

The Future (March 23, 2015)

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David Cash, former Commissioner, Massachusetts Department of Environmental Protection and Department of Public Utilities

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Michael Dworkin: I'm Mike Dworkin, I'm the professor of law at Vermont Law School where I direct the Institute for Energy and the Environment, and there are a few disclaimers I have to make. You have sat through these, but I need to do them and maybe they will amuse you. I'm on VELCO's Board of Directors, Vermont Electric Power Company, but I'm not speaking for VELCO. And I'm on the Board of Directors of the Vermont Energy Investment Corp, which does Efficiency Vermont, and Efficient for DC and half of Ohio, and I'm not speaking for them. And I used to be on the Executive Committee of EPRI's Board of Directors and I am not speaking for them. I am not speaking for Vermont Law School, and even though I am the Director of the Institute for Energy and the Environment there, I am not speaking for it either. It doesn't have opinions, it's just is full of opinionated people. So you get me, but you also get three really first rate speakers, who know what they talking about, and are good at describing it. I am not going to run through the bios at length because they are set out well in the promotional materials, the brochure that you've got for the program. But what you will see is high expertise, long experience, strong communication skills, both from the professional and quite literal in the telecommunications-communication media as well. People who have had to make decisions, and they've lived with the consequences of their decisions, as are a lot of other folks. So, they have not just thought about it, they have acted on it and have seen what has happened when they took their actions. I want to move fairly quickly to what they're going to say, but I want to suggest a little bit about how to think about it.

You've heard long lists about things that are good and bad about lots of proposals. And if you actually looked at Section 248 of Title 30 of the Vermont law, you'd see 12 or 14 pros and cons, but I am going to suggest that for simplified reasons, you can distill this down to what I call a "trilemma." A trilemma has three parts like a triplane and a tricycle. And the parts are problems like in a dilemma, where if you work in one and the other parts gets harder. And here are the three. One is operational reliability. Will the system work, will the lights go on when they're needed, will the air conditional when it's needed, will the smelter go on when it's needed? Will the system function and what does it take to make it work? So operational reliability is one. And the next one is economic or financial. It is sometimes called the price although I'm going to suggest that it is the bill that matters, not the price, and we can talk about that at some point. And the third one is environmental sustainability, which certainly includes greenhouse gases at a vital level, but in fact it includes a lot of other things too, including mercury, lead, heavy metals, toxic solids, total suspended solids. There are a lot of pieces of the environmental part. But those three parts of operational reliability, financial effect, and environmental effect, are something that if you ask those three questions about everything that anybody says, you've gone a long way down the path of moving forward. Where as if you only ask one of them, which most people do, you

can pick anyone of three, but there are people guilty of only caring about that one, then you are not reaching into the tensions that have to be dealt with to make real progress.

So I ask you to think about those three, I'll ask you to listen to the folks that are going to present for what will hopefully be for 8 minutes each. I've said I will really try and be fierce about that. I'll ask them to comment on each other for a just couple of minutes, and then we will open it up for what I said to some folks would be like question hour in Parliament. That means you folks get to ask questions and see what the people on the podium do to dance to that tune. So with that said, Mary do you want to come ahead? We will start to talking about the situation as it looks from Green Mountain Power and to the larger world that it's a symbol of, and we will go from there.

Mary Powell: Wonderful, well it's wonderful to be here. I am Mary Powell, the CEO of Green Mountain Power, and I do speak for Green Mountain Power. So it's really nice to be here, really great topic. You know, I have had the great fortune of working with many folks in the room. And have had great fortune working on many important transactions for the state of Vermont that involved our friends to the North. So, [I am] really pleased with this conference, I think it is just a wonderful topic and very timely to keep talking about. Most of my remarks are going to be captured in this power point, that yes, we are actually going to play it to music, because it is the afternoon, and I don't know about all of you, but I just can't just listen to people and read power points together. So it is going to go to music. But first to give you kind of an overview of where we are headed and where we started.

Where we started a number of years ago, was in launching an energy vision for Green Mountain Power. The most important thing to know about the vision that we launched and about the direction that we see ourselves going in the future is that it is really based on sort of four fundamental beliefs. One is, that we have to be customer obsessed. Obsessed, we have to be obsessed with understanding what our customers want, understanding where our customers want to go, and maybe even trying to anticipate things based on current trends that they may not even know they are going to be wanting in a few years, but that we sense that they are heading in that direction. So it is really a piece of being customer obsessed as an organization. We really fundamentally believe that in our role that is one of the most important things we can do. The other three things are really the three things that we based our whole power portfolio strategy on. Which is around producing for our customers a portfolio that is low cost, low cost, so part of being customer obsessed is keeping that portfolio as low cost as possibly can now and into the future. That it's low carbon. Our customers in Vermont have told us for years, decades, they care deeply about renewable energy, they care deeply about the environment, they care deeply about actually local renewable, energy resources. So the low carbon part is a really important part of our strategy. And then lastly, reliability. I heard that talked about, so it's that piece of - and I like the remark of, yeah, its true in other countries, I think we take for granted what we have here and we can never forget that reliability is really important and it is getting more important every single year. And another piece of reliability that you'll see tied into where we are going is that it is tied to resiliency. So it can't just be having an incredibly reliable system because, oh, we have this wonderful contract with Hydro-Québec, we have these wonderful contracts. But we also have something called weather that is getting more severe. So as we think about the future how do we anticipate a way to get to a more reliable future?

So really the short was to summarize where we see the vision of where we are going, is really fundamentally moving away from the big bulk system that we have now over the next couple of decades and moving much more towards a consumer driven, business driven, locally driven, much more resilient system of delivery. Do we think that that means that the bulk system we have today is magically going away or should? Nope. We actually think the real challenge for us is going to be how to deliver on a superior way on both. How do we make sure we are making the really important investment decisions, we're purchasing power where needed and at the same we are aggressively, aggressively leaning into a very, very different energy future? So we call it - what we talk about Green Mountain Power is becoming the energy company of the future. We are creating the energy homes of the future, we're creating the energy businesses of the future, we're launching a major - we just got some really nice attention for a solar project we did with battery storage that is going to be part of a microgrid where we are creating Rutland, Vermont as the energy city of the future. So we really want to be at the front, you know, the front line of making this really seismic shift over the next couple decades, which we will believe will be a lower cost, lower carbon, much more incredibly reliable future for delivering energy to our customers. We see it as a huge opportunity. I am excited because this conference tomorrow has a session on how to partner further. And I think this provides an incredible opportunity for us to think not so much about what the historic relationship has been, but what the future relationship could look like much more around innovating for a very, very different future, so it's wonderful to be here.

Michael Dworkin: Now, if you want an example of the theory that it is easier to build the future then to predict it, that is what we saw there for a while. I want to ask David to talk now. You all know that I am from Institute from Energy and the Environment, not 'or' the environment. And I take real pleasure in seeing other people that bridge that gap too, and David is someone who has been really responsible on a statewide level for both of those realms and to some degree for pulling them together. So it is a real pleasure to have him come and talk about it now.

David Cash: Thanks Michael, and Mary that was great and just really unfair. So I am going to change my presentation to an interpretive dance. That would be funny though. So I need some caveats too. I think on the program it says I was former Commissioner at the Massachusetts Department of Environmental Protection and former Commissioner at DPU there, so like Michael I'm not speaking for anyone besides myself. As of Inauguration Day on January 8th, I was only speaking for myself. So here I am, which I am very excited to do. Michael, I also love your "trilemma" framing, so I am going to try and fit some of the things I am saying into that here. Just to remind you all, the pieces of that are operational reliability, I think was one, and economic or financial issues and environmental issues.

I am reminded of a quote from President Eisenhower, in which he said, 'If a problem cannot be solved, expand it.' So I would actually argue that the solution to these problems don't get harder as we layer on the different pieces, I actually think they get easier. And some of the answer to the problems stare us in the face, once you expand what the problem is. I'm not sure if there is "quatrelemma," but maybe there is or even more pieces, but I think as we expand it, I think in a way it gets easier. I also really appreciated it - two panels ago and John Kassel's presentation, particularly where he was talking about this transition using the Escher diagram as an example.

But John I have to disagree with you. I think it goes well, well beyond looking at the transformation of fish to birds, or something like that. What we need is fundamental, fundamental transformation of our energy system. It's an energy system that has been around for 100 years, that was designed with how to regulate natural monopolies that did not have an obsession with customers at all. That was based on centralized fossil fuel. That was being shipped in from other places. We need a fundamental transformation, so taking an Escher diagram, and I don't know what, turning it into a sculpture or interpretive dance! I knew I would be able to come around to that. So it is a seismic shift, and to see a utility thinking about the world in this kind of way is very, very exciting. And I have been surprised at how many utilities have not caught that kind of vision of the world and figuring out how to transform.

And the drivers that end up in this trilemma are many, and because there are so many drivers there are a lot of solutions on the table. We know that some drivers are economics, that rates and bills go up. That there is a huge amount of volatility; I mean we know that, right? We've just experienced a winter with very volatile prices because of volatility last winter. We are ignoring economic opportunities by sticking to this old system. We want to give more customer choice and customers are demanding that kind of choice. We want a reliable system, and I really liked Anne's presentation and I worked very closely with ISO when I was in Massachusetts, and I have not - it is rare to find organizations like that, that have the kind of integrity, professionalism and smarts that ISO has. It was always a pleasure working with them. And I think the rules that govern them are outdated. She mentions looking at reliability 10 years out. That's not how we should be defining reliability. I'm fine with our regional operators looking at transmission and saying well just north of Boston is congested let's, let's socialize costs all around the region to deal with that congestion because it affects everyone, that's fine. But how come we aren't thinking that reliability is depending on LNG from Yemen. Reliability is depending on natural gas being shipped through pipelines, limited pipelines from the South. Reliability is depending on coal. How come we aren't thinking that? And how come we aren't having NERC saying, reliability is getting more focused on distributive generation, renewable sources that don't fluctuate. We should be having socialized costs for transmission out 30 years, 40 years.

It's been so interesting being part of the debates here, about bringing Hydro-Québec, Nalcor, other Canadian based hydro into New England where we're limited in thinking about reliability in such a short term. We should be saying, let's bring transmission in every way we can. We are taking what, one, two lines? We should be talking 10 lines, 15 lines. We should be talking about transmission from far offshore wind. Because the mix, is not going to be the mix that we looking at here of natural gas, coal and maybe some oil in the winter. It's going to be hydro from Canadian it's going to be off shore wind from one of the best resources in the entire world, off the coast of New England and the Canadian provinces. It's going to be solar distributed, when you drive up the highway, like the last person said, we should be seeing solar everywhere. We should be figuring out how utilities make money, and can be revenue happy, and customers be happy with their control of their own electricity system. And I think those are the kind of things that the fundamental changes, that we are going to have to see. A fundamental change in looking at the opportunities of clean energy future. A fundamental change in how we create businesses models and how regulators, like I was, like some of you in this room, like those in the future are going to have to figure out how to create the right playing field for green power and all of the green powers. And we are going to think about some sort of new regionalism.

I mean it has been crazy working across states and regions, in such a way that collectively, we all know what the answer is, and yet it has been really difficult to get there. So I am confident that these kinds of conferences, these kind of discussions, having the different players at the table as we do here, having academia, having business, having government of all different levels, national, state, etc, municipal at the table. We are going to move to that clean energy future. Thanks.

Michael Dworkin: And thank you. Now I wanted to invite you and denote that what I saw when I looked at Québec's page on energy is that it starts with energy efficiency, it turns to renewables and then it has a sort of third strand, which is heavy on the Northern Plan, "Plan de Nord," which I think has your fingers on it in some ways. And all of us, wondering, you know, whether it will contribute to a better future for us. I know you want to talk about all three of those and maybe more.

Pierre Arcand: Well, first of all, thank you very much professor. For those from Québec, Ms. Powell is the Sophie Brochu of Québec.

Mary Powell: It's a big compliment.

Pierre Arcand: She said to me it's a compliment. And Mr. Cash is a former Commissioner from the BAPE. So people living in Québec will understand the environmental agency in Québec is called the BAPE. So it is a great pleasure to be here today. I think we are proud in Québec of the sustainable business relationship we have development with Vermont over a number of years in the energy field. I think that today's meeting offers new opportunity and hope and we always think very highly of Vermont and what you have done over the last few years. The discussions here today show the strength of the relation between Québec and Vermont. I think this relationship has made us the true pioneers of clean energy in North American. One of the projects that links us is a major contract for the sale of power to Vermont by Hydro-Québec. 26-year contract, that has served as the corner stone of our energy relationship. And it is important to understand that this contract represents the continuation of a business relationship between Hydro-Québec and Vermont that has been going one for several decades. I would like first of all to use today's platform to thank Vermont's authorities of recognizing the renewable nature of hydroelectricity by means of legislation that was passed some years ago. So of course we remain open to a range of market opportunities to export, of course, the clean, renewable and, I would say, reliable power that it produces.

So before I lay out Québec's approach to energy policy I would like to debunk a couple myths about global energy patterns, because no matter how great our dream is, I think we are facing a lot of challenges. First of all, myth number one. We are running out, we say of fossil fuels. The answer is of course false. There is no shortage of available fossil fuels in view. Peak oil as we knew it a decade ago has proven to be a false theory. They have new technologies that have greatly increased available reserves of fossil fuels in North America. Second, myth number two, we say renewable energy can meet all electricity demand. That may be an ultimate goal, but when you look at the reality, the demand for electricity is increasing across the globe, despite effort to promote renewable energy and energy efficiency. If renewable energy capacity doubles

worldwide, overall demand will easily outpace it in the near term. The myth number three, access to capital is not an issue. Well, I think it is false. Public financial pressures, and I think in Québec and Vermont we are facing those kind of pressure, across the globe mean that public funds are not generally available to help finance large infrastructure projects. Private funders need a certain amount of predictability, certainty and a positive working relationship with governments; in some cases across international borders. Finally we see many nations who want to reach a target of 50% of reduction of GHG emissions between the 1990 level by the year 2050. I think we all need to understand that this represents a very strong and real challenge. Now lets outline the vision that we have for this future relationship.

First of all Québec and New England are pursuing the same objective and facing the same challenges raised by changes in the world's energy market. We have geographic proximity and the values we share make us nature partners. We have a remarkable level of cooperation between Québec and Vermont. First of all, Québec was involved in the creation of a first cross board carbon market in North America called the Western Climate Initiative. In a partnership with the state of California. And let's hope another province in Canada will join us very soon. Along the state of Washington as well was decided to be part of WCI. So to move forward together, Québec and Vermont have agreed to open discussion at the administrative level on possible links [between] the WCI and RGGI, the Regional Greenhouse Gas Initiative. I can state today that I would like us to work more closely and develop some concrete initiatives. I think if we want to fight against climate change I think we need, all together, to set a price on carbon. In Québec we have chosen to reinvest the revenues collected in measures to fight climate change, multiplying the effect on the market itself. I firmly believe together we can generate even more benefits from this challenge. I would like also to invite all New England states to join this movement. We will continue to enrich this collaboration and in one area where Vermont can certainly help us, is in the field of energy efficiency. I think that the industries in Québec have done pretty well because of the WCI involvement in which we were. But I think we are, and are not very good in energy efficiency, lets say it. And someone said to me the other day, well, you are the hummers of the green energy. People are not really working hard at that. Now we have another example of that relationship is of course the Québec-Vermont electrical vehicle-charging corridor. We have been able to extend this promise changing infrastructure from Montréal to Burlington and on to Montpellier. It makes a significant contribution to the comprehensive transportation electrification plan that is one of Québec's energy objectives. So again we hope that these initiative will inspire others, and I think that this is a promising project for the whole of the Northeast.

Now, again to sum up that challenge that we face today require us to go beyond what we have already achieved. I think it is possible to deal more effective with energy challenges of today but we need strong government leadership. In fact I would like to tell you that we are working right now on a new energy policy for Québec, covering the years 2016 up to 2025, which will be released this fall. We hope to improve our performance in the area of renewable energy efficiency and technological innovation. There are still areas where we see a positive contribution from cooperation and the sharing of resources. Today, we have reviewed the results we have achieved as a result of the Vermont-Québec relationships, I can only conclude that we have more work to do together.

Professor Dworkin talked about the Plan Norde. Just, this is a project about the 49 parallel. Nowhere in the world where you have two thirds of your territory that has not been significantly worked on. And we want to do it carefully and one of the things we want to do is that we want 50% of that territory for industrial purposes and another 50% for non-industrial purposes in the creation of the corporation that will be established for the Plan Norde. It's really included in their mission and is their goal, and is one of the goals always to have, in that particular territory, 20% of protected areas by the year 2020. So we are working hard, we are working good spirits with Vermont and I can only conclude we are at the beginning of a long and fruitful journey. Thank you very much.

Michael Dworkin: Well I want to thank the three of them for a noble version and conciseness but even more important a nice blend of vision and substance. I wanted to ask each of the panelists if they wanted to comment briefly on the other two. Then I might ask a question and then we'll open it up to all of us. Mary, do you want to start?

Mary Powell: Sure, it was wonderful to hear both of you. I really see great promise in alignment in actually what we all have been talking about. You know relative to some of your comments David, I was thinking, you know, honestly I have found it, in the context where we are going very challenging working within, not even so much the literal constraints of the regional system, and the regulatory system, but what I would call the cultural constraints of that. Because I think some of it is that we have to fundamentally work on having a regionally system that is more supportive of innovation and moving forward. But you know to me you really can't get to that until you deal with the cultural substance of, you know, there is still - you know decades and decades of, you know, black hat, white hat thinking, that just goes deep into our regulatory systems that is really a challenge. So, you know particularly relative to ISO, you know we had a lot of challenges in the context of the work we're trying to do because of the very reasons you're talking about, which is, it could be wonderful talented people, but the reality is the rules of the road are still driving people toward behavior that really isn't supportive of innovative thinking and problem solving. You know, that was really my big take away.

I see great promise too, in our relationship with Québec. I really appreciated your remarks. You know I - the work we've done on the corridor, the electrical vehicle corridor, is really significant. We've only just begun though. We have a lot more work to do. You know my kind - what I try to bring to each conversation I have like this is, just imagine a world where we actually we're all dedicating intellectual, human, and financial capital towards meaningful change, together. I mean it is actually stunning when I think how fast we can actually accomplish stuff versus what can really happen so [easily] in the political world, regulatory world and then certainly in the world I operate in is, you know over thinking, over-planning, and coming up with all the reasons why things can't happen instead of why they can. So, those are some of my takeaways.

Michael Dworkin: Perhaps I'll show my age by suggesting John Lennon could have been the tune for that. OK, David, would you like to comment?

David Cash: Sure, I have two quick notes. Both Mary and Pierre pointed to this and I think it should be highlighted. The title of this conference is, Power from the North, and yet both talked about the importance of energy efficiency, using less power, and I think that has to be a

fundamental part of this fundamental shift. And I really appreciated Pierre's acknowledgement that we haven't even started yet, or not very good. I would even say, coming from Massachusetts, where we are so proud that Massachusetts has been number one in energy efficiency for the last three years, beating out California. Anybody from California here? It was part of my contract that I had to say that whenever I was in California. But even in Massachusetts, it's not enough. Not even close to enough. I forget it is in the tens of thousands of homes that we audit every year, all of the utilities audit out of a residential base of like 2.5 million homes. That is not even close. So for two - utilities to really be thinking about how they can play in the game of energy efficiency is really important.

And that brings me to my second point, which I didn't hear as much, and that is I think that the utility is that - you are definitely getting there, you know, especially when you had your Ben and Jerry's up there, and etc. That we need to be thinking about energy - as utilities providing a service, and the service is, cold ice cream or cold beer, or a car that you can drive because it's electric or the lights in your house. And how that is provided can be through kilowatt hours that are coming through your line, or it could be better lights that use fewer kilowatt hours, or batteries that are being charged by solar at night. Or whatever the service is, that is what people care about. You mentioned in the last panel about being in a country where lights go out all the time, right? People aren't getting their services; they are not getting lights, their not getting medicine cooled, all that kind of stuff. And I think that is part of the vision of the future is what is the service that we provide. Which is why being customer focused is so important because what they care about is their cold beer, not how many kilowatt hours they will be consuming.

Michael Dworkin: Pierre, what are your thoughts on all of this?

Pierre Arcand: Well I think, first of all I would like to say we have a lot of work to do, needless to say. As a government we have been working very strongly and in the last few years to improve the situation. I was Minister of the Environment for a period of two years and one thing that you realize often is that the governments do not necessarily have the vision that is takes because there are so many conflicting priorities sometimes that it is difficult to wind up with this. Unless it is coming from communities, from local groups - I think they are the ones who are putting [on] the pressure. I remember very well, for example, when we were talking about the field of transportation about the California standards for cars. I remember very well, I was involved at that time and I discussed at the time with the Canadian federal Minister and he said well, you know, these standards are too much, too much change for the industry, too tough. But there was at the time a lot of pressure from western states in the United States. And of course Québec decided to go along with those California standards, and Ontario started to think about it, and all of a sudden many states or provinces decided that, because of the pressure from their own constituents, that it was something that needed to be done. And after being told that you know it was too much, it took about three or four months, all of a sudden their was this announcement from the federal government in Washington and in Ottawa to announce that those standards would be adopted for all [of] Canada and the United States. Just tells you that often that is the way it works, it starts at the local level and moves up, not the other way around.

Michael Dworkin: And that laboratory of the states concept is vital to a lot of what we do. Let me look around before I start asking questions. Who would like to raise one? Is there a microphone that gets delivered?

Guest: From University of Montréal, graduate program of Environment and Sustainable Development and former member of the Québec Environment and Public Hearings Board. Monsieur Minister, merci beaucoup. It was a good myth busting exercise, much appreciated, Mr. Cash, you're right, there is great deed needed to be done. I am going to ask you a question, keeping in mind what the critics might say about that. Is it really a matter of will? Or just determination, or clarity or vision, because people, some people, point to the fact that there are very serious problems. We didn't come from fire, wood, coal, petroleum, higher and higher and higher energy densities. This was not for, like - it's almost like an deterministic path. For us to reverse it and go and supply all the needs of Vermont, and Burlington, Montréal, Marseille and Paris with lower density forms of energy, thermodynamically, etc., economically, the challenge is huge. So I would say, that is behooves us all to understand the significance of that, and not simply tell people we need more, we need more, we need more, I mean we have to understand some of the inherit difficulties in what we are trying to do, that is all.

David Cash: So you're asking me why I am such an optimist? You make incredibly important points and I don't mean to underestimate the enormity of this challenge, and I think there are a couple answers to that. One answer to, can we move to that? I think one answer is we have to move to that. As a global community, we're going to have to move to that. Now, I think the more rational way to move to that is to figure out a path to that goal of 100% renewables sometime in the future. 100% carbon free, I should say. We can think of technologies that can be carbon free that still use fossil fuel, although there is a lot of debate about that. But that path should be one that has the minimal amount of economic disruption that supports people that addresses issues of poverty, all of those kinds of things, that all are difficult very difficult to do. I don't disagree with that. But I think that is incumbent on us in government to come up with that answer. And I think we are going got have to. So we can wait, and we will see more calamities, more sea level rise, more energy disruption, all of those kinds of things, and then decide to act. And then it is going to be a lot harder.

The other piece is a lot of this has to do with correcting policies and communicating about them in a fundamentally different way then we have. So for example, often this cost issue comes up, and any of you who have been in part of the rate-making process in any level of government realize that a lot of these policies we are putting in place increases rates, right? But what we don't take into account is our dependence on fossil fuels has been on the backs of not ratepayers but taxpayers. That we still subsidize fossil fuels, that we have a hundred plus year history of subsidizing fossil fuels. So natural gas electricity might look low-priced on our rates, but in fact we have been paying for that, and continue to pay for that. In essence, we haven't been honest in how ratepayers slash taxpayers pay for that. Relative to that, we don't take into account what the externalities are for fossil fuels, right? So we might have very energy dense materials we are using and in that way become more economic, but we also have environmentally problematically dense fuels as well, right? And that's not taken to account. So in New England we have, in particularly in the Boston metro area, though I know it has been kind of wimpy up here, the amount of snow you have gotten up here compared to Boston, oh my gosh. But in Boston, in

Boston like, economically we were shut down for weeks. Our T didn't work, and there were questions of why that didn't happen. But there were lots of snow; some estimates were something like \$250 million a day in lost economic opportunity. Did the fossil fuel companies pay for that? No. The ratepayers and tax payers paid for that. Low-income people who couldn't get to work, paid of that, right? So when we talk about all the rate payers paying for solar panels, and I don't get them on my house, but - you know, it is a very different kind of question and we have not done a good job of explaining that and articulating that, and we are going to have to do that to get to this future.

Michael Dworkin: I feel like I'm at town-meeting as the moderator for today - point, point, point. You just have to remember the names of your nearest 2,000 neighbors.

Guest: Ok, I just want to make a preliminary comment, which is that the wonderful thing about certainty is that it allows you to sleep at night. And secondarily, that it is OK to be certain and later be wrong. So I share the certainty of some that we are barreling into 100% renewable energy future, lickety-split, sooner rather than later. And when I try visualizing that, again so I can sleep at nights, and that isn't really a joke, I obsess amount this a lot, like Mary's obsesses about her customers. And I see that to create abundance supply of renewable energy, we need to go to the offshore wind, we need to go to Midwest wind, we need to go to maybe concentrated solar power out of sunnier climates. We need, definitely, go to Hydro-Québec, and there one degree sources. So that leaves me wonder what does the transmission grid look like? Not the local distribution, what does that transmission grid look like? And how do we get there? Is it socialized cost, a national policy, regional organizations, the merchant model, which was brought up earlier this morning? And I would just appreciate feed back from you experts, whoever is bold enough to tell me how I can sleep at night about visualizing the future transmission grid. Thank you.

Michael Dworkin: We had a shot of that a few time earlier today, but the folks up here now might want to chime in as well. I have some thoughts, but why don't you go first.

Mary Powell: You go ahead.

Michael Dworkin: We have a transmission grid, which is characterized by this fundamental fact. On one side of it, there are 14 to 18 million people in New England and about 14 thousand substations. On the other side of it, there is somewhere in the neighborhood of 300 to 500 hundred generators. But there is really only about 20 or so bulk transmission lines. So we've got hundreds feeding into dozens, feeding out to tends of thousands and millions. It is why they call it a bottleneck. It means extreme vulnerability. Building around it takes some redundancy. And If you have redundancy, a fact of life is that you will have things that you will not be using all the time, and you will be accused of excess investment, but it is there in case you need it. The ability to have flexibility and resources probably requires building more then you need immediately, because if you build only what you need, then you con only get access for what you build for. So a transmission system that takes central station power, serves it to tens of thousands and distributes it, inherently has tensions. Now can you get around them? One way to get around them is to insulate not 10,000, but 10,000,000 homes. So that you don't need as much transmission moved around. Another way is to put not 10,000 but 10,000,000 solar panels up, so

they're on the customer side, not the distribution side. I think that the chance to getting off a grid system entirely is a long way down the line. But the idea of a grid system that is a backup to more and more distribution has real potential. I mean I think it is pretty much what Mary is talking about in 20 years.

Now, how quickly do we get there? I wish I knew how fast climate change was moving in. You know, there's a probability and then there is a distribution of probabilities. I am going to sound like Don Rumsfeld, you know if I say, the things that we know and the things that we don't know that we don't know. But I think that it is a strong powerful tool that we have right now, we don't want to abandon it, and yet we want to wean ourselves off of it. And that metaphor of a child weaning themselves off of nursing I think is part of where we are going to go. Does anyone want to comment on the panel?

Mary Powell: The only thing I would add is that if you are going to lose sleep, I wouldn't lose sleep over worry about lack of investment in the transmission system. I don't think - I have not seen that and I don't see that coming down the road. So if you are going to lose sleep, I would still be losing sleep over how we are going to get to 90% or 100%.

But I would love to knit together the two questions, cause in my mind, you know, some of my passion of where we are going is all of the things we've mentioned, but a part of it that we don't talk about enough is the economic story around moving to a different system. You know, we got to remember that the system we have now was built over 100 years ago and it is built and - were you and I to sit down today and start a business, we would not build a business where the delivery system ensured we lost 40% of our product by the time it got to market, right? We wouldn't start a raspberry business and figure out how can 40% of the raspberries be spoiled by the time we want to sell them, right? So it is really fundamentally is about tackling reliability, resilience, the environment. So it really is to me it's economic. I would love you to come to Rutland and see these homes. Because what we have done is, we've done what I think what customers really want to see. And I'm not saying like, oh we have arrived, we have just begun. Which is they want comfort, they want convenience, they don't want to worry about energy. And they actually don't want to feel guilty about when they use it, right? But we were able to dramatically reduce their footprint both on - completely eliminate oil and really dramatically reduce their electric consumption through the combination of solar, air source heat pump technology, and now we're hopefully going to be partnering on, you know, with Tesla on battery storage.

So I really think that, fundamentally, what you're are moving to - and P.S., it is a model that, it is a working family, working class family, that is going to be able to operate more economically in the future. So it's the triple bottom line, I mean it hits all three facets. So I think that's the piece we do have to move to. And I agree with everything you said about - the system needs to be there, it will need to be there for as long as I can see. I'm not at all worried about investment though, and I don't think you should be either.

Michael Dworkin: Monsieur Minister?

Pierre Arcand: Well the only comment I can make on this, because the United States system is a bit complex sometimes I have a hard time understanding myself what is happening - but to refer to one of your points that is very important, about two years ago in Québec we had a commission on the energy issues and we [asked], what should we do? I think there were 450 presentations that were made, and the conclusion by the commissioners who were there at the end of the day was very simple and exactly the same conclusion you said a few minutes ago, when you said well, you know, the important thing is to control your energy. So the most important thing is the energy you don't consume. And since we have in the province, energy that is available in the next 10 to 15 years, we have surpluses. We may try and export those surpluses, but the recommendations of the commission is that - don't venture into building new dams right now, don't try to go and - of course they talk about wind power as well. And of course the wind power industry was not very happy about that, but at the end of the day that was their main recommendation, let's try to control the energy that we are using, right now.

Michael Dworkin: I think about two hours ago, sitting at this panel, somebody said if you are worried about oil combustion, don't worry about oil production, worry about oil consumption. And if you choke off the consumption and deal with the demand side, then you reduce the incentive of having excess supply. Did you want to comment further? Let's see, I'm looking out here.

Guest: From the University of Québec, Montréal. First of all, thank you very much for this panel this afternoon it's a great conversation we are having today, especially about the future of the grid. I heard very clear comments about the vision of the future grid from Mr. Cash and Ms. Powell, but I would be interested about Mr. Arcand's view on the future of the electricity grid, especially in regards to the centralization and distributive generation. I think this is something more complex in the context of Québec with the electricity monopoly. We have a bulk system, bulk power, huge power lines, electricity line, huge production from hydro dams. And I want to know how will the next energy policy bring forward more possible change in the system, and is there any political leverage that the Québec government is likely going to bring to give more room for decentralization and distributive generation for consumers that would like to open up the energy system and potentially become some kind of "prosumers," producers and consumers at the same time? Thank you very much.

Pierre Arcand: Well first of all, of course the energy policy is expected to become public sometime in November or December so of course I won't start to - we are right now in the process of consulting the stakeholders in the field of renewable resources. What do we do with oil, what do we do with other elements like that. We are looking at the best ways of course to operate and it is always a challenge right now because the system that we have rather simple in the sense that the most of the electricity is being provided by a state owned utility that is owned 100% by the government. And of course the government - right now the dilemma we face, we have really two, well, I would say two opposing views in some ways. People who say for example you should increase the rates because that is the only way that people will stop consuming, that is one thing that is being done. Or some others say no you have to, you know, especially the low income people, they have to have rates that are really under control and that should be your main goal. So this is one of the debates that we have at one point to understand and see what we can do in the future, and that's the first thing.

About what you were talking - about the relationship, and especially when we talked about generation, the problem that we face right now it is an interesting idea, an idea that is of course of worth thinking, but my first comment right is that again if you compare it to other general types of energy it is still very high cost. And the problem we face is that I have a dozen if not more groups, people who come with new ideas or new technology, and the challenge is always to make it economically possible. And that's one of the big challenges that we face. Because no matter what we do, you know we got an increase in electricity rates of 2.9% just two weeks ago. And you should see the amount of emails I am getting from people, it is unbelievable. So those were saying you should increase the rates and people will stop - That is not real life, what real life is right now is that every time there is an increase with rates people are complaining a lot. So again, one thing is for sure is that in our energy policy we are going to of course have to get rid of oil as quickly as we can, for the rest, give me a few months to really tackle something that is smart.

Michael Dworkin: Mr. Janda.

Richard Janda: Thank you very much. Richard Janda, Faculty of Law, McGill University. There seemed to be a kind of culture clash between the vision of a distributed network, decentralized network, that we heard from Mrs. Powell and the vision still from Québec of bulk sales. And I am wondering if in fact there is a closer connection between those two visions than we might be tacking advantage of. Can we think of Québec's resources as storage resources as well? Can we think of Québec being able to offer to Vermont the ability to enable their goals as well by having power coming into the grid that could be stored? The problem of intermittent power - this is something the Québec's ponding facilities seemed to be well oriented towards. I am just wondering if we couldn't have a closer connection between these two sets of goals.

Pierre Arcand: I think these are the kind of discussions that we can have in the future about that, of course. We are quite flexible and willing of course to help our partner in any way we can. Again, it is a question of willingness, technology, there are all kinds of things related to that, but it is certainly something we could have a very good discussion.

Michael Dworkin: I think I am going to ask a follow on that which is, I took a look at the Vermont joint owners agreement for purchase from Québec in some detail almost 22 years ago, when I drafted the board order approving it. And it has provisions, which, on a moderate time frame like a month a head allows significant rescheduling. And on a shorter timeframe like a week a head allows smaller reschedulings, and a day a head allows some rescheduling. But it doesn't seem to allow rescheduling an hour or 15 minutes or 10 minutes a head. And it would need to have those provisions to really be a firming contract to backup variability in wind and solar. Is it feasible to try and pursue those? Obviously it would have tremendous value if we could.

Pierre Arcand: I would have to talk to the experts at Hydro-Québec on this, very honestly. It is certainly possible but I would have to talk to those experts before giving you an appropriate answer.

Mary Powell: Yeah and I actually just want to say relevant to your point, I actually feel like maybe in my zeal to sort of get going and get to the power point I didn't mention it strongly enough. But, you know a big part of what put us in a really good position to move in the direction we are moving was the stabilizing we did around our portfolio starting in 2008. Where Hydro-Québec and having Vermont also lead in terms of deeming that as renewable large-scale hydro was very, very important in terms of how we thought about, how we make this transition. It is going to take a very long time, so - I believe that there already is that incredible partnership working, we have other partners' as well in Québec that we talk to on a regular basis, hydro producers and others, that are important, because right now the portfolio still is largely met by larger resources, because Vermont, historically, had very, very little investment in generation in Vermont. We have a lot of different plants but they are very, very tiny. So it has been very important

David Cash: Can I take a very quick shot too? This reminds me of a question from the last panel, a person over here asked about, well, won't large-scale hydro stop local renewable energy development? And that has been an issue in Massachusetts. It is one reason someone mentioned a bill a last summer didn't pass, that was one of the driving reasons. I think if we go back to the discussion of the necessary transformation that is going to happen, the amount of renewable energy that we are going to need, I think going to provide opportunity for large scale, small scale, distributive, all of those kinds of things. Certainty in the midterm, at least.

Michael Dworkin: And in light with the person who said, enlarging problems instead of narrowing them, it may be in solving what to do with HQ problem actually helps the what to do with distributive generation instead of hurting it. Let me just see there is a hand coming up back there. By the way we are down to the last 15 minutes, and so I am going to ask people to try and be relatively concise. People have been pretty good, but lets be even better if we can.

Mark Stephenson: My name is Mark Stephenson. I am on the board of Burlington Electric, the local utility here. My question is, how does Québec become more aggressive at building conservation programs? Hummers aren't as popular these days.

Pierre Arcand: Well, it's a good question. I think we have some, you know - we've been really successful with industry. We have been - I was looking at some - if you compare, for example, in our industries, if you compare them to the 1990 levels of greenhouse gas emissions, we have reduced in the industry probably something like 25% of greenhouse gas emissions, which is a certainty an improvement. It's with the general public it is more difficult. Transportation is on the rise, for example, greenhouse gas emissions from transportation. We have been having programs to help homeowners, for example, come up with better solutions to ensure that we have more isolation in houses in general. But I think clearly we need to do much more. I think it's an incentive that the government will certainly be looking at, but also we need absolutely to make sure that what we are providing right now is not only reliable but this is something that, in the future, will have a certain cost and maybe eventually a consumer will have a choice. You know, for example, I know that I have seen some suggestions from some people that say, for example, you know, the primetime periods, for example, you should charge more during the primetime periods and force people to use, for example, the dishwasher at 10 o'clock at night instead at using it at the primetime period. These are the kind of suggestions right now are being made to

us. But clearly, I don't know what will be the exact outcome of this, but clearly we need to have stronger programs.

Michael Dworkin: In the back in the middle.

Nicolas Muszynski: Hello, my name is Nicolas Muszynski, I work for Renewable Energy Systems Canada. I do renewable transmission and storage project development. I have a question, kind of a fundamental shift in the way that we see our system, kind of like what Mr. Cash is talking about and in the context of kind of cash-strapped capital investments. When we look at the type of investments that are done in the energy sector and oil and gas industry, so for instance the Energy East Project is I think a \$13 billion project proposed. Obviously, a lot of people would think that that is a little bit of a large project, but nobody thinks that people are completely nuts to think of investing in that. When the same type of investment, which will probably actually get you an HVCD between Newfoundland and England, to be able to balance Europe and North America with renewable energy - so I was just wondering why is there such a -I guess when we look at the transmission projects and the invests that are done in renewable energy, people often think it's completely bonkers. But when we're looking at the traditional power, not traditional power but fossil fuel investments, it is kind of like a run-of-the-mill, normal, business as usual proposal.

David Cash: That's an awesome question. And you are not even talking about siting, right? So like I can think of several fossil fuel projects that were sited in New England without much kind of community engagement, and I can think of a particular one off the coast of Massachusetts, you know? You know I think that, I think part of the answer to that is cultural, you know, that we are a fossil fuel based economy and have been for many, many years. And so the culture of developing fossil fuel projects is one that is relatively natural. Maybe even more important, is that, I would think, our regulatory structure is set up to deal with development of fossil fuel infrastructure and that hasn't been the case with renewables. It's more difficult because we don't have the tools yet, and the tools are scattered, right? So if you're developing some project in New England and you want to get RPS credit that well then, which state of RPS, we all have slightly different programs. You know it is a very different regulatory structure. As I mentioned before the rules of the game favor fossil fuel, right? Because what we are thinking about is reliability in the next 10 years. You can pretty reliably build a fossil fuel power plant and a pipeline, get everything done, much less reliability when we are talking about transmission. If we are talking about reliability on the decadal, 30, 40 years, the rules aren't set up for that. So, and the financing systems are not set up for that. And some financing tools haven't even been there until recently, you know. When you think about the homeowner disincentive for solar, for example, large capital outlay with a 20-year payback, very difficult. You get new financing in the game, where people can aggregate, third party can come in, rent a roof essentially, make all the investments, give long term power, purchase agreements to a residential customer, you got a very different ball game. So we have seen in Massachusetts the huge growth in solar and I know that it is the case in Vermont too, is because we have these new tools. So I think that those of us, who are really pushing hard, are pushing for those new tools so there can be a level playing field. Cause there isn't a level playing field now.

Michael Dworkin: I'd add one very technical but vital point. Almost every form of governmental assistance for renewables has come in with a very short sunset, in the 24 to 36 month period. Whereas the multi billion-dollar oil facilities that I worked on when I was at the University of Houston, those facilities aren't wondering whether their governmental subsidy will disappear. It has been in place since 1917, it has never had to be touched. They could build on it and build off it and could recover on it. Their reassurance in that realm, it is not only larger but more reliable. By the way, there is a very interesting woman named Janet Milne who is a professor at a Vermont Law School, who writes about the environmental implications of tax subsidies and tax policy. And she writes with real insight if you want to get into the details, and as with many things it turns out the details do count.

Tom Hudspeth: Tom Hudspeth I teach here at the University of Vermont in Environmental Studies and Natural Resources. So I think I've been reassured here a little bit by with the love fest that I have been seeing between Vermont and Québec today. Because as I read just in the paper and hear on the news, you know the largest utility, Green Mountain Power, and Vermont Gas, are both owned by Gaz Métro, which is a for profit business based institution in Québec as I understand it. Is that right? And so we had mayoral elections here in Burlington a while back, and even though this doesn't have to Burlington directly, one of the candidates who didn't happen to win said, Vermont is like a developing country with Québec as the first world nation, so we are totally dependent on it. We are colonized on it or protected by it. Should we have trouble sleeping at night? Everything is now a love fest, but how about if the politics change, are we setting ourselves up to be, you know, for vulnerability?

David Cash: I think I'll back up here [laughter].

Mary Powell: So, you know, from my prospective we are really thrilled, Green Mountain Power is a Vermont corporation with a Board of Directors, and we bring decisions and strategy and everything you saw today to that group and that is the group that makes the decisions. We are very lucky in the type of investor that we have in Gaz Métro is one that really supports and understands the need for, and the depth of understanding of each of the companies to do what they think is in the best interest of their customers and who they serve. And we are fully regulated; they to are also a regulated gas distribution utility in Québec as well. So they also, I think one of the reasons when I was at Green Mountain and we first talked to them - I think they were the eighth investor that had come talk to us about not being publicly held anymore. And just to remind people when you are publicly held you're not exactly local, either. It just means your investors are all over the world, and all over the country.

Michael Dworkin: I think at one time, I was told, Green Mountain Power's largest group of investors was a set of dentist from southern California.

Mary Powell: Could have been, could have been. So when you are publicly held, you know, you are still accountable to investors, they are just all over the place. And you know, one of the things, one of the biggest reasons we made this switch was because of our customers obsession because also being a publicly held company at our very tiny size was costing customers over a million dollars a year in just different accounting and legal fees, etc., to just comply with all the parts of being publicly held. So from our perspective it just has been a really wonderful

relationship that has worked very well, and has - you know, another part of it was they have been in Vermont for 20 some odd years and we'd never heard of them. So that made us really believe that they meant what they said when they believed in local control, and that has been absolutely our experience. So for better or for worse, I guess you can blame stuff on us, if you don't like the things Green Mountain Power is doing.

Michael Dworkin: Probably have time for one more, and then after the question, I am going to ask that everybody wait and we will move into the closing ceremony and some very worthwhile thanks. So let me just do a quick.

Vincent: Bonsoir Monsieur Minister. Thank you for being here. I am a student at Carleton, my name is Vincent. I am also an energy efficiency professional, from Québec, so on behalf of the energy efficiency industry in Québec, well frankly, we're not that bad. But we do agree that there is still a lot more to do, and this hinges a lot on electricity prices, as you were being told this morning by an economist from the Université Laval. There has been a proposal and a number of recommendations made in the past to use the additional dividends that might be, you know, provided to the Government of Québec from Hydro-Québec and use fiscal levers to give back to the low income consumers and therefore dampen the rate shock, or the shock that would incur on them from those price hikes. So what do you think about this option? Is it a viable option? Is it something that might help the social acceptability of increasing electricity prices?

Pierre Arcand: So first of all, when I am talking about, it is not the energy efficiency that you are doing that is the problem. It is the consumer that sometimes - we are far ahead as a consumer compared to what is happening of course in Europe, for example, and even in Ontario or in the United States. So we are big energy consumers, that is one of the problems that we need to face. Don't worry it is not with you, that's the first thing. The other thing is that we have a energy board that makes decisions about the increase in rates, for example, and they have in their decision, because we've been asking for it. They have been asking hydro to provide a plan to help low income earners. And they have a certain amount of time to present this plan and see how we can improve their situation because there has been an increase 4% a year ago, and now there is an increase of 2.9% and the inflation rate is not going that fast right now. So obviously this is a concern as a member of government and I was pleased to see the Régie de l'énergie, which is the energy board, ask hydro to come up with a plan for low-income earners.

Michael Dworkin: I am going to ask David and one question for Mary.

David Cash: Very quick and I think your question actually shows what the fundamental problem is because you framed it as, you know, if there is greater prices for energy that will help energy efficiency. Well the problem is that energy efficiency doesn't play in the same market on the same playing field that kilowatt hours produced by a generator do, right? So even at Hydro-Québec or other relatively cheap electricity you get X number of cents per kilowatt-hour, right? Still energy efficiency is most likely much less than that, and yet the rules of the road are such you can't compete with that. You have a better, cheaper product than generators do and yet the market is set up so that you can't deliver that product.

Michael Dworkin: I think it is time that we need move on I am afraid, sadly. All the questions I want to ask are going to stay with myself as well, so I am in comradeship with you on that. I do want you to stay where you are for a moment so we don't get chaos as we do a turn over to the people for we owe some thanks and they want to say a little as well.

David Massell: First I think we owe this remarkable panel a round of applause. So no one moves a muscle for just a second or my thanks will go unheard. I know we are eager to grab a cup of coffee and a cookie and all that is available, and we can stretch our legs but bear with us for a moment. I want to name, publicly name those who have provided financial sponsorship, because you can't run a conference without money. And I want to publicly name those who have provided voluntary partnership and have given us advice and have provided outreach because you need advice as well. So the logos are right up there on a beautiful banner. And they are: The University of Vermont and numerous sub-units of it, which I don't have time to read right now; the Government of Québec provided crucial financial sponsorships; the State of Vermont; Brookfield Renewable Energy Group; UVM Clean Energy Fund, which is a student run organization; the Government of Canada; Transmission Developers Inc. New England; Renewable Energy Systems Americans; Hydro-Québec US; Green Line Infrastructure Alliance, St. Michael's College; TD Bank; Vermont Electric Power Company; Canadian Wind Energy Association; and the regional educational television network, RETN. Thank you very, very, very much.

And in terms of collaborators, again, I'm just going to say the University of Vermont because practically every subdivision of the University of Vermont has chipped in here. It's an interdisciplinary project, energy, right? State of Vermont includes the Vermont Department of Public Service, thank you; the Vermont Department of Economic Development, thank you. The Government Québec's, Boston delegation, heroic partnership, thank you so much. Vermont Council on World Affairs; St. Michael's College; Renewable Energy Vermont; again, RETN; the Vermont Law School, thank you Michael; Sherbrooke University' Bishop's University; Champlain College; and last but not least, Community College of Vermont, CCV. Thank you very much.

Richard Watts: I'm Richard Watts with the Center for Research on Vermont, and two things I would like to add. One, we did this conference a little differently, we had a vast pool of labor from the undergraduates, mostly students here at the university of Vermont, you have seen many them at the table, with the mics, most of them are gone so I won't read their names but Dan, Freddie, Nel, if you see any of them say hello, and thank you. And the one other thing I would want to add is that we are hoping to keep this conversation going and so we have been doing short video snippets, with some of the key partners here. If any of you are interested in being captured like that please stop and see me. And we are also going to make available all of the video from this, but we going to try and edit it a bit so it is accessible, and then we will have a variety of reports and all of that to come out. So all of you are probably going to get an email about that at some point and if you don't feel if in some way you are on that that list and you would like to be just drop your card off at the desk on the way out.

Jennie Stephens: So thank you all for participating in this rich discussion. We've clearly had a great day with many different interests, and priorities and perspectives that we have heard today.

I just have two quick points that I want to make to wrap things up, final thoughts. One is about the critical role of the university as a convener for this kind of discussion. And facilitating this dialogue with multiple increasingly interconnected and complex issues that are facing society when we think about issues of energy, the environment and sustainability, universities have great potential to go beyond teaching and doing research and actively engaging in discussions like this. Outside of academia or inviting external members of society into our buildings and facilitating this, so thank you all for participating in that.

The second, last point I just want to make is just kind of a theme that was recurring I think in each of the panels, and that actually had to do with, Louise McCarren maybe said it in the first panel, all of our predictions and assumptions are always wrong, right? We actually can't predict the future, and we all think we know what the future is going to look like. And I tell my students when we are doing research, when they're coming up with research questions, you can't ask a research question on, what is the future going to look like? We can't do research on the future, right? And we - our predictions, our assumptions, our projections for where we will be in 10 years, 20 years, 30 years - it is actually much more unknown than we really appreciate. And I think John Kassel mentioned it again in the second panel, when he introduced this concept that we could be looking at a very different world with climate refugees potentially here in New England, right? And that isn't something that many of us are thinking about in our planning. And then Mary Powell and David Cash both again, just now, were talking about this fundamental shift, and we are just getting started, we don't know how it is going to happen but the world is changing rapidly, and I think faster than we ever appreciate and acknowledge. Humans like stability. We are all about trying to know where we are going, but I think we really don't really know where we are going. And it is great to be able to have this conversation and acknowledge that openly and kind of explore the different possibility and perspectives. So thank you all for coming, and let's thank everyone again one last time.