, is in charge of that, is also to have a long-term research agenda as part of Smart Grid 2.0 Strategy—I'll come to that later. It's also important to have an international embedding of the Austrian research into the European Research Area on the one side, but also, into international research and, of course, the competitiveness of Austrian industry is also an important issue.

This slide, unfortunately, only in German, it shows you where the strategic research and the process was embedded. There were three processes in parallel; there was technology roadmap process going on with \_\_\_\_\_ Horizon 2020, which was similar to the process that Eric was describing at the European level, and there were some workshop on current issues apart from our workshops that we held. This fed into the Smart Grid Strategy, and this Smart Grid Strategy then fed into the energy research strategy of Austria, which was just published last week.

Now, let me come to the participatory process. We did the—this as a foresight process mainly. We used the foresight methodologies, and maybe let me first give you a definition for those of you who might not be familiar with this concept and with this method, the definition of the High-Level Expert Group on Foresight for Europe from the year 2002. There, they have defined that foresight can be seen as a systematic participatory future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilizing joint actions. So in that sense, it's well fit to be used for these kind of processes, be it visioning, action planning, roadmapping, whatever.

In this process, we used foresight scenario building, envisioning the time horizon for the SRA for planning of research is 2035, so longer than the other—most other research agendas, and the time horizon for scenario building envisioning the—for the exploratory scenarios was 2050 because in infrastructure systems, we have these kind of long-term horizons to be considered. The participation aspect was that we invited stakeholders. It was a deliberative processes, so they were really involved in defining the issues, but it's also important to note that these kind of activities are also part of networking, building new networks between stakeholders who previously

haven't been talking to each other, and it's also a kind of coordination mechanism.

Involved stakeholders were coming from research community, also, as the main addressee, then—or the main actor in this field then doing the research that's defined by the SRA research organizations and universities. We had stakeholders from innovative industry, both from engineering, in electrical engineering, as well as mechanical engineering and thermodynamics, of course, and from ICT. We also had policymakers from funding agencies and from city administration. We had stakeholders from energy providers, both from urban as well as rural energy providers in mixed production, and also, interest group representative only talking for the renewables energy providers. And finally, last but not least, we also had the grid operators there, both from urban as well as rural areas, from electricity, gas, heat, and cold. So altogether, these were more than 40 stakeholders that were involved.

The steps in the process, which started in October 2013 to April 2016—were that first, we started with a screening of energy-related foresights, international roadmap processes in desk research; we developed the briefing paper on that, which was the basis for the first stakeholder workshop, the big picture workshop, which took place at the end of 2013 with 23 stakeholders. There, we developed—out of these inputs, developed storylines for scenario building, and after that, these scenarios were consolidated in desk research and fed into the second workshop, which took place in February 2014 with 20 stakeholders involved. There, we developed a vision for 2050 from different perspectives, from production, grid, and user perspective, and we identified the critical success factors to achieve such visions. From that input, the consolidation of research themes was done in desk research, and also, in relation to international activities, research activities, so looking into what's going around in other countries. A final stakeholder consultation workshop then took place in November with approximately 40 stakeholders. It was a final consultation process, and also, there were written inputs to the final version of the Strategic Research Agenda, which was published then, nearly one year ago.

Now coming to the content of the SRA, first of all, you can download this SRA from the link given below. Unfortunately, it's only in German, but modern translation programs can do quite a good job in that so you get a glimpse of it and you also have this presentation.

So I won't really mention the exploratory scenarios for 2050. The main dimensions there around which this was developed was, first of all, that we have different situations in rural and urban areas and we have different foci or different attitudes towards the future of energy systems coming from, on the one side, more centralized, and on the other side, a decentralized system. For that, we developed four scenarios as a basis for the work. One was in sustainability in a decentralized energy system for a local grid; the other one was sustainability in an internationally integrated transmission grid; and the third scenario was a laissez-faire, or business as usual, scenario, assuming a climate policy failure—so, what if climate policy measures failed? Which we

don't hope, but this is also important to learn about the critical issues, obviously. And also to learn about the critical issues, we had a breakdown scenario where no energy strategy is available, no transition pathways are clear for the stakeholders, for the actors, and there is a policy failure. This led to a vision and the identification of the critical success factors from the point of view of producers, grid operators, and users, as already mentioned.

And here, you have the formulation, what came out of the process in the form of a small text, but there \_\_\_\_\_ graphics drawn by the stakeholders, which are also documented. The message of the stakeholder, apart from of—what you can read here was also to the scientific community that there is danger of researchers remaining in their ivory tower, and we took that seriously, given that we have valuable inputs from the stakeholders.

So from this vision, critical success \_\_\_\_\_ were identified and led to the research topics. On the left side, you see our starting hypothesis on how we thought that the stakeholders would agree that we should structure this SRA. It was disciplinary silos, more focus of electricity grid and engineering issues, ICT infrastructure engineering issues, grids for gas, heating, and cooling as well, strong energy-related research issues, as well as for mobility infrastructure, and then there was a separate silo for societal aspects and for urban regions like smart \_\_\_\_\_—relation of Smart Grid and smart \_\_\_\_\_.

It turned out, taking the advice of the stakeholders, that we have to turn to a trans-disciplinary approach to research on these critical success factors. So the structure changed towards structure—infrastructure development, governance of energy transition, electricity-related issues, district heating and cooling grid, micro grids and gas grids, and also, integrated research areas.

I will briefly go through this, coming to—nearly to the last part of the presentation. This graphic, it acknowledges that the SRA has to be continuously updated and the themes of the SRA co-evolve with evolutionary and disruptive technological developments, so there has to be, like, not only after ten years to the next adaptation, but there needs to be a continuous adaptation and the awareness that there can be disrupted technologies.

Now, let's briefly go through the research topics. This already shows that the—these topics are a mix of socioeconomic issues and engineering issues. Let me just pick out the first one that came out in very many aspects that we need definition and clarification of the strategic framework conditions for electricity grids of the future. So technology is not so much the problem—and that was this \_\_\_\_\_ surprising. So technology is not the big issue. As long as we don't know where to go, technology doesn't help us, but it's there.

With respect to the district heating, there, it's also the same issue, Point 3, definition and clarification of the strategic framework for the future of heating and cooling grids and gas grids, and also, when it comes to this cross-domain infrastructure development, this is obviously also an issue regarding hybrid grids. This was also—or is a big issue in Austria if you want to have this integration of renewable energy sources. We need to have some hybrid grid

solutions, and for economic and organizational framework for \_\_\_\_\_ is also one of the socioeconomic research topics.

Now let me come to what is maybe new compared to other strategic research agendas. We were not so much only focusing on markets and regulation, which is often the case—and this was also the case in the ETIP-SNET roadmap that Eric presented—but we took another approach going one step further that the governance of the energy sector has to be—is changing and has to be changed if we want to integrate renewable energy sources and if we are facing when facing the digitalization. So the need to be research and changing actor networks, there are incumbent actors, but we know that there also will be new actors emerging, have to emerge, if we want to have an energy transition.

We need new business models and market rules. There is a big question mark, and we have a lot of projects now where we look into business models. So far, many business models either have failed or, in the preparatory phase, it turns out that it's not feasible. This relates to, sometimes, the storage aspect as well as to hybrid grid, et cetera. Of course, this is even worse when the market rules are not clear.

Eric already mentioned the behavioral aspects. We want to highlight here and have highlighted that it's not only the individual behavior, but that there is also, in sociology, a big debate on social practice so that behavior is not only determined by the individual, but by where and in which social practice this is embedded. This relates not only to the consumer, but to all grid users, this can be—and consumers are often seen as the end users of the households. But households can also be not only consumers, but also, feeding into the grid in the future. Of course, safety and security for industry and end users is a big issue there.

So—and not only the governance of the energy sector, as such, has to be researched on, but also the multi-level governance issues. And what you've heard already now from Eric and—on the European level and the Austrian level, we have so many different administrative levels and we have stakeholders that have, now, much more to say than they might have had to say when our energy electricity grids were built 40—50—60 years ago. So it's much more complex, and the complexity of reconciliation of interests between levels and between incumbent and new actors is a big research question as well.

And of course, the legal framework of the energy transition is also under debate and things are already changing, but as, also, Eric noted, they're changing slowly in this governance, in this formal process of democratic legitimation.

We also need new process for the integration of societal groups. Not everybody is integrated still. We have energy poverty issues, just to name one. And particularly in Europe and in many countries in Europe, data protection and privacy is a big issue here.



The next point is the development—developing a transition pathway towards intelligent energy system, and we have already—I already mentioned this when I explained the research topics in \_\_\_\_\_ and electricity grid. What is important here is that there need to be an orchestrating of collective visions of the future of energy systems. This is not only a top-down issue, but there has to be a consensus generated, and that's probably a new role for government to—and for governments to do this—take this role of orchestrating.

We also need to generate and provide open access to strategic knowledge. Those incumbent players, if they are needed for the energy transition, they need to be provided with strategic intelligence, which they might not have had so far. This is an important task. This also came from stakeholders that we're talking to. We obviously have to generate and understand a societal acceptance for Smart Grid transition, and the adaptation of visions throughout time is also a means of orchestration.

Finally, we also looked into and asked for the RTI policy issues. We have seen that there is a need for reorientation in RTI policy towards energy transition. We need more mission-oriented RTI policymaking. It's also important to include technology assessment aspects, particularly with digitalization issues, safety, security issues. We need horizon-scanning and foresight processes. It also turned out that there is a need for new instruments, for example, regulatory innovation, \_\_\_\_\_, an instrument that hasn't been developed yet and which is just starting to be discussed. And there has to be a new weight on non-technological research.

I think I will—I will, yeah, just brief—only briefly go through these cross-cutting issues, information and communication technology, ICT safety security concepts, security by design, data protection, privacy, consumer rights, the key words here—and business cross-cutting because it's not like the energy electricity grid and the gas grid as the hardware, but it goes into so many aspects of the energy transition that it's cross cutting. And of course, energy storage, which was also—already highlighted by Eric, but also, power to X—power to gas, power to heat, et cetera. This integrated analysis and modeling is just starting and is very important. And of course, the energy efficiency issue, the local use of energy—of renewable energy and the high efficient transmission infrastructure are still to be researched on, and particularly, also, of course, the integration of the energy grid as such.

Now, coming to the last two slides, what was the impact? And what is the impact of the Strategic Research Agenda process in Austria and maybe beyond Austria? One aspect, our dimension, it's part of Smart Grid 2.0, the process that took place between 2013 and '16. It was contracted by BMVIT, the ministry responsible for energy research, and it also fed into the Smart Grid Technology Platform roadmap, which was done in parallel. And the SRA was a main input to the BMVIT energy R&I strategy that was developed in 2016 and '17 by BMVIT and the KliEn—that's the Austrian climate and energy fund—and this, finally, will lead to new topics for the Austrian energy R&I funding programs as well as for ERA-Net Smart Grid Plus, which is also one of the possibilities of \_\_\_\_\_ in our research programs in Europe. It's also

used for national consultation processes when the countries are consulted by the European Commission, for example, in Horizon 2020, where the countries think that there are research topics, which are not only relevant for Austria, but for other countries or for all of Europe, then these topics also will feed into Horizon 2020, but also, in the development of the new framework program, FP9, that will come after Horizon 2020, which is now discussed. We also have that it was an input to the ETIP-SNET R&I; it provided an input to this as there was a local workshop in Austria and it was possible, also, to give input on the SRA in this workshop.

The SRA process is also helpful for other processes, for example, the economic, environmental, and social impact Joint Program of the European Energy Research Alliance, which is also developing a strategic research agenda on social science humanities, has also taken up some of these aspects; particularly, the transition issue is raised there as well. And it's also likely that there—that the process also provided input to strategies of research organizations and other stakeholders to other organizations. And last but not least, it will have an impact on—and it will—components of this will be taken into the white paper on the Strategic Research Agenda for Smart Grid transition.

Okay, so, what were the main learnings, to come to an end? The process showed that it's very important to go from a disciplinary focus towards inter- and trans-disciplinary research. Stakeholders identified research needs regarding the governance besides government, so, also, other stakeholders requested for strategic intelligence information that is provided by research projects. There is need for long-term orientation and stakeholder deliberation in this process. There is a changing role of government, and namely, as driver of the transition process rather than top-down guiding and giving only regulatory frameworks.

We are partly experience the end of a technology push, policymaking towards RTI policy from a demand side perspective, which includes the users not only—not only the users—the households, but also, industry, and which includes, also, new instruments like innovation or \_\_\_\_\_ public procurement processes. There need to be a focus on the user side of local grid, and—which are not merely distribution grids anymore as they are bidirectional, not hierarchically organized, and the consumers' energy management is important, integration of local renewable energy sources, and the provision of storage, but not only storage, but also, the conversion into energy—other energy carriers is a strategy for the future.

And last but not least, the lack of social science and humanities turned out to be a big issue. There is a need to move towards trans-disciplinarity, towards capacity building, to learn how to collaborate, to think out of the box, and we face a substantial lack of funding of basic, applied, and trans-disciplinary research in the social science humanities as a basis for devising the policies, institutions, legislations, and economic tools for a sustainable energy transition with integrated energy grids as a goal. And mission integration should also pay attention to this. This is probably the last—maybe the most

important message, that if research—energy research funding is doubled, then this should also apply to—at least apply to social science humanities in the same scale.

So thank you for your attention and I give back to Stephanie.

**Stephanie**

Great. Thank you so much, Klaus. I want to thank both you and Eric for the outstanding presentations. We're going to swift—shift to a short Q&A section. We remind that the attendees, you can all submit your questions in the question pane, which is on the GoToWebinar toolbar. Feel free to type those in, and if we don't have a chance to get to all of your questions, we'll make sure to connect you with the panelists' offline after the webinar. And the—we've had a question about where to find the presentations. You can see the link right on the screen now for <https://cleanenergysolutions.org/training>, and you'll be able to find the presentations and a recording there.

Our first question is for—it is about how extensive were the metrics develop—used to develop and assess the SRA roadmap by grid storage in Europe; for example, were the major details of the metrics left for utilities to decide on their own or were they mandated? And Eric, would you be willing to take that one first? Or Klaus? Just a reminder, you're both on mute right now.

**Eric**

Sorry, Stephanie. Could you just repeat the question so just to make sure that I fully understood?

**Stephanie**

Of course. How extensive were the metrics to develop and assess the SRA roadmap by grid storage in Europe? For example, were the major details of the metrics left for utilities to decide on their own or were they mandated?

**Eric**

Yeah, what is meant by the matrix? So I'm not sure I get it.

**Stephanie**

The metrics, the standards used for assessing the roadmap.

**Eric**

Ah, okay. Okay, okay.

**Stephanie**

Were utilities given freedom in that regard?

**Eric**

Okay, yes. We were given total freedom. So if I understand where the word "metrics," it means the metrics we used to assess what would be included in the roadmap, so maybe you refer to the monitoring process. So for the monitoring process, yes, we had three level metrics, so to measure the coverage of the research activities of the ongoing and the finished projects at the EU and national level.

So, what we did is that we interviewed project coordinators, technical directors of the project, or the people that were in charge of a specific result to assess to what extent the—specify R&I activities in the previous roadmap, but also, in our roadmap were covered. So it was a three-level matrix and it was assessed together with the experts of the project. So it was low coverage, medium coverage, and high coverage. So, what we did is that when we had

the high coverage, when we assessed that projects covered well already, that they were already a research result that covered well the R&I topics that were specified by some of the stakeholders, we decided not to include them. So I hope this answers the question.

**Stephanie**

Thanks. Thank you. Our next question is about stakeholder engagement, and the attendee would like to know what are the best delivery channels or platforms for SRA to collaborate with relevant stakeholders, especially mid-to large organizations?

**Klaus**

I'm not sure if I really understood well—I mean, basically, what we did in the Austrian case, that we invited all stakeholders to take part in the process, at least all stakeholders that knew of the Smart Grid 2 process, and so everybody was invited. So there was the possibility for everybody to take part. What we did, we took care that from the different and most important stakeholder groups, that we would have representatives. So we were also actively looking for stakeholders if we thought that they would be needed. Yeah. So there were both large- and small-scale companies were engaged in the process.

**Stephanie**

Great, and I think part of the question is just what methods did you use to engage stakeholders? Was it just invitations or were there any channels that...

**Klaus**

Okay.

**Stephanie**

Yeah.

**Klaus**

That's what I tried to explain in the different steps of the process. So we had two stakeholder workshops, dedicated stakeholder workshops. They were half-day, they were intensive workshops in different working groups working on all the issues. So that wasn't like we were presenting something, but we really got the input and it was hard work for the stakeholders in those workshops. And the final stakeholder consultation workshop was obviously providing some presentation of the draft SRA, and then this was discussed based on this. And then there was also the possibility for written comments on the SRA.

**Stephanie**

Great, and then along the lines of the stakeholders, did you face any particular problems when working with them?

**Klaus**

I don't know—I mean, the...

**Stephanie**

Any issues with...

**Klaus**

I mean, I can tell—maybe Eric can also tell from their local workshops they had, but for us, I mean, we worked with professional facilitation based on network and organization development knowledge, so we are preparing the workshops very well, several days of preparation. We tried to give a lot of input also, like expert input, but we also consider the stakeholders as experts in their field. So, I mean, like, in 90 percent of the foresight process that we are doing, we are not facing substantial problems and the stakeholders are

quite satisfied with the outcomes, and they were in the Austrian case. So maybe Eric, you want to add something?

**Eric**

Yes, I can add something, Klaus. So for the European roadmap, it was a little bit more complicated for two main reasons. We had to deal with the member states, meaning that the roadmap had to be approved by the member states, and as we explained, so 27 European countries with different energy systems and sometimes different strategies, national strategies, and then we also had to try to synthesize and to consider at equal level the different lobbying forces, I would say, for each flexibility mean. So you had the strong lobbying forces in energy storage industry players; we had also strong lobbying from thermal generation players. So I would say that's the—that were the two main difficulties.

As far as the workshops, for our concern, it was not a difficulty for us because it was a data gathering process. We were listening and just trying to understand what was going on at the national level. But at European level, yes, there is—I mean, it is a challenge to make all member states agree on a common text and then to find the right balance in terms of research innovation activities between lobbying forces, which sometimes have opposite interests.

**Stephanie**

Wonderful. Thank you both so much. If anyone else has another question they'd like to ask either Eric or Klaus, you can please type that in the question pane there and we'll be sure to connect you offline. We are going to wrap up now, and thank you so much to the attendees and the panelists for participating in today's webinar. We really appreciate your time and hope, in return, that there were some valuable insights that you can take back to your ministries and organizations. We also invite you to inform your colleagues and those in your networks about the Solutions Center resources and services, include no-cost policy support through Ask an Expert. I invite you to check the Solutions Center website if you'd like to view the slides and listen to a recording of today's presentation as well as any previously held webinars. Additionally, you'll find information on upcoming webinars and other training events, and we are also posting our webinar recordings to the [Solutions Center YouTube channel](#), and please allow a few days for those to be posted.

Finally, I would ask: Please take a moment to complete a short survey that will appear as we conclude the webinar. Please enjoy the rest of your day and we hope to see you again at future Clean Energy Solutions Center events. This concludes our webinar.