

Getting Building Codes Right: The Importance of Long-term Energy Targets And Frequent Revision Cycles

—Transcript of a webinar offered by the Clean Energy Solutions Center on 13 November 2013—
For more information, see the [clean energy policy trainings](#) offered by the Solutions Center.

Webinar Panelists

Jens Laustsens	Technical Director, Global Buildings Performance Network
Niamh McDonald	Buildings Policy Analyst, Global Buildings Performance Network
Hans van Eck	Unit Manager, Head of the Department of Domestic Buildings, National Building Code, and EU directives with the NL agency, a division of the Dutch Ministry of Economic Affairs
Duane Jonlin	AIA Energy Code and Energy Conservation Advisor, Department of Planning and Development
Kevin O'Rourke	Manager, SEIA's Low Carbon Technologies Team

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Sean Esterly Welcome to today's webinar hosted by the Clean Energy Solutions Center and the Global Buildings Performance Network. We're very fortunate today to have Jens Laustsen, Niamh McDonald, Hans van Eck, Duane Jonlin, and Kevin O'Rourke with us to present on Getting Building Codes Right: The Importance of Long-Term Energy Targets and Frequent Revision Cycles. One important note to mention just 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 as 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 today, I'd just like to go over some of the webinar features. You have two options for audio: you may either listen to your computer or over your telephone. So if you choose to listen to your computer, please select the mic and speakers option in the audio pane of the go-to webinar panel, by doing so, you 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 use to dial in. Panelists, we just ask that you please mute your audio device while you are not presenting and if you have technical difficulties with the webinar, you may contact the GoToWebinar's Help Desk at 888-259-3826.

Now, I encourage everyone to submit their questions throughout the webinar if you have any. You may do so by typing your question into the question pane and that can be found in the go-to webinar panel. If you are having difficulty viewing the materials through the webinar portal, you

can find PDF copies of the presentations at cleanenergysolutions.org/training and follow along as the speakers present and as the presentations get on their way, I will send out a link to that webpage so that you can follow along with the PDF copies if you choose to and also in a week or two, an audio recording of the presentations will be posted to the solutions center training page.

We have a great agenda prepared for you today focused on Getting Building Codes Right: The Importance of Long-Term Energy Targets and Frequent Revision Cycles. Before our speakers begin their presentation, I'll just provide a short informative overview of the Clean Energy Solutions Center initiative, then there'll be a brief overview of GBPN and then following the presentations, we'll have a question and answer session where we will have the opportunity to address questions submitted by the audience and then closing remarks and finally a very brief survey for the audience.

This slide provides a bit of background in terms of how the Solutions Center came to be. The Solutions Center's initiative of the Clean Energy Ministerial and is supported through our partnership with UN Energy. It was launched in April of 2011 and is 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 and policies relating to energy access, no-cost expert policy assistance, and peer-to-peer learning and training schools such as the webinar you are attending today.

There are 4 primary goals for the Solutions Center: it serves as a clearinghouse of clean energy policy resources; also serves to share policy best practices, data, and analysis tools specific to clean energy policies and programs; and the Solutions Center delivers dynamic services that enables expert assistance, learning, and peer-to-peer sharing of experiences; and then lastly, the center fosters dialogue on emerging policy issues and innovation around the globe.

Our primary audience is energy policy makers and analysts from governments and technical organizations in all countries, 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 the expert policy assistance. This ask an expert service is offered through the Solutions Center at zero cost. We have established a broad team of over 30 experts from around the globe who are available to provide remote policy advice and analysis to all countries. So for example, serving as our expert in the area of buildings, we are very pleased to have Cesar Trevino, founder of the organization Green Building and Alternative Energy. So, if you have a need for policy assistance on green building planning and design, or any other clean energy sector, we encourage you to use this useful service. Again, it's provided free of charge. For request/assistance,

you may submit your request by registering through our ask an expert feature at cleanenergysolutions.org/expert. We also invite you to spread the word about this service to those in your networks and organizations.

So just to wrap up, 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 participate in webinars like these.

Now, I'd like to provide an introduction for our panelists today. First up is Jens Laustsen, Technical Director with the Global Buildings Performance Network; and then following Jens is Niamh McDonald, the Buildings Policy Analyst at the Global Buildings Performance Network; and then next, we will hear from Hans van Eck, Unit Manager and head of the Department of Domestic Buildings, National Building Code, and EU directives with the NL agency, which is a division of the Dutch Ministry of Economic Affairs; and then our third speaker is Duane Jonlin, AIA Energy Code and Energy Conservation advisor with the Department of Planning and Development in Seattle, Washington; and our final speaker today is Kevin O' Rourke, Manager of SEIA's Low Carbon Technologies team. With those introductions, please join me in welcoming Jens Laustsen through the webinar.

Jens Laustsen

Thank you. As mentioned, I am the Technical Director of Global Buildings Performance Network and we have focused a lot on building codes because we see building codes as one of the most important policies to get energy conservation in the building sector especially when we look at the new buildings, but also in increasingly terms for the existing building style. We find in GBPN that it's very important therefore that all jurisdictions get their building codes right as the title of this set of webinars and we have analyzed building codes and we have come up with different elements and one of them is what is said here: long-term targets and frequent revision cycles. We want to focus on that building codes should be very dynamic and we will come back to this a little later.

Can I have the next slide please?

This is an overview of our presentation here. First, I would say a little about the Global Buildings Performance Network, who we are and what we do. The second part would be run by Niamh McDonald who had been the project manager on this project, on building code and comparisons, and she will talk about the rationale for the webinars and she will talk about a tool for online comparison of building codes and I hope you would find that very interesting, then she will talk about the dynamic process and the long-term targets, and finally, give a little hint on the upcoming webinars.

Next slide please.

This is a slide to illustrate who we are in the Global Buildings Performance Network. We find that the problems around buildings or the challenge with buildings is a global challenge, but buildings need to be understood locally. Therefore, we are a network with a global center here in Paris where we are currently 8 people trying to bring all of these together and be a voice in a global scene, but we also know that we need to go deeper down in the regions, so we have 2 larger hubs, we have one in the US, the IMR, Institute for Market Transformation with Jason Antonoff leading this work and we have one in Europe at BPIE led by Oliver Rapf and then we have reasonably established a small team, currently 1 person is sitting and working for us out in China and we have some ongoing work in India that have been our major focus from the beginning. We try to cross-fertilize between these regions and we try to learn from best practices and drag out what have worked in one region and this is what we're trying to do today. We are a part of the Climate Works Network and we get our main funding from them, so we are together with many other networks and financing. We try to help people telling how to do more than tell them what to do, so we hope that this webinar would be useful in this way. With this, I would hand over to Niamh who will probably request the next slide. Thank you.

Niamh McDonald

Thanks very much Jens. Thank you for the introduction also, Sean.

As Jens has mentioned, I'm going to start with outlining a little bit the rationale for this webinar series and why we are focusing on getting building codes right and the actual practical how to develop best practice building codes.

Last August, the international Energy Agency and the United Nations Development Program hosted a webinar to launch their joint publication modernizing building energy codes to secure our global energy future. This is a very interesting webinar and it discussed how to plan and implement and monitor, but there were a lot of questions from the audience about how countries practically implemented such best practices and what were the real challenges that people were facing on the ground when it came to pushing our best practices forward. Also, what were the key lessons that code developers have learned and how are these best practices and key lessons transferrable to other jurisdictions. Based on these questions, we decided to host a series of webinars that aim to directly answer those questions and we want to unpack a little what's going on with the [Indiscernible] [0:11:24] best practice building codes, what are these countries doing right and how can we learn from this. Throughout this webinar series and I should just mention that today's webinar is the first in the series of 3 webinars, we're going to hear from code developers from a number of different countries from across Europe, the US, and Asia including China and we're going to see how these codes are developing. Some of these codes are obviously at different stages of development but they represent best practice within their region and relative to climate also.

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In 2012, the GBPN started to work on developing a comprehensive methodology for defining best practice elements of energy codes and for analyzing existing building codes in light of this methodology and these criteria. We developed a series of criteria, which you can see here on the slide, and I'll discuss in a little bit more detail later on and these criteria form the basis of a Policy Comparative Tool. The tool facilitates the comparative analysis of building codes from different countries and regions and we have included 25 building codes in the tool. The aim of the tool is to support policy makers to understand the mechanisms behind dynamic codes. To really understand what makes a best practice code and how we can work or countries can work to develop those areas of best practice. The findings of this tool are the basis for this webinar so through the analysis that we've done with this tool, we found that there are certain areas or certain themes where countries may be struggling and need a little bit of support, but on the other hand, there are other countries who are performing very well in certain areas and will have a lot to share with the rest.

Next slide please, Sean.

Before I go on to discuss the findings of the tool, I'm just going to touch a little bit on the methodology that we used. A consensus process is used to develop this methodology and we gathered 65 experts in the field of energy efficiency to discuss what are the core elements of a best practice building code and what came out of this process was 5 themes, you can see them highlighted here: holistic approach, dynamic process, implementation, technical requirements, and overall performance. Now each of these themes is supplemented by three criteria and they're also represented there as well as a number of subcriteria. This was with 64 international experts, so it's quite a rigorous methodology and we also—you can see below, we scored the 25 building codes included in the tool on the basis of the criteria listed above and also the subcriteria that are not included here.

Next slide please, Sean.

More in-depth information can be found by this methodology on our website. We have a detailed policy paper that's been written on this. For this whole tier, you can see the policy comparative tool and the 25 building codes again listed there. The key findings for this tool in actual fact, there's no such thing as an overall perfect code. Every code can vary from each other, some codes were extremely strong when it came to holistic approach, others have performed very well when we looked at dynamic process, whereas others had made great progress in terms of technical requirements. We found that a lot of codes addressed technical elements very well. This is obviously a central aspect of moving towards zero energy, that's the basis. That had been addressed quite well across the

board. We also found that many codes have very strong policy packages and this is an essential element in supporting the move towards zero energy. We also found that there was a need for finding zero energy targets and clear roadmaps towards zero energy and this is an area that many codes can focus a little bit more on. There is also an absence of overall performance bodies and a need to address compliance across all codes. These key findings have really formed the bases of the webinar series and have got us thinking about dynamic process, what is really important when we talk about dynamic process and long-term targets? How have building officials managed to set these targets? How have they established revision cycles and developed appropriate roadmaps and maybe we can change slides please, Sean?

This criteria acknowledges the importance of dynamic process and in turn, significant decrease in energy consumption. As part of the theme, the criteria and subcriteria assessed where the targets were assessed within a realistic timeframe and were accompanied by a roadmap that's appropriate for achieving those targets. You can see here, this is a screen shot of the slide where we've just ticked all of the elements under dynamic process. You can see how countries have rated under those themes.

Next slide please.

This is another screen shot from the website where we've just focused on zero energy targets and you can see, as I've emphasized earlier, some codes have scored well while others were, if they had zero energy targets, they were lacking roadmaps and other supporting measures, but there's definitely a lot to be learned from the codes that have scored well here.

Next slide please, Sean.

Revision cycles, this is another screenshot from the website. You can see again that there are some good examples of best practice while we can certainly learn in other areas from other codes.

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As part of the dynamic process, we also considered levels beyond the minimum standards set within the code. We wanted to see if these levels have been encouraged by labeling and certification schemes and if code developers were encouraging developers to clearly define classes and exceed the minimum standard set within the code.

Next slide please, Sean.

To conclude with, there was clearly a need for stronger energy targets that are supported by frequent revision cycles in a number of jurisdictions, while on the other hand, we've seen that there are a lot of positive examples right there and we'd really like to learn from these positive and

practical examples and to see how countries have been implementing these targets and revision cycles. Later today, we'll hear from the speakers a little bit more about how they have driven change within their countries, how have they managed to set these targets, what was the political context at that time of the development of the code and also the market context, was the market supportive of these changes and/or did it take some effort to get them onboard.

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I'm looking forward now to hearing from the 3 speakers who will give us some more insight into the experiences that they've had in their own home countries and in the next webinar series which will happen on the 11th of December, we'll address the importance of performance-based building codes or performance-based approach to code development. On the third webinar, we'll look at enforcement and some lessons learned from jurisdictions around the world and that will happen on the 15th of January.

Without further ado, I will hand the mic over to Hans who will give us some insight from the Netherlands. Thank you.

Hans van Eck

Okay, thank you. [Indiscernible] [0:20:57] things to do. Yes. Okay, it's all clean now. Good morning, afternoon, or evening, depending on where you are on this moment on our wonderful and precious spaceship, Earth. Hans van Eck speaking. It's quite a challenge to tell you something about 25 years of experience here with building codes in the Netherlands in 15 minutes being not a native speaker, but I will do my best.

Let's start with on the managerial housing department of NL Agency and the agency is situated within the central government and the market enterprises and organization. We more or less linking between policy and implementation. As I look at the history of building codes in the Netherlands, we have quite some experience. We started the whole process of putting—getting building codes done in the early 70s, late 70s and then we started with the huge national insulation programs 1.5 million existing dwellings were insulated at that time, that's approximately 30% of the building stock but if we get that, we find out that it's, in some cases, was not optimal solution depending on the quality of the building and what's already done in these buildings. That was more or less the starting point for the determination of energy performance standards. We worked on this for 4 or 5 years and in 1995, we already started with the energy performing requirements in the building legislation and since that time, we go to this whole process, which I will describe to you later, every 2 to 5 years, that's for the new-build houses. Since 2000, we also had an energy performance advice and subsidy program running that's especially focused on existing buildings and at the moment, we have more than 600,000 dwellings who have [Indiscernible] [0:23:42] and improvements were done by the owners of those buildings and a bit earlier or later in time, we got in Europe the EPBD, the Energy Performance of Buildings Directive,

that's also focused on energy performance of buildings, and in the Netherlands, it's especially focused on existing buildings and at that time, we've had more than 2 million, 2.3 million labels, on the market already. Our building codes are well known in the Netherlands and we have a long time experience on that. If you look at the effects of this approach, we have, since the introduction in 1995, reduction of more than 40% in energy use in the in housing sector as well as the nonresidential sector. That's quite a sufficient number, I'm sorry.

If we go in the future at the moment, we are working to what we call the road to 2020 because in 2020 we want to go to really zero energy buildings. Both the Netherlands as well as the European Union have set projects to reach this goal and the graph shows the way to that is zero energy target over the years. We have an EPC at the moment 0.6, then we go in 2015 to 0.4, then 2018 to 0.2, and then finally in 2020 to 0. I will explain later what that means.

For the nonresidential sector, we have more or less the same approach. What you can see here is that for the new governmental buildings, we want to reach the near to zero energy building or EPC in zero level at 2018 to set an example for the commercial sector. These are also the targets we set European wide, so I think Kevin will show figures like these later in his presentation.

How do we do that? Because, we said, okay, we just lower the targets or higher the targets depending on how you want to see it, but what's the approach behind that? How are we setting the height of the EP requirements? Well, we started with the development of sample through reference buildings reflecting Dutch building stock and then we calculate the cost and savings related to the proposed energy performance level, so that to give you an idea, how much does it cost to get a higher quality in the market and what will be the savings not only in energy, but especially in cost are related to these investments, so that that gives you really an idea, is it cost effective or not, how much will it cost, and who should pay for it.

In the more political decision making process, we start with these feasibility studies and then, and that's our opinion or at least not my opinion, the most important part is the consulting of the building sector, not only the building sector, but also consulting with representatives from the housing and social housing sector and only if this consulting is finalized, we go to departments for political improvement. It's not that the government is setting the goals and say okay market, go on whatever it costs, but it's really an interaction between markets and politicians to get these done.

What has been in practice, I'll show you now an overview in what the effect was of those EPCs in 1995 until 2011. In 1995, we started at a level of average energy use in households for space heating of about 1400 cubic

meters natural gas. In the Netherlands, almost 99% of the houses are heated by boilers run on the natural gas. That's our reference. That's what people understand and that's what they know what they have to pay for. Now, at this moment, we are on the level of 0.6. The average consumption for new houses built under these codes are now around 600 cubic meters. A huge saving has already been achieved. In this one, you see the same figures, but then in graph.

Can we go on like this successfully towards the EPC or zero energy buildings? The answer is no as we find out in 2010 more or less. We find out that we need more detailed calculation methods and therefore, we introduced a new set of norms to get this point right because if we go with the very rough calculation method, it's very difficult to calculate this specific and very small savings at the end of the line going to zero energy buildings.

What we achieved was a new system with a higher degree of accuracy; new techniques were put in, biomass, micro power, solar [Indiscernible] [0:31:10] and also power generation in nearby houses were included so you get a much more detailed and much more complicated methodology but it was and is necessary to calculate near zero energy buildings.

The interim observations at the moment are after working with this new methodology for a few years, it's future proof, so this is what we will use to go to near zero energy buildings. Steps in legislations are set, parliament has approved the whole road to the 2020 based on this methodology and the techniques are available. We have already at the moment a lot of houses who meet the near to zero energy building level at the moment and very important, the political will is there but will the market be ready on time because you can build these houses on small scale but then we build on the bigger scale and is it affordable?

What we do to get there or to get more ideas, we launched at least a series of national programs and activities focusing on [Indiscernible] [0:32:40] development [Indiscernible] [0:32:42] and reducing financial barriers. I will show you in this graph an overview of the activities which are running at the moment in the Netherlands.

Is it affordable? That's always the big question. I don't know—I think it's in other country, but in the Netherlands, we always think about what does it cost and what will it bring to me. Until now, we were able to lower the EPC value without unacceptable negative cost effects on the market so that what we find out that due to the fact that it was a constant product development a growing market volume for energy saving materials and rising energy prices, we could keep the balance between energy savings and investment cost, but what will it be in the near future?

I show you a graph now that explains a bit of what's going on. At the horizontal line axis you find the energy consumption per square meter. At

the vertical axis, the total investment cost to get measurements done to get to that lower energy consumption program per square meter. If you look at where we are standing now, the red box that's now on the graph is the area where we are going in now. That's the area where we need more costly measurements done to reach the near to zero energy's goal. If we, as we say it in Holland, we are more or less climbing the mountain, and at this moment, we are only on the [Indiscernible] [0:34:43] on mount Everest, so it's becoming, at this moment, more and more difficult, but we have a methodology that gives us a good opportunity to communicate with all the involved parties and to find out what is the market, what are the politicians willing to pay for the energy saving and to reach the direct zero energy target.

The big uncertainty in this whole thing is the development of energy prices because this will dramatically influence the outcome of the future cost of [Indiscernible] [0:35:34] studies and the question is, of course, will there be a really political will to go for the environmental targets if the balance between cost and benefit will not be in complete balance.

How do we get it affordable? At this moment, we have a lot of subsidy schemes running. That's what I always say, that's an old approach, just buying the energy saving or closing the gap between savings and investments cost. We see in the last few years good signs and the good signs are that we see there are more and more green loans getting on the market and we see all kinds of more market-driven solutions coming up. I'm very positive that at the end, we will reach the near to zero energy targets and the environmental targets because if you look at it, the question is not if it's affordable, maybe more is it affordable not to go to this direction and I hope that 2020, the Netherlands landscape will be enriched with modern versions of our beautiful windmills and we will get it done.

I think I'm having done with my time. I want to thank everyone for his or her attention and I want to give the floor to the next speaker, it's Duane Jonlin. I hope I pronounced it well. Thank you very much.

Male Speaker Hi Duane, are you on the line?

Duane Jonlin Hello. Can you hear me now?

Male Speaker Yes we can.

Duane Jonlin Okay. Just getting my screen here ready for you. All right. Thank you and well, I would say good morning here, but I guess it's good afternoon for most of you. I'm so honored to speak with you hear and I hope that this leads to a longer-term collaboration amongst all of us. I'm very excited about this, so please keep in touch. My e-mail address is on the last slide.

Energy code development in the States is highly political and is fragmented into hundreds of separate city and state ordinances. Typically,

the more liberal parts of the country require more efficient buildings, while conservative areas allow lower efficiency and this springs from some fundamental belief systems here. Global warming is not thought of as just a difficult scientific problem here, but rather it's something that people either do or do not believe in like Santa Claus, so it's not effective to mention global warming in code development meetings; instead, we can only defend energy efficiency in terms of their financial return on investment, but this is interesting, energy efficiency is one of the only things we do that is good for the planet and good for the economy at the same time so there should be a good convergence up there.

For those of you who forgot their geography lessons, Seattle and Washington State are in the upper left hand corner of the map there and we have a climate rather similar to the Netherlands, actually, a lot of clouds and rain. The state and the city here each have their own laws regarding long-term energy use reduction and these laws that are written by people who wear very nice-looking suits but the laws don't have any details on how all these energy reduction is going to happen. So, who knows, perhaps Santa Claus will bring that too. The state, you can see from this chart, has charted out a 70% reduction in energy use by the year 2030, however, there is no particular intermediate timetable in the law, so we just have to provide this in a way that is actually has to also be understood as cost-effective to the owners and tenants of buildings. Every 3 years, we have a huge debate about whether more efficiency will be cost effective or not. This is one problem with this go-slow approach we have, is that, the changes are just never-ending. Every 3 years, the engineers and the builders are just getting used to 1 code and a new addition arrives. Denmark actually did just what we're trying to do, but they get 3 big reductions of 25% each over once every 5 years and Washington State is trying to do roughly the same thing with 8 smaller steps over 24 years.

Seattle has a long-term goal of being completely carbon-neutral by 2050 and we have several intermediate goals. We're generally following a more aggressive path than the Washington State is, so many of our code provision start here in Seattle and then are taken up by the state in future years.

We're very proud of our accomplishments here in Seattle, but if you look at them from a worldwide perspective, we're only doing well in comparison to some of the worst energy wasters in the world, so we always think Canada and Russia, since they're the only countries with worse performing buildings than we have.

Politics and money are tightly connected. It's another good reason to make a strong business case for your code proposals. It's easy to make ambitious plans when everybody is making money but much harder to do it when the economy is doing badly. This is a bit of strange because the best thing we could do for our local economy in the long run is to send less money overseas for fuel. The trouble is that in the short run, it costs

more for businesses to change their practice than to stick with their normal practice. Climate change seems like it's a long way off in the future compared with the survival of your business this year, so to make real progress, you need to frame the arguments so that both the environmentalists and the business leaders see an advantage for themselves. This is politically tricky.

That is one of my favorite quotes from a leader here on US on energy efficiency, but ideally, we should have hundreds of buildings constructed to a higher energy standard before that becomes mandatory code. By the way, these numbers that I have on there, I hope I've got the units correct, but those include all the energy use including plug loads and processes and everything, but just having these visible in your community certainly changes the debate dramatically.

Developers and builders in the US usually fight against high efficiency standards. This is a bit amusing because each one of these developers and builders has an impressive sustainability page on their website showing what their great commitment is to environmental protection, but if you ask them to give up any of their standard practices, you'll hear a big explosion. When we're asking everyone to go through a painful transition, is it better to feel a little pain over and over and over or just to get it over more quickly as Denmark did? My feeling is that rather than the many small steps, perhaps a few larger steps and more difficult ones might have been a smarter policy.

Standards for new building construction are important. Reducing energy use in our existing buildings is much more urgent because there's so many of them. One idea I have heard is that we should set a target date, perhaps 12 or 15 years from now, when all the large existing buildings will have to meet a stringent energy standard and then provide good loans for the work to upgrade those buildings, but let everyone know that you will lend less and less money every year, so this would give the owner an incentive to upgrade their buildings sooner rather than later and could pay for itself since the energy savings would be generated that would repay the loans. I've never had the courage to try to propose that officially in Seattle, but who knows, maybe in the future?

It's always helpful to think of the energy code as a floor that defines the worst building that's allowable by law and if some very high performing buildings are also built in each community, it will be easier to convince everyone that high performance is a reasonable thing. This is a photograph of the national renewable energy labs in Colorado here that is zero energy, very large building. Perhaps, you could have each building that is just meeting code minimum pay some kind of fee that would be put into a fund for very high performing buildings, thus financially encouraging the development of some leaders beyond code minimum.

It is always a struggle to get support for new regulations from the builders and developers. Every industry resists new code restrictions or expenses and each new code proposal is bitterly contested here by the affected industry; however, new regulations also provide new opportunities for other parts of the construction industry, so it's good to gather support from the firms that would benefit and also, I would say that having an energy code that's based on performance rather than like ours that are based on many specific prescriptive requirements might make it easier and be less threatening to individual industries.

Working with builders and building owners is a good thing if we're going to develop policies that impact the construction industry. It's good discipline to prove that the energy savings will outweigh any additional energy, any construction costs and perhaps our financiers will start valuing energy efficiency as well. Finally, if we place a label on each building showing how well it performs, like the Michelin rating for a restaurant, the public might start valuing efficiency as well.

Anything that becomes a code requirement tends to drop in cost from what it was before because it rapidly goes from being a special order to being a standard practice. Since our tax policies in the US keep energy costs very low compared with most of the world, it's even more difficult for us to present a business case for efficient buildings. For those of you in countries where energy is expensive, it's much easier to convince politicians and building owners of the value of energy efficiency. So tax policy is a big deal there and interestingly, that last bullet point here is a well-observed phenomenon that if you do many things in a building or all the things you know to do very well, then the cost for each of them tend to drop and there's a great synergy.

Next, I want to just go through a few of the new code requirements that we enacted in Seattle this year. This first one, our target performance path is a simplified energy code, actually very much inspired by Denmark, that simply sets an energy use target for each building type and then leaves it up to the design team to find a way to hit that target any way they like. The team will submit an energy model to get their building permit and then after construction, we'll track their building's energy use until they operate for a full year within their energy frame. Like I mentioned before, here in the US, we have to do this second part because our energy is so cheap that there's not otherwise much more motivation to pay attention to our gas and electric bills. I just looked it up and I believe electricity in Denmark is 6 times the cost that it is here in Seattle, so it's much easier to get people in expensive electricity areas to pay attention to that than it is here where we have electricity pretty much coming off of our mountains all the time.

Commissioning is our word for an independently verified study of a new building showing that all the energy systems work as they were intended. The problems that commissioning agents discover are sometimes quite

shocking. This process extends well past the construction phase and into the building occupancy phase, so Seattle now is requiring a separate permit to ensure that all the systems are tested and working properly together even well after the tenants move into the building. When a building undergoes an extensive renovation, something that really extends the life of the building, we now require that its energy performance reach nearly the standards for new buildings. There will never be a more economical moment to improve the building's performance and if such a huge change to a building only happens once every 40 years or so, we can't wait another 40 years to get to that point. These projects might actually also be able to use that target performance path that I mentioned earlier.

That picture on the upper left is the roof of my own house there. I had that [Indiscernible] [0:50:59] system put on the roof a year ago, but already the system is dramatically less expensive than it was just last November. It makes sense to wait for a few more years for lower costs to fall even lower. Our new solar ready rule requires buildings to reserve space on their roofs for very large future solar array. We're asking for 40% of the roof to be all ready for a new building like for a future solar system like you would see in that picture on the lower right. They only have to install a very small system right now, then they'll be able to put a large system in 5 or 10 years from now without the expense of moving vent pipes and fans and other gear out of the way on the roof. It's solar PV is one of the only things in the entire building construction industry that's getting cheaper as we go forward, so saving that money for a few years down the road might be a smart investment and put money now into making the building envelope.

Seattle already requires an advanced metering system in each building so that the building managers can track their energy use in real time. This new rule we have here requires tenant spaces that fill at least a full floor of a building to provide a separate dashboard for the tenant itself to be able to monitor their own energy use. The idea is that the building management doesn't have much control over what is going on within the tenant's space, but a tenant who can see an hourly basis of how their energy use is going now compared to how it was this week last year or something like that, has a much better chance of being able to study that.

The plug load rule requires offices and classrooms to have half of their outlets controlled with occupancy sensors or automatic time clocks, just as we do for lighting systems now, this way, there will be 1 controlled outlet next to each standard outlet. Electrical loads that are plugged into the controlled outlets will turn completely off when no one's using them and now that we've seen that in newer buildings which are getting more efficient as far as their other systems, the plug loads represent more than a third of the total energy use in a commercial building, so it's anything that can reduce that energy significantly is going to be a very significant reduction for the overall building energy use.

Finally, America's busy making progress in little steps. The oceans and atmospheres are still relentlessly warming up, so to get from this state of affairs to net zero energy buildings, we'd have to say that progressive cities, regions, and countries need to show the path for the ones that follow that are not quite as progressive. Notice that the steep path in this picture is easier to climb because people who came before have helped make it a better and more climbable path and that would probably be the people on this phone call. For focusing on results, my strong belief is that the US needs to transition away from our prescriptive energy codes and towards performance-based and verified building energy standard. We need hundreds of buildings that use very little energy and are economical to build but that also provide great beauty and comfort. You can't have your high-efficiency buildings be ugly or uncomfortable and this will change what everyone thinks of as normal and make it easier to bring the minimum code standard up to a higher level in the next cycle and finally, we can speed up our progress tremendously if we engage those groups that oppose such regulations and listen to them and learn from them. When our arguments become strong enough and convincing enough that our adversaries adopt them as well, then we'll know we're doing it right.

Thank you very much, and like I said, do stay in touch.

Sean Esterly All right, and we'll be switching over to Kevin now for his presentation.

Kevin O'Rourke Hello, am I live?

Sean Esterly Yes you are and we hear you loud and clear, Kevin.

Kevin O'Rourke Hello. I'm live and we're ready to go are we? Yes. Okay. Hello?

Sean Esterly Yes, we hear you and see your slides.

Kevin O'Rourke Okay, so everybody's ready to go, okay. Thank you very much.

I must say I agree entirely with what the 2 preceding speakers have said and I'm sure that some of what I say will merely reaffirm what they're saying, but I hope to offer a few other insights from our particular experience and it's—while we've got a relatively positive assessment on your comparative tool, I wouldn't be pretending that everything's perfect. I think there are some significant challenges and I'll close on that point, but to tell the narrative here.

Can you see the full screen here or am I hidden? Is this tool in the way?

Sean Esterly No, we see the whole thing.

Kevin O'Rourke Okay, okay.

Sean Esterly We see the presentation.

I work with the National Energy Authority in Ireland called the Sustainable Energy Authority and our job essentially is focused on energy efficiency and on renewables and if you like, on integrated systems. We've a population of 4-million people in Ireland and a relative young building stock with about 60% of the build since 1980.

What I'm going to talk about really is the evolution of Ireland's building energy performance standards, the process of target setting, some of the factors influencing the pace of change, the trends in energy use, and I'll talk about future directions. My focus is predominantly on the housing sector and that's again an issue I'll return to and we do have many challenges which, again, I know we share with just about every other country when it comes to issues like enforcement and skills as well as the challenge in our presentation with this kind is to some degree, one is engaging in post rationalization of the past. The past doesn't always feel as coherent at the time as it seems in retrospect, so in terms of putting this narrative together, I suppose I've been trying to do that and of course equally important, more important since the purpose of it is to actually derive lessons, it's visioning the future.

There's a long chronology attaching to this whole story and we started from a very low base, I'd have to say in the late 70s in Ireland, wherein elementary insulation first got introduced and that was purely at elemental level. I think attic insulation or roof insulation was the first. That got a little bit strength in the early 80s, but once the crisis receded, we ended up with something of business as usual, gradualist approach to improvement and we in fact had about 78% I think at one point of Irish homes in the late 80s were reliant on solid fuel heating systems predominantly open appliances with efficiencies of less than 50% for their main source of heating. We were starting just 25 years ago from a relatively poor base. We've had since 1991 was actually the first introduction of formal building regulations which strengthened the elemental values somewhat further and those got strengthened further into 1997 with the introduction for the first time of a building energy and overall energy and buildings calculated method of performance approach if you like, but the real progress has been made in the—it has been made quite strongly over the last 15 years. We've gotten to further strengthening in 2002 but we've had a significant change in impetus since the middle of the last decade and I won't go through this in detail because I will be touching on some of this later on. I suppose we had the introduction of building energy rating we've introduced incentive schemes, strengthening of energy standards 5 times in the past 15 years overall with the introduction of renewable energy obligation and energy efficiency retrofitted programs or renovation programs introduced for housing and other sectors in the past 5 years also.

This is all in the context of the climate in which we had a very profound economic downturn but the momentum has continued in this particular

area because it's seen as an enterprise and job opportunity and helped as an economic regeneration issue. That's affecting mainly the retrofit but rather than the new build but there has been, I think, an influencing effect from new build into the retrofit market in terms of industry capacity. We were dealing with that sort of background. I won't dwell on that, paint the history up to the end of the 1980s in the interest of time.

I suppose, as I said, the important find as far as targets are concerned is that targets first found their way into formal policy in 1997 even though I was part of the study group that recommended it back in 1981, so that just fell on [laughs] and how much inertia there was in the system back at that time, but in the 90s, we got national climate change strategy and green paper on sustainable energy. SEIA was effectively established. Its precursor was established in the mid-1990s and fuel power began to be addressed. We saw just a greater, let's say, ground swell of public consensus and indeed industry receptiveness to really more progressive energy standards.

The building regulations, the most recent variations on them are for housing had introduced energy and carbon performance targets from 2006 onwards. The 2 steps, 2008 and 2011, reduced energy consumption and CO2 emissions by 60% relative to the mid-2000s. We introduced a mandatory renewable energy contribution per square meter of 10 kilowatt hours [Indiscernible] [1:02:22] 4 kilowatt hours electrical, introduction of thermal bridging and air permeability criteria particular limits on efficiencies of heating systems and particular measures on space and hot water use and another element actually which I should include there is that lighting is very much part of the methodology. The actual computation procedure at that time is primary energy per square meter. For space heating, water heating, associated electrical mechanical power for pumps and fans and lighting and its primary energy where the typical prime energy for electricity is 2.5.

A broadly similar approach has been taken in nondomestic buildings, but there hasn't been the same aggression in the strengthening of the standards, but there has been a codification and a systematization of the requirements in the right direction and currently there is a review initiated by the ministry for the environment of the standards, foreign and domestic.

The format, I think I've already apart from the performance targets energy and carbon, there are backstop limits on aspects such as elemental U values, boiler efficiency, and air leakage and we've had as I've said hot water heating, heating control, pipe and duct insulation, and lighting coverage as well.

The building energy rating got introduced about [Indiscernible] [1:03:52] energy performance and buildings directive in early 2006. In late 2006, it was formally legislated for but it began to get traction seriously at the end

of 2008 and the common methodology is used for this as for the building energy performance figures and I think this is all pretty familiar to anybody in Europe. For those of you outside Europe, I think this is again rather familiar. I suppose what's significant here is that, again, we've had over 350,000 building home energy ratings in the period since in less than 5 years which represents one-fifth of our housing stock which I think is quite a considerable pace of building energy ratings and I think it has had a very strong empowering impact in the market and there have been studies shown that it has impacted on prices and of course, one of the things that building energy ratings tends to favor is it gives something of a market edge to new dwellings over existing in terms of the energy dimension of their performance.

This is kind of the outcome of if you like sort of progression and standards as an indicative outcome here at the right-hand side showing the relative building energy ratings from A to F A being best, of course. You're seeing that we migrated from a level in the early to mid part of the last decade, about 156 kilowatt hours per square meter primary energy down to 63 kilowatt hours primary energy today in the standards and with the near zero cost optimal studies are indicating that a figure of the order 40 kilowatt hours per square meter constitutes a near zero energy building as far as the [Indiscernible] [1:05:54] recast is concerned, but I'm sure that's very much open for debate at the moment. We've had this progression, as I've said, through these steps and we're now heading for near zero.

Another way of representing this I suppose is just looking at the energy in carbon indices and we've been moving down instead all the time from a ratio of like a 1, we set the benchmark or the datum level in 2005 and are moving down, as I said, towards low zero carbon or as energy-positive buildings hopefully within this decade.

There were 4 questions I was asked to address as to (1) what are the market conditions at the time of the targets being set and introduced? I suppose they were very buoyant in the mid 90s Ireland went through a nonhealthy construction boom from the mid to late 90s right through to about 2006 to 2007. We had a lot of industry innovation and confidence in that market. We had a lot of competition on energy standards between the masonry and timber frame sectors. It was becoming very, very visible. The nature of Ireland is very open economy. There's a lot of exposure at the construction industry players as to having worked abroad. There was a lot of internationalist influence, let me just say and technology changed and less and less fears that there might have been in the past of innovation in the construction sector and that would've been derivative too from other sectors of the economy with which we had extremely rapid change. We have a very, very strong ICT sector in Ireland.

Was it a struggle to get support from the market and if so how did we manage to get from them much less struggle, much less inertia than in earlier decades? There was a general greening of societal attitudes, I

would suggest, in that period. Again, we're a very open economy, very much open to the world. We're a small country which hears a lot of the global debates. We introduced in 2001 a house of tomorrow program which was a demonstration program which was at the time we set it as a new agency, a target of 40% improvement over the then building regulations and I think that that certainly provided an evidence base to support the regulatory case for strengthening the regulations in 2007 to 2008 and associate commission started on cost effectiveness as the competitive factions within the industry might have had to give emphasis to it too and we also of course had the introduction of building energy rating which I've already referred to and we've had industry support, the major insurance company that was providing insurance to the typical house building industry engaged us on a number of occasions—for a couple of years in nationwide roadshows that's for builders/developers to introduce these new standards and we were in shock that we survived those events and there was a more positive mood in the room greater than negative. This is all against the background, I'd have to say, and I'd come back to the growing debate about enforcement.

The political context mirroring what I've just said was again was that climate change and energy policy consensus has been really much a cross party consensus in Irish politics in this area. I know that that's—it doesn't look like being fractured at the moment as far as sustainable energy issues are concerned in the building environment. It may be they had more challenges in some other areas. There has been a willingness to lead. We had significant sustainable energy elements with international development plans in the last decade and we've had an attitude at policy level in government departments particularly towards the implementation of energy performance buildings rate which has not been looking towards minimalist compliance but more actually—we've managed, I think to our efforts, in the early parts of the last decade in the middle of the last decade to persuade those in those positions to actually see it as an opportunity in terms of the sort of issues that Duane just mentioned. We had a green party in government in the latter part of the decade which certainly helped, but I think there had already been the target improvement of 40% had already been published in the white paper even before that government was formed even before that election, so I would say if anything opposition parties tend to say that sitting governments are not aggressive enough in their pursuit of standards.

Was there technical capacity? The industry certainly has one which we had some hazards with innovation but the change here was not absolutely radical. There was a learning that by doing through the likes of the house of tomorrow and greener homes type experience greener homes was the grand scheme for renewable energy systems that had been introduced along with accompanying training courses and standards in those areas. There were a lot of resources put in place to actually try to support the industry in its taking those on board both at its pacifier level and at trades

level. I think the more on its pacifier level than trades level and I think there could be a weakness there certainly at trades level which again I'd try—not could be, there definitely there is I think a variability across the industry in terms of the state of skill and awareness of a lot of good practice issues that are required by the new codes. There had been courses run by the major training bodies but there still would be doubts, as I said, about quality of site practice and the demands of ongoing skills development and the EU's BUILDUP SKILLS initiatives particularly significant in that context.

What else has driven climate change? I think I would just say there has been institutional trust and collaboration between the government ministries and ourselves as an agency. There has been very much a partnership approach and I think there has been, I'd say, a strong trust ingredient there, which I think there has not been the sort of clashes and conflicts that sometimes can exist between government ministries.

I suppose I've eluded a couple of times now to the question of enforcement. This is a very live issue in Ireland but there is a new system of audit chain accountability being introduced onto the building control legislation and new [Indiscernible] [1:13:19] but it's much more, I feel like, legally binding and legally accountable as far as the responsible professional and construction parties are concerned and I note and correctly it was noted that within the rating we received and the comparative tool, this was seen as an area of weakness and I think that is a valid assessment.

You can see here that enforcement standards in the middle of the thing is the lower scoring item.

What in part—what have been the outcome of all of these? We're seeing—roughly speaking, we've had an 18% reduction in energy use per dwelling. This isn't all attributed to building regulations, as I will point out in a minute, but there's been quite a dramatic change in the period of 2006 to 2011 in a study that we published just 2 months ago. This shows the average dwelling energy consumption has fallen by that much not just in fuel—mainly in fuel but also in electricity. We've seen the trajectory of CO2 emissions per dwelling falling from about 10.6 down to I think 6.4 tonnes per dwelling and the decarbonization of electricity certainly has certainly helped in that component but we see the carbon component has equally fallen significantly across the whole building stock. Overall across the stock since this is the Odyssey of those if you are familiar with the EU Odyssey methodology, the pace of improvement in the energy efficiency index of the dwelling stock has travelled, more than travelled in the period since 2006 relative to the previous 11 years. When we analyze this, there are 3 major contributory factors: new build, let's call it [Indiscernible] [1:15:19] quality through the building codes; retrofit upgrading which has been very aggressive, we've had a quarter of a million of our homes retrofitted in the past 4 years; and behavior change which would include of

course responses to both economic downturn and energy prices but also many other DIY type actions taken by people.

Looking at the next steps, the roadmap to 2050, this is a document that we published, I think, nearly 3 years ago as a kind of a visioning and envisioning of the future pathways towards both new build code standards obviously going to near zero and below and upgrading of the existing stock.

Live challenges, these are the major emphasis on retrofit renovation, the enforcement regime. The whole question of the cost dimension to the cost output methodology which I think has particularly referred to [Indiscernible] [1:16:34] in his closing remarks and I think when it comes to that methodology, we do have a challenge in relation to setting of new codes as to whether we do them on the basis for example of energy prices or carbon prices, snap shots of what they currently are and assessing cost effectiveness on that basis or on the basis of projected energy or carbon prices or indeed renewable energy components in these electricity mix over the lifetime of the building. Do you look to a 30-year time horizon and do you accept these type of trajectories that are being proposed say in smart grid or renewable integration expectations. That's a huge challenge, I think, not particular to Ireland but I think it's for most countries.

Approaches to renewable energy integration, what are the best approaches, what flexibility onsite, offsite. As smart grid and [Indiscernible] [1:17:31] treatment of electricity on the primary energy gradient, the need for more attention to nondomestic buildings and the course is to set skills challenge as well as in all of these regulation does drive innovation I think this remark was made earlier. We see the example for example in window standards, it's now cheaper to get a double glazed window and not yet a triple doted window but a double glazed window rather than a single glazed and hopefully the day will come when triple glazed windows to pass house standards will be nearly as cheap as double glazed windows but we do have a question obviously in the capacity of industry to adapt to the pace of change that they're having to engage with and with the degree of complexity of systematization that's involved and in what is still very much a craft based industry in terms of [Indiscernible] [1:18:26] practice. There is not.

So we're dealing in an arena in which we have all of these steps in the process between the dreaming of a building and delivering a building. We have all of these players who are playing on the stage or in the orchestra. We have all of these other now specialist service providers coming in to try and support them and then we have the oversight and infrastructure if you like through registration and regulation trends. Very, very complex arena. Huge challenge, not just the skills of those on site, it's the skills of all of these other players as well and their, of course the infiltration of these skills consistently across the industry and the behavior of the industry. It's the supply chain, skills chain, quality chain issue.

If I was to summarize in terms of what had been the success factors that I suppose would characterize this making sense of the past as I would call it, there has been the ingredients of leadership, political consensus, a target setting approach informed by evidence, and in an environment, I think, of confidence, confidence not just in the business case but confidence in I suppose the wisdom of the whole thing. Capacity to adapt and innovate, skills and enforcement and more challenging and I suppose the core of it is approaches of partnership among stakeholders, policy support, and evidence.

I think that concludes my presentation. Thank you very much.

Sean Esterly

All right and thank you to each of the panelists for the great presentation. We have a few minutes left to address some of the questions of the audience so the way this works, unless it's a question that's specifically directed at one of the presenters, I'll ask it and feel free to chime in panelists if you are able to answer the question.

The first one, we have an attendee that was wondering if anyone worked on EE building code enforcement and if so, if you can talk about your experience with that, their experience was that although a lot of the countries have the EE building code, enforcement is lacking especially in the MENA region, Middle East-North Africa region.

Jens Laustsen

This is Jens Laustsen from GBPN. We have looked at the enforcement and this will be a topic for one of the coming webinars, so let's use this to make a little commercial that in January, we would focus a lot on enforcement and why countries are not doing it right and how they can do it right, but as Kevin and other presenters mentioned, this is a big problem in many places but we also found some good elements but I wouldn't go too deep in this now unless anybody else needs to comment. I think we should save it for the special webinar.

Sean Esterly

No, that was good.

The next question from the audience is to Jens and they were wondering if your calculation method included user behavior correction, for example on direct rebound effect.

Jens Laustsen

[Laughs] That's some very good questions. We looked into in GBPN and maybe Niamh will add a little on that. We try to look into how well does codes perform and we try to look into, and are still working on this, how they are performing after they have been constructed because as it's embedded in this question of course when people get a better house, they might also start using more energy and it's one of our findings so far is that in general, there is a rebound effect and people use more when they get a better home. Would you add something Niamh?

Niamh McDonald Yes, in the methodology we used to develop the tool, we didn't lock out behavior but we are doing a separate study on the impact of building codes and as Jens has said, the rebound effect has certainly come up quite a bit in the literature.

Sean Esterly Great. Thank you, Niamh and Jens.

The next question is directed towards Duane. The attendee asks, do you see any movements that US states may raise energy taxes to make up for lower prices due to things like Shell gas and in order to make energy efficiency measures more beneficial?

Duane Jonlin Well thank you for the question. The answer would be a very definite no. No politician seems to be able to survive here by suggesting any additional tax of any kind so we have to find other ways to work around it, but taxes and indirect taxes on energy cost remain very low here.

Sean Esterly Great. Thank you, Duane.

That does conclude the questions that I received from the audience. Again, thank you to the panelists for answering those and now at this point, I'd just like the audience to take a quick survey based on the webinar that provides us with some feedback and allows us to know what we're doing well and where we can improve. Heather, could you please display the first question and that first question is, the webinar content provided me with useful information and insight.

The second question is the webinar's presenters were effective.

The final question: overall, the webinar met my expectations.

Great, thank you for answering our survey and on behalf of the Clean Energy Solutions Center, I'd just like to extend a hearty thank you to all of our expert panelists today and to our attendees who are participating in today's webinar. We had a great audience and great questions and we very much appreciate your time and I do invite everyone to check the Solutions Center training page over the next few weeks, we'll be posting the presentations, the slides, and an audio recording of today's presentation and on there, you can also go ahead and browse any of the previously held webinars which were also recorded and look at those slides and listen to those recordings. We also invite you to inform your colleagues and those in your networks about Solutions Center resources and services including the no-cost policy support and with that, I hope everyone has a great rest of your day and we hope to see you again at future Clean Energy Solutions Center events and this concludes our webinar.