Smart Grid and Clean Energy for Local Governments

Webcast Transcript

April 29, 2010

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Webcast Agenda and Meeting Logistics

Slide 1: Introduction Slide

Operator: Good afternoon. My name is Salima, and I will be your conference operator today. At this time, I would like to welcome everyone to the Smart Grid and Clean Energy for Local Governments' conference call.

All lines have been placed on mute to prevent any background noise. If you should need assistance during the call, please press star then 0 and an operator will come back on the line to assist you. Thank you.

Miss Zinsmeister, you may begin your conference.

Slide 2: Title Slide

Emma Zinsmeister: Thank you. And thanks, everyone, for joining us today for the next installment of EPA's Local Climate and Energy Program's webcast series. Today's topic is going to be Smart Grid and Clean Energy for Local Governments.

My name is Emma Zinsmeister. I work here at the Local Climate and Energy Program with my colleagues, Neelam Patel and Andrea Denny.

Today's call is going to provide an introduction to Smart Grid and its potential for energy efficiency, increasing renewable energies, and potentials for greenhouse gas reduction that local governments may be able to take advantage of in their communities.

And you'll hear about what composes a Smart Grid, challenges and considerations for implementing Smart Grid technologies, and how these technologies are being deployed in communities across the country.

Slide 3: Webcast Agenda

Emma Zinsmeister: So our agenda for today will be – I will give a short introduction to our program here at EPA. And then I'll turn it over to Stacy Angel, also from EPA, who will talk about the implications and opportunities for clean energy and greenhouse gas emissions reductions from Smart Grid.

Dan Ton from DOE will share about Smart Grid activities on behalf of the U.S. Department of Energy and some of their Smart Grid implementation grants and what's going on with those activities.

And then we'll hear from two communities who have some experience with deploying Smart Grid in their communities. We have Brewster McCracken from the Pecan Street Project in Austin, Texas. And we have Kara Mertz from the City of Boulder, which is implementing the

Smart Grid City project in partnership with Xcel Energy. And we'll go through some questions at the end.

And I'm going to turn it over to Nikhil from ICF right now to run over some logistics of how as a participant we can interact with the GoToMeeting software for the duration of the webcast. Nikhil?

Slide 4: GoTo Webinar Software Logistics

Nikhil Nadkarni: Sure. Just a couple of quick logistics here. You will be muted throughout the webcast. In terms of asking questions, we'll get to that in a minute. But you'll be able to send them in, in writing, and we'll be asking them at the end of the webcast.

Today's session will be recorded and will be available for download in a few weeks at the link shown on your screen as well as you know related materials will be posted there. And if you have any logistical issues during the webcast, please feel free to email me at NNadkarni@icfi.com. Next slide, please.

Slide 5: Questions (GoTo Meeting)

Nikhil Nadkarni: So if you have a question, just use the pane labeled "questions" on your right – on the right side of your screen there. Type it in, hit send. Please be sure to include the name of the presenter that you would like to answer the question. You know, for example, a question for Emma, just type in "Emma" and then your question, so we know how to direct your question, and we'll be collecting all of them and asking them at the end.

Slide 6: Optional Feedback (GoTo Meeting)

At the end of the webcast, once it’s over, this window that will pop up with a couple of questions, please take a minute to provide your feedback as well – we'd find it most helpful, and that should do it for logistics.

Emma Zinsmeister: All right. Thank you, Nikhil.

Introduction to EPA's Local Climate and Energy Program

Slide 7: Local Climate and Energy Program

Emma Zinsmeister: Just broader introduction to the Local Climate and Energy Program here at EPA, what we offer is an informational and peer exchange network for local governments to help advance your climate change and clean energy goals while at the same time pursuing you know the priorities that are important for your community.

And we focus on cost effective established best practices emphasizing energy efficiency and serve to provide a gateway for interested local governments to EPA and its resources and other partnership programs.

We offer a suite of tools and resources and guidance and also help to share success stories between communities through peer-to-peer exchange and networking.

Slide 8: Climate and Energy Program Goals

Emma Zinsmeister: Both of our programs are essentially to help assist you with reducing greenhouse gas emissions while achieving your sustainability goals and to understand and integrate the potential for maximum multiple benefits as you have varying priorities across your communities and your constituents from energy savings, cost savings, public health, variety of benefits that are possible to integrate with your energy efficiency and climate change program.

Slide 9: EPA Local Climate and Energy Program Approach

Emma Zinsmeister: And to go along with that, we work within a multiple benefits framework to help demonstrate how your action and how the policies at your level can help achieve variety of goals, and we provide tools and resources to help you quantify some of these benefits to help gain buy-in from your local elected officials, your communities, and to advance your program.

Slide 10: Local Climate and Energy Program Resources

Emma Zinsmeister: This just shows sort of the variety of resources that we offer within our program. And I'll run through several of these. The slides contain lots of links so you can get to our new website and other tools. You can check these things out in more detail, and we encourage you to do so.

Slide 11: State and Local Climate and Energy Website – Released on February 16

Emma Zinsmeister: Most recently in February, we released a brand new website designed to help provide sort of a one-stop-shop for local governments in getting access to information about resources at EPA, for developing, implementing and evaluating climate change clean energy program, all kinds of informational resources, how to – information on developing action plans,

inventories along with maps showing where different locations of communities have done some of these efforts already.

Slide 12: Webcasts and Training

Emma Zinsmeister: We also include a calendar of upcoming events, webcasts of our own or from other programs and also podcasts and video recordings of the webcasts that we have offered. And this call today is part of our regular webcast training series.

You'll see here that we have some future topics coming up, green roofs, transportation control measures, heat island reduction are all topics we're going to be covering in the near future. And we will be sending out more information about those dates in the near future. And there's information later in the slide about how to join our Listserv if you're not already on it to get those updates.

Also, some additional links here to other programs at EPA that may be helpful in providing resources such as the ENERGY Star Program, our State Climate and Energy Technical Forum, webcast from DOE and other information on EPA programs.

Slide 13: Local Climate and Energy Webcasts Widget & iTunes Channel

Emma Zinsmeister: As part of our new website launch, we've created two new tools to help you stay informed about what we have for resources, and these are kind of exciting new media things. We have a webcast widget, which you can actually add to your own website. You'll see at the right of the screen the image there. You can actually take the code from our website, add it to yours and this image will pop up. And each time that we update it with new information about the upcoming webcast, that information will automatically be updated on your site as well, so you can always get the latest information about what calls we have coming in the near future.

And also, we have set up an iTunes channel that you can automatically receive recordings of our podcast from the webcasts as we post them up so you can – you can get this information and actually you know listen to it in an iPod or other MP3 player. And there's plenty of information on the website there to explain how you can do that.

Slide 14: EPA ARRA Resources for Energy Efficiency and Renewable Energy Projects

Emma Zinsmeister: And we have a number of resources that we've made available to help support Stimulus efforts with funding through the American Recovery and Reinvestment Act or are doing projects that could be – could be supported by EPA resources.

You'll see here that we have a site that links to many of these things that I've listed here, a few documents that demonstrate how EPA's program and resources can help support your Clean Energy/Energy Efficiency Program along with some toolkits and other webcasts.

Slide 15: Resource Giude: State & Local Guide to U.S. EPA Climate and Energy Program Resources

Emma Zinsmeister: Some more detailed information about what these documents contain and here, you can see how we broken it out into what programs at EPA can actually help to support which types of programs, in case you're looking for resources.

Slide 16: Climate Showcase Communities Grant

Emma Zinsmeister: We have here also a Climate Showcase Communities grant program. Back in February, we announced the first 20 grants from this program. It's designed to help showcase documentable and replicable greenhouse gas emissions reductions in communities to help build capacity for climate change actions as well as develop lessons learned for other communities.

And, actually, as I'll mention in a moment, a couple of communities from our first round of grants that implemented or will be implementing some Smart Grid technologies as part of their projects.

Slide 17: Climate Showcase Grant Framework

Emma Zinsmeister: And, overall, the program is designed to help demonstrate integrated and sustainable community approaches for achieving lasting greenhouse gas reductions while also achieving other co-benefits; other environmental quality improvements, environmental justice, job creation, and also to help build networks and peer exchange, which will be opening up to other communities outside our grantees to help facilitate the sharing of lessons learned.

Slide 18: Climate Showcase Communities & Smart Grid

Emma Zinsmeister: And as I mentioned, there are two grantees that do have some Smart Grid components to their projects. The West Chester, Pennsylvania area school district is actually going to be installing some building dashboards and 600 schools to help monitor energy and resource use as part of its efforts to improve energy efficiency.

And in Honolulu, Hawaii, the Department of Community Services is going to be working on energy efficiency in retrofits in marginalized communities, also installing some real-time energy monitors as part of that effort.

So we will have, hopefully, in the future, some more insight and lessons learned to share about these technologies from these grantees as they've got – as they develop results and track their progress.

Slide 19: Local Climate and Energy Strategy Guides

Emma Zinsmeister: Lastly, one of our major resources is a series of local climate and energy strategy guides that helps provide information on designing, implementing, evaluating climate change mitigation programs through a variety of strategies that can be integrated into a comprehensive approach.

We cover energy efficiency, renewable energy, transportation, community planning and design. And we will, in the future, be developing some guidance on solid waste and material management. So those are available at the Web link below on our website and you can check those out. We'll be issuing new ones on the Web as they're developed.

Slide 20: EPA Partnership and Technical Support for Locals

Emma Zinsmeister: And as I mentioned before, we strive to provide a gateway to other EPA resources and the technical expertise that these programs have to offer. So these are variety of other EPA programs that may be of interest and have resources you can use. And you can get to the many of these through our website.

Slide 21: Smart Grid Background Document

Emma Zinsmeister: And, lastly, in the email you received prior to the webcast, we attached a Smart Grid background document that's intended to serve as a concise primer on Smart Grid for local governments and kind of summarize them to the point that we'll be covering today in the webcast such as what is a Smart Grid and how does that relate for local governments in your Clean Energy goal.

Slide 22: Local Climate and Energy Contacts

Emma Zinsmeister: So that's it for our program. Here's some contact information if you'd like to reach me or my colleagues, and our main Web address and our state and local Listserv that I mentioned that you can stay up-to-date on our program and resources. I'm going to turn it over to Stacy Angel.

Smart Grid: Implications and Opportunities for Clean Energy and Greenhouse Gas Emissions Reductions

Slide 1: Title Slide

Stacy Angel: Thank you, Emma. While my presentation is being pulled up, I'll give a bit of background about myself. I've been working with the U.S. EPA and our partnership with Department of Energy on State Energy Efficiency Technical Assistance. And there's an effort, the National Action Plan for Energy Efficiency we've worked on, and through that, a lot of interest was coming from the state side on how the Smart Grid technology may help with energy efficiency.

And as you look into some of the Smart Grid deployments, a lot of the innovation is occurring at the local level, which makes me very happy to be here today to learn about what the local governments are doing as well.

Slide 2: Why Look at Smart Grid?

Stacy Angel: So on – Page two, from an environmental perspective, particularly with our focus in the Climate Protection Partnership division, is the reduction of CO2 emissions. So we'll be looking at the Smart Grid as a potential enabler for greater use of clean energy.

There have been early studies to look at what greenhouse gas reduction could come in the electricity sector from using more Smart Grid technologies. And those studies suggest the range of 2 to 12 percent of the greenhouse gas reduction in the electricity sector. And we'll talk more about the studies later.

And legislation at the federal level in 2007 recognizes Smart Grid for a number of benefits, not all environmental but within that is increase use of energy efficiency, renewable energy, clean demand response, and distributed generation.

Slide 3: Smart Grid Technology Overview

Stacy Angel: OK. So, for folks on the line who aren't familiar with what is Smart Grid, first of all, there is no one definition. So, I just want to make that be clear for folks. We all may have a different idea in our head of what is Smart Grid.

So this slide in the presentation shows the broadest definition of the Smart Grid where you would have information and communications technology, the whole way from a power plant and where electricity is generated to help optimize that power plant, optimize water use or have it generate more efficiently, across the transmission and distribution grid, and then even down to a home or a building that has an appliance that then can communicate to that electric grid or within small areas, a term called micro grid, which may not go into the fuller utility system but help the electricity use within different buildings work together.

OK. So the potential for greenhouse gas reduction from Smart Grid technology is sort of an area under development and being understood and many pilots are under way. Methodologies for measuring that are under development.

Slide 4: Smart grid & GHG Emissions Reductions

Stacy Angel: And there's a next slide that will show some text that I'll speak to here while they move the presentation onto that slide. And I just want to sort of not to hold up the webinar, so I'll keep speaking to this slide if folks don't have it in front of you.

Here we go. Perfect. The areas that sort of rise to the top for greenhouse gas emissions reduction after using Smart Grid technologies would be enabling more energy efficiency, be it through providing customers with actual information of their energy use in a way that the information delivery and feedback could motivate behavior changes or investment changes in the home and building level that could lead to more efficiency.

Also, there are studies to show with higher penetration of renewable energy -- this could be wind or solar generation for electricity -- in order to maintain the grid reliability, so we can still get power out to all the buildings and homes the way we need to, some of these sensors and controls that can come from a Smart Grid will help maintain the reliability and bring on electric generation resources that maybe harder to predict than some of the traditional resources. But there are methods to predict their energy use and their intermittency, and these technologies can have all that work together.

And there are other options outside the Smart Grid which can help with that as well. Smart Grid is just one of the options. There are also studies to show that better control of voltage along an electricity transmission and distribution system can help reduce line losses itself on the system.

But, overall, most of the emissions reductions potential is not intrinsic to the device itself just by putting a Smart Grid device out or an in-home display unit or an advance meter. That alone isn't reducing the emissions. It's something that is enabling, and it will require that the technology being used for the purpose of bringing upon efficiencies and emissions reductions.

And there are some complimentary policies that have happened at the state and local level, which support, making sure that these benefits can come from the Smart Grid technology.

Slide 5: Early Estimates of Smart Grid-Enabled Electric Sector Energy/CO2 Savings in 2030

Stacy Angel: So, to overlay with the broad definition of Smart Grid, from what an early estimate out of specific Northwest lab had shown benefits from the Smart Grid and they've looked at energy saving and CO2 saving from 100 percent deployment of the Smart Grid technology that will then be used in a way that existing demonstrations and pilots have shown the benefits to come.

So, the biggest areas for emissions savings from the spin-off study are 3 percent reduction in energy use from the electricity sector based on the consumer's response to more energy information and that's looking at the residential sector.

Also, about three percent reduction from properly used advanced diagnostics in homes as well as small and medium buildings. There's a three percent reduction in greenhouse gas emissions from supporting increase use of electric vehicles. A one percent reduction seen from having better information to measure and verify the energy savings from administered Energy Efficiency Programs.

And then if that data helps make more certainty for the savings from those programs, they even show an extra half percent could come from reinvesting savings from the programs to more efficiency.

And then on the far left side of the diagram are the savings that could come from line losses, line loss reductions using voltage control and the distribution system. So, those are the electric power lines that go right up to the homes and buildings.

Slide 6: What is the *Net* CO2 Impact?

Stacy Angel: OK. But from the environmental perspective, we don't want to lose sight of the net CO2 impact from these technologies. Most of the technologies themselves will use electricity. And as they are communications technologies, and information storage might be needed, the data center load as part of what's generally happening in the U.S. can increase.

So efforts to look to support Smart Grid may also look to support electronics efficiency and data center efficiency efforts and then that can help for the net impact to CO2. That is a benefit to the environment.

Slide 7: Savings Comparison: Smart Grid vs. Established Energy Efficiency Options

Stacy Angel: And if you were looking at a Smart Grid for energy efficiency specifically, which has been my main focus, personally, looking at these technologies, you could look at the three percent for consumer impact on energy use as you would look at full energy efficiency potential.

There are other options out there for energy efficiency potential but are outside of the Smart Grid. And those studies show that 11 to 24 percent of total electricity consumption in the U.S. could be avoided by more energy efficient technologies and programs and policies by 2020. And that those types of – that quantity is what – what's called an economic efficiency.

And then most of the Smart Grid studies of these technologies are still new in deployment of pilots and demonstrations. And, frankly, I think cost would be fairly high, if you're looking at economic efficiency potential. You're looking at more of a technical potential estimate on the slide I showed earlier, which on the traditional efficiency type potential studies, which many of the local governments or states may be doing, would see numbers three times that which we're

seeing from the Smart Grid. So this is not the only thing you can do for efficiency, but it does have a significant contribution to things you can do for efficiency.

Slide 8: Policy Considerations To Enable CO2 Reductions from Smart Grid Deployments

Stacy Angel: The last two slides, I just want to leave out some questions. Across the country, the factors affecting how the Smart Grid Technology will be used vary quite a bit. So these are some questions that local governments could look through when they're looking at their own deployments, and see what other policy considerations should be addressed as they deploy a Smart Grid deployment to ensure that energy saving.

And environmental savings benefits will come from the deployment such as, is there a clear direction that you are looking to get emissions reductions to energy savings from the deployment? Will there be a way to measure that and verify that it's happened?

Our customers are getting access to their energy use information. Will clean distributed generation truly be encouraged through the deployment or will there be other types of economic or rate barriers preventing customer investment in those technologies?

Is there a full diverse stakeholder group providing input to the deployment to ensure all benefits are considered and barriers are addressed? And is there a way that this Smart Grid deployment can work to support other clean energy activities you may be doing?

Slide 9: Additional Environmental Considerations

Stacy Angel: As I'm in with the Air office of the EPA, I don't want to go too far into other media. But I'd like to close with a slide encouraging folks to look and work with their environmental stakeholders in their area to see if there are other local air quality effects, waste disposal issues, land use issues or ways to improve water efficiency and water use.

Slide 10: Contact Information

Stacy Angel: Thank you.

Emma Zinsmeister: Thank you, Stacy, for your presentation. Next, we'll have Dan Ton.

Smart Grid Activities by the US Department of Energy

Slide 1: Title Slide

Emma Zinsmeister: Dan Ton is a Program Manager of Smart Grid R&D within the U.S. Department of Energy, the Office of Electricity Delivery and Energy Reliability.

He's responsible for developing and implementing a multi-year research and development program plan for next generation Smart Grid Technology, is to transform the electric grid in the United States through public and private partnership.

He also manages Smart Grid investment grants, and previously, Dan managed the renewable systems integration program within the DOE solar energy technologies program. He holds a Bachelor of Science in Electrical Engineering and a Masters of Science and Business Management from the University of Maryland.

All right, Dan, go ahead.

Dan Ton: Thank you, Emma. So, I would like to give you an overview of the Smart Grid activity by the U.S. Department of Energy.

Slide 2: Presentation Outline

Dan Ton: So, this is the presentation outline. I'll go over the enabling applications of Smart Grid and talk about the value streams and implementation challenges. And I'll touch on the DOE Smart Grid development plan in terms of near term activity and longer term technology R&D. And I'll talk about the opportunities for local government and Smart Grid resources.

Nikhil Nadkarni: Hi, Dan. We're having, I guess, a bit of lag in seeing your screen, if you could just accept the presentation request?

Dan Ton: Accept?

Nikhil Nadkarni: To show your screen.

Dan Ton: Right here? Show me your screen, right? Is that it?

Nikhil Nadkarni: Yes, just select the PowerPoint, yes, in the drop down list there.

Dan Ton: Which one? Is it this right here?

Nikhil Nadkarni: Yes. Just – well, just to "Show Your Screen."

Dan Ton: OK. That's it?

Nikhil Nadkarni: Yes. Perfect. All right, thanks.

Slide 3: Smart Grid Enables Dynamic Optimization of Grid Resources and Operations

Dan Ton: OK. So in our view, one of the Smart Grid key functions is to enable the dynamic optimization of grid resources and operations, you know by having Smart Grid integrating the information and communication technologies with the power infrastructure.

And so, from – like, Stacy was mentioning, the Smart Grid starting with the generations to the transmission to the substation distribution and to the consumer, and so that the renewable, more renewable can be integrated with the grid, better, wider area monitoring control, you know better substation automation to prevent outages – one example, distribution automation in micro grid all the way to the consumer advance mirroring infrastructure of plug-in hybrid integration.

Slide 4: Smart Grid Enables Consumer Participation and Demand Response

Dan Ton: So, the second function of the – key function of the Smart Grid is to enable consumer participation and demand response. And so, starting with the utility – let's see. Am I missing something? Can I go to the next slide? All right. Can you – can you show the next slide, please?

Nikhil Nadkarni: I guess maybe just use the page, Dan.

Dan Ton: I did that. It didn't work.

Nikhil Nadkarni: Did you try the – I guess the arrows in the lower left of the – of the screen?

Dan Ton: Lower left. I don't see any lower left. Oh, I see. OK. Great. Thank you.

Nikhil Nadkarni: Yes. No problem.

Dan Ton: Well, basically, from the – from the utility indications to the consumer portal and building energy management systems, costumer can have opportunity to you know integrate renewables like solar and wind on their building, incorporating energy efficiency program, as well as you know integrating plug-in hybrids, other Smart appliances and Smart – and new devices, and other distributed generation and storage so that consumer can participate in the demand response program to lower peak demands and also selling the excess energy produced.

Slide 5: Smart Grid Value Streams

Dan Ton: OK. So, this is the value stream that we're anticipating to – when we're implementing Smart Grid, in terms of – basically, there are six different areas that we need to, you know, provide investments, improving in foundation and infrastructure on the bottom. The capacity is basically the Smart Grid has a potential for significant reduction in peak demand and through customer participation and dynamic pricing and Smart Grid enabling technology, for example, 20 percent peak demand reduction projected by 2019 under the full participation scenario in a published report by FERC.

In terms of power quality and reliability, Smart Grid enable operation controls with allowing all critical loads to be served at all time and will allow delivery of a range of reliability services for other load based on the power quality reliability requirement.

In terms of energy efficiency, Smart Grid enables energy efficiency programs and plug-in hybrid integration has potential for direct 12 percent reduction energy consumption. And I think Stacy mentioned that, in terms of the CO2 emission.

Operation efficiency, improved asset utilization and transmission and distribution automation enabled by the Smart Grid would significantly enhanced the overall capacity factor of the electrical system.

Clean Technology, Smart Grid Communications Control require to timely balance the electricity's supply and demand and enabling higher level of renewable technology integration.

Slide 6: Smart Grid Technologies Needed to Address Variable Generation Effects on Grid Operations

So, this graph shows that you know recent – and within the recent study has concluded that it would be technically feasible to supply within two decades as much as 20 percent – or even 30 percent of total electricity consumption from variable renewable generation sources.

However, we know that increasing amount of renewable energy causes some undesired consequences. One example, this data here come from a recent study done by NREL, and the upper left is a typical dispatch curve in the Western Electric Coordinating Council, WECC, with no wind. This graph includes export to other regions outside of this study area. And the operation in the study area goes from no renewable to 11 percent, 23 percent, and finally, 35 percent of renewable.

And at 35 percent renewables integration, mine-cycle units are mostly completely off—gas turbine output has increased and the coal plants are cycling significantly. Even the nuclear units are trying to cycle some but the reality indicates at a need to spill some of the wind generation.

So, total generation inside the study area drops because the other part of the WECC with 23 percent renewable penetration now reducing the need for import. And you can see that you know by having so much of renewable integration without being able to – managing efficiently, the coal plant, nuclear are running efficiently and not allowing efficient plans like gas turbine combined heat to participate in the energy mix. And so, the bottom line here is that Smart Grid would enable renewable integration by managing different renewable sources more efficiently.

Slide 7: Smart Grid Challenges

Dan Ton: So what are the challenges we're facing, and based on the system report in July 2009 to the Congress, we identified four main challenges that we're still facing moving forward. Those are – you know what are the costs to the consumers and utilities and how do we recover those

costs, interoperability standards, there are many different technologies and standards out there and continuing, changing the challenges to design some standards allowing all these different type of technologies and systems to talk with each other.

Other technical barriers, including renewable integrations, plug-in hybrid to integrate with the grid and then we do have changing technologies on top of changing policies. And at the – one example, at the federal level, we have the cap-and-trade policies being discussed and the state level RPS as well as National RPS policy has not been finalized yet.

Slide 8: Regional Differences Affecting Smart Grid Deployments

Dan Ton: And so, with regional differences will affect the Smart Grid deployments. We can tell that you know regional differences in generation resources. We have more wind in midwest and more sun in the southwest. We have different business economy in different parts of the country, different climate topology, topography, environmental concerns in public policy, and that's creating different value streams and incentives and obstacles in deploying the Smart Grid.

And so, the Recovery Act is looking at you know this different – these differences and try to implement a program that can promote the implementation of Smart Grid more effectively.

Slide 9: American Recovery and Reinvestment Act ($4.5 B) **Jumpstarts** Smart Grid

Dan Ton: So with the Recovery Act funding, the Department of Energy has $4.5 billion in total to jumpstart the Smart Grid deployment, and these are the – a program that are looking at nearer terms, versus the longer term technology development from the BASE program within DOE.

So, out of that $4.5 million, $3.4 billion is focusing on the Smart Grid investment grant, which is focusing on the program, which is less than three years. We have a Smart Grid demonstration program, which is focusing on the deployment of technologies which are from three to five years. And then there are some $10 million to provide to NIST to do to work on the interoperability framework development. There's some funding for the resource assessment and interconnection-level transmission analysis and planning at the state level as well as state electricity regulatory assistance, $50 million.

And then there's some funding for enhancing the state government energy assurance capability and planning for Smart Grid resiliencies, basically physical cyber attack on the grid. And we do have a funding $100 million for workforce development, to develop a program for university training as well as utility training program.

Slide 10: Recovery Act: Smart Grid Investment Grants (100 projects: $3.4B Federal; $4.7B non-Federal)

Dan Ton: So, more details on the investment grants, you can see it on the left side, there are a lot of systems and equipment that are going to be installed as the result of this investment grant. Just for an example, in terms of Smart meter, there will be 18 million meters, will be installed as

part of this program, and that's resulting about 13 percent of the 142 million customers in the U.S.

And you can see that all these equipment and components will be combined to provide impact on the transmission level, enhanced situational and awareness and electric system reliability and resiliency.

We will be able to detect data and put into a network and allow us to predict what's happening you know, in terms of a blackout, one example. We'll be able to – based on our estimate, you know we have about 1,440 megawatts of peak demand reduction per year. And some transformational changes in consumer behavior and energy consumption will come out of this as well – and that will help us toward the path of energy independence.

And so, we are also collecting data to build, as well as impact benefits, and those are – besides from the equipments that I just listed, CO2 reduction, job creation, efficiency is one example, and that – beginning to come in as we roll out the grants.

And it's right now probably out of the 100, we probably have 70 – maybe a little bit more than 70 grantees have been signing the contract with DOE.

Emma Zinsmeister: Hi, Dan, sorry to interrupt. I just wanted to let you know we have about two minutes left for your presentation.

Dan Ton: Sure. OK. So, on top of the Recovery Act, we also have a BASE program of about $125 million to address both short- and long-term R&D needs for Smart Grid. And including in this program budget support is the activity to promote international collaboration on Smart Grid development and deployment.

Slide 11: Selected SGIG Projects – Breakout By Type of Power Company

Dan Ton: OK. So, basically, you know we try to provide some breakout of where the money goes. It mostly goes to the investor-owned utilities, some of those – seven percent go to coop, 16 percent go to municipal utilities, and the rest go to ISOs and RTOs. Yes, and as this slide, just quickly go to this slide.

Slide 12: Tracking & Reporting of ARRA Project Results

Dan Ton: So, basically, from the Investment Act, Recovery Act and Demonstration Program, we'll have the data hub that can be shared with the public, in terms of what are the impacts and benefits and consumer behavior that we collected from the project. And those are available at the website called smartgrid.gov, along with the Smart Grid clearing house, which is the data hub that's collecting, not just the government but on the private side of the project.

Slide 13: Longer-term Smart Grid R&D Multi-Year Program Plan (FY10-14)

Dan Ton: OK. So, in a longer term, we just have R&D solicitation that came out. It's $10 million per year, and it's available on Fed connect and grant.gov website. And teaming is encouraging to carry out from utilities as well as community and goal area.

Slide 14: Opportunities for Local Governments

Dan Ton: On top of that, we do have some international activities that we promote using city-to-city zero-carbon communities collaboration between countries and countries and that is being proposed within DOE. And there's a lot of interest from the international arena to collaborate on that concept.

Slide 15: Examples of DOE Projects Involving Municipal Utilities and Local Governments

Dan Ton: So maybe– I just wanted to mention that we have some examples that we can – you can read it from the website. Basically, we have City of Fort Collins to the project called Renewable Distribution System Integration. It's developing a zero-energy district to substantially increase the use of renewable and distributed energy resources.And within the same city, within the investment grant, they are installing 79,000 Smart meters and in-home demand respond systems using Smart thermostat and air conditioning and water heater control switches.

Another community is SMUD – and within the SMUD, they're installing 600,000 Smart meters. They have a program with 100 electric-charging stations and 50,000 demand respond controls including programmable Smart thermostat and home energy managing system.

Slide 16: Smart Grid Resources

Dan Ton: So, with that, I just wanted to turn you to the resources that's available on the Web at the smartgrid.gov, and that concludes my presentation.

Slide 17: Contact Information

Dan Ton: Thank you.

Emma Zinsmeister: Thank you, Dan. Before we move on to our next speaker, I just wanted to remind all the participants that you can submit your questions online through the question pane, and when you do, please direct them to a particular speaker. If you have someone in mind that you would like to answer them, just address at the – please ensure that the question is directed at them. Thank you.

The Pecan Street Project

Slide 1: Title Slide

Emma Zinsmeister: Our next speaker will be Brewster McCracken from the Pecan Street Project in Austin, Texas. Brewster is the Executive Director of the Pecan Street Project, and he was the lead author of the Pecan Street's successful Federal Stimulus application, which received a grant from the Department of Energy Smart Grid Demonstration Project fund, which Dan just mentioned.

The grant is to develop an advanced energy Internet at the Mueller site, sort of mixed-use development in Austin. And Brewster will be talking about that. Previously, he was elected to two terms on the Austin City Council, and he served as the Council's Mayor pro tem.

And through that elected position, he also served as the board member for Austin Energy. He has a – he's graduated from Princeton University and the University of Texas Law School and has a masters degree from the LBJ school. So, Brewster?

Brewster McCracken: Thanks, Emma.

Slide 2: The Pecan Street Project – collaborators

Brewster McCracken: So, what we are is we're actually an independent organization that has applied for 501 (c)(3) status as we focus on research and development of Smart Grid and clean energy systems. We are a public-private organization that our board members are – as you see on the screen – Austin Energy, UT, Environmental Defense Fund, the Chamber, and the City of Austin.

We also have other utilities working with us on our technology advisory committee on our demonstration project, including the independent system operator for the Texas Interconnect.

Where we are is at deploying at the Mueller Community in Austin, which is a 711 acre mixed-use development, that is, two miles from the University of Texas campus and three miles from the state capital.

We're integrating distributed generation and in this case, solar with water, electric vehicles and energy storage both from the utility side and on the customer side of the meter as well. And then one of the things we're also going to integrate is different pricing models that will be tested across different technologies we test.

Slide 3: The Pecan Street Project – Why Mueller…
Brewster McCracken: So the question is, why do we choose the Mueller Community in Austin for our demonstration project.

Slide 4: The Pecan Street Project - Mueller

Brewster McCracken: What you see on the screen, there are some factors that drove it. It is a public-private development project in Austin. That, actually, was that and then we're able to leverage our matching funds from the nearly $200 million of local funds that were going in to redevelop the Mueller Community. As for those of you who are familiar with the Stapleton Redevelopment in Denver, it is very similar to Stapleton, including The Catalyst, the Master Developer. Mueller is a city that is based in Denver and Catalyst is the basically, the number two developer on the – on the Stapleton Redevelopment.

One difference is because Mueller came along a few years after Stapleton, it has some differences, mainly, that every building at Mueller is green built, every single one, including the world's first LEED Platinum hospital, which is the Michael & Susan Dell Children's Hospital. And it's an 80 county regional hospital.

A side note on that, the perfection of power required for a hospital– it needs some very exacting standards of perfection. And it turned out that the systems and the classic way of delivering electricity turned out to be a lot easier to operate than the supposedly redundant fail-safe software.

But that was a learning experience, and it works great. But it just – just because they're Smart Grid, the real world experience is that there are complexities that need to be learned. But there are benefits to that as well.

Slide 5: The Pecan Street Project – demonstration project approaches

Brewster McCracken: And for those of you who may be familiar with the history of poor "Topsy the elephant," there are good ways and bad ways to go about a demonstration project. Most famously in the bad category is Thomas Edison who was leading the call for DC power against George Westinghouse and Nikolai Tesla who advocated AC power.

So, Edison said, "Guys, you know AC power is so dangerous. I'm going to show you how. It can kill an elephant." So, he electrocuted poor Topsy, the elephant. The nation was so horrified that we now use AC power for our transmission. So we're not going to be doing anything like that in our demonstration project.

Slide 6: The Pecan Street Project – How we will do it

Brewster McCracken: But we have two fundamental approaches. One of which is the innovation on the utility side of the meter. Which is solar on commercial rooftops and that in storage, both which will be owned by the utility, and they're testing new price and business models. So I'll show you graphically next to what – what this looks like.

Slide 7: The Pecan Street Project – Pecan street smart grid approach utility-side

Brewster McCracken: And so, this is the utility side of the meter element of our demonstration project. This is a conventional Smart Grid demonstration that's being done in a lot of areas around the country.

I mean, these are difficult to do, but in other words, we're not, by any stress, the only one who's doing this. What we're looking at though, as you see in this graph, is if you think of the Mueller Community as a micro grid and that's what we are establishing, is this community to be islanded from the substation.

And when you look at this, not only would you pull in conventional resources to power your grid, which in the case of Austin are nuclear, coal, natural gas and wind, primarily. They were also going to integrate within the micro grid, within the Mueller Community solar utility and solar and commercial rooftops that would link both directly into the grid and into located energy storage.

Then, also, if you think of the collection of customers as being a grid management assets in terms of the utility's operation of micro grid, then you can achieve that management of the aggregation of customers through items that we're going to be using such as demand response, net metering and some new pricing models such as dynamic pricing that could charge different rates during the – depending on the time of the day.

All of which to achieve goals of levelizing energy use and that helps to avoid having to build a new capacity. But also, we are committed to creating an open platform for the private sector so that new technology can be introduced both through customers and on – potentially, commercial rooftops and it would be integrated into grid subject to some pricing and system protocols.

Slide 8: The Pecan Street Project – demonstration house

Brewster McCracken: We're going to build a demonstration house at Mueller. And I know Kara is going to talk next in the – Boulder Xcel has done an outstanding job of demonstration analysis. It's really a model for all the rest of us working to do it.

So, she can speak a lot more, and I'll start taking notes when she speaks – if she speaks to her demonstration analysis. But we're going to do one, too.

Slide 9: The Pecan Street Project – innovate on customer side of meter

Brewster McCracken: We're at, I think one of the areas we're going to see – what we're taking on, there's something that's a little different. And it speaks the fact for starters that we – because of vertically integrated utility, and also, we have an integration of billing, of water, and electric. We're able to integrate some things that may not easily be integrated in other efforts around the country.

For instance, in the City of Austin, Austin Energy, it appears to be the largest utility in the nation throughout the world that controls building codes. The LEED code is based on Austin Energy's original Green Building Code from the early 80's. And when we say rebuilding it in Mueller's

Green Building, it's either under LEED or under Austin Energy's own Green Building Code standard, which is the longest run in the country.

But, also, we integrate the billing of electric and water, and that means that from a grid management standpoint, we are in a position to integrate water and electric in our Smart Grid demonstration project which we're doing. We also – because of all the experiences in Green Building, we're able to integrate that in and actually make adjustments to building codes based on the learning. That – and – so that – all the things can be brought together. And the final thing is we'll be integrating Smart land – I mean, native landscapes from the Lady Bird Johnson Wildflower Center that are selected for the carbon sequestration and water usage profiles.

That's already happened, actually, in the public areas at Mueller as – we're going to be able to actually collect data and quantify the impact of the full suite of these systems, so we'll see graphically next.

Slide 10: The Pecan Street Project – Pecan Street smart grid approach customer-side

Brewster McCracken: So what you see is the concept of the net carbon-zero home. And so, when you look at the aggregation of the homes and businesses as a potential aspect of the utility, the question is also how's the grid serve the premises of the future? We're going to be working with a thousand residential volunteers and 75 commercial meter volunteers at Mueller to install different mixes both of pricing models and of technology configuration of their home and then test how these all relate with each other.

So, what you see is the home in the future that has – something that we'll be deploying in Mueller, which is similar in concept to, like, an alarm system, but it's actually a computer that would measure, for instance, homeless distributed generation from your rooftop solar generator. What's your real time water bill? Do you have a leak in the sprinkler head? What is the energy and water usage of your dishwasher and your washing machine?

And, finally, I think the thing that is – the looming opportunity and threat out there, there is integration of electric vehicles. Well, how does that impact transformer performance – for instance, if there are 10 people who are home owners on the same transformer all start charging their electric car at the same time, does that blow your grid or not? So, these are issues we're going to be able to test in an overall highly integrated setting with real customers.

Slide 11: The Pecan Street Project – Integrate electric vehicles

Brewster McCracken: And so, you'll see we're integrating electric cars.

Slide 12: The Pecan Street Project – business model and technology commercialization

Brewster McCracken: And then, finally, we're looking at some new business models and pricing models. We're able to do that because - kind of luck of good timing. But the City of Austin, as we began our demonstration project, was going through a once in every generation complete overall – a rebuild of this billing system.

In Texas, cities don't build – don't build for taxes at my counties. So, in the case of Austin – I mean, the $80 million, some billing system that IBM and Oracle are building for the City of Austin is for water and electric, basically. What that means is we are able to take this new billing system. And Oracle is building a parallel data system on their architecture that we're able to run in parallel, multiple pricing models. So, you might have 75 of our volunteer participants who will be running off of a new pricing model for electricity that is a flat rate with some dynamic pricing on top of it, similar to how your cable bill is priced. You might have a different group of customers who have a different pricing structure for electric vehicles from conventional electricity. You might have a demand response rate – a net metering rate.

So, we're working through this billing system, but we're going to be able to test them out, see how billing systems work in different technology configurations and start finding out from a data standpoint, which pricing models have the most impact and consumer behavior to maximize carbon impact, pricing impacts and water and electric and probably natural gas, too.

And, finally, what are the technology commercialization opportunities that arise from different pricing models. You know, for instance, if you have an App Store model that the computer in your house can access, does that cause electric usage to go to the roof or if it's environmentally focused or energy management focused apps, do they help consumers actually save electricity and reduce carbon effect?

We don't know the answer to that. It hasn't been tested in the real world. So, we're going to follow that. And the final thing, that is – we're going to do there is – we have a separate opportunity, which is grid testing for the private sector. It turns out – we found this out by accident. But we started doing this in 2007, allowing the clean energy incubator at the University of Texas to have companies coming out of that. Beta tester technologies on Austin's grid.

We discovered when we did it in March of 2007. We're the first utility in the nation to do it, and our immediate reaction is – well, we think we're good, but we're not that good. So, what's – what's going on there. And it turns out that it helps that we're a municipal utility on the Texas Interconnect so that we actually – we're able to bypass both state grid rules and also federal grid rules and thereby avoid the problem that, as you all know, the dirty little secret in the utility industry is the throw-down squirrel, which is that every time there's a power blackout, a squirrel allegedly causes it.

And for some reason, they don't - the Feds in particular – but even the Texas grid operators don't like to test the systems out. We're able to do in the local level, and we've been having some really good results for companies. The first company that participated in it was ActaCell, the lithium-ion battery company out of the university. They became one of the first two companies that Google funded.

Slide 13: The Pecan Street Project – next steps… Late April

Brewster McCracken: So, we're going to name the next day, since we're on April 29, we've actually selected and they don't know who they are yet. But we know. And we're going to have actual customers on our Project Management Committee. I think that's a unique feature for our demonstration project.

Slide 14: The Pecan Street Project – next steps … next 60 days

Brewster McCracken: We're going to be seeking input from the private sector since that members of our – board members of our demonstration projects are all public sector or NGOs. But we're seeking input from the private sector about what technology suite and pricing model should be demonstrated. So, that – we'll be doing that after next two months.

Slide 15: The Pecan Street Project – next steps… early June

Brewster McCracken: And then we're going to – at the end of June, we go out with a request for proposals for the private sector to join us in the demonstration project to provide concepts of technology suites and pricing models to test. And so, it'll be a research collaboration opportunity.

Slide 16: The Pecan Street Project – demonstration project proposals

Brewster McCracken: So, I mean, I've gotten –already kind of into this, but the things we're doing, that we think are impactable are, at the end of the day, the opportunity to work with real customers on a variety of pricing models and technology models to test their impact out on a range of public policy goals.

Slide 17: The Pecan Street Project – demonstration project proposals (2)

Brewster McCracken: But – so, we recognize that there are risks, as well as opportunities of testing our ideas on an actual grid with actual customers. We don't want the Smart Grid tea party to rise.

Slide 18: The Pecan Street Project – demonstration project proposals (3)

Brewster McCracken: But at the end of the day, we are a public interest organization, and so, the systems we're testing, we have to have a higher purpose to them, and that is to – we're looking for system to demonstrate environmental superiority and advance public interest.

So, what I was able to visit here, locally, here in DC earlier is that – like, for instance, if you look at a new pricing model for solar and commercial rooftops where you get paid, if you have a building to rent, plus, royalties for the amount of electricity produced from your commercial rooftop, well you know the biggest source of flat rooftops in every city in the nation is schools.

And suddenly, you've developed a business model of carbon-free electricity to help – that could help fund the education of school children. So that's an example of the important public interest opportunities that could arise.

Slide 19: The Pecan Street Project – How Pecan Street is different

Brewster McCracken: The final slide is – you know this gets in areas where we see that we're different. We are an unapologetically and environmentally focused Smart Grid effort is driven from public policy. This photograph is actually in the middle of Austin, Texas, the nation's fourteenth largest city. This is kind of who we are.

We're integrating water, and also, we're a technology-based economy and we are very focused based on what we do in our economics, creating an open platform, because we've been getting hammered economically on the semiconductor and software industries. This is the chance to repurpose for new opportunities for the core of our private sector as well.

Slide 20: The Pecan Street Project – Contact Information

Emma Zinsmeister: Thank you, Brewster. And, again, if you have any questions, participants, please enter them online and we will get to those after Kara's presentation.

Smart Grid City – Developing the Smart Grid of the future

Emma Zinsmeister: Kara Mertz graduated from the University of Wisconsin Madison with a Civil Engineering degree. And afterwards, she moved to San Francisco and worked with the City of Fremont, Union City in Newark, California as a regional recycling coordinator.

She also worked at a large-scale food waste composting firm in New Jersey and has done some backpacking through the Canadian Rocky Mountains. She is now the local environmental action division manager for the city of Boulder managing the city's waste production and energy program. And thank you for joining us today, Kara. Take it away.

Kara Mertz: Thank you so much. I appreciate it. So, this is actually the – City of Boulder and Xcel Energy have partnered on this Smart Grid City project in Boulder, and it's a slightly different animal than the Pecan Street Project. So, it could be interesting to look at the ways that the projects are structured differently and maybe the challenges that we see a little bit differently.

So, just to give a little bit of background on the project, I think I'll – my slideshow will basically go through the history and how Smart Grid City came about and then what Smart Grid meant to the City of Boulder when we started, the nature of the partnership between the city and Xcel Energy and then some issues and opportunities that we see.

Just to give you a little bit of background, I guess, Xcel Energy is an investor-owned utility that serves the city of Boulder. We have a franchise agreement with Xcel Energy, so it's a slightly different, well, quite different scenario than Austin where it's a municipal utility.

Slide 2: What led to Boulder's Smart Grid City?

Kara Mertz: Just kind of starting of what led to Smart Grid City in the first place, in Boulder, we do have a long history of preserving our environment. In 1898, the Colorado Chautauqua opened and a hundred and ten years later it still stands as a national historic landmark and cultural center.

Slide 3: Open Space and Mountain Parks

Kara Mertz: In the late 1800s and early 20th century, the city started to purchase the mountain backdrop in Boulder, and then in 1967, the city was the first city in the nation to vote to tax itself to preserve open space around the city.

Slide 4: 1976: Curbside recycling

Kara Mertz: In 1976, the largest, actually, still, Eco-Cycle, which is still the largest community-based recycler in the United States began one of the first curbside recycling programs in the nation where we're collecting recyclables in the back of school buses. That's what this picture is.

Slide 5: 1976: What led to Boulder's Smart Grid City?

Kara Mertz: And what led to the Smart Grid in Boulder is that in 2002, the city passed a Kyoto protocol greenhouse gas reduction goal, reducing Boulder's energy impact to seven percent below the 1990 levels by 2012. In 2003, our City Council-directed staff to begin to investigate creation of a municipal utility department much like Austin's where we would essentially, if we did that, be taking over control of our electric utility from Xcel Energy.

I think it's interesting to note that our Council's interest in forming a municipal utility originally grew out of its desire to create significant conservation and alternative energy programs for Boulder.

And then in 2005, the city embarked on kind of a two-pronged investigation to test, at the same time to do two things—one, to test the viability of creating a municipal electric utility and simultaneously, to prepare for negotiations with Xcel for renewal of our 20-year franchise agreement.

In 2006, on kind of a different track, the staff created a climate action plan to act as a road map to achieve the Kyoto goal and in November of that year, residents in Boulder, once again, were the first nation to tax ourselves to pay for, this time, emission reduction strategies.

Slide 6: Objectives identified by City Council

Kara Mertz: So, if you remember, at this point, I'm just kind of walking through history. The city was still looking at creating its own municipal utility and Council discussed and acknowledged that, that was a monumental effort to create a municipal utility and they acknowledged that the desire for green power and energy efficiency wasn't really enough to garner full community support for a municipal utility since it would – the community would have to shoulder significant investment in trust and money and to municipalize.

And so, in 2004, Council broadened the objectives and at that time, the objectives that were identified for both the municipalization efforts and the franchise negotiations which were renewable energy, reliability, conservation and energy efficiency, and then re-stabilization and economic vitality as well.

In 2007, Xcel Energy approached the city to gauge our interest in becoming the nation's first demonstration Smart Grid City. And at that time, the Council saw the potential benefits of a successful Smart Grid demonstration to help achieve all of the objectives that were identified as part of the municipalization efforts with a significant reduction and the risk in both financial and social capital essentially.

Slide 7: Greenhouse Gas Inventory

Kara Mertz: This is just a picture from – a graph from our climate action plan inventory greenhouse gas inventory and if you see when combined, residential and commercial buildings represents approximately 75 percent of Boulder's emissions. Part of that is because we're very,

heavily dependent on coal for our electricity as opposed to Austin or some communities that rely more on hydro or nuclear or even natural gas power.

Slide 8: Smart Grid and Boulder's Climate Action Plan goals

Kara Mertz: So, participation with Xcel as a Smart Grid, Smart Grid City is expected to have significant impacts on the city's ability to reach our climate action plan goals. The benefits of Smart Grid is they relate to lower residential peak demand and energy consumption as well as the decreased line losses that we talked about earlier.

Our estimate is to reduce Boulder's current electricity use by up to 10 percent and this translates to carbon emissions reduction of 15,000 to 50,000 tons annually and that translates to, just to give you an idea, about between 3 and 13 percent of our current climate action plan emission reduction goal. And the range reflects the fact that the actual results, carbon reduction results from Smart Grid will depend quite a bit on the specific system features as they unfold and then the customer behavior and uptake as well.

I guess I should stop for a moment and explain that the Smart Grid project and I apologize I don't have a graphic for this, but I think we've got a couple of graphics that came earlier in this webinar. The Smart Grid demonstration in Boulder is from substation to customer interface. So, we have – there's not a whole lot going on, on the generation side of the grid, but we have, Xcel Energy has installed kind of Smart substations and then Smart meters on 25,000 of the 40,000 meters in the city. Most of those are residential. And then we also are testing in-home energy management devices so that they'll be – and I'll talk about this a little bit more, so it's kind of from substation to customer.

So, studies on the Smart Grid elements have shown also that when you add the potential for renewable energy into the mix and this was talked about a little bit earlier that emissions reduction obviously could be significantly magnified, depending on, you know, whether you get to that 25 or 35 percent renewable energy on the grid.

So, as the Smart Grid City program unfolds, we'll be measuring its effect on the city's capitals and we're working with Xcel to come up with kind of reporting requirements for them to report to the city, the energy reduction and greenhouse gas reductions that results from Smart Grid.

It is quite interesting because it's an investor-owned utility that serves all of the rate payers in – well, they have many rate payers in the state of Colorado, and Boulder is just one of its service areas. We really have – some of our challenges with the project arise out of just trying to get information from Xcel so that we can understand how it's impacting the climate action plan.
Slide 9: The Xcel Energy – Boulder partnership

Kara Mertz: So that gets a little bit to the Xcel Energy and Boulder partnership.
When were looking at what it would take to create our own municipal utility, we certainly realized that we couldn't make the public investments in the technology that Xcel Energy and its partners have been able to garner. And I should explain for those that are unaware that Smart

Grid City project is a partnership between Xcel Energy and about a dozen other private sector companies that all invested, basically, their own risk capital in the project.

And so, these dozen or so partners have invested up to, at this point, the estimate is about $100 million or $140 million, depending on who you ask and it's obviously quite an expensive project for a city of a 100,000 people. But there are so many different technologies that are being tested and the idea behind the project is to figure out which of the technologies is the most cost effective before Xcel decides what to roll out to the rest of its service territory.

So, Xcel Energy and its partners provided the financial capital and what the city provides is basically a window for Xcel into the minds and the motivations of our residents and businesses. Since we've had staff working with businesses and residents on the climate action plan program for two-three years now, we see ourselves as understanding and representing the desires of those people.

One of the challenges is to ensure that there's an open line of communication between the desires of the community, and to the extent possible, our job is to help identify how the desires of the community are in alignment with the desires of the Smart Grid partners.

Slide 10: Smart Grid City

Kara Mertz: The elements of the Smart Grid project in Boulder – I kind of went over this a little bit. So I'll just go through it quickly. Grid efficiency and this refers to the fiber optic network and transformers and et cetera that allow for the two-way communication on the distribution lines. And then consumer behavior, which residents and businesses are able to track energies on a 15-minute basis.

What we've also found and this is a bit of a subtlety is that automation is really important. For the demonstration homes that and I'm sorry, Brewster that I don't have these pictures of them. But for the demonstration homes that we – that Xcel and the city have equipped, what we found is that, when people are able to look at their energy usage, it has a little bit of an effect on energy use.

But when you can set it and forget it essentially and control thermostats and appliances based on customer-defined criteria, but that they don't have to think about or manually adjust, that has a much bigger effect on energy usage. Demand response is allowing Xcel to control thermostats and appliances as separate from customer control.

And then finally, distributed generation and storage, the Smart Grid, theoretically, allows for unlimited expansion of renewable and storage and what we're aiming to do here is to motivate our residents and businesses to keep upping the ante of putting more and more risk distributed generation and storage and electric vehicles on the grid and then we'll work with Xcel to really see what effects that does have on the grid as the project evolves.

Slide 11: The partnership evolves

Kara Mertz: The partnership has also evolved over the past three years. As it unfolds, we are checking back in with the community and the City Council and working to evolve the partnership between the city and Xcel. The city established several climate action plan technical teams that provide feedback to the city and to City Council.

And the challenge is that while the city has a broad-based of constituency, they don't always align with Xcel's constituency. So, we absolutely need to refine the partnership and figure out ways to make sure that we are identifying where things overlap and what's kind of out of control of our residents and what's, you know, kind of the purview of Xcel as the entity that controls the project essentially.

Slide 12: Issues - customers

Kara Mertz: Some of the issues that we're finding with respect to customers as we roll out the project, the project was announced early on, so back in 2007, essentially, as you know there was a lot of media attention around the Smart Grid City project in Boulder.

And between 2007 and pretty much today, much of what Xcel and its partners have been focusing on have been installing the infrastructure to enable Smart Grid and the customer applications have pretty much yet to be rolled out.

So, there's all this pent-up anticipation in our community about what will Smart Grid get us and there's been kind of ebbs and flows in the community perception around Smart Grid so that's something that I would give as advice to other communities that are doing a Smart Grid project. Don't talk about it much in advance of, when customer applications are available because it's so invisible to the customer that it makes it – you kind of have this pent-up demand and what wound up happening, or any anticipation, what wound up happening is everyone was all excited about it in Boulder for about six months. And then they started to get distrusting about what was going on behind the scenes and why were things taking so long and kind of rumors start.

So, what we found is that our community needs a feedback mechanism much like the feedback mechanism that's inherent in the Smart Grid itself, so between the customers and Xcel, because when people feel uninformed, rumor starts.

So, another question that has come up is that it's unclear why not all premises have received Smart Grid tools and not everyone knows why. We have 24,000 meters in Boulder and there are, as I said, 40,000 customers. So part of the reason is that's part of the test is our idea – Xcel is testing something to say, "Well, maybe we don't want to put Smart meters in everyone's home because down the road, maybe there'll be a meterless solution where appliances and loads are speaking directly to the grid, and you don't have to have a meter in between." So, it's really important to just keep communication lines open.

Also the relative number of residential versus commercial meters, all the commercial meters have actually gone to – Xcel just made a recent decision to put the commercial meters in schools and government buildings instead of actual businesses so that's been a little bit of – there's been some discontent in the community around that.

And then – although Xcel is attempting to target lower income residents, it doesn't have the same impact on peak load reduction as it would when they – as it does when they target residents with central air conditioning.

And here in Boulder, there are some statistics, let's say only about 30 to 40 percent of our residents actually have air conditioning. So, there's some discontent around that and we just really – the critical success factor that we've found is that you really do need a feedback loop between the customers and the utility, whoever it is creating the – Oh, I don't know why it's going backward, sorry.

Slide 13: Issues - technology

Kara Mertz: There are some issues – I'm almost done here – some issues around technology. Questions have arisen with respect to Smart Grid City and one of them is – oh, wow, I'm stuck on this other – sorry – the standards that National Institute of Standards and Technology and others are developing nationally, question, "Will Xcel's project be able to communicate? Will the Boulder project be scalable and transferable to the rest of Boulder and to other communities? Is the platform being used in Boulder open enough to allow for maximal innovation and adaptation as Brewster was talking about? And do the grid uptakes make it more or less secure?"

So, again, the key to success will be ensuring a system is in place to answer the community concerns and questions about the technology.

Slide 14: Issues - regulatory

Kara Mertz: Per regulatory issues that we are encountering is how will the rates be restructured to incite peak demand reductions? Can time-of-use pricing structures, be introduced to change behavior?

So there's a docket before our Public Utilities Commission right now for time-of-use pricing, but they haven't been implemented yet. And one of the questions that the city has is – are there ways to incite conservation in addition to peak demand reduction? So, one of the differences between the city's goals and Xcel Energy's goals is that the city's more interested in just overall conservation and Xcel is more interested in peak load reduction so that needs to be, just acknowledged, I guess.

Also Xcel – can Xcel introduce a carbon or a green pricing signal in addition to a strict time of use pricing to allow customers to make choices based on, up to the minute information about the presence of renewable energy on the grid? How much green power can really be accommodated into the Smart Grid? Can the city have access to aggregated data from – on energies from Xcel that will give us enough information to both monitor the success of our climate action plan and feed into the peer-to-peer comparisons that we feel like will help make the changes happen? And just a big looming question of how will our national carbon tax affect the pricing and Xcel's ability to continue this test in Boulder and elsewhere.

So, in this case, the challenge in critical success factors will be to create along with regulatory bodies, including our Public Utilities Commission, a feedback loop that gives tools to the residents and businesses and the communities so we can see success in combating climate change itself. And this is really what eclipses this individual Smart Grid City project.

Slide 15: Contact Information

Kara Mertz: So, that's a picture of Boulder and my contact information.

Emma Zinsmeister: Thank you, Kara. Before we go into a question and answer session, I just wanted to mention since Brewster had brought up in his presentation the potential for solar on schools that EPA's green power partnership offers a program and a number of resources for helping to install anti-generation and purchase green power for schools so that's something that folks may want to check out if you're interested in exploring that opportunity.

Questions and Answers

Emma Zinsmeister: We only have a few minutes left on the webcast, so we're going to probably take about one question per speaker and then all of the additional questions that we have received, we will get written responses to, from our speakers and post them online within a couple of weeks when all of the presentation and webcast materials are posted online.

So, Emily, if you want to ask us the first question?

Emily Rowan: Sure. So, the first question is for Kara, and it is how is the Smart Grid City project being funded?

Kara Mertz: So, am I on the audio?

Emily Rowan: Yes.

Kara Mertz: Okay, great. So, the Smart Grid City project is funded exclusively from Xcel Energy and its private partners. Having said that, Xcel has gone to the Public Utilities Commission to seek rate recovery for a small portion of the Smart Grid City project, and the state Public Utilities Commission is reviewing that request right now.

Emily Rowan: Okay, great. Thank you. Our second question is for Brewster and the question is – what sort of local energy storage devices do you use in Pecan Street and what types of electric vehicle integration are you planning for?

Brewster McCracken: So, what kind of storage? Well, for starters, we look at a variety of storage technologies starting with batteries, you know. It might be metal-air flow batteries, lithium ion, lithium halide, whatever it's called, and capacitors possibly and then also thermal storage.

Our energy profile is different than what Boulder is –because we have about 98 percent air conditioning in Austin. We are mortally petrified in climate change, unbearable that four months, you know, as it is.

And then the second part of it was electric vehicles. We're going to test them if almost for starters in-homes, we've initially thought about doing it on the grid itself through like clean charging and how that might be used as almost like kind of an aggregated storage. We may do that, but it seems that the more interesting range of things to test are about the integration of the vehicles into homes with the transformer loads but also the ability to, let's say, use rooftop solar that's captured and something like a bloom box during the day and so you would charge your car at night off solar power from the day.

And then how that – how the home in the future could actually integrate the vehicle into it, not as a drain on electricity but actually, is helping to actually power the home. The final thing I'll send out is, that General Motors that it found that when they're first looking at electric vehicles that it

takes like, you know, say 75 kilowatts to power a car and then they realized it takes something like 5 to 10 kilowatts to power a house.

You know, like, "Wow, our future is running homes." So, I think there's some really interesting possibilities as you integrate vehicles in there to achieve some system and environmental goals so that's the part will likely prioritize.

Emily Rowan: Great. Thank you. And the final question is for Dan. And one of our participants was interested in the slide with the percentage adoption of renewable and wanted more information on the unintended consequences that you mentioned while you were discussing that slide.

Dan Ton: Yes. So, we do have a renewable system integration study with industries and national apps and that can be available for your download on the website and I can – I'd be happy to send you the website on that document.

Emma Zinsmeister: We can – we can get that Web link from you, Dan and add that to the written responses to the question.

Dan Ton: Sure.

Emily Rowan: Okay, thanks. But I think that's all the time we have for questions today.

Emma Zinsmeister: All right. Thank you to everyone for joining us through the webcast. As I mentioned, materials will be posted on our website within the next couple of weeks, and if you have it already, please join our Listserv and we'll get you updates on upcoming webcast and upcoming topics.

And thank you to all our speakers. We appreciate your time and sharing your experiences with us and we'll hopefully have you all in our next webcast. Thank you.

Kara Mertz: Thank you very much.

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