Chapter 5
From Carbon to Clean—How to Attract Investment in Smart Grid Infrastructures

Reed Hundt

I think you all know that Eli has been a thought leader in telecom and energy for quite a long time. He was a great mentor to me when I got to the FCC. The last time that I accepted Eli's invitation we went over the history of the Internet in 15 min. Thanks to YouTube it went viral and all the broadcasters in the United States attacked me. It was great to feel the love again.

So I don't know that I can say anything quite as disruptive today, but I'll do the best I can. I come to the electricity topic, with about as much background as I had frankly when I went to the FCC which was not very much. But in 1992 in the Clinton/Gore transition, Mr. Gore asked me to chair the part that designed the carbon tax of the era—the British Thermal Unit Tax. The BTU tax passed the House of Representatives. Then it had to make its way through the Senate Finance Committee and after Senator Baucus looked at it for a minute or two he said that it was dead. The Senate did not then and does not now like carbon taxes, it seems.

History repeats itself, and in the case of electricity, it is history that we are trying to escape. In this transition, President-Elect Obama asked me to chair the group that examined all the economic agencies of the government. It was like being a bankruptcy lawyer examining distressed assets. We had 85 people in the team. We spent a lot of time looking at housing. We spent a lot of time looking at the Securities and Exchange Commission. About 20 of us decided that what we would focus on was how to pay for the conversion from carbon to clean. What we called the great conversion. And our team helped Carol Browner's come up with all the ideas that are in the stimulus bill: tax incentives, the loan guarantee, the grant in lieu of ITC, the whole framework. The work was rushed because of the circumstances and the starting point was that we had a lot of money to throw at problems and really it was a scramble for who would get the most. In 1993 after the BTU tax failed but OBRA (Omnibus Budget Reconciliation Act) was passed, President Clinton decided that in

R. Hundt (✉)
Coalition for Green Capital, Washington, DC, USA
e-mail: rehundt@gmail.com

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addition to the tax measure the other thing he would do would be health care. And the result was that the Democrats lost the House and lost the Senate in 1994. History repeats itself. I am not saying the Stimulus has caused the loss of the House, but it was one of the factors. The basic concept proved unpopular.

Some people say that the president has not sold it well. My view is that this is an example of a product that when advertised people learn not to like it. I think the stimulus overall was absolutely necessary, but at the same time it had a structure that is not sustainable in the United States political system: that is to say, deep and persistent government spending as the way to change industry structure. That's what's not sustainable. Every device that I hope you turned off, that you are petting your pockets to make sure you didn't leave somewhere at lunch, every one of those devices is using a network built between 1997 and today. And in the 10 years, 1997–2007, $850 billion was invested into the United States to build the networks that you are using. $850 billion is a number that, approximately, would have our economy go from being an intense carbon emitting economy to a nearly non-carbon emitting economy. What happened in communications was a complete and total rebuild of the infrastructure, in the United States, all the way from the devices to all the means of transmission. And in the course of it all of the business models have changed, and the industry structure has changed. Long distance doesn't exist as an industry anymore, just to give you an example.

Fundamentally the changes were driven by technology, but Congress passed in 1995 and signed in early 1996 a new law that permitted people to invest in technology with the prospect of reward and with the ability to take risks. The risks and rewards became part of the communications sector. You could make 30–40% IRR in your deals. So when Congress switched in 1994, everyone said the world politically had come to a dead stop, that we would be in a desert of policy making, and in fact what happened 1 year later is that congress passed the Telecom Act. And that's exactly what I believe we can see and what we absolutely have to see in energy. The Senate is tilted towards the interests of people in the middle of the country and not on the coast—which means it's a Senate where few liked cap and trade. The political base did not agree with the policies of California and New England. We are going to have that Senate not just for one Congress, but several Congresses. So with that Senate and House we are in a situation very similar to the situation of telecom in 1995. We want to hope and pray that before or after the pitched battle for the soul of this country called the election of 2012, Congress decides that in this one area it's going to go ahead and do reform.

That is only possible if the reform, in my view, has the following characteristics: If it is not about regulation, but is about deregulation; it is not about primarily protecting the shareholders, but is about primarily increasing investment; it does not tell particular utilities what to do, but does create many choices for them to go forward with different business models. It needs to be legislation that does not focus on CO_2. If we can pass legislation like that, in fact so much CO_2 will be taken out of the air in the next few years that we will be stunned. We could see greater emissions reductions than we were going to see under Waxman-Markey in the next 5 years. Waxman-Markey was designed to pass a regulatory scheme today with big impact

in 2022. That was the plan of Waxman-Markey, that was the way the allowances were allocated, that's the way prices were set. It was designed to say we know that this operates as a drag on the economy, we know that it's a tax, we don't want it to be inflicted in this decade, we want it to be inflicted in the next decade and we want it to be durable for decades because putting a price on carbon is the way to save the world. In the switch, I propose what we want is to see industries make massive investments in the next 2–3 years which in turn are going to have immediate effects on job creation, business model changes, and the thing which we shall not mention, not Voldemort, but CO_2 emissions. If and when this occurs, then in the back half of this decade the distance between where we are then and that decision to tax carbon directly won't be very far. So we should be optimistic and pragmatic about the current situation regarding energy.

Now I am going to talk to you all a little bit about some elements of pragmatism. I am going to begin at the abstract level. Environmentalism is a cultural matter. A culture is a web of beliefs and values. The belief held by environmentalists is that climate change is real. The value is that we are stewards of the earth. Culture in the form of religion, Weber wrote, meets capitalism, and then you have the Industrial Revolution. So what strange, cruel, and peculiarly Protestant God decided the sequence of the Industrial Revolution? First coal and iron created what Blake called the "satanic mills" that destroyed England's "green and pleasant lands" and led to the second phase of the Industrial Revolution: steel, electricity, and the internal combustion engine. These gave the West vast wealth, bound us to 60 years of non-stop war in the Middle East, and of course laid the ground work for the crisis of climate change, getting us to the third phase of the industrial revolution: computing and communications, and maybe clean energy and energy efficiency. Will this version of the industry revolution be truly sustainable, able to wrap all around the world, and in fact something that gives us an enduring high quality of life as well as wealth? So we should decide. But it would have been nice if we had started with the third phase of the industrial revolution instead of the first two. If Einstein had been born just a little ahead of Edison instead of behind, if Maxwell hadn't preceded Marconi but it had been the other way around, we might have skipped the second industrial revolution, or at least some of it. We are in energy the victims of a tragic accident in the history of invention.

The Say's Law of entrepreneurship is that invention creates its own demand. So in communications we saw an industry that in 1993 had approximately the same revenue as the electricity industry and that because of invention—in every shape, form, or fashion but most obviously in the form of mobile communications— new revenue flowed to that industry in staggering volume. Very roughly, it doubled. In electricity it remained flat until 2008, and in 2009–10 it's down. When you don't have new revenue flowing in, you are eliminating the essential key to innovation, because revenue pulls innovation into an economy. It is never true that there is a breakthrough which without any demand gets into the market. There has to be demand for the breakthrough. It either makes goods and services faster, better, and cheaper, or it creates an entirely new market, called "Brave New World" in the Shakespearean phrase. So there are only two kinds of entrepreneurship: one is called Brave New World and the other is called Faster, Better, Cheaper.

Brave New World means it is just really cool and you buy the Apple product no matter what it is, even though it costs two or three times as much as any substitute you can find. Faster, Better, Cheaper means the new produce is more valuable per dollar than what it substitutes for—because it saves time, or is easier or more fun to use, or is the same but cheaper. Whatever is the category, the breakthroughs have to pull 850 million dollars or more into the sector.

We also had in the 1990s a quantitative easing, by the way. Quantitative easing in the 1990s was stock options that didn't have to be expensed. In fact, in the 1990s, we printed money through stock options. On a net basis, Americans sold 2.1 trillion dollars of stock in the 1990s. That's a lot of freshly printed money. There were a lot of things going on in ICT that led to the investment boom that in turn led to the transformation of the new replacing the old. By sad contrast, in electricity, demand has plummeted along with the collapse of the economy. Where we thought in 2008 that natural gas at $12 a thousand cubic feet would preclude that fuel from competing with wind or even solar, and where we thought in 2008 that we needed to add 2% to the generation capacity of the United States every year, we now see that we don't need to add much generation for the United States until the end of the decade, except as replacement for what now exists. As an irony of history, the recession has done more to reduce CO_2 emissions than all of the regulatory efforts in the last 3 years. So if you wonder why there was no compelling push to pass this energy legislation in the last 2 years, these are the reasons. There's no demand, CO_2 emissions were dropping naturally, and by the way we discovered in "fracking" a whole new technique to get natural gas. So we can keep the price to below $5 per thousand cubic feet for lord knows how long. So all the facts have changed, and this sector is not primed for reform. What are we going to do about it?

Well, what we're going to say is that IT needs to be CT. Information technology needs to be clean technology. And then in the fusion of these we're going to get new products, new services that are going to be offered all across the country. Some of the products will be Brave New World, such as making every building into a San Diego, or really a perfectly comfortable environment. Some will be Faster, Better, Cheaper. Energy consumption won't necessarily be faster. It's a little hard to beat some of the laws of physics. But absolutely it can be better and cheaper. This is the opposite of using a BTU tax to raise the price of carbon and having the Piguo approach propel change. Instead, in order to localize energy generation, empower users, and implant risk and reward, we're going to want to increase the value proposition for clean technology.

What do we have going for us that we can really count on the IT side? Thing number 1: The internet is becoming the network of things. We can count on, through embedded micro-processors, through efficiency gains in the utilization of wireless broadband, through these certain advances of technology, a network of things that includes every single appliance in the United States. Second, we can count on the cloud, in massive data centers, to have software that manages seemingly infinite amounts of data drawn from the network of things. So energy efficiency is going to be a two-way story everywhere. Somewhere in the cloud there's a thing called a computer that will be telling your refrigerator to use a little less energy because

there's a little less milk in the container. This is the way that we're going to see the dry cleaner work with a data center: the shirts and software are going to be in the same network.

To create new value, it's going to be necessary that a law creates the opportunity for that new value creation and also value capture by the creators. The electricity grid is a great ocean of voltage. It leaks all the time, so somebody has to pump new water, i.e., volts, into it. Everyone in the water management business, the grid business, is always saying, we need a czar to make sure that the water level, i.e., the voltage, is the same everywhere, across a very, very broad region. That's why we have to have monopolies. That's why we can never have alternative forms of generation. We can't have any competition. This is too tricky. Telecom doesn't work like that.

Well, electricity does leak all over the place. Like my grandmother said, it comes out of those sockets there and you shouldn't stand too close to them. That may be true. I see all of you edging away. But what's not true is that it is absolutely necessary to have one firm to run the whole thing in some region in order to solve the physics problems. In fact, we know from many illustrations in places like Texas that it's possible to have a regulatory regime that opens the door to new entrants and competition and causes load shift. Different places can produce the water pumped into the great ocean of voltage so we can move from a dirty source to a clean source. We can move from a high cost source to a low-cost source. We can even more from AC to DC. We can do all this in the same way that we have virtualization in a server. That is, by using software algorithms we can see at any given moment exactly where the incoming water/voltage is being generated. We can have algorithms that select for clean electricity and for cheap electricity. These are the algorithms that will drive innovation, that will open the doors to building the new industry.

This can be done on the state level but it's also the kind of high art that's suitable for fundamental change in the methodology of regulation. So how did a Republican Congress figure out the role of the FCC vs. the role of the states in 1995–96? That Congress said that the FCC can decide on the methodology that would be followed by the states, but it couldn't tell the states how to implement it. Therefore, it couldn't tell the states the price to set. That decision about methodological choice was the whole ball game. As FCC Chair, I worked for 2 years with the state commissions to have them be comfortable with my decision about the methodology, and they were totally happy with the process, and when we issued the decision, they sued me. And the case went to the Supreme Court, State of Idaho vs. Reed Hundt, and we won. Well, it was called State of Idaho vs. FCC but we won 5–3, and that's exactly what would happen if the Congress empowered FERC to set methodology of electricity regulation, not to set prices or preempt states as to the rate making but to set the methodology. And first, you have to use methodologies that open the door to load shifting algorithms, which they have in Texas. Those familiar with Texas know that the change on a day-to-day basis is absolutely staggering. There are days now when wind provides most of the electricity in Texas.

Second, if you can switch load by geography by resorting to independent transmission, distribution firms and end users could have much more sophisticated choice of energy sources. This is a version of smart grid.

Third, we can have the load shifted from central generation to distributed generation. Coal is a form of distributed generation facility; coal is carried to the place where it is used for generation. You can put solar on your roof, or a very small wind catching fan on a pole. Humble and grand, there are many versions of distributed generation.

If we take these load shifting steps, we can actually see profound change in the fundamental platform that we rely on. About 128 gigawatts of coal facilities, which is about one third of all the coal fired facilities in the United States, are at or past their end of their useful life. The owners are ready to phase it out. It would cost about 50 billion dollars to convert all of that to natural gas. And that alone would take out about 5% of the thing that we need not mention—CO_2 emissions. And it would be done in 24 months. This is pretty amazing. So $10 billion takes 1% of CO_2 out of the emissions stream. By a law of big numbers, to take out all the CO_2 costs a trillion. I told you that $850 billion would roughly do the job, so I was close. You may say, no that could never happen and I say let's see if we can't make progress.

What are the incentives that the owners of these facilities need? They need to be able to have accelerated appreciation; they need to be assured that efficiency gains are not used against them in rate returns. They need to be able when they are building wind to have the equalized expensing treatments relative to generation facilities that require fuel. If I have a coal facility and I buy coal, I incur an expense for buying the coal. I get a write-off called an expense on my P&L so I pay less income tax. But wind doesn't get an expense item because the wind is just blowing for free. To have an equalized treatment, you have to allow some extra expensing of the capital expenditures for wind. On the consumption side, there are 110 million residences in the United States. To reduce carbon emissions in the residential buildings of the United States costs about ten times as much per ton of CO_2 as reducing the same amount of carbon emissions from electricity generation or from commercial buildings. But you get the good deal if you focus your efforts on energy efficiency in commercial buildings. That formula of ten billion produces 1% reduction in CO_2 emissions is roughly an approximation for what will happen in energy efficiency in commercial buildings. We have five million commercial buildings in the United States. That is plenty big as a target population.

There doesn't seem to be any easy way to address energy efficiency of commercial buildings by way of boot strapping the energy efficiency story into the mortgage story by adding efficiency costs to mortgage loans. This is pretty much the same thing as saying, if you want to get to the United States; it's really a bad idea to jump on board the Titanic. Meaning who would think that the mortgage market in the United States was a place to go for reform of the energy business? Right now, not so much. So when Fannie and Freddie said to the Department of Energy, forget about using our loans to secure loans for energy efficiency improvements, we see we need a different way forward. Going back to the telecom analogy, we have to find new ways for new people to make new money. It's going to be necessary for the energy

efficiency solutions to be, as I was saying, two-way. We will need in commercial buildings an array of embedded chips in appliances all through the buildings, having them managed in the cloud. As another example, it's not necessary to have state regulators have life and death say over mergers and acquisitions in electricity, which they do. This way what you end up with is one of the most fractionated and the least economic way built to scale industries in the entire United States. The electricity industry looks like the grocery business before A&P. Opening the door to consolidation, particularly of the natural monopolies in distribution, opening the door to new services getting new, these are steps that Congress can take that are pro-investment.

The last thing we should discuss is the green bank. A green bank is a low-cost long-term lending facility. It would not take deposits. It would be run by the private sector. It would not extend agency debt. One thing that cannot happen in Congresses, as far as I see, is any addition to the debt of the United States. We could let green banks, as we do with the United States Postal Service, to borrow from the United States Treasury. A green bank could borrow on a really nice long-term note at a low rate and then we lend it out into the clean energy industry at 50–70 extra basis points. This way you can lower the cost of capital by about 200 basis points over what's commercially possible today. Then you can triple the amount of potential wind capacity of the United States and still have the exact same return average. This is the optimal time to borrow low and lend out a little bit higher. It's the optimal time to offer the financing deals to the rural companies for transmission. It's the optimal time to say to the utilities, we want to phase out the 100 gigawatts of coal we'll let you make money doing it. Congress should have no reason to disagree with a thing that I'm saying. So I want us to be optimistic. I want all of you to do a better job than I did in selling the stories, but please start selling it as soon as you can.