

Getting Building Codes Right: Lessons Learned on the Road to a Performance-Based Approach

—Transcript of a webinar offered by the Clean Energy Solutions Center on 11 December 2013—
For more information, see the [clean energy policy trainings](#) offered by the Solutions Center.

Webinar Panelists

Niamh McDonalds	Global Buildings Performance Network
Jim Edelson	New Buildings Institute
Ian Finlayson	Massachusetts Department of Energy Resources
Christiane Egger	OÖ Energiesparverband, Austria

This Transcript

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Sean Esterly

Clean Energy Solutions Center and the Global Buildings Performance Network. We're very fortunate to have Niamh McDonald, Jim Edelson, Ian Finlayson, and Christiane Egger joining us today. This outstanding group of panelists will discuss "Getting Building Codes Right: Lessons Learned on the Road to a Performance-Based Approach." One important note of mention before we begin our presentation is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center's resource library as one of many best practices resources reviewed and selected by technical experts. Now, before we begin our presentation, I just want to go over some of the webinar features. For audio, you have two options. You may either listen to your computer or over your telephone. If you choose to listen to your computer, please select the "mic and speakers" option in the audio pane. Doing this will eliminate the possibility of feedback and echo and if you select the telephone option, a box on the right side will display the telephone number and audio PIN you should get to dial in and panelists, we just ask that while you are not presenting, please mute your audio device and if anyone has any technical difficulties, you may call the number that's on the bottom of the slide right now and that is 888-259-3826. We encourage all attendees to submit any questions that they might have throughout the webinar. If you do have a question, you may submit that through the "questions pane" in the Go To Webinar window and if you are having difficulties viewing the material through the webinar portal, you will find PDF copies of the presentation at cleanergysolutions.org/training and you may follow along as our speakers present. Also, an audio recording of the presentations will be posted to the Solutions Center training page within a few weeks.

I'm getting some background noise from one of the presenters. Could everyone just make sure that you mute your microphones right now, please? Now, we have a great agenda prepared for you today that is focused on the importance of adopting a performance-based approach through energy code designs to achieve ambitious energy target.

Now, before our speakers begin their presentations, I will provide a short informative overview of the Clean Energy Solutions Center initiative and then, following the presentations, we'll have a question-and-answer session where I can present the attendee questions to the panelists and then, closing remarks and a brief survey.

Now, 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 our partnership with UN Energy. It was launched in April of 2011 and it's primarily led by Australia, the United States, and other CEM partners. Outcomes of this unique partnership include support of developing countries through enhancement of resources on policies relating to energy access, no-cost expert policy assistance, and peer-to-peer learning and training to all such as the webinar you're attending today. There are four primary goals for the Solutions Center. First goal is to serve as a clearinghouse of Clean Energy policy resources and the second goal is to serve—to share policy best practices data and analysis tools specific to Clean Energy policies and programs. Third, the Solutions Center delivers dynamic services that enable expert policy assistance, learning, and peer-to-peer sharing of experience and then, lastly, the center fosters dialogue on emerging policy issues and innovation around the globe. Now, our primary audience is energy policy makers and analysts from governments and technical organizations in all countries. Then, we also strive to engage with the private sector, NGOs, and civil society.

One of the more key features that the Solutions Center provides is its no-cost expert policy assistance. This is known as the "Ask an Expert" and the Solutions Center has established a broad team of over thirty experts from around the globe who are available to provide remote policy advice and analysis to all countries. So, for example, in the area of energy efficiency and buildings, we are very pleased to have Cesar Treviño, leader of the Mexico Green Building Council, serving as our expert. So, if you have a need for policy assistance on energy efficiency and buildings or any other Clean Energy sectors, we encourage you to use this useful service. Again, it's provided free of charge. So, if you want to request assistance, you may simply submit your request by registering through our "Ask an Expert" feature at cleanenergysolutions.org/expert and we also invite you to spread the word about this service to those in your networks and organizations. So, in summary, we encourage you to explore and take advantage of the Solutions Center resources and services including the expert policy assistance, subscribe to our newsletter, and then, participate in webinars like this.

Now, I'd like to provide brief introductions for our distinguished panelists today. Our first speaker will be Niamh McDonald, Buildings Policy Analyst at the Global Building Performance Network and following Niamh, we will hear from Jim Edelson, Senior Manager of Codes and Policy at the New Buildings Institute. Then, our third speaker today will be Ian Finlayson, the Deputy Director of Energy Efficiency Division at the Massachusetts Department of Energy Resources and then, our final speaker of the day is Christiane Egger, Deputy Manager of OÖ Energiesparverband, Austria. I hope I pronounced that correctly. With those introductions, please join me in welcoming Niamh to the webinar.

Niamh McDonalds

Thank you Sean. Okay. So, good afternoon everyone. My name is Niamh McDonalds and I'd like to start by welcoming you to today's webinar on performance-based building codes. So, the webinar will focus on the experiences of countries who have implemented performance-based measures and the key lessons that they have learned from doing so. Today's webinar is actually the second in the series "Getting Building Codes Right" and the aim of this series is to delve deeper into some of the best built—best practiced building codes that are right there and to hear how they have gone by developing these codes. As part of the series, we are asking questions like 'What are the key drivers for change in these countries?' 'What were the main opportunities and the barriers that we're faced?' and 'What are the key lessons that countries have learnt while implementing these performance-based measures?' So, the real aim of the series is to facilitate the sharing of best practices about how to implement state-of-the-art building energy codes. The webinar series is based on the DBPN policy comprised of two. So, let me just bring us back to the start. So, I'm just showing you a little demonstration from our website. So, what you can see here is based on twenty-five best practice building codes, all representing best practice in their region. There are fifteen criteria that we've especially developed and these codes—the building codes are scored against these criteria. So, you can analyze and compare the codes using an individual criterion or by selecting multiple criteria and you can see that on the screen right now. So, you can demonstrate. You can look at them by score. So, all of the codes are scored against these criteria or you can look at them alphabetically. If you hover over the icons, you can see the scores that have been awarded to each of the codes against those criteria. So, the key lessons that we've learned from this tool is that there's no such thing as one perfect or overall best code and that some codes have scored better in some areas while others have scored better in others and we can all share best practices. So, based on our analysis using this tool, we find that there are three areas in particular that require a little bit more focus and these are the focus of this webinar series.

So, our first webinar focused on the importance of long-term targets and frequent revisions cycles and those are available to download on the Clean Energy Solutions Center website and we have today's webinar and the third webinar will focus on enforcement looking at best practice

experiences from different countries, particularly Sweden and the US, and that will happen on the 10th of February and more details will be available on our website so keep an eye into that.

So, back to today's webinar, although basic steps toward your energy can be taken by improving individual elements of the building, we really need a holistic or performance-based approach to code design and construction if we're going to make any meaningful energy savings. So, as part of today's webinar, we're going to hear from Jim, Ian, and Christiane who have all been involved in application for and/or developing performance requirements in their region. So, Jim is going to start by giving us an overview of the current situation in the US. He's going to talk about the drivers for change that they are saying in the US and he'll touch on outcome-based building codes also. Ian is going to provide us with more detailed information and some real experiences from Massachusetts. Then, we're going to hear from Christiane and she's going to provide us with some more insights from upper Austria and going to talk about their progressive code in Austria.

So, without further ado, I am going to hand you over to Jim. Thank you.

Jim Edelson

Ah, thank you Niamh. It's an honor to be available to provide these slides for the audience today. As Niamh said, I'm going to talk a little bit about the US situation and the reason that we are interested in performance-based codes. Sometimes, we call performance-based codes the outcome-based codes and sometimes, we refer to them as codes based on modelling, but that's a different level of performance.

I work for the New Buildings Institute. We're located in Northwest United States. We are a nonprofit organization. We work specifically at commercial building energy efficiency. We are involved in levels of programs and research starting with building science all the way through the design guidance up to policy, which we're mostly talking about today and we provide code assistance to the states and at the national level in the United States.

What I'm going to try and talk about today and explain is the drivers to performance codes in the United States and go through the three different sort of concepts related to performance. First, we'll talk about design, which is really what the model codes are oriented around what level our building is designed to perform us and that is, today, being driven in many other states and cities by reductions to the 2030 goals and zero net energy. Beyond that, I'm going to then talk about the operation of the buildings and this actually achieving those design levels and what are the shortcomings that we experience today in all facets of codes and then, the final thing I'll touch on will be deployment and this relates to the—why discrepancies and variations amongst states and cities within the United States and then, even within those states and cities, the levels of compliance that are achieved in each.

So, to start with the design level of codes, this is a frequently seen graph. It plots the 90.1—actually, 90.1 is the—one of the primary model energy codes in the United States and as you can see, if we were approximately at a hundred EUI, that's the energy used intensity in terms of KBTU per square foot. We've come from about a hundred and the 2012 code is somewhere below sixty and we expect that the 2013 will be close to fifty and this is the same with the 2012 IECC, which is the other major model energy code in the United States. Beyond that, you can see the plot of the red line and also are the actual architectural 2030 goals. That's a nonprofit organization that set a zero energy goal for 2030 for buildings and houses in the United States. So, that's the outline of where we want close to goal and where we would like energy use in buildings to go.

In actuality, even though we've set these goals and put these levels into the prescriptive portions of codes, what we do know from surveys and research is that there is of much wider range of outcomes in actual buildings once they are operated and occupied and so, that is one of the real drivers behind performance codes in the United States. It's that though we may intend our buildings to operate at going to zero at twenty three, we do see that that will be harder than just making a code that says that buildings will going to zero.

This is some research that the New Buildings Institute a few years back. This is referred to as a lead study and in here, a lot of people emphasized the range of variability just among high-performance buildings, which elite buildings are, but what I want to emphasize is more specifically is what happens as EUIs tend towards zero or closer to zero and as you can see, this table, which represents the ratio of the actual energies in buildings to what it was modeled to perform at increases and this is a clear trend and as a building is designed to use less energy, the variability increases especially at the lowest then. That has to do with many factors that could be operations or complex systems, but one of the main obstacles to achieving very low energy uses is what we call, sometimes, miscellaneous equipment or plug votes and as you see in this next table, this is an actual example of what we call zero net energy retrofit that was in Portland, Oregon and this was actually submetered and you can see the pie chart on the left. There are four large blocks of energy use, cooling, heating, lights and equipment. As a building with retrofit in it and again, this is actual meter data. The miscellaneous equipment clearly dominates as buildings get closer to zero and in fact, it exceeds all the other energies for this building as it was retrofit to zero.

Another way to look at this is on the—this is information from the Energy Information Administration. This is the largest US building database. What we have here, it shows that in another sense the lighting, the HVAC, and the water heating all were major portions of the energies in 2005, but the projections are all the growth and we—this is actually 2008 data. We believe it's underestimated, but all the girls and almost, the entire energy consumption net growth between now and 2030 is going to be in this

miscellaneous equipment especially as the systems and the building designs get closer to zero.

So, we—this is a schematic that NBI put together and as you could see if you look now around 2010 or 2015, the design components are decreasing in importance, but what is slower to decrease is the operating characteristics of the building whether it's used correctly, the controls are commissioned correctly, schedules are set, and the nighttime hours are observed and then, on top of that, you know, what are the tenants doing? Are they bringing in the space-eaters and as you'll see—as you see on this table, it really will be—the design components have already started to decrease from 2000 through 2015 and now, what are mission is and one reason for changing the performance code is to get to these operating characteristics and tenant behavior within the commercial buildings. So, that brings which the operation phase of energy codes and this prevents two big challenges that are target to the enforcement and I think Ian will go through similar graphs to this, but it's easy to click a number and to choose a target and like I said, on the design phase, but what's really happening again is that there's a wide range of variation in buildings into how they're actually performing. So, that means how do we set these targets so individual buildings can actually meet them? One of the hopes that we have in the United States is the rapid spread of disclosure ordinances or disclosure laws and you'll see across the United States. Although there is a wide variation, both residential and commercial buildings are seeing increasing frequency of mandatory reporting of energy use, but that still brings us, even if we are able to set the targets and we do have the data, that still brings us to what we call—what I call the big red line for energy codes and that certificate of occupancy and our energy codes in the United States are construction codes, which means when the certificate of occupancy is issued and the building starts being used, there really is no enforcement capability among normal court official and their statutory authority.

So, what we're seeing develop in various jurisdictions and this is some of the lessons we're starting to learn about performance code is how can we start getting at the energies after condition or after the occupancy sort of has been issued. One use is what we call temporary certificate of occupancy and that will be proposed in International Green Construction Code, one of our green codes and that will be hopefully adopted the next year as a green code. Seattle is using something like a performance or a surety bond that ranges up to four dollars per square foot. You heard Duane talk about that in the last webinar in this series.

I will go a little bit more into the what Boulder, Colorado is doing and we are also seeing some ordinances in cities like New York City that calls for periodic retro commissioning for larger buildings. So, we are starting—this is more of an operations code. This is done with construction code. So, we—this is one of the large challenges we're going to perform as our outcome regulation in the United States.

So, Boulder, Colorado has really identified—this is a lot of words, but if you look at the bold face in this paragraph there, you can see that they are driven by the Climate Action Plan. They realized in 2010 that they were not on their path to meet it and so, they needed additional policy. So, what they came up with something called “Smart Regs” and this is an ordinance that actually requires multi-family buildings to achieve energy levels and demonstrate energy performance and in addition to the environmental benefits, they also site building quality, safer, healthier, and more comfortable housing and lower energy buildings. Actually—this has actually been a very—it exceeded their expectations of success. They’ve actually had five hundred units achieving compliance in the first year. Many of the profit owners did not know that their buildings were not performing until this regulation to the fact and so, they are actually exceeding the requirements at this point and it’s gaining broad support and hopefully, we’re doing some work in Boulder in hopefully supporting them in making this type of program more widespread.

So, we are just beginning to touch on these types of regulations and as you see, it’s mostly serious experimenting. As I said, it’s beginning one of our major problems and make it more about this in the next webinar is that the United States is not a single-energy code, but the energy code is enforcement and adoption is devolved down to state and city level and you can see a whole patchwork here. The orange or red states, whichever look—how it looks on your screen are the ones that have actually adopted the most recent model codes; whereas the white or the white codes have not state-wide building codes at all. So, for instance, Colorado, which actually adopts codes city by city and we just saw Boulder with one of the most advanced codes is right next to Wyoming, which has no building energy code at all. So, this is really another—a very big challenge for achieving codes and performance codes.

I’ll touch so—and so, this is the question of deployment within the United States and there is a federal law that set states to have goals of ninety percent compliance rates. There, as you see, we don’t have the money or the resources behind to achieve that. One of the solutions that is now on the table is coming out of the IECC, which is one of the model energy codes and that was the proposal called “RE-188,” which sets an energy resource index—energy rating index for each of the climate zones in the United States and this is a performance approach that takes into account all of the energy used within the house and this is a platform that we believe can be, as you can see, just moving those goals closer to zero will turn the A platform towards net-zero for those communities that use this approach and then, this also increase compliance because it can use third-party inspectors to actually achieve energy compliance and energy code compliance and that is one of the big shortcomings enforcement of our energy codes.

So, I think—hopefully, I only had ten minutes to go through this, but hopefully, I’ve touched on the major concepts that we in the United States

are looking to work through to get to the performance codes and the net zero goals and that includes, you know, the design of the building, the model codes that go to zero getting pass that certificate of operation and achieving performance so we can actually achieve the net-zero goals within the individual buildings and then, deploy those types of codes across the states and cities.

I just want to close this to let folks know that this is not particularly a federal issue that's one-way fortunate. The fortunate thing is that if the congress was involved, it would probably be a setback and that would be a more difficult path for us to achieve performance goals and net zero, but it also eventually could be an opportunity because as the country realizes that it's not meeting its energy use targets can be a positive force.

So, with that, I'd like to turn it over and hand the mic over to Ian Finlayson from the Commonwealth of Massachusetts and he'll talk more about the successes in one of our most progressive states in the United States. Thank you.

Ian Finlayson

Thank you Jim and it's a pleasure to be on this webinar and to be working alongside Jim and Christiane again because they are both people who've been quite influential in terms of what's been happening in Massachusetts over the last few years. So, to build on what Jim was saying, I'm going to walk you through a little bit of what's been happening in Massachusetts over about six-year time period now and we, by no means, have all the answers, but we started on a pathway towards performance-based codes and then, related to that operational ratings and I think it's something that we will look to continue to do for a few years ahead.

So, as Jim was describing it as a sort of design, operate, deploy, I'm going to talk mostly about the design in terms of why we chose performance-based code and then also a little bit get into the operate in terms of why we're looking at energy ratings for existing buildings, and less so on the deployment because we're still a working progress there and I think Christiane has more experience in that arena.

First, a little on background on Massachusetts, we're a fairly small state within the United States. We like to have undue influence but the reality is that we're not a big player when it comes to energy. What this diagram shows you is that we have no in-state energy resources other than renewables and energy efficiency. We did an assessment of that in 2007 and 2009 and realized that it was really a penalty for our economy at the state level to be importing a lot of fossil fuels from other parts of the country, not all of them friendly to Massachusetts and the United States.

That really led to some landmark energy legislation at our state level. The two pieces that I want to draw your attention to today are Global Warming Solutions Act and Green Communities Act. What the Global Warming Solutions Act did was it set greenhouse gas targets both for 2020 and then

for 2050, and required us to produce a plan and show ongoing tracking reporting towards these goals; where the Green Communities Act was much more energy-focused and it expanded our investments in energy efficiency both in new building construction and in renovating existing buildings. It required that we moved to adopting the national model energy code that Jim was telling you a little bit about and do those updates regularly. On the national picture that Jim showed, we were one of the bright lights, states that are maintaining that energy code adoption.

Another thing that it did and this turned out to be quite influential was it established a local government program that towns and cities can elect to become green communities and that as you see has been a significant driver of change in our state.

Just to give you contacts per clean energy and climate plan, we had been trending alone at more or less level emissions since 1990 before we had a major policy intervention. When we made our plan to 2020, the biggest portion of that, the largest wedge if you can describe it that way, is from the building sector. Then the second largest wedge is from the electricity supply, which is primarily supplying the building sector.

It became very clear that building had to be a major source of energy savings and emission saving. Then within those two wedges, there is this explicit for advanced building energy codes, which is 1.6% of the total by 2020, primarily from new construction.

So, that's all good and well but that doesn't require us to do performance-based code, so why did we make the decision to move in a performance-based direction? There are a lot of factors but to get to the primary driver of that we had... Our incoming governor in 2007 went to a major energy conference and regional energy conference and asked, really called on both public and private sector actors to come together and deliver a report to the state recommending how we could get to zero net-energy, and setting some target goals for zero net-energy for residential buildings around 2020 and commercial buildings by 2030.

I'm not going to read the whole report to you although it's available for download but the number one recommendation from the commercial task force is up here and that was to establish energy performance standards and then on one recommendation from the residential [Indiscernible][0:32:01] task force was also to establish energy performance standards.

It was fairly clear from that body and over the intensive year of convening of that group that if we were going to get to zero net-energy we would need to take a performance-based approach and do that in a fairly comprehensive manner.

That really started us down the path. The first thing that we took a look at was our energy code for the state. Again, Jim sort of laid out that the model codes in the US are the ASHRAE standard 90.1 and the IECC, which stands for the International Energy Conservation Code. That's not really international but it is an energy code. Those codes as we adopted them in 2009 were primarily prescriptive in approach and they do have performance options but they were somewhat underutilized and they didn't offer many design trade-offs.

As a first step we said 'Well we can add a more directly performance-based option on residential side' and so we used the system that's most prevalent in the US, the HERS rating which is governed by a nonprofit group called RESNET. Then for folks in Europe, you may be more familiar with Passivehaus methodology. We added a Passivehaus option not expecting a large uptake of Passivehauses but to signal our intent to reward people taking more of a whole building performance-based approach.

Now beyond that we realized that if we were going to move codes in a significant way, we needed to have an alternative to the base code. A number of towns and cities in the state were already asking to go beyond ASHRAE and IECC base codes, so similar to Boulder in Colorado. We really try to partner with those interests and we developed something called the stretch energy code.

Essentially that takes a performance-based approach on migrates the code towards a performance-based approach. On a residential side, we use the HERS index from RESNET which is calibrated off a standard new home in 2005 at being 100 on the scale and a zero net-energy home at zero.

For the first run of the stretch code, we set a target of 65 or 70 depending on the size of the unit so small and multiple-family units didn't have to meet as aggressive a target as larger single-family homes. Now the advantages of this in terms of moving down the performance pathway to echo Jim again, it brought in a third-party energy specialist who works with the builder from the design phase all the way through to that Certificate of Occupancy. It also brings in diagnostic testing, so really testing the air leakage both of the whole home and of any ducts in the home that are common in the US for heating and air-conditioning systems.

Finally it allows more design trade-offs so you can get more energy efficiency hopefully at less cost to the builder because they have more design flexibility. That was the residential code and we more or less developed that in-state with a lot of input from folks that were doing these programs through national-level efforts like the EPA Energy Star program.

On the commercial side, you'll see down on the bottom of the slide we worked with the New Buildings Institute. I got to meet Jim Edelson back in 2008 around this project where again, we wanted to move towards

performance but we wanted to use existing tools and protocols that were previously developed. We used the ASHRAE 90.1 standard but required performance modeling and they had developed that method and it's already been picked up and used by the US Green Building Council for LEED ratings.

We leveraged that existing standard and then we worked with the New Buildings Institute to develop our prescriptive option in a way that added some flexibility and some design trade-offs to encourage builders to save more energy but to do so at relatively low cost.

That got us really started down the road of performance-based codes. At the time we had heard from a handful of communities that had expressed strong interest in this and we've been pleasantly surprised by how well-received this has been. We're currently at over 50% of our state accounts in orange on my screen or the darker color... have chosen voluntarily to choose this stretch energy code and primarily that's driven by both the town council—sorry—or city council level. It's very much a local issue and we're seeing that customers are voting with their feet and saying 'We'd like to know more about the energy performance of our buildings and we'd like to be more efficient and more climate-friendly.'

Our crude explanation of the value proposition here is that if you provide these energy ratings through code in this case then you increase awareness that adds market value to the buildings that are being built and that leads to greater investments in energy efficiency, which is our end-goal.

We talked about that from a design standpoint so far but we realized that to Jim's point, a lot of the action is in how buildings are operated and how people use their buildings. When we're talking about existing buildings, the building code in the United States really stops once a building is occupied and so we're now working on how we would rate those buildings and use... So I want to talk briefly about what we're doing right now in the residential side and so the slide here shows the scorecard that we now developed.

There are three variations on this but this is the most widely used one right now. This is a scorecard for existing homes where a homeowner chooses to get a free energy assessment. They can get a scorecard like this at the same time, which shows their energy performance in actual annual units per year but also then the greenhouse gas footprint and some expected energy-saving numbers if they are to take advantage of the recommended energy improvements. We're really trying to move to encourage homeowners to understand their energy usage and to take advantage of opportunities to improve their energy efficiency.

Beyond that, we also have a pilot for commercial office buildings where we're looking to have... as buildings move out of construction into operations or as older buildings turn over, the opportunity to inform those

users and those owners. In other sectors, anywhere we have leverage we're interested in introducing performance concepts to building owners and operators.

We have something called the 'Meet the Greenhouse Gas Modeling Requirement.' Large commercial developments in the state, which could be hospitals, supermarkets, casinos, or laboratories, they typically all have to come to our office and show with energy modeling that they are reducing their greenhouse gas footprint over what the model energy code would require.

For schools there's a national high-performance schools standard but in Massachusetts we have a slightly more stringent version of that and we provide incentives for people to build greener and do that with energy modeling. Then with our public buildings at the state level, we also have beyond model code and beyond LEED standard.

That's roughly what's happening in Massachusetts right now. In terms of some of the lessons learned that we think might be relevant to other places, I'd definitely say that we've taken the approach of trying to educate performance everywhere where possible but with some prescriptive back stops so that energy performance is not giving away or reducing standards but improving them.

We definitely took the path of least resistance in building on existing above-code programs that have been funded through the worker for federal government and the electric and gas utilities in our state, and then initiatives like the Green Building Council's LEED rating program.

We found that legislation was a real game-changer in terms of reorienting people and their expectations for what ought to happen in the building sector. We found that training is an invaluable piece of the puzzle. It's not enough to just set design standards or labeling standards. You really have to do outreach to as many stakeholders as possible to explain why you're doing this, how it works, and how they can take advantage of it.

We've been pleasantly surprised by how much interest there has been in this from customers, homeowners, building operators, and building users. We really think that they want information and they want fairly complex information to help them understand their buildings.

Finally we found that government at the local has been a real driver for change and that there's a lot of grassroots movements that really want to see energy savings and climate savings, and that if you can tap into that, it's a very helpful dynamic in moving the ball.

That's my summary. I'm happy to hand over now to Christiane Egger who can tell you what happens with a longer period of time to implement these things.

Christiane Egger

Thank you, Ian. Good morning, good afternoon, or good evening, wherever you are. My name is Christiane Egger. I worked for the state or the region of Upper Austria and I'll try to share our experience with performance-based codes that we have gathered over the last between 10 and 20 years.

Just to give you a bit of backgrounds, the State of Upper Austria is one of the nine Austrian states located between Vienna and Salzburg, for those familiar with Austria. What is important, we... the building legislation in Austria has gone on state level and regional level so those familiar with the European situations, the implementation of the European building performance directive is done to 95% on the state level.

My own organization is the Energy Agency of the State. We promote energy efficiency and renewables and with right services to all building consumers, to all companies, to households, and public bodies. We support the development of legislation and policies.

An important building-related program is the energy advice or energy consulting, auditing, program. We provide to 10,000 face-to-face energy advice sessions to homeowners, businesses, and public bodies, and in most cases it has to do with building-related investment, new homes, new schools, renovation of the business building, or something else.

We have been involved in building rating, 'building certification' as we say in Europe since the early '90s and my organization has created more than 100,000 buildings since '93. We also manage a network of companies that are active in energy efficiency and renewables. There is a website in English in case you're interested. Together, these companies are 170 in our state, had a turnover of \$3 billion, and they employ nearly 9000 people. They do lie in the fields of solar thermal, biomass heating, and energy efficiency in buildings so actually three things that have to do mostly with the building sector.

Renewables and energy efficiency have a long tradition in our state. Today renewable energy provides the third of our total primary energy. 15% of that is clean biomass so mostly biomass for heating, 11% is hydro, and the other renewables. In the heating sector, we have already achieved a share of about 50% of renewable heating of building and echoing the slide of Massachusetts by having the renewables we have today, we avoid input of fossil fuels in the order of \$1-2 billion every year.

This has been going pretty well in the '90s and in the first half on the previous decade. In 2007 the state government decided that by 2030, all electricity and space heating will come from renewable energy sources and clearly in this transition, the building sector has a key role to play and especially performance-based building codes are a key element.

Easy to say, 100% electricity and space heating from renewables, how are we going to do this? I always use this picture of the carrots, the sticks, and the tambourines. Carrots for financial incentives, sticks for the legislation for the regulatory so what we are talking most about today, and the tambourine is the information, the awareness-raising, and the training.

If we look at the sticks, a key element here is building rating and building labeling or/and disclosing. Then we have performance standards for heating and cooling. I'll show you a slide in a moment. Then once a building is in operation, that is the obligation for regular inspection of boilers and air-conditioning systems, and we have an obligation to use renewable energy for heating in all new public buildings and in all new buildings larger than 1000 square meters.

Now if you... I would mention the performance standards and how they developed over the years. On that slide, you can see it's the example of the performance requirement for single-family homes over the last 20 years. You can see from the year '94 when we started out with building requirement in the order of 110 kWh/m² in year. Today we are at 54 and with the requirements laid down in European building directive that require us to already have to plan until 2020 so that 2020 we'll go down to 34.

This gives a very clear message to the building sector of what is going on. It allows technologies to be developed and in a role I think this is very important and maybe the only way to progressively increase building requirements.

Knowing the energy performance of buildings is also helpful when you have financial incentives. In our case, a main instrument in the housing sector is we provide low-interest loans for efficient construction and renovation which is also based on energy performance indicators, and then we also provide investment plans for renewable heating and specific energy efficiency measures. For commercial buildings also there are brands available based on energy performance indicators from the federal level and there are range of other instruments in this field. Last but not the least, the tambourine, the energy advice, the training Ian just mentioned is also a very important element of this building policy.

Now taking back a step, what is for us an energy performance indicator? It's the slide we use when we give presentations to the wider general public. Miles per gallon for the U.S. audience and for the building in a simplified manner this would be heating or electricity or CO₂ or accumulation of all these per square meter and year.

Now if we look at the factors that influence the 'energy performance indicator' in our climate and in our way of calculating it, we have the orientation of the building, the solar gains, the insulation quality, the ventilation losses, the heating system, the use of renewables, and the

geometry of the building. Why are energy performance indicators so important in our point of view? They allow for a comparison between similar building uses that empower the building owners. The calculation of energy performance indicators is quite complex and has become even more complex when you include CO2. It's really something that only a few people, experts, would understand but if you had a rating A to B, that's something everyone is able to understand.

It helps us to motivate to use renewables. It gives impulse for building improvements and renovation. It allows us to as I try to show you just a moment ago to drive legislation and it helps us to better target our [Indiscernible][0:52:11] funding into the right channels.

Our history, we started in the '70s in Austria and in the different Austrian states to have u-value based building codes. Then in '93, we for the first time introduced the energy performance indicator as funding requirements. In '99, that was the big step. We had for the first time building codes that were based on energy performance indicators for heat and also still using minimum u-values which we still do just to make sure [Indiscernible][0:52:54] proposition that in case something that not too extreme solutions are being chosen. In 2002, the European building performance directive came into law, the first one that required energy performance indicators. In 2007 we required them for the first time also for non-domestic buildings and since December last year, also implementing the European legislation, the energy performance indicator must also be stated in all advertising. This is really for those of us who had been doing this for a couple of years. This really makes a very big change. If you open up the advertising section of any newspaper here and where a really state is exercised, they all include the energy performance.

A key element of the rating is the performance certificates. We started in '93 as a part of the funding program and since '99 it's a requirement in the building law. We required for a new construction and renovation for housing and nonresidential and for any sales and renting.

So, even if they don't touch the building at all but it's been sold or rented out then an energy performance certificate has to be issued and included in the contract. Public buildings and large buildings must display the energy performance certificate.

We also try always at the same time to improve the building shell and the heating systems so you can see here the developments for the heating systems of single family homes so in '99 about the 3rd had slight heating and its already installed renewable energy technologies. Today oil-heating has disappeared from new homes and more than 85% use renewable energy sources. Speaking of renewable energy sources, the most important in our case here is automatic biomass heating, so these are fully automatic system either wood pellets or wood chips. In case of wood pellets they are

delivered by bulk in a truck and it's become standard solution for homes and also more increasing number for domestic buildings.

In summary, some of the lessons learned when developing codes deducting them, we have to always find the right level and this is a very difficult task between a high level of energy efficiency ambition and of high-level market activation. For example, for renovation it will set the requirement too high in the efficiency sector then this might attract people from renovating, so we really have to find a very good balance here. Then as I try to show you we try to continuously tighten the requirements in the incentive programs. We aim to avoid "boom or bust" programs like you sometime see them where they have programs for one specific technology then all the market rushes there and then you have a shortage on that so we try to keep this in a good balance. Information, training, that's what Ian already mentioned and quality assurance are key. There is no "one fits it all" solution for mobilize different market segments so this also something we have learned. Financial incentives work for some segments. Legislation which is in theory work for everyone is also better adapted by some market segments than in others where you find a less high level of compliance and come back to what I said earlier the right combination of "sticks, carrots, and tambourines"

If you're interested in learning more of what we do and we'd like also to come to a meeting where you not only here the people but also see them. I would like to invite you to our conference on Nearly Zero Energy Buildings, which will be held at the end of February. It's a very large international conference and it will be great to see many of you there and with that I think I thank you for explanation then hand it back to the organizers. Thank you.

Sean Esterly

Yes and thank you Niahm, Jim, Ian, and Christiane for this great presentations. We do have some questions coming in from the audience and I just like to remind the audience that if they have any questions they can submit those through the question pane and we'll take this time now to present those to the panelist. The first question I received is for Jim. Jim can you provide a little more detail on the conditional occupancy proposed in the IGCC.

Jim Edelson

Yeah thanks for the question. There is a large group of national organizations working together to draft the proposal that will be submitted to the International Green Construction Code as of January 9th and its being coordinated by NIBS the National Institute of Building Sciences and we believe this is similar to a proposal that was in the IGCC in the last cycle but it will set targets for energy consumption and in the proposal there's a temporary certificate of occupancy issued for up to 36 months and within that 36 months the building will have to provide a 12 months of data to show that it meet its energy use target. So, that is the proposal. We welcome input if any of you want to contact me directly.

- Sean Esterly Great. Thank you Jim. The next question is aimed towards Austria is passive house play any role in Austria?
- Christiane Egger Thank you for that question. Passive house had a very important role in pioneering technical solutions. So for example triple place winners were first developed and used in passive buildings today. Triple-glazed windows are a style of solution that practically in most all new homes would use triple-glazed buildings. However passive house is a private initiative by a private group of people, so this is different from the building codes aside from what our government set but it was always a source of inspiration to a certain segment of the market however we have learned that this segment had actually is wheeling an interest [Indiscernible][1:00:18] house remains more less since the last 10 years on the same level which is about 3% to 5% of renewables.
- Sean Esterly Thank you Christiane and the next question is also for you and it asks what about the financing incentives. You talked about how there's a really important role in developing new technologies like biomass and gasification. How about financing incentives to achieve those goals?
- Christiane Egger In Austria since World War II a small levy that everyone pays on their income tax. It's for housing levy and this levy is used for supporting the investments in new housing and in renovating housing. So, this is an existing instrument that has been around more than 50 years. So, what we have done beginning in early 90's was to introduce energy criteria into this—and energy performance requirement into this housing programs and we have tightened this over the years and we find that actually in our specific situation this has a stronger impact on the market than the regulator refill because all homes are aware of these programs and what they are required to do in order to get these funding. In addition to supporting energy efficient construction, we also provide a direct trends for our heating systems so biomass heating, solar thermal, and heat pumps where you get about 20% investment grants of depending on the specific circulation if installed one of these.
- Sean Esterly Great. Thanks again Christiane and the next question is for Ian and the question is a common argument against introducing performance-based building code is that they will negatively affect small builders. Have you experienced this in Massachusetts and if so how did you address the issue?
- Ian Finlayson Yeah, thank you for that question. So, Massachusetts is a state that is—it's a not a major growth market unlike some of the southern and western states in US and so we have a lot of small builders and there's still a big piece of the construction market and certainly most of the remodelling market. We really haven't experienced any problem there. I mean that's not to say that all builders in the state love having to pay more attention to energy codes but we've seen plenty of small builders be successful and embrace this approach. Generally, they have taken advantage of the training and they care about word of mouth and reputation so that often

times most have participate in county and city level discussions or end codes and many of them have become quite strong support of this approach because it allows them to showcase how new buildings can be much better energy performance than existing homes. A lot of times that's their competition in the market.

Sean Esterly

Great. Thank you Ian. The next question that we have is just directed towards everyone I believe and that is what was the most difficult task in going to performance-based codes and the second part of that question, what implication this had for enforcement of codes?

Ian Finlayson

I guess I can start that with the experience in Massachusetts. I think as soon as you proposed doing something that's different from what's been done in the past and then additionally its different from what the national model codes are proposing then there's quite a high bar of scrutiny. Now why would we do something different than what the national model codes are already doing and why would we have more than one option for codes in the state. Those were the primary concern and that was where the discussion was early on but I think once you take that step and people start to work with performance-based codes they very quickly see the benefits and a lot of that I think is on the information and awareness side. So, being able to compare a home with other homes is—it seems simple but it's a real game changer for a lot of people and for builders once they realize they can build much better than the competition be it existing homes or other new construction it's really valuable to them to have that information and make it available to the public. So, it's the first step I think is the hardest and then we see that it gets easier after that.

Christiane Egger

Okay maybe I can add. As Ian said it's really when you start. I think in our case I think it goes to educational challenge. We have many small builders who have very little time available to attend training courses. What made it easier in our case we started not with the building requirements, we'll start it with the voluntary funding program. So, this allowed the market sectors to learn over a period of time a couple of years and then when it became the code they were already familiar with these energy performance indicators. So, that was very helpful however this is a longer period that will take at least a couple of years I guess in those places in the world.

Jim Edelson

Yeah, this is Jim and what I'm going to say about that is that—you know Ian mentioned the model codes, international model codes and we are having some resistance to introducing these concepts into the national model codes but we see a growing interest from code officials in these performance codes because in the end they're really a measurable quality and easier to enforce in the end. So, it's a matter of time I think as people become more comfortable with the concepts.

Sean Esterly

Alright thank you again to all three of you. In the next question again it's for Christiane and it concerns energy performance requirements in upper

Austria and the question is are the presented requirements only for heating and cooling or additionally include the other energy consumption associated with the building such as ventilation or domestic hot water?

Christiane Egger

Thank you. This is not a certain easy question to answer because in fact we decided along the 9 Austrian states when implementing the European Building Directive that there are actually four different performance indicators and some of them are heating only. Then we also have warm that includes the CO2 so that's all energy use. It also depends whether it's for the funding programs or for the building codes. In general the housing the requirement is at the moment for heating only. For non-domestic buildings this also includes heating, cooling, ventilation, lightings, and our building-related energy uses.

Sean Esterly

Thank you and the next question is again for Ian and that is what do you see as the role of stretch codes playing in facilitating funding from utilities for code compliance efforts?

Ian Finlayson

Sure. In our state and a lot of the states certainly in the northeast of the country and the west coast, we have significant funds from gas and electric utilities that are directed towards improving energy efficiency in new construction and in home renovations and they're tasked with incentivising performance above code. So having a based code and a stretch code allows us to say well based code communities are not going to get those incentives unless builders are voluntary going beyond the based code but stretch code communities—you got a situation where all the builders are going beyond that based code and so there's more of a comprehensive incentive program available to them because the utilities and the builders know if their building in communities that a stretch code uses that they will be above code and it's just a question of how far above code these builders are willing to go. So, we have some builders now building subdivisions that are better than that zero, their energy positive homes, and they are maxing out on utility incentives but we have the majority of builders building just beyond the stretch code level and taking lower incentives from the gas and electric utilities but that's a relatively streamlined process and we're actually working to make that more streamlined going forward. The tambourine as Christiane calls it, the education and outreach component that scenario where were really looking to collaborate much more with the gas and electric utility programs too so that were doing joint trainings or co-sponsoring trainings, so that the information comes along, so the builders are made aware of the incentive opportunities and the performance requirements at the same time.

Sean Esterly

Alright thank you and another question from the audience, has there been any talks of exporting the Austrian Building Apprenticeship Training Programs to the US?

- Christiane Egger Thank you for that question. At the moment we are just trying to sell equipment but—no that's a joke. Yeah well we have what we call it Fuel Educational Systems meaning that our apprenticeship programs where people spends—they are learning to be a builder or learning to be a heat installer or an electrician and they spend part of the time in the business that is committed to a teaching role where they also do some practicing work and spend a part of their time in the school. I'm not aware of any action. We have problem of exporting this but if anyone is interested in some further information we'd be very pleased to provide that.
- Sean Esterly Great. Thank you Christiane and another question from the audience, given the pending disruptions coming to the SOP of utility business models is there any chance utilities would borrow to retrofit rather than build new generation?
- Ian Finlayson So, I can speak about that again in the Massachusetts context with our Green Communities Act of 2008. We essentially require gas and electric utilities to prioritize investments in energy efficiency above investments in new generation capacity or purchasing—I mean the generation capacity isn't owned by the gasoline or electric utilities in our state but before they sign contracts to acquire additional resources they have to first show that they're maximizing investments in energy efficiency. So, we have more than doubled our investment in energy efficiency since passing that legislation and we now make investments in the order of \$600 million a year statewide in energy efficiency and that covers both new construction and existing building retrofits. So, I think the legislations probably needed and there has to be a reconciliation factor so that shareholders of these gas and electric companies don't take huge losses but that can be figured out.
- Sean Esterly Thank you Ian. One more question for you. This question is for Christiane and it is how did you make the case for funding the 10,000 customer education outreach meeting?
- Christiane Egger Thank you for the question. I think this is easier in a small state where politicians that fund our programs are closer to and continuous business, etc. but we have been able to show that actually the energy applies and the outreach program is a very cost effective solution especially when it is combined with the other two pillars of our building policies that I try to outline. So, we are able to show significant savings and from the energy advice programs and so probably have been able to convince our funders to continue to provision of this funding.
- Sean Esterly Alright and thank you again Christiane and that is all the question that I have received from the audience. So, I just like to thank you again for addressing those and for a good discussion and thank the audience for submitting those and we have a few extra minutes. I'd like to give each of you a chance to—for any closing remarks or anything that you'd like to say. We'll start with Jim first.

Jim Edelson Hello! Yeah, thanks again for this opportunity to address on international audience and we do have goals in many of our states and in many of our cities but not yet nationally and we will be evolving our codes eventually towards more performance orientation just to be able to achieve those goals. So you know I think this is the right topic to be talking about getting people and the communities comfortable with these concepts because this is a way we are actually going to achieve the goals, to make the impact on the global greenhouse gas emissions, so target set that would need to achieve. So, I hope these moves forward. Thanks again.

Sean Esterly Thank you Jim and Ian if you'd like to go ahead with any closing remarks you might have.

Ian Finlayson Yeah, I mean if there are any state or local or regional government had been listening to this I would say that this is not a light undertaking moving to performance based codes and building rating in my mind but I think it fits very well into a lot of other planning goals that we have at the state and regional government level and also the local level as people set climate targets or energy targets or are worried about congestion or other challenges in delivering reliable energy to buildings. It really seems to hit out a number of different challenges that we have in governments with a fairly comprehensive solution. So, I encourage people to take a really close look at it and look at where they have leveraged to start down this process and we've had success so far and we're looking forward to maybe following in Austrian footsteps a little bit. I think it feels like there's some momentum coming behind this approach.

Sean Esterly Thank you Ian and Christiane.

Christiane Egger Well I think I'll come back to what I said earlier that the building sector is a very wide field there's no one fits it all. If anything and the beauty of performance-based codes is it empowers flexibility and informed choices and we found once we were able to explain the concept that many people like very much that they could make their own choices what they want in terms of the technology as one so they want to use provided they met the energy requirement and with that flexibility and the ability to choose the bright solution for yourself I think this is what has really driven the policy in this field that I cannot actually imagine any other building codes than performance-based approach.

Sean Esterly Thank you again for the panelist. Now, I just like to ask our audience to take a minute to answer a quick survey. We just have three question from the webinar that you viewed today. Your feedback just helps us improve for the next ones and know that we are doing well where we are. So Heather could you please display the first question. That first question which can be answered in the webinar panel is the Webinar content provided me with useful information and insight.

Sean Esterly The next question. The Webinar's presenters were effective.

Sean Esterly The final question is overall, the Webinar met my expectations.

Sean Esterly Alright thank you for answering our survey and on behalf of the Clean Energy Solution Center I just like to extend another hearty thank you to all of our expert panelists and to our attendees for participating in today's webinar. We did have a great audience, great discussion at the end, and some good question and we just appreciate your time. So, I'd like you to—the attendees to check the Solution Center Website over the next few days or the next few weeks. We will be posting an audio recording of this presentation as well as PDF copies of the slides and you can also look at the other green building performance networks webinars on similar topics.

Female Speaker Sean sorry to interrupt you guys. Niamh would like to make a closing remark as well because we jumped over here before we wrap thank you.

Sean Esterly Definitely. Sorry about that Niamh go ahead.

Niamh McDonald No problem Sean. I just want to express my thanks to the speakers and also just to say that best practice sharing is really a great way of fast tracking towards zero energy and a great way of making renewable energy savings, so rather than starting from zero it's better to build on what we already have right there. So, thank you again to the speakers for facilitating this and thank you Sean.

Sean Esterly Thank you Niamh. Yup so again you can just see these audio recording and the slide on the Solution Center website and just hope that everyone has a great rest of your day. We hope to see you again at future events and with that we conclude our webinar.