Chairman Wellinghoff Keynote address at the the Renewable Energy World Conference & Expo North America

MC: Our final speaker for the keynote before we get to the awards presentation this afternoon is Jon Wellinghoff, who was named Chairman of the Federal Energy Regulatory Commission by President Obama in March 2009. Chairman Wellinghoff is an energy law specialist with more than thirty years experience in the field. Before joining FERC, he was in private practice and focused on renewable energy, energy efficiency and distributed generation. He was the primary author of the Nevada Renewable Portfolio Standard Act and worked with clients to develop renewable portfolio standards in six other states. The Chairman is considered an expert on the state renewable portfolio process and has lectured extensively on the subject. Please join me in welcoming Chairman Jon Wellinghoff.

Chairman Wellinghoff: Thank you for that introduction. It's a great pleasure to be here today. Little tough though hitting cleanup for the lineup we've had ahead of me here. First of all, how many of you saw *60 Minutes*, saw the Bloom Box on *60 Minutes*? I understand they're going to be selling them down in the exhibit area later on. We can get one of those and we can all go home, all be done.

Bloom box, for those of you who didn't see it, there's a piece on *60 Minutes* last week that talks about what appears to be a fuel cell and apparently a number of very large companies, Google and eBay and others, have purchased these fuel cells to test them out, and there was a lot of hype about it as being sort of the newest, greatest, latest energy thing, cheaper than coal and easier to run and so on and so forth, although it does run on natural gas so ultimately there's a little issue with carbon and a few other issues. So I think renewables will be around for awhile, and we're going to talk about renewables but I was really fascinated by, again, my predecessors- sentient buildings huh Roger? That's pretty interesting.

Well I'm going to talk about not only renewables, I'm going to talk about the entire system, and the system as how it works in this country and what we need to do in this country to move it forward. But again that's very hard to do with what Roger's done here in Austin, Texas, and what the city of Austin's done, they truly are leaders in the nation, and what Chairman Smitherman and the Texas PUC and ERCOT has done here. They truly are leaders in the nation, so we can only aspire in this nation to be at the level Texas is now with respect to the advances in renewable energy and what has been done with respect to those systems.

But we do have tremendous potential in this country and we need to understand the level of potential in this country. We have in the Midwest, excluding the Texas area, but if we just talk about from the Dakotas on through Oklahoma, we probably have 600 GW of wind energy there. If we talk about Wyoming, Colorado, New Mexico and Montana, we have another 200-300 GW of wind energy. Offshore on the Atlantic Coast, my friend Ken Salazar, the Secretary of the Interior, says we have 800 GW of wind energy. Another several hundred GW of potential wind energy in the Great Lakes. We certainly have enough wind energy in this country to fulfill our needs if we can integrate it fully and reliably into the system, and that's something I'm going to talk about in a moment.

We can look at, of course, new wind additions in this country, and you can see how rapidly they've been advancing. These were for the 2009 numbers, the numbers to the far left on the slide are initial estimates that, in fact, because of the economy we were going to decrease the amount of wind installed in that 2009 period and, as it turns out if you look at the actual numbers that I've just put in, we actually increased substantially above even our 2008 figures where in 2009 we added some 9,900 MW of new wind energy throughout this country, and we're now over 35,000 MW of new wind energy. That's more wind energy added than, certainly, any new coal systems and, of course, new nuclear systems as well.

And I think I have to agree with my friend Roger Duncan that nuclear does have promise in the sense that it is a low-carbon resource, but, right now, it's just too expensive, it's just going to be too expensive, I think, to ultimately be something that we can rely on in the near-term future. There may be breakthroughs, and we certainly do need to continue research and development but, ultimately, I think from a stand point of costs, renewables are ultimately going to be not only the low-carbon but the low-cost resources.

If we look at geothermal systems, an area that I'm very familiar with (I represented a number of geothermal companies prior to my coming on the Commission in 2006). Tremendous potential. We have 50-60 GW of geothermal systems in the western United States that are developable, and there is a new geothermal-type area that's been recently, sort of, discovered and discussed. Southern Methodist University's done some analysis here in Texas and Louisiana, and it's determined that there's somewhere in the neighborhood of 100 GW of what they call geothermal, geo-pressure zones where you really, in essence, have hot water in areas where you have deep wells of oil and gas drilling that can be, in fact, developable, or you can bring up that hot water and take it through Rankine cycle-type, low temperature engine that will produce electricity. So there's tremendous potential there for geothermal systems. And of course, geothermal can be expanded beyond the electric area as well. There's geothermal heat pumps, of course, are viable throughout this country where we can have low-cost heating and cooling as well.

The other renewable resource is central solar- I actually liked Chairman Smitherman's slides cause one of the slides he showed on solar was actually this project, and this project is not in, proud to say, not in Texas, but it's in Nevada. This is the project at Nellis Air Force Base in Nevada. It's about a 14 MW solar PV system. It's a system that I actually worked on. One of my clients, Power Light, put this system in in Nellis Air Force Base, and I helped negotiate the contracts on it, again, one of the largest PV systems in the world, and I am proud to say, being from Nevada, Nevada on a per capita basis has the highest amount of solar per capita. It has the highest amount of geothermal per capita as well. So solar, certainly in the desert Southwest, Texas, throughout New Mexico, Arizona, Nevada, California, we have enough solar potential, literally thousands of gigawatts of solar that could be developed and could ultimately be utilized to provide for our needs in this country.

But what we have to remember, in respect to all these resources, is what Bennett Johnson said, who was at one time the Chairman of the Senate Energy Committee: that transmission is the Achilles heel of renewable energy. These renewable energy resources are at remote, specific, designated locations where the wind blows or the sun shines. And two other resources I didn't mention here but are also very viable and abundant in our country are hydro resources, including hydrokinetic resources, in-stream and off-shore resources that are currently being developed by a number of firms, and FERC, our agency, permits those hydrokinetic resources. We currently have, for example, over 3,000 permit applications in the Mississippi River alone for hydrokinetic development there. And another renewable resource, of course, is biomass.

But all of these are remote from loads. They are not next to loads. You can't move a pipeline there, you can't move a railway car there to move the fuel to a sited generation plant near the load, so you have to transmit the power from the resource. You have to get it there. And this issue of transmission is going to be the make-or-break in this country of whether or not we can develop these resources that need to be developed to lower our carbon footprint, to revitalize our economy and to get this country going where we need to get it going.

So, in starting on transmission, I will start out with this slide you saw of ERCOT and, actually, I'm doing that because I've got a couple of things that I want to say about that, actually, I think, Barry didn't say. One was, he mentioned this but I think this is important to reemphasize again, Texas did this by creating competitive, renewable energy zones. I emphasize the word competitive. It's absolutely important that if we are going to make renewables work in this country that we set up competitive markets, competitive systems. Texas has a competitive system. You have ERCOT. You have a competitive system not only for the marketing of electricity, but you have a competitive system here that your commission put forward for the development of transmission. That's extremely important.

It's something we're struggling with at FERC. We're trying to work to do this as best we can. We oversee – of course, not Texas with respect to competitive wholesale markets – but we oversee six other markets, including SPP, that Chairman Smitherman showed you: the Midwest ISO, the California ISO, the New York ISO, PJM, which is the Mid-Atlantic ISO or independent system operator, and the New England ISO, all under our jurisdiction. They're all vibrant, wholesale electric markets there, but we have yet to have a vibrant, competitive transmission construction and development system in this country, and I think we need to look at the lead that Texas has put out there for us. They've thrown the gauntlet down, and I think the federal government needs to take it up and move forward with it, so that's why I really wanted to emphasize that with respect to Texas.

And then I wanted to say another thing about Texas with respect to the resources because I had the pleasure of having dinner with Chairman Smitherman a couple of weeks back, and we were talking about Texas, and I said "Barry, well how much wind do you have in Texas?," and he said "well, we know through this CREZ process that we can develop these transmission lines and, by developing them to load, we can deliver something like 18 GW of wind." And I said, "Well, but how much wind do you have?" And he said, "Well, we don't know." And what he's telling me is that you literally have so much wind in Texas that it's literally almost limitless in the sense that it's a matter of how much transmission you can put in and how many systems you can, ultimately, put in. So it shows you, really, how much resource there is not only in Texas but, really, in this country. We have virtually unlimited renewable resources if we can develop them, if we can get the transmission in, if we can deliver them to loads and get this done.

So let's look at the country as a whole. Something a lot of people don't realize, Texas is somewhat of an island, ERCOT is separate from- electrically, physically- separate from the rest of the country. There are a few weak interconnections between Texas and the two other interconnects, the Eastern and Western Interconnect, but it's not interconnected in a strong manner. Neither is the Eastern Interconnect connected to the Western Interconnect in a strong manner, so each of these stands alone. But when you look at these three, you have to look at how you do the planning in the three, and, right now, the Department of Energy finally, after all these years, for the first time has put out some money to the three interconnects to allow for interconnect-wide planning. Now, ERCOT has been doing interconnect-wide planning for awhile, certainly, and the CREZ process demonstrates that, but the rest of the country, the Western Interconnect and the Eastern Interconnect, have never done interconnect-wide planning. This is the first time. We're starting this now for the first time to do interconnect-wide planning.

Why is that planning important? Well, if you look at the lines, and I think this was, you know, demonstrated by looking at what the CREZ process had to do in Texas where there were really, literally, no lines in the upper part of Texas where the wind was, they needed to build the lines to move the wind, you've got the exact same situation in the rest of the country, where the major portion of wind are in the middle part of the country here there are virtually no transmission lines so ultimately we have to do planning to figure out how we can ultimately make those lines planned in an efficient, effective way and then move those lines to the loads, because the load centers are, of course, on the west coast and the east coast of this country and within, I think it's within 150 miles of those coasts, are about 75 percent of the electric users in this country.

So you ultimately again have to figure out how those remote, location-constrained resources can be effectively delivered to loads. Now, we deliver them to loads not only from the areas in the Midwest where you have resources but also offshore. As I mentioned, off the Atlantic shore you have the Atlantic shelf that goes out 150 miles and is relatively shallow. We need to figure out, again how to put in a system of transmission lines that will deliver it onshore. But you ultimately have to do it in a reliable fashion. Now, here, this from a wind standpoint shows you how some of the wind development areas we're looking at. One here – that's 14, this large gray area here – is something that was proposed as a project called Green Power Express. It doesn't specify where exactly the lines are going to go but ultimately you're going to move wind from this upper-Midwest area in the Dakotas. In fact, there's an area here called Buffalo Ridge in the Minnesota-Dakotas area. On that one ridge, it's a long ride, it goes for 50 to 100 miles, there are apparently 55 GW of developable wind energy on that one ridge alone, and so, delivering that energy, you've got to be able to figure out how to deliver that energy into the hubs of Chicago and the other population centers of the Midwest, and you have to do this with either direct DC lines, which is one option that you've heard from the presenter from ABB. It can be done with high-voltage AC lines, 765 KV AC lines, like some of the ones Chairman Smitherman showed you that are being developed in the plans in SPP.

But ultimately, this planning has to be done in a comprehensive way, and you're crossing state jurisdictions, you're crossing also ISO jurisdictions as well, and as you cross those you have to figure out how to do cost allocations, which was something else that was talked about. And cost allocation comes under the jurisdiction of FERC, so we have to determine how to spread these costs among the beneficiaries who are going to use and then, ultimately, pay for these lines, and there are, right now, multiple ways to spread costs. You can spread costs in sort of a peanut butter way where everybody pays for the costs or you can say, well, only the costs go to the specific beneficiaries where particular power is going to go and have a very narrow definition of what the benefits are. So there's multiple, different thoughts about how you can spread costs from an allocation standpoint, and you have to decide from an interconnect-wide planning perspective how these costs are ultimately going to be spread.

So all these things are going to come into play: planning, cost allocation, and the other part is the siting. Right now, siting is done primarily by the states and that can be problematic from the standpoint, again if you're going from across multiple state and across multiple regions with a line, and you have one state that's sort of in the middle decides that it doesn't want that line to come through that state, well, what happens? Well, there is now what you call backstop siting authority by FERC. We have some ability in very limited instances where the Department of Energy demonstrates a corridor as being congested, and they have to designate it ahead of time, so in some part of the country, and then a developer tries to develop a line in that corridor that's designated as congested and a state blocks it and does not within a year act, then they can come to FERC for backstop authority. We can try backstop siting that line. But it's very narrow, and there's also been a court case that's limited our authority even more there, so there's now some bills in Congress to try to open that up a little bit, and I hope we're able to do that from a standpoint of, again, being able to develop renewable energy resources in an effective manner.

So the other thing we have to do is also have to open up balancing areas and balancing authorities. These are the wind penetration levels in the western United States with a number of different utility companies across the bottom here, and the one that has the highest penetration is Bonneville at 30 percent, and, right now, Bonneville Power Administration is trying to determine how they're going to stabilize the wind within their balancing authority. Balancing authority is an area where within that area the grid operator controls that area and must keep that area within balance from a frequency standpoint, so they have to balance the loads with the resources, and they have to be exactly, precisely the same within like hundredths because if they get out of frequency, then you get a blackout. Well Bonneville's having all kinds of problems trying to figure out how to do that right now, and you can see some of the other areas in the West have a lot less wind in their area. Well one way to solve this problem is to simply expand the balancing authority. If we did this in the West for example, across these entire areas, instead of having a 30% peak load of wind in their area, the balancing authority area would only have 7 percent. So there are multiple strategies for people to use to integrate in these variable resources like wind and solar, that do vary at times of the day and vary during seasons, in ways that we can ensure that the grid is reliable.

But FERC is responsible for the reliability of the grid- in fact, we're responsible for the reliability of the grid even in Texas and, as such, we have to ensure under a set of rules that we've passed that things are done to make sure the lights stay on. So integrating wind in and integrating solar are very important to us. We want to figure out ways we can do that to maximize that integration, to maximize the development of those resources, those renewable resources, but do so in a way that does not impinge reliability at all. So those are challenges that we have.

Now, there are other countries who are doing planning. In Europe, they're doing extensive planning with respect to developing some of the offshore wind projects that you saw in some earlier slides, in developing solar, developing geothermal. They have, in the Sahara region, there's a whole solar development proposal linking that into the European area and then offshore wind in the North Sea. Very extensive concept of a very robust grid throughout Europe. In other countries, they're going beyond planning. In some countries, they're actually constructing the lines today. This is China. China's doing a very, very aggressive plan to put very high voltage lines, much higher than we have in this country. Our highest AC lines are 765 KV. China's putting in 1,000 KV lines in a number of places. Again, in many instances, to move location-constrained solar resources from their western province to again load centers where they have their main population centers and manufacturing in the east, and they're actually doing it today. They're not talking about it. They're not planning. They're not worrying about cost allocation. They're just doing it. It's ultimately getting done.

So let me talk about another area. When I talk about reliability and stabilizing the grid and how we're going to do that, all of you here may see an automobile, what I see is a grid stabilization tool. OK. What this is is a Toyota Scion that was driven to FERC in November of 2007 from the University of Delaware. The University of Delaware team took this Toyota Scion and they took the guts out of it. They took the internal combustion engine out and the transmission, and they replaced it with an electric motor and with lithium ion batteries, and they turned it into an all-electric vehicle, an 18 kWh car. And in addition to doing that, it has about a 120 to 130 mile range, they drove it down to FERC to Washington, DC, and they parked out in front of our building. We plugged it into a 220 volt circuit and we ran it through a meter so we could see what was going on, and they had some other little devices in this car. They put into the car what they call an AGC, an automatic generator control, that is the same controller that is in a combustion turbine or a combined cycle gas plant that is used by the grid operator to run up and down so it can provide what they call regulation services. And regulation services- remember I told you that grids have to be stabilized in control areas and you have to make sure that the loads match the resources that come in and so, if you can't do that, you've got to somehow call upon those resources, those generators to match it with what they call regulation services on sort of a three-minute schedule. You've got to make sure that every little minute, you've got that load matching. Even though the load may be going up, it looks like a smooth curve, but if you look at it as sort of a micro-view of it, you're in essence seeing it go up and down all the time, because people turn their lights on and off and turn their air conditioners on and off, etc., all that stuff is going on and off all the time, so you have to have the grid matching it, and the way they match it right now is with these fast-cycling gas units. Well, you can do the same thing with a car. The car can, in fact, match that cycle and, in fact, we did that. And here is the car over a charging cycle actually matching the regulation cycle. The car is charging in this green line. The green line's going from zero charge up to 100 percent charge, OK, or a little above, actually, 98 percent charge, and it did this over a six-hour period, OK. This was actually night-charging, it was doing this. At the same time that it was charging, it was receiving this blue regulation signal from PJM, from the grid operator, it was actually coming from the grid operator. And it was matching that blue signal with the red signal, so each time a regulation signal would come in, it would match that regulation signal, it would go, it would go down. And as you can see, in doing that, it was still charging. It was not discharging the batter. The battery was actually charging at the same time. So what it was doing was matching the regulation signal and, at the same time, charging the battery in the car.

What did that mean? Well, it meant a couple of things. Number one, this car was stabilizing the grid. This car could have helped more wind get into the grid system. What it also meant was, the payments that normally would have gone to a combustion turbine to provide regulation services, which happen to be the most expensive level of services for the grid except for energy and capacity, would be paid instead to this car. So right now there are three Toyota Scions that have been converted to all-electric vehicles that are at the University of Delaware that plug in at night and charge and, when they plug in, they get paid by PJM to provide regulation services. And they're getting paid somewhere in the neighborhood of $7 to $10 per day per vehicle. So we're talking about $3,600 a year to charge your car.

So what does that mean? Well, let's see what it means for an electric vehicle. I call it the cash-back hybrid. If you take a standard internal combustion car and you purchase it- you know, a relatively lower-level car, $17,000 car – over its lifetime with gasoline, maintenance, that's going to be the cost of the car. If you take, say, a Prius, which isn't a plug-in, but it does have a battery that help you, in essence, increase the mileage of the car, the Prius is going to cost you a little more, but ultimately it's going to, at some point in time, pay itself back over the incremental cost of a car that doesn't get better mileage than it does, just a straight internal combustion engine. Now, what if we take a plug-in hybrid electric vehicle, but that plug-in doesn't provide regulation services? It's going to cost quite a bit more than the Prius, but ultimately it's going to get a payback as well because it's getting its electricity solely from the grid. The Prius has to use gasoline. That electricity from the grid, to the extent you're driving it, you know, within its range, is going to cost you somewhere to about a dollar equivalent to gasoline so, depending on what you pay for gasoline, it's going to be a pretty good deal, but the problem is its batteries are going to be very expensive cause you need a lot of battery to get a forty-mile range or, even like the Scion I showed you, to get a 120-mile range, that battery's going to be very expensive. But what if, in fact, you started getting regulation payments? What's going to happen? Well this is what's going to happen. You're going to ultimately pay back the cost of that incremental cost of that car much, much quicker from a standpoint versus an internal combustion engine. You're going to do this, I calculated here, in less than four years from an incremental cost. So this type of interaction with the grid- that is not a pipedream, it's not something five or ten or fifteen years in the future, but is happening today in PJM, PJM is paying now cars to do this today- can help us move to an electric transportation system that has all kinds of benefits, but one of the biggest benefits for this conference is the ability to integrate renewables into the system, because it can help us significantly integrate renewables into our system.

And so if we look at that type of integration, there are other things that will do this as well, and I'm going to talk a little bit about the Smart Grid that Roger talked about and then I'm going to wrap this up. Distributed energy systems, certainly storage, in the upper left of the slide here is a flywheel system that is used for storage, that's going to help integrate wind into the system as well. In fact, there are now 5 MW of flywheel storage on the New England ISO, independent system operator, grid. There are going to be 20 MW very shortly on the New York ISO, independent service operator, grid again helping to integrate wind to provide regulation services into the grid and also spinning reserve services. Another storage system down here in the lower left is Ice System's Ice Bear. I just saw where Ice Bear, which is a company out in Colorado, just got a 50 MW contract with the Southern California Municipal Utilities to put in these systems. Ultimately what they do is store ice at night, so when wind may be off-peak and generating more energy than we need, we can put it into systems like this to generate ice during the evening times and during the day to cool the house, so, ultimately again, you're shifting the usage. And we have then some distributed generation gas systems and, of course, down in the lower left we have PV systems on your house. All these systems are going to help us integrate central renewable systems in further.

But when we go beyond that, we talk about sentient buildings. I want to talk, Roger, about sentient toasters. I want to talk about toasters that are starting to take over here. We're going to ultimately have smart consumer controls. You're going to be able to control everything in your house with your iPhone, there's no question. There's already apps right now, applications for an iPhone to control your thermostats, your pool pump. Whatever you may want to control in your house, applications are already available. You can already do that.

In addition, you're going to be able to control your appliances, or your appliances are going to control you. And ultimately these appliances are going to be able to work in a ways that help the grid help you still allow you to keep your beer cold and your ice cream frozen but allow you to lower your utility bills. And the way they're going to do that is they're going to start understanding the refrigerator. And I know that Whirlpool's already doing this, GE's already doing this. They're already moving into their next generation refrigerators- by next generation, I mean like next year- putting in the control abilities to do this where they'll understand, the refrigerator will understand, you've got a compressor in the refrigerator, you've got a defrost cycle, you've got an ice maker cycle, and you've got sweat tapes. I didn't even know you had sweat tapes until I talked to this Whirlpool guy the other day. I didn't know my refrigerator sweated but apparently you've got these tapes that prevent your refrigerator from sweating as well. There's four different types of loads in a refrigerator. All those can be controlled independently. All of those can be used independently for different purposes. First of all, you don't want all four of them to come on at one time, and you certainly don't want all four of them to come on during your peak. There's no reason that you should be making ice or defrosting your freezer during Roger's peak load. And, you know, if you did it off-peak, you know, Roger should be paying you to move that load off-peak and, ultimately, you'll be able to do that. And you also should have the ability to have the grid operator to say "Well, gee, let's crank it up a couple of degrees at night. It's not going to bother anything, but we can store it a little bit more by doing that." In fact I found out the other day an amazing statistic. There is more storage in the water heaters in this country than there is in all the pump storage in the entire country. So we have the ability, if we can start controlling appliances, if we can start controlling the things in our house, in ways, again, that are going to take this kind of sentient knowledge that Roger's talking about cause nobody's going to sit there with their iPhone all day doing that. Nobody's going to want to do that. You're going to have to have the ability to do it through pre-programmed ways that will say "Look, I want the lowest rate or I want the highest comfort or I want all kinds of choices that you're going to have."

Through the competition that Barry's given you, that competitive system, you're ultimately going to be able to control your costs, control your loads, and we'll be able to operate the grid system better so we can give you more green energy. That's all going to be able to happen and come together, I think, in one way through something called the Smart Grid. And when we have a Smart Grid, when we put all these things together, ultimately all we're really talking about is the ability to enable two-way flows of information and power. If we can do that and we can do that in a market system, and it needs to be a market system, then we can all make this work together in ways that I think we can really get to where we want to go to improve our whole system and ultimately have the vision of the future for our electric system so we can have a better economy, we can have a cleaner economy, and we can leave it to our children.

Thank you.