# Regulatory Issues and the Deployment of Smart Grids

—Transcript of a webinar offered by the Clean Energy Solutions Center on 22 January 2013—
For more information, see the clean energy policy trainings offered by the Solutions Center.

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Vickie Healey: Good day, everyone. I'm Vicky Healey with the National Renewable Energy Laboratory, and I'd like to welcome you to today's webinar, hosted by the Clean Energy Solutions Center. Discussions today are focus on key regulatory issues associated with the deployment of smart grids, and we'll be drawing on case studies from Europe, and this training will dealt into the regulatory regime anticipated cause and benefits of smart grid, and those practices that foster grid integration and regulatory framework that support or in some cases, hinder smart grid deployment. We are fortunate to have two excellent panelists today that are representing Enerdata and they'll be presenting on this topic.

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Now, before we begin, I just need to make mention of a disclaimer and the Clean Energy Solutions Center does not endorse or recommend specific products or services, so the information that's provided in this webinar is featured on the Clean Energy Solutions Center Resource Library as one of many best practices resources reviewed and selected by our technical experts.

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Before we begin, I'm just going to go over quickly with 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 to your computer, please select the "mic and speakers" option, which is located in the audio pane on the right side of your screen. By doing this, it will eliminate the possibility of feedback and echo. If you select the telephone option, a box from the right side will display the telephone number and audio pin that you should use to open and gain audio access. Before we go further, there's some background noise at the moment which [Indiscernible][0:02:13] next point.

If you wouldn't mind, please be sure to mute your telephone or your computer. So, again, we eliminate the possibility of feedback noise. Again, if you select in the telephone option, a box on the right side will display the telephone number to use to dial in and the audio pin you should use to gain audio access. We ask that you please, again, mute your audio device before the presentations begin. If you're having technical

difficulties with the webinar, we do have a helpdesk at [Indiscernible][0:02:46] webinars which you can dial in. The phone number for that is (888) 259 3826 and the helpdesk will be able to offer you assistance.

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To go over on how you can ask questions, we do encourage our attendees to participate in the webinar by asking question and providing relevant comment. So, if you would like to ask question, or add a comment, we ask that you use the questions pane. Again, where you'll find this on the right hand side of your screen and you may type in your question. If you are having difficulty viewing the material through the webinar portal, you will find PDF copies of this presentation located at http://cleanenergysolutions.org/training and that's where you'll be able to follow along as our speakers present. Also, I want to let you know that an audio recording of this webinar and PDF copies of the presentation will be posted to the Solutions Center training page within a few weeks.

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So today, we have a really terrific agenda prepared for you that will focus on the potential of smart grid technology to transform electricity market and the regulatory framework that is needed to support deployment of smart grid, and realize their benefit. Before our speakers begin their presentation, I will provide a short informative overview of the Clean Energy Solutions Center initiative, and following the presentation, we'll open up to have a question and answer session, and then, we'll wrap up with a short poll actually to get your feedback on how the presentation would perceive by you, and a few closing remarks.

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This slide provides a bit of background in terms of how the Solutions Center came to be. The Solutions Center is an initiative of the Clean Energy Ministerial and is supported through a partnership with UN Energy. It was launched in April of 2011, and is primarily led by the government of Australia, and the government of the United States, as well as other CEM country partners. An outcome to this unique partnership includes support of developing countries through enhancement of resources on policies relating to energy access. We also offer no-cost expert policy assistance and peer-to-peer learning and training tools such as the webinar you are attending today.

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The Solutions Center has four primary goals that I'll go over. First, 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. Lastly, the Center fosters dialogue on emerging policy issues and innovation in Clean Energy policy occurring around the globe.

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

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Our marquee feature that the Solutions Center provides is our expert policy assistance. We call this "Ask an Expert" which is a valuable service that is offered through the Solutions Center. We've established a broad team of over 30 plain energy policy experts from around the globe who are available to provide remote policy advice and analysis to all countries and at no cost. I'm pleased to inform you that Bruno Lapillone and Bertrand Chateau who are cofounders at Enerdata serve on the Solutions Center policy expert team.

So, if you have a need for policy assistance from smart grid; regulations, renewables, energy efficiency, plain transportation, or any of the other Clean Energy factors, we welcome and encourage you to use this useful service. Again, this assistance is provided free of charge and to request assist that you may simply submit your request by registering through our "Ask an Expert" feature, which is located at http://cleanenergysolutions.org/expert. We also invite you to spread the word about this service presented in your network and organization.

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A few ways on how you can become involved or take advantage of the services offered through the solutions center. We encourage you to explore and take advantage of the Solutions Center resources and services including the expert policy assistance, which I just mentioned. You could subscribe to our newsletters to keep up with relevant and current events happening in the world of Clean Energy policy, participating webinars which is you were doing today.

You recommend relevant resources that would be value added to the Solutions Center and to our audience and we invite you to test and provide feedbacks on our recently released Global Renewable Energy Opportunity Tool which is certainly in beta version, and we're accepting feedbacks and comments on that tool. You'll be able to find this tool on the Clean Energy Solutions Center website if you're interested in doing so.

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We also offer a policy forum where blog and article discussions are provided, and we encourage you to read and comment on the blogs that are located on our policy forum page. On our policy forum, you'll find many interesting and informative articles including the article written by Bruno and Nicolas, which is in-support of today's webinar topic, expressing the progress of Clean Energy policy development, and implementation occurring in countries around the world. We also follows similar articles posted by our partners at Leonardo Energy, the Renewable Energy, and Energy Efficiency Partnership, IRENA, UNEP, and we also offer podcast developed by Bloomberg New Energy [Indiscernible][0:09:33].

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So, today, we have two terrific speakers and I'll just provide a brief introduction. You'll see their bios here on the screen. First, we have Bruno Lapillone. Bruno is a co-founder and Vice-President of Enerdata. Again, I'd like you to know that the Solutions Center is very honored and excited to have Bruno serving on our policy expert team covering the area of energy efficiency & demand-side policy evaluation. Our second speaker is Nicolas Brizard who is an associate consultant at Enerdata, and Nicolas will be our first presenter for today. So, at this time, I'd like to turn the presentation over to him. Nicolas, welcome.

Nicolas Brizard: Thank you Vickie, and thank you very much for these nice introductory words. We would also thank the Clean Energy Solutions Center for giving us the opportunity to speak today, and to present a work with [Indiscernible][0:10:46] last year.

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So, we'll start with a brief introduction about the project and Enerdata. So, Enerdata is a French-based information and consulting firm, and we specialized in the global energy industry and carbon market. So, we are approximately 25 years of experience in those issues, and also energy efficiency, and most of the work we do is grounded in heavy modeling works, and we used for that global, meaning worldwide energy models called POLES. Maybe some of you know this model, which is also used by the European commission by the way. We like [Indiscernible][0:11:46] which is also set of products that we propose, and again we cover all the countries in the world that of energy statistics to provide.

So, that's about Enerdata and the project and the subject of the presentation today comes from the work that we've carried for the European parliaments in 2011 and start of 2012, and we have carried out this project with a number of other partners; ISIS from Italy, IZT from Germany, and Tecnalia from Spain, so it was consortium. Enerdata was in charge more specifically of the financial and regulatory implications of

deployment of smart grids. I should say from the start that the focus of this work was primarily in the European Union. We've hired a workshop in Brussels last April and that would be a forthcoming publication anytime **sooner now** [Phonetic][0:12:54] .

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Quickly, for the agenda of the day, so, I just thought with a reminder of where we spent today in terms of electricity markets, organization, and structure. Then, we will move on to the challenges that we have to face today, and that explains why the regulation as we adapt. Then, we will see that smart grids are but implying new cost for good operators and that has to be taken to account to the extent that will be part number four, to the extent that the regulation of framework will have to adapt in order to be more favorable to the deployment of smart grids. They would identify the key success factors for good regulation for smart grid, and then we will move on, and we would cover the demand response aspects of the program, and we will finish with the concluding remarks.

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Quickly, so, I would just like to remind, so, that might be specific to Europe, but I think it's for the true foremost of the electricity markets, but today, the model that we have in place is still largely based on a large-scale centralized generation, and which is basically a model in which you have a large generating plants producing electricity which is transported or transmitted over long distance high-voltage grids, and then distributed through local medium and low voltage distribution networks to the end-customer.

So, basically, that is a specifically true for distribution networks or grids, you basically have unidirectional "top down" flow of electricity, and you are very little or no participation from the consumer, maybe with the exception of the very large interruptible customers. So, we can see the note showing that the electricity network is still operating today in a mostly passive way, and by that, I mean that it is to the supply to adjust to the legal upload or demand that is addressed to the system.

A very important part is that because there's no storage on the utility scale available in the electricity industry, the system's dimension meaning the generation cost, the grid cost are calibrated on the maximum peak load. We'll see later what the consequences are. From [Indiscernible][0:16:09] point of view, so I would go back to the first point. The dominance in this model in that context was the vertically integrated monopoly where one company would cover pretty much all the cost of [Indiscernible][0:16:24] from generation to retail with a differences across the country.

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So, at the top of 1990s and somewhere earlier than that in the 80's, we started to see a new paradigm emerging, which is basically market liberalization. So, the idea was to provoke more competition, to make the markets more and more efficient. So, the liberalization process overtime, included; a mix of privatization, unbundling, and we'll come back to that; introduction of competition, more consumer choice, et cetera.

But, as we will see later, some parts of the chain have been privatized or liberalized, but some have remained standalone-regulated business because they display natural monopoly characteristics, because they are networks, it doesn't make sense to duplicate infrastructure and the monopoly characteristics. This is very important and it actually structures most of the presentation today. We should understand the business, so, I will call them DSOs for distribution system operators. The business of these DSOs, their revenues and from a regulatory formula, so, their revenues or the revenues they get from tariffs or prices is regulated.

In Iraq, this is set at a national level. We should also mention the fact that the focus of the regulation or the regulatory formula as being towards cost efficiency, meaning that each operator towards [Indiscernible][0:18:23] possible to minimize OPEX and make sure that investments were [Indiscernible][0:18:29] to avoid this so-called "gold plating" syndrome. The regulation also incorporated some very important non-economic objectives like security of supply, power quality, grid integrity, and of course, the access of third-party on a [Indiscernible][0:18:49] basis.

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So, this is a simplification of the structure of electricity markets. So, [Indiscernible][0:19:05] as a reminder, you have the competitive services, powered generation with base supply and wholesale supply, so these are the white bubbles, and in blue, you have the part of the value chain which are still regulated and this is the key powered transmission and system dispatch often in one, and at the same company, and at a lower voltage, they hold a power distribution company.

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So, we set the scene and now we have to mention some of the challenges that the grid, and that we forecast from now on the [Indiscernible][0:19:57] grid. So, the challenges that the grid are facing are numerous, and we can categorize them in two main types of challenges; you have the supply-side challenges and the demand-side challenges. So, under supply-side, you're all familiar with the fact that there's a good share of renewable energy in the [Indiscernible][0:20:21] techniques of

most countries, and that the display characteristics such as non-dispatchability and intermittency.

So, I'm talking about wind and PV for the most part. Also, collected but not the same; the growth in distributed generation which is for the most part connected to the distribution network which is by the way the least resilient part of the grid, and also, the emergence of the number of technologies; heat pumps, micro-CHPs, micro-grids, storage, and VPPs. On the demand-side, I think what is [Indiscernible][0:21:02] is that in most countries, European and also the [Indiscernible][0:21:05] country, you still have a very timing proof of the peak-load in the systems and actually the peak-to-base ration tend to increase.

It means, that most of the new usage on the demand-side added to the peak-load, so it makes the demand "peakier," and as we mentioned earlier, it means that in order to address that, we have to add more generation capacity, and also to increase the capacity of the grid itself, so, that's when you [Indiscernible][0:21:40] to keep in mind. In the future, you know the very important development which is the [Indiscernible][0:21:47] course and that has to be managed from a great point of view. So, to summarize this point, we have to keep in mind that traditional girds have not been designed to cope with these challenges and they have to be "smartened."

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So, as a summary of the challenges, here is a chart showing the evolution of network regulation objectives over time. So, it started in the 80's & 90's, with the idea to forecast some cost-efficiency and reduce the cost of using the grid for [Indiscernible][0:22:30], and then, over time, a number of additional objectives piled up, and actually address by both the good companies and the regulator from the regulation point of view, and uses reliability with power quality, with grid integrity, and security of supply, and sustainability, with the integration of renewables, and a newer requirement such as DSR demand slide response, energy efficiency, and in the future, most probably electricity course.

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So, we haven't yet explained too much what we mean by smart grids. Actually, it's quite complex and moving concept but [Indiscernible][0:23:25] to say, I think that it's a diverse portfolio of technologies. Some of them are still under development but an interesting point is that most of the so-called smart grid technologies are readable or not far from being mentioned technologies. But they had to be tested and because there are many technical and organizational configurations that are possible, and you have to test them with demonstration projects or [Indiscernible][0:23:58] projects, and it's not a blank page, so, we have to

keep in mind that the smart grid technologies will come as an additional layer with existing grid.

So, it's an increment with existing grid and we will see later [Indiscernible][0:24:14] cost. But in a nutshell, a smart grid is the result of the convergence between new information technologies and control technologies. So, it's not on new smart meters often people who thought [Indiscernible][0:24:33] smart grid and smart meters. So, smart meters for me is one element amongst many of the smart gird technologies, and also different from the super grids, and here we'll not talk actual about the super grid which is for me, the high-voltage transmission lines which is covered by DSOs.

So, on the next slide, we'll see that these smart grids technologies have cost. So, here I do heavily on study provision 2011 by the Electric Power Research Institute, an American-based institute which carried out the minor edge, the most comprehensive advance to evaluate smart grid investment cost and benefits. There is no insurance in Europe, so as I know. I think that the [Indiscernible][0:25:33] by the EPRI study [Indiscernible][0:25:37] for Europe. The size of the networks is roughly the [Indiscernible][0:25:44] in the US. I know that the issues are probably different, so the EU focuses more on the integration of renewables and [Indiscernible][0:25:59] electric industry where the US is more on fixing and aiding grid and peak management for [Indiscernible][0:26:07] and dynamic pricing. That's the main point.

On the next slide, you have picture or visualization of the main results of this EPRI study and it's quite interesting, so more than the absolute level of the smart grid cost. You have low case and high case scenario shown on the chart. I think what is more important here is the breakdown between the types of network or market segments. So, what is [Indiscernible][0:26:53] is that most of the cost will go to the DSO, so, the distribution of company or in other words, the local page segments of the grid.

Here, I should make the point that the cost it makes made by the EPRI, so the span over 20 years, but the only concern smart grid components. So, all the [Indiscernible][0:27:16] investments, the need to upgrade the transmission lines, et cetera or the substation is not included here, except if they are needed or considered as a smart grid component. But, I think I want to say here is that the cost is going primarily to the solution companies with an impact on the bills of residential and commercial customers, so, they will bear most of the cost whereas the industry should not be impacted in a significant --

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It’s a challenge to summarize in one slide that the main components of regulation models. So, here is a short typology of regulation models. So, this is important to understand because it’s an often-overruled issue but regulators and he is to deal with that in order to find the right balance between investment and spending. If again, DSOs are not incentivize in a current way, they will not invest and in particular not in smart grid technologies.

So, going back to the typology, one order way of regulating the networks if there’s so-called cost-based regulation, the cost-based regulation is basically designed in such a way that DSOs can recover 100% of OPEX and CAPEX; OPEX being operational expenditure and CAPEX capital expenditure. So, basically OPEX your everyday cost [Indiscernible][0:29:27] at the rest and CAPEX investment cost [Indiscernible] 0:29:34].

In general, the way it works is that you apply a guaranteed rate of return for the DSO and this is applied to the so-called RAB which is the regulatory asset-based, which is a way to define the boundaries or the scope of your investments base. So, basically, all the cost of past through to customer, so, there is no risk for the DSO, and that’s a way that regulators over time, I found to kept the profits because remember, you are dealing with a monopoly here, so, you are a way or another **to cap or to keep in shape** [Phonetic][0:30:16] the profits.

The next point is that this is quite a way to get profits, but it is not a good way to incentivize the companies to be efficient or to reunite OPEX or to be thrifty meaning that there are no limit from the CAPEX [Indiscernible][0:30:39]. So, it’s often described as **inflationary** [Phonetic][0:30:46] model. So, improvements competitive cost-based regulation is their capped regulation where regulators are subject to cap either prices or revenues for the DSOs and in order for the DSOs to be incentivized. The regulators apply minimum efficiency targets over the regulatory period, which is between three to five years. If the companies or the grid operator is more productive or more efficient over the stay than the target set a result of the regulatory period, then the profit can be retained. So, that’s the way companies are incentivized to become efficient and productive.

At the end of the period, the efficiency gains [Indiscernible][0:31:48] to customers, and then the process start again for a number of years for the regulatory period. So, this is a model which is incentivizing more of the companies to be efficient, but most of the time, the focus is on shortened efficiencies, so the minimization if CAPEX, and over time, experience has shown that companies tend to underinvest or start by -- not altogether but also it [Indiscernible][0:32:22] for lack of innovation. I want

[Indiscernible][0:32:27] the yardstick which is a model which is a refinement of the cap regulation, and we mentioned on which regulations.

So, in order to compensate because the model we described so far are financial models, in a way of financial regulation models, but the output regulation was implemented over time to make sure that technical targets or objectives were not forgotten. So, it's more and more often how to see incentive outputs regulation put in place by regulators to make sure that the quality of service for the security of supply is [Indiscernible][0:33:10] by the DSOs, and for that, the [Indiscernible][0:33:15] system or on this management if he wants.

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Maybe to highlight what's taking place or the main trend that we check in terms of regulation and so, most countries are moved, I'm talking about European countries here. So, most countries are moved away from the cost-based regulations or the cost-plus regulations if you want towards incentive-based schemes. In practice, there's the models that are in place today on mix of cost-based incentive and output regulation elements or [Indiscernible][0:34:00] what has happened in nut shell **complete simplification** [Phonetic][0:34:08] of the regulation models where the regulator refine over time the regulation model, and actually it is a very complex learning-by-doing process which can take years, and which is an endless process in a way.

I think what is important to notice is while most countries know the implemented and incentive model, cap regulation model, but is already showing signs of [Indiscernible][0:34:41] efficiency gains in the first years proven actually here and most countries but doesn't really mean to have how much efficiency you can add over the years. One other issue with the incentive-based regulation is that it doesn't really encourage investments. So, most of the countries in Europe, at least in Northern Europe, so with the other countries, Germany, the Netherland, the UK are working hard to rebalance the regulation model that we had in place away from pure cost efficiency towards more investment and innovation.

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So, we'll just go through a number of issues which are related to just the situation today and in fact [Indiscernible] 0:35:39] the incentive regulation system. So, actually because you have the regulatory period of three to five years otherwise same, you have time inconsistency issue which is due to the discrepancy between the CAPEX time horizon, so, when you invest in a heavy duty material or equipment, then you can recover your investment to over a number of years which is more often beyond or higher than the side year of the regulatory period.

So, probably it means that you have an upfront cost, and delayed, and sometimes uncertain revenues or so, which is important for smart grid. You have investments that are [Indiscernible][0:36:30] expose by the regulator. So, it means that grid operators are [Indiscernible][0:36:36] in general to choose equipment and solutions that are well understood and recognize by regulators which are hindrance in a way to renovate your smart grids solutions.

Another important fact is that, according to Eurelectric, which is the professional association of the main utilities and distribution companies in Europe, there's a very significant share of the DSOs of almost 3/4 on them that have the right meaning written on investment capital, which is lower than the WACC, the Weighted Average Cost of Capital. It means that they are basically destroying **shouldered** [Phonetic][0:37:22] value on investments.

So, it's not a good starting point. So, even with more less conventional types of investment, many of the DSOs are already showing value, and that can only be made worse if smart grid investments come while without the right regulation come to the [Indiscernible][0:37:47] because then, that would increase investment cost, and we'll make it even more difficult for DSOs to recover across good regulation from here. I was mentioning that the last point of this line that many European countries are now initiated a review of the network regulation; the UK being pioneer and leader in that [Indiscernible][0:38:11] called RIIO model, RIIO meaning Revenue Equals Incentive Innovation and Outputs model.

So, it's a state of the art regulation model, which is very complex so, we have to see over time if it really delivers and prove valuable. There's work in progress in Germany, the Netherlands, Italy, and the Nordic countries. I do know that the process is always slow in France and a bit more cumbersome. But France has [Indiscernible][0:38:48] to implement some incentive elements in the regulation of the DSO companies.

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So, maybe now to mention what could be the [Indiscernible][0:39:09] tools or the key factors of success for good regulation that would be favorable to smart grids, I think, in the first place, what is very important is to ensure regulatory stability and clarity, so over time, regulators have to build a reputation, and a bit like central banks if you want. Regulatory risk is a very strong deterrent to capital-intensive investment, which is the type of investments where you were dealing with when we talk about smart grids.

Sometimes, you have to be careful about how complex the benchmarking techniques are because that can make [Indiscernible][0:39:52] for DSO is

very complex and [Indiscernible][0:39:56] and sometimes, there are even legal technicalities that could present experimentation, and that has happened actually in Europe where some EU funded projects were actually proved illegal for technicalities again, so, for that has to be legal. Another way to make sure that smart grid investments take place is to provide the DSOs with incentives to invest, and that it starts with; first, the ability for the DSOs to recognize as part of their regulatory asset based those new investments against the idea would be to go against the point we've mentioned earlier, which is investment of conservativeness.

Another way, which is favorable to DSOs, is to extend the regulatory period, and that is upon regularity, for example whether the regulatory period has been exempted from five to eight years stopping in 2015. The very pragmatic way of incentivizing investment in smart grid is what second placing initially where the regulators as authorized DSOs to get higher rate of return on specific smart grid investments. So, if I'm correct, the WACC of the DSOs if it was [Indiscernible][ 0:41:32] then we are allowed to add 2% point on top of their WACC to recover from investments, so, making investments as a result more interesting.

Then, you have whole range of output regulation which can directly or indirectly incentivize smart grid investments. You have quality regulation. One of the issues with the current regulation is that very often, you have the revenues of the DSO which is dependent on the volumes transported or sold through their network, meaning [Indiscernible][0:42:10] transported and distributed. Today, with the lower growth or sometimes fall in the demand for electricity in some European countries, also with the old energy efficiency policy, you're starting to observe a volume-risk for DSOs in Europe, and the idea here would be to [Indiscernible][0:42:32] revenues from volumes.

Then, you have [Indiscernible][0:42:38] KPIs or Key Performance Index. You can incentivize the DSO again to connect more distributed generation, to lower the level of process, to add more dynamic pricing schemes, et cetera. One important point, maybe to finish with this line is the fact that the regulation should remain [Indiscernible][0:43:07] possible "technology neutral." The regulator never tried to pick up winners or winning technologies, and I think that's especially very important when it comes to smart grids because they're not very complex technologies.

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So, I will finish my part with just mentioning the specific case of research and developments. We've mentioned so far investments, so, even if there are innovative smart grid investment, as also a case for increasing the experimentation with smart grids and to do more demonstration projects

and large-scale projects. The issue is to finance those R&D projects and **demos** [Phonetic][0:43:57] .

If I can observe that in the past and not only in the electricity but also the [Indiscernible][0:44:04] industry and other related businesses that incentive or with the regulation and [Indiscernible][0:44:08] and to be followed by a drop in [Indiscernible][0:44:13] by the payers in the market, and it's also clear now that the incentive regulation alone is not sufficient to generate enough R&D standing. So, regulators are to find in Europe that I'm working on that at the moment.

They have to find a way to incentivize again DSOs to address in more innovative projects, and to allow the deployments of smart grid technologies. So, I won't get into the [Indiscernible][0:44:45] those, so as to say that, for example in the UK and Italy, again some of the most advance countries in terms of deregulation. They have funded specific R&D projects either from [Indiscernible][0:45:02] and they sometimes allow some of the companies to recover through network tariffs, some of that cost R&D and smart grid investments. So, that's it for me while **we pass the flow to** [Phonetic][0:45:21] Bruno.

Vickie Healey: Nicholas, Thank you so much for that information and yes as he just mentioned will be our next presenter is Bruno Lapillone who as I mentioned earlier the co-founder and Vice President, Enerdata. So, Bruno, welcome.

Bruno Lapillone: Thank you very much. So, as Nicholas mentioned, it is agreed to be smartened and smart meter than any important component although in the chain probably now the most expensive component with the more complex one. Smart meter will be useful to act from demand to adapt the supply to demand, and usually this technology, this practice is called demand response, DR in short. So, demand response basically aims that lowering the electricity load curve at perfect time smooth change in the electricity use pattern of finer consumers either through price signals or incentive payments.

We'll explain it on the next slide what is it about. Also, demand response can be done through direct information sent to the customers as a communication tool just in case of emergency to ask them to lower the load. It's the simplest way to do demand response. So, in short, demand response aims at making the demand more elastic. It's usually considered for electricity for most of the examples and the reference to deal with electricity but it can also be applied to gas or **why not** [Phonetic][0:46:58] for distributing. Demand response, we'll have three main effects on the demand.

The first one in the center of the slide is to reduce the peak load and basic ideas so, you [Indiscernible][0:47:13]. Another way to shift load to avoid everybody consumer to save time is to move some consumption or related time or to advance it. So, these two types of demand response, we're not really saying that these will just move the consumption at another time. But it serve as said [Indiscernible][0:47:37] demand response is something that is also being favored by regulators usually to save electricity, so, not only on this time but at a more long lasting effect on demand.

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The next slide explains how smart meters are positioned in the smart grid simplified compared to the real scheme that was shown in a real slide. The smart meters are the tools by which the smart grids send signals or information to consumers, and also the grid will share information from consumers. But smart meters can be seen in a broader view as a way to provide information to consumer on their behaviors through this approach and this can lead to energy saving by providing information on our energy use in the household, and which is a broader meaning of smart meters that is sometimes considered. In that case, additional smart [Indiscernible][0:48:43] in addition to the smart meters.

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Next slide presents a variety of the demand response product and is proposed by utility. This is a very typical classification. This one is based on [Indiscernible][0:49:02] project and reports. Basically, I'm not going to read everything. We just point out the most important issue. There are two types of demand response; demand response that are based on price signal which is a more conventional approach and another one that is incentive-based. In case it is price-based, it is the tariff that will give signal to the consumer to adapt the consumption so the simple one will be the time of use raised tariff which will have block of tariff standing on block of time, these are being practiced for many countries for some time but it depends on the number of blocks that you add.

It can grew up to real time pricing which will be more sophisticated and will adapt the price according to the real cost of the wholesale price market. Then, if we look at the incentive-based demand response, again, there will be two approaches; one approach will be to provide lower price for consumers that accept to disconnect part of the load to renew the load at big time. It is the emergency demand response for in the sense of the interruptible approach or the approach will be to give some kind of credits or payments to the consumers in exchange for shifting the load or reducing its load.

With the case of the so-called auxiliary service market program, the direct load control and the demand bidding, and there is another aspect also that you can [Indiscernible][0:50:46] is the gap at the market program where the consumers can access supply over electricity of the grid and supply the electricity sale, and will bid on the market in the same way that the producer will bid for capacity. The direct load control is one aspect that consumer may not be favorable with in that case smart meter will be used to modify the load and the consumer [Indiscernible][0:51:20] and review remote control by the company [Indiscernible][0:51:24] towards smart meters.

*Next slide please.*

The next slide tell the different type of insight of the various scheme of demand response in terms of energy savings, load shifting, peak clipping, [Indiscernible][0:51:51] explained on the first slide. It's not all black and white when we spent on energy saving, it means [Indiscernible][0:52:02] energy saving but also, there will be a sudden big sharing as well. Also, this slide show the different target audience for the different approach, so, for instance, the direct load control where the utility can control the demand on the consumer [Indiscernible][0:52:21] residential and small consumers whereas the capacity market program or interruptible tariff [Indiscernible][0:52:28] for a lot of consumers.

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So, what is the regulatory framework for demand response and the smart meter which is very communicably considered together? Until now, the energy-incentive quality has been promoting the decision of efficient equipment, efficient condition [Indiscernible][0:52:57] to review the load and the consumption. Now, the regulatory framework is aiming at transforming the consumer behavior, and to make them active consumers, so, to go from passive customers to responding customer. This means a change for the utilities, but again, it's not black and white, it would be more concept where utility will have to take in [Indiscernible][0:53:28] the efficiency business model compared to a volume-based model where they try to sell the maximum energy to the consumers.

Many countries and increasing number of countries are implementing demand response program and the smart meter roll-out program. Smart meter roll-out program means that they are deploying smart meter all over the country or state in large countries. Interestingly, and this is amazing, one of the most interesting regulatory initiative at EU level, there is a new directive called the energy efficiency directive adopted as of recently in October 2012 that aim at changing the market in that direction. First of all, it mandates the installation of smart meters for new connection and needs the replacement, and suggest that the smart meter be installed everywhere

in all EU countries, and that the condition, it is cost effective [Indiscernible][0:54:28] while the needs to avoid [Indiscernible][0:54:36] would cost a lot for utilities, but it is a good direction.

What you can see at the second point that it just would be minimum functionality of smart meters in terms of providing information for the consumers, so, smart meters should be seen as meters and any products the utility to read meters or to send [Indiscernible][0:55:00] to consumers. This should have some functionalities aiming at energy efficiency, and other aspects in this new level if the obligation for free & informative billing to all consumers by 2015 in all EU countries, and if we access to metering & billing data which we then able to propose a new service and products.

*Next slide please.*

So, I will give some example of smart meter roll-out. Italy and Sweden are probably the most advance countries in the sense that most of the consumers now are equipped with smart meters would be the [Indiscernible][0:55:46] smart and somebody would expect that we had some kind of smart meter. There are some provinces in Canada that also deploy the smart meter, British Colombia, and Ontario. Ontario started as early as 2010, in Australia, in the USA as well, then, there is a full roll-out of smart meter that is more received in UK and France between 2014 and 2019.

Korea is the first emerging country [Indiscernible][0:56:28] country but Korea also has a very ambitious goal to equipped 60% of the consumers and also consumers by 2016 with smart meters, but also in countries where smart is [Indiscernible][0:56:46] opposition and the opposition you link for this year utilities and other people having access to information with deep rather concept, and in the Netherlands, in California there is a strong opposition by some parties to the roll-out of smart meter. In the US, finally, not on the slide but the decision of smart meter is progressing well in studies from professionals sold in 2006, now is about 1/3 of [Indiscernible][0:57:21] smart meters, and it is planned that half of American also got the smart meter by 2016.

*Next slide please.*

Who pays for and who is doing which? Well, smart meters are installed by utilities by distribution companies as we've discussed earlier. The utility will pay for the cost of the installation but [Indiscernible][0:57:55] it could be reflected in the bills that the consumer will pay either it will be charge by the distribution utility or maybe at least it's some kind of a charge in the various stocks that the consumer have to pay for in the electricity bill.

Smart meter for the moment are not fully viewed as energy efficiency especially to like to add relay tools to promote energy efficiency.

There are many uses as paying for demand response tools like to implementing time of use, pricing, automatic billing, [Indiscernible][0:58:43] in countries that started the deployment, but we can expect that in the new countries that will [Indiscernible][0:58:49] government because of deregulation of the European commission, there will be strong pressure to use smart meter in the more comprehensive way, and to really enable the customers to control their energy use.

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Most of the conclusion actually applies to the part as presented by Nicholas. Smart grid technologies are really reliable but the development of functional smart grid is far from being straightforward more research and development and lots of skill demonstration [Indiscernible][0:59:29] to experiment the complexity of the system being the play between technology, regulation, business model, pricing, and consumer behavior. The key issue will be who will pay and how to share the current benefits and risks across all the stakeholders. There is a need to develop with national and the international technical standards, and one of the risks can be opportunity.

First of all, in the context that's used in European countries [Indiscernible][1:00:09] for emerging countries but the impact of economic crisis may have an impact on the deployment of smart grids by lowering the capacity of DSO to invest in the smart meters to pay for the cost. Also, there is a competition with renewable. Consumers are already paying a lot in some European countries to support the vast deployment of renewables for this increased the appeal and deploying smart grids means to increase the bill of consumers so there is a question of rebalancing the subsidies of renewables to smart grid development or balancing more risk.

The issue of cost-benefit that I mentioned for smart meters so far, the regulatory board can impose the deployment of smart meters and the big impact for smart meters depending on how they will cost. Of course, the most sophisticated they are, the more they are satisfactory. So, there is a national cost-benefit analysis that the European company's analysis that is being on the EU level and that will be published by the middle of the year that should give some more information about the issue concerning smart meter.

With respect to smart grids regulation, it's not only for technology, there is still a need for more research and the final statement smart meter and demand response are important components of the complex system of

smart grids. So we thank you for your attention and we are ready to answer the questions.

Vickie Healey: Great. Thank you Bruno and Nicholas, both, for this outstanding presentation. It's been very informative both from a technological viewpoint as well as regulations and quality of content, so we thank you very much.

We have had some really good questions coming from the audience. So we'll use most of the remaining time for our question and answer session, and so, just to get started, our first came in and the question is "Why will residential and commercial customers bear the burden and most of the smart grid cost rather than the industrial customers?"

Nicolas Brizard: Yes, I'm not sure I got all the question [Indiscernible][1:02:55]. I think it relates to the EPRI study. So, we'll divide the person who had the question if that person wants more details about the methodology to go to the EPRI study, which is available from the website as far as I know. But we'll try to answer from the questions about "Why is it that most of the cost will be burdened by residential and commercial users, as opposed to industrials?"

Vickie Healey: Correct.

Nicolas Brizard: [Indiscernible][1:03:33] because we would have to check the EPRI and methodology but for me purely because most of the -- well, at least some countries, not being the case for all countries, for example you take Germany, the industry [Indiscernible][01:03:55] tend to be, particularly from tariff increases and maybe network tariff leads to network tariff increases, also the fact that -- as I was saying, most of the investments would have to be carried out at the level of the [Indiscernible][01:04:14] so as a key -- because in general, the transmission system is considered to be smart enough as of today. The cost of smart grid falls on to distribution grids which means that the people or the type of customers that are connected to this is more residential and commercial as opposed to industrial in a neutral [Indiscernible][01:04:45].

Vickie Healey: Okay and you said that --

Bruno Lapillonne: I guess the question --

Vickie Healey: I'm sorry. Go ahead. I'm sorry.

Bruno Lapillonne: I got a question about, "What is the rationale of the recovering smart meters cost from the customers?" Well I think this was well explained by Nicholas about the way the cost of distribution is calculated. In distribution company, the invested smart meters can represent quite a large investment, 4 Million during the case of France, how much is the -- I had €4,000,000 to €7,000,000. So in this calculation of the cost, this will

basically to counting in this topic. So we'll have to recover the cost and it will have to be based from the revenue and the revenue is coming from the sales to customers. So, there is no way to avoid this because at the end it's the customers will pay for it.

Nicolas Brizard: It's a good question because it's actually the cost. What happened was that --

Bruno Lapillonne: That was a difficult decision to work out the smart meters to some extent even before designing on the financial detention rates or the financing of the sort outs would be covered. So at the end of the day, there was a negotiation between the distribution company and the regulator and the state, so they came to deal the following agreements. So, that would be, in theory, no cost for the end-consumer, but the distribution company will get its money back from saving on meter reading, which will become automated, and the owner fees on the meter will go back to the distribution company at the end of a period of few years, so far the figure in mind.

But, it has as I recall from creative thinking and negotiation, but France is not probably a good example in terms of best practice when it comes to regulation, I think.

Nicolas Brizard: Oh another -- you need, if you want a sustainable business for DSOs, you have to allow them one way or another to cover the cost.

Bruno Lapillonne: It's part of the cost.

Nicolas Brizard: If it's not the cost we covered for Paris or then it has to come from the segregate [Indiscernible][01:07:25] that could happen in some developing countries if they want the end-customer not to be supporting at any cost, but the money will have to come from somewhere else, or if money goes to the smart grids, then they would have to save on other investments which might be counterproductive.

Vickie Healey: Okay, great. Thank you both. That was a very thorough answer to a good question. Our next question is, first of all, the requester is stating that they are very appreciative of the explanation of the regulation model and the question that is coming out of that is, "What is the difference between rate of return and cost-plus?"

Bruno Lapillonne: For me, the way I understand it cost-plus price [Indiscernible][01:08:27] OPEX to operate with no expenditure, and then in a cost-based model, cost-plus is a way to allow the distributor to recover its operational expenditure, and you apply to target the market, so it's really costless, the market, meaning the money and the rate of return applies primarily to -- it's a rate which is applied during the regular tariff [Indiscernible][01:08:57] with smart grid investments or CAPEX [Indiscernible][01:09:00] question.

I see one question about the how can demand response [Indiscernible][01:09:17] through right signal. I've collected some studies that I could share some assessments mainly regarding the US to the impact of demand response program on really energy saving not on big saving but this an issue that we would like to investigate more and you can say that saving between 5% to 10% will be evaluated from exposed to link to demand response or smart meter [Indiscernible][01:09:55].

Vickie Healey: Okay, terrific. How do you feel legal technicality is threatening demand response programs like direct load control or in technological innovation can be -- it's got old basically by legal views of privacy rights and freedom to operate consumers devices at utilities volition?

Bruno Lapillonne: Very interesting question. To answer that, maybe I would take the example of -- well I think because if you want to allow direct load comfort, it's a very imperative technology and you need a lot of information, so from the point of view of the customer, there has to be values somewhere and well for somebody, what a good life [Indiscernible][01:11:07] because I'm not necessarily passionated by my [Indiscernible][01:11:10]. I think what most customers want is a so-called set and forget system while you have to set beforehand to commit with the contract.

How the company or the creator will use your load capacity to aggregate it to evaluate in the capacity market for instance. So, I think that the questions are more about contractual issues and it has to be experimented because I'm not certain that many titles or experiences, how they have been tried. I don't think we have a clear picture yet of old issues that are related to that.

Another example which is -- sorry for taking that reference which is [Indiscernible][1:12:10] begin -- there was a company, **Voltaris** [Phonetic][01:12:17], I think that was **Voltaris** and they were able to aggregate to direct load control some customers in the technicalities [Indiscernible][01:12:30] but anyway, they were able to aggregate on the deeper side of the some load and evaluate in the market but they have to fight against the regulator and **EDS** [Phonetic][01:12:47] to have the right to continue with the business load.

So, this is still being discussed at the moment, because some companies feel threatened by this type of new operators and try to react because the basic thing that this is [Indiscernible][01:13:03] some of the business and that they might end up with non-working power generators on their end. So, this is happening whole lot of each year and I think it will settle over time but it will take time, and that's for sure.

Vickie Healey: Okay --

Bruno Lapillonne: Another question?

Vickie Healey: Yes. Okay, here's a good one from one of our audiences in this. Do you feel that emerging countries such as India, where there are massive power outages and blackouts have not yet started on regulatory measure to roll-out smart grids, well, at the same time, China is surging forward whereas India on smart grid regulatory measure?

Bruno Lapillonne: If we cite the cost of the smart meter or [Indiscernible][01:14:12] the consumer in India, in the country where you have these power outage which are linked to be free in demand. This is good also to be in demand, other way we're using the outage. The issue is who will pay? So, it may be useful for a lot of consumers to deploy some kind of demand response approach or starting by eliciting these to the consumers.

Nicolas Brizard: The only point is that the presentation we made today was focused on Europe where you have a market configuration where the DSOs are stand-alone entities. I'm sorry I'm not familiar with the structure of the electricity distribution business in India, but if you have some [Indiscernible][01:15:16] integrated businesses that is probably easier to deal with investments, but then it will be their decision to allow or to decide between high-risk small grids or other priorities so that will be one, maybe a natural form for me.

Vickie Healey: Okay, thank you. The next question goes back to the topic of what's happening in France and it's really two parts, the first part being "To what extent is the slower progress on regulatory review in France a consequence of the heavy reliance on nuclear generation, large scale generation, preponderance and massive stock cost?" and then the second part is actually quite a bit different, "How large an impact do you see coming from battery-electric vehicles, do those post a potential for transformative change that would challenge smart grid planning and technology neutrality?"

Bruno Lapillonne: No, sort of progress. Well I think probably not. Well, there might be relation that can direct only to the structure of the French electricity system but, I think to make a general answer, I think in France, the state and different companies for a very long time [Indiscernible][01:17:07] when it came to [Indiscernible][01:17:08] marketable recession not to mention privatization but I think it is specific to France compared to other countries because in some countries, should I mention the UK, maybe not in other related industry, privatization and liberalization was seen as a way to fix the services, rather in France it was always considered that the increase in the supply industry was recently good shape and doing their jobs and very few people [Indiscernible][01:17:43] so, I think that will be the answer for this first part of the question.

The second part is how large in impact do you see coming from the battery electric vehicles? Well, [Indiscernible][01:18:08] for the impact, I think that was clear from the presentation, it's potentially huge, so, when I said that this should not be left unmanaged, it has to be -- even if you don't use the batteries, since it is stored in the system, the very least you have to manage the time when the batteries are recharged.

You have to allow all users to charge their -- to allow the batteries to be recharged, I think at the same, so you have to manage that and or either the DSOs will be in charge of that. So, potentially, a very large and deep impact on the grid. So it could be depending on how it's managed, it could be either blessing or curse, and these are some careful consideration, and I will not discuss the direct keyword of how they know a lot of evil on the roads in a short time because that appears in other topic. I think that [Indiscernible][01:19:22] is still right timing without aggregating.

Vickie Healey: Okay, thank you. We have so many questions that are coming on this topic, but being mindful of the time, I think we have time for one more question and then perhaps, Bruno and Nicholas, I could send you a few of the remaining questions that could be answered via an email perhaps, if that's okay with you?

Bruno Lapillonne and Nicholas Brizard: We'll do our best.

Vickie Healey: Okay, thank you. So, this next and last question is, first of all, we received a nice thank you for the presentation, but the question is "What lessons learned and/or best practices could you share for developing countries about the main risk or areas of special attention that was faced in Europe in terms of regulatory issues for smart grids?" So, I guess basically just asking for a few again, lessons learned and best practices experienced in European case study?

Bruno Lapillonne: That's a very interesting question. We haven't worked on this using this angle or from this angle but I hope it's clear from the presentation that in Europe or between the US and probably Latin-American countries and some Asian countries, that in order to have these programs, you have to have financial regulatory framework or market. So, if you have [Indiscernible][01:21:14] integrated business and probably less problematic, so, it's all internal for the companies so then it [Indiscernible][01:21:24] so the primary right when you have non-bundle transmission or disconnection network, then you have to -- because the scope of the business is only related to the grid and then you have to sign, or to revise, or design a business model which makes the deal so viable and able to invest in the right technologies, and now, I think for countries that have started to unbundle and to go down [Indiscernible][01:22:07] then it depends on the maturity of the regulatory and government's system in place.

Even in Europe, France is [Indiscernible][01:21:14] the most advanced countries in the respect of regulation because of the start from the market. So again, it's a very long and [Indiscernible][01:21:14] process to design the right regulatory framework, not only for smart grids, but in terms of investments and companies. I think the only advice to [Indiscernible][01:21:49] great variety of situation in the developing world, but I think it has to be very cautious causes, and it has to be shared and discussed with all stockholders what you have in the -- for example what [Indiscernible][01:23:08] all stockholders were involved, and they have very detailed consultations where the models are **patrolled** [Phonetic][1:23:20] and discussed by all parties and the builders of consensus.

So one way or another, you have to use the strategies which we [Indiscernible][01:23:32] consultation, cost of building and very pragmatic determination. Don't to be too complex to start within for sure. You can increase the complexity over time when you already mastered well the basics, and then you can refine the model as much as you want but [Indiscernible][01:23:59].

Vickie Healey: Alright --

Bruno Lapillonne: You know, I can have that all countries can learn from the most of the other countries even within the [Indiscernible][01:24:09] some countries. Sometimes we learn from more advanced countries and in the same way, some emerging countries can learn from some [Indiscernible][01:24:20] that are more advanced and progressed in that direction.

I participated in the seminar in Latin-America, and I was surprised by the degree of maturity in several countries in the field of [Indiscernible][01:24:33] which is they are taken for granted and discuss it in the same way as we discussed it in Europe. So, the technology is not an issue. Cheap technology will come from China and the usual country so as Nicholas said, it's a matter of regulatory framework. At least in Latin America, it's quite advanced but also in several Asian countries as well, so it could work everywhere.

Vickie Healey: Okay --

Bruno Lapillonne: Maybe just a final word I have to admit an answer to the question but we included in the annex a short bibliography that we used during the project, and there are few terrific studies out there which are already available from the website of the various institutes or research centers and that's worth of information by [Indiscernible][01:25:37] out there, so, I invite some of the attendees if you want to [Indiscernible][01:25:43] further this topic to check the bibliography.

Vickie Healey: Okay, great. Thank you. Thank you both. So Bruno and Nicholas, with that, I just really want to thank you so much for the outstanding presentation. We've had some great questions --

Bruno Lapillonne: You're welcome --

Vickie Healey: -- and many more have comments and we've been able to respond to, so, I will try to get some of these questions to you to answer when your time is available, and thank you so much. Before we move on to the evaluation part, I just wanted to offer both Bruno and Nicholas the opportunity to add any additional comments or closing remarks you'd like to make.

Nicholas Brizard: Not very, except to thank all the attendees from all over the world for attending in the presentation and asking interesting questions.

Bruno Lapillonne: Yes, I would like to thank [Indiscernible][01:26:46] for the initiative of this webinar, I think that's quite interesting, from the questions we have received. So, we are pleased to answer most of them.

Vickie Healey: Terrific and yes we've --

Bruno Lapillonne: Thank you.

Vickie Healey: -- received many compliments. Thank you. We've received many compliments about the webinar content, so thank you so much.

Unknown Female Speaker: We'll start.

Vickie Healey: That's okay. So again, back to the audience before we close today's webinar we like to just post three really quick questions to obtain your feedback and this evaluation questions are very important to us and that allows our audience, you, to inform us on what we're doing right, and also areas where we might be able to improve.

So we'll allow you a few seconds to consider and answer each of these questions thoughtfully --Oh, there you go -- Thank you Heather for putting up the first question for our audience which is "Was the webinar content provided to you was useful information and insight and I'll give you a few seconds to respond to that by putting on one of the radio buttons next to the answers.

Okay, I thank you so with that, we will close the first polling question and move on to the second one and the question "Is the webinar's presenters were effective?"

Thank you and now we will move to the third and final question, which is overall the webinar met my expectations.

With that, we will close the third polling question, and move on to the next and final slide. So, real quickly, again, this is Vickie Healey at [Indiscernible][01:29:31] and on behalf of the Clean Energy Solutions Center, I'd really like to extend a very hearty thank you to Bruno and Nicholas and also to our attendees for participating in today's webinar. We had a terrific audience and we very much appreciate your time. I invite you all to check the Solutions Center website over the next few weeks. If you would like to go back, and again view the slides and also listen to our recording, an audio recording, of today's presentation, as well as perhaps review some previously held webinars.

Additionally, you'll find information on upcoming webinars and other training events and we again invite you to inform your colleagues and those in your networks about the Clean Energy Solutions Center Resources and Services including the No-Cost Policy Assistance Support that I mentioned earlier. So with that, I wish you all a great rest of your day and we hope to see you again at future Clean Energy Solutions Center event. This concludes our webinar.