

Intersect Keynote Speech

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Introduction

In 1988, I began working at FERC. Since then, the electric power industry has evolved from the equivalent of largely vacant scrubland to a mature hardwood forest. How did that happen? And how does that set the stage for what happens next? Today, I'll look at three main things:

- Where we are now, highlighting the diversity of both participants and platforms today.
- Then back to 1990 to see how different the electric world was then.
- And finally, to see how two key trends have contributed to the changes: marketization and decarbonization.

For the most part, I'll steer clear of the other giant energy ecosystem - petroleum and transportation. That's a fascinating, but very different world from electric power.

The current ecosystem

So – what does the modern electric ecosystem look like? Let's go to the Colonnade Hotel in Boston MA. It's March 13 of this year. The Participants Committee for ISO-New England, the local RTO is meeting. Let's see who's here:

- There's the chair. She's from the supplier sector - a diverse group that includes power distributors, but also brokers, load aggregators and others.
- Next is an old acquaintance of mine, Tom Kaslow, representing generators.
- Then come alternative resources – that's a special sector in New England to recognize that new technologies like renewables and batteries aren't well represented by traditional generators.
- And here are the transmission companies.
- Then large end users - oddly represented by the Environmental Defense Fund. Not sure why that is, but the end users chose him.
- And last the public power entities.

These are the recognized participant groups in the RTO, which runs both markets and reliability for the system. It is the platform where all these participants interact. Sometimes, the interaction is quick, like offering into the market. Often, it's more sustained, as on reliability planning and tariff structures. As you watch the meeting, you'll see the participants both competing and cooperating – alliances constantly forming and reforming, just as members of an ecosystem interact fluidly.

RTOs now cover a good majority of the country by population. They all provide broadly similar platforms for market participants – with, of course, lots of specific variation. Even in regions without RTOs, like the southeast, the existing utilities provide many ways to involve participants. Open access for generation covers the whole country, not just RTO regions. And it has led to the entry of many generation players and technologies. Prominent among them are natural gas and renewables. In 2018, almost 60 percent of non-utility generation came from natural gas and non-hydro renewables.

Overall, in 2018, coal generated about 27 percent of our power, down from over half in 1990. Gas was over a third (up from an eighth in 1990). Non-hydro renewables were almost 11 percent. Nuclear and hydro have stayed roughly the same. The relative shift from coal to natural gas and renewables is one of the hallmarks of the present. We generated 37 percent more power than in 1990, but we emitted a bit less CO₂ in 2017 than we did in 1990, and it's down substantially from our peak of a decade before. And that 37 percent increase in generation? Almost all of it happened by 2010. In 2018 we generated only about 1 percent more than in 2010.

On the market side, RTOs are the base of a much richer electricity ecosystem. Building on the prices established in the RTOs, other platforms offer a wide array of products. Among the most important are ways to manage risk. Enter, for example, ICE, the Intercontinental Exchange. ICE offers forwards and options on a bewildering array of geographical locations and timing. And platforms like ICE in turn provide niches for lots more players. Traders and bankers and speculators. Lions and tigers and bears.

And that's not all. This complex of markets and participants demands more and more information, on everything from weather to outages, from the location of LNG ships at sea to overall economic trends. And so: a plethora of information services, offering detailed reports of almost anything you can think of.

That, briefly, is the mature hardwood forest that is today's electricity market.

Back to 1990

It was not always so. Let's now go to FERC in 1990. George H W Bush is President. You can see a much younger version of me in that office over there, with a view of a multi-story parking garage, and the statue on top of the Capitol peeking just above it. A Capitol view in real estate language. And over here are a bunch of analysts working at Herfindahls, that is, concentration measures, in gas markets. And here are folks trying to see whether the first independent power producers have market power or can have market-based rates. That last is bizarrely silly – but then, we were young and foolish.

What does the electricity ecosystem look like? As far as the eye can see, there are vertically integrated utilities – they generate, transmit and distribute power. Independent generators? Not there, though a few are proposed. Alternative suppliers? Not even imagined. Companies that mostly identify as transmission? Perish the thought – it's an integrated system, thank you. Separate distribution entities? Well, quite a lot of those, actually, mostly small munis, gathered like grass in the shade of the integrated utilities. But altogether they're not big enough to get much attention, except politically.

Large end users – yes, here they are. They go to the state regulators to get the tariffs they want.

One group is very much here - the public power entities, ranging from those small munis to the Bonneville Power Administration.

Still, compared to 2019, it's an impoverished set of participants.

How about platforms? You might think there's nothing here. But that's not quite right. Start with the regulatory system. It's an attorney-rich environment as it still is today. It uses cost-based rates, and rate cases can take years. Don't get me wrong - natural monopolies need good regulation. But when the regulatory system is the primary platform people see, the result is lengthy, plodding and dear – as Hobbes might have said.

And there are also what you might call proto-markets. The Northeast has power pools, the predecessors of today's RTOs. Utilities formed the pools to optimize dispatch over a region. But, having done that, the utilities play little role day to day. Mostly the machine runs itself.

Elsewhere, one utility sometimes sees that a neighbor has a lower marginal cost. Sometimes they agree to split the savings from sending the cheaper power to the more costly utility. But each deal is separate – the platform is the telephone company and fax machine. The whole thing is haphazard at best.

Overall, there's no need for, and no scope for, a variety of participants in these proto-markets.

In 1990, the electric industry is still in its long infatuation with economies of scale and the resulting return on rate base. Four fifths of the power comes from coal, nuclear and hydro plants. Natural gas is at about 12 percent, and non-hydro renewables – mostly wood and waste – are 2 percent. Petroleum had been as high as 17 percent during the gas shortages of the 1970s, but it's now down to 4 percent – headed to less than one percent now.

So there it is: the electric ecosystem of 1990 – a scrubland that covers the ground that will become today's hardwood forest.

Crucially: it's a system rife with inefficiency and therefore ripe for change. Some of the problems:

1. Many advantageous deals never happen. The machinery of deal-making is just too clumsy.
2. Each utility builds its own generation. But some companies are more equal than others. A study in Maine shows the same plant costing three times as much for one utility as for another.
3. Utilities and their regulators handle any risk management that happens - not NYMEX or ICE. This mostly transfers risk to rate-payers. But that's not good. Rate-payers are typically the most risk averse of all parties.
4. Finally: There's no way to tap the value of many new services. In natural gas, the people who build the first salt dome storage caverns can put huge jolts of pressure into the pipeline almost instantly – an immediate increase in deliverability. But the shortest gas deals last a day. So how do you make money with salt domes? It's a question with no good answer.

And that's a big point both for innovative services and risk management. The biggest source of inefficiency is probably from players who aren't here, from niches that are missing, from platforms that don't yet exist.

Forces of change – Marketization and Decarbonization

So, a system rife with inefficiency and ripe for change. But how did we go from scrubland to hardwood forest in 30 years? I'll look at two major forces that have reshaped the industry: Marketization and decarbonization.

Markets first. Until the 1970s, the United States regulated rates and terms of service for almost all the big network industries. Beginning under Jimmy Carter and continuing under both Ronald Reagan and George H W Bush, the nation began to marketize these industries – that is to deregulate many or most prices and services. By 1990, the process was well advanced in industry after industry - in railroads, in airlines, in telecoms, in natural gas. By 1990, electric power was the last largely untouched industry. That was about to change.

How did that work? After approving the first independent power plants, FERC wanted utilities to provide open access to aspiring generators. The response was slow and grudging. So, in 1996, it issued Orders 888 and 889. Order 888 required utilities to unbundle their generation and provide open access to all generators. Order 889 set standards for opening information about the transmission system. These Orders did three big things:

1. established today's open access regime for the transmission grid,
2. enshrined competition to provide generation, and
3. recognized that information is the life blood of a well-functioning market.

In 1999, Order 2000 followed and set the model for the RTOs that still govern most of the country. With the growth of RTOs came also all the derivatives markets and information services that we see today.

Marketization in electric power has succeeded because it was a sustained, bipartisan and pragmatic policy:

- It was sustained: No administration since the 1970s has opposed it.
- It was bipartisan: Those administrations have been both Republican and Democratic, and Commissioners from both parties have consistently and overwhelmingly backed it.
- It was pragmatic. When the California crisis ousted a governor and threatened to bankrupt the state, the response was reforms like price caps and an investigation function at FERC. Faced with severe opposition to the so-called Standard Market Design in the Southeast and the West, FERC let those regions continue with open access but without RTOs. It also got a new Chairman. Today, the overall policy is simply accepted as the world we live in. And given the issues around decarbonization, that is something of a miracle.

Let's go to **decarbonization**. There's no question that the electric industry is less carbon intensive today than it was thirty years ago. That's obvious from the shift to natural gas and renewables and the changed pattern of emissions. But no one would claim the policy as a political success story. We all know that today's carbon debates are highly partisan and bitterly controversial. That's why we see a major executive push to limit carbon emissions under Obama, and now a major effort to support coal generators under Trump.

It was not always so. In 1990, the first Bush administration proposed amendments to the Clean Air Act that passed with 411 votes in the House and 89 in the Senate. In those days, the big issues were acid rain, urban air quality and toxic emissions, not carbon dioxide. Still, the legislation included

measures that ended up lowering carbon intensity – a framework for alternative fuels, conservation, and the promotion of clean coal and natural gas.

Since then, much public policy has supported decarbonization. For example, many states have enacted renewable portfolio standards so that part (or eventually most) of the generation mix comes from renewables. The Federal government has supported research for solar power and batteries as well as providing various forms of subsidy for wind, solar and electric vehicles.

BUT. It's easy to overstate the relative advantage non-hydro renewables have received

1. States are anything but uniform in their RPS standards. Some are ambitious - think California. But 21 states covering 45 percent of the population have no RPS standards.
2. The Federal government has supported research in many other energy industries too – fusion power anyone?
3. And government has supported most energy industries in one way or another. Depletion allowances, for example, or protection of sea lanes, or ethanol. It's like fossilized agriculture policy. The per unit support for renewables has been high – but that's probably what you would expect for an infant industries policy.

My point here is not that decarbonization policy has been ineffective, but that it has been partial and conflicted. Unlike for marketization, the politics have moved from rough consensus to deep controversy.

So how have we decarbonized as much as we have? The answer to that lies in the add-on effects of technology.

Let's look at two trends separately – the shift from coal to gas and the rise of non-hydro renewables. For the shift to gas, the overwhelmingly important driver is fracking, a development that is almost entirely independent of carbon policy. As late as 2004 or 2005, fracking was a marginal technology. But then producers combined it with horizontal drilling, and the result has been a large, entirely unforeseen growth first in natural gas production and then in petroleum as well. EIA projects that next year, the United States will be a net exporter of energy overall. That's not the result of a restrictive carbon policy.

The dynamics of the fracking boom look much more like Silicon Valley and Moore's Law than the boom-bust cycles and dry holes of the past. Frackers improve their process every year with metronomic regularity, offsetting any effects of taking the best deposits first. And since shale fields are vast, the nation now exports a significant portion of the world's LNG volumes, quite aside from the growth in electric generation. In retrospect, the high gas prices of 2003 through 2008 are the anomaly in an overall low-price gas regime that stretches from 1985 to the present.

The effect on emissions is that natural gas generation produces considerably less carbon dioxide than coal plants. The shift to gas has driven many older, less efficient, high emission coal plants into retirement.

Turning to the rise of wind, solar and batteries. Here, the declining costs are at an earlier stage than for fracking but seem to be following much the same dynamics – their own form of Moore's Law. We don't know yet if they will be as successful as fracking, but it certainly looks similar. For both batteries and solar, the technologies appear to be around a take-off point. If you think that was an inevitable result of federal dollars, maybe you'd be interested in one of those fusion reactors.

Conclusion and Invitation

So here we are.

In the rest of this conference, you'll be hearing a lot about the prospects for our energy ecosystems – you'll hear about new participants, about new platforms that will structure the niches that they will need, and about one of the major forces likely to drive the changes – electric vehicles. As you're listening to all this, I'd like to leave you with three thoughts:

1. Current market arrangements need to change. Today, RTOs aim to minimize the variable cost of operation and to optimize the system for geography. Many of tomorrow's generators will have operating costs little above zero, and they will stress the system much more with rapid changes over time than space. RTOs have add-ons to deal with these changes, but that's what they are – add-ons.
2. Just as in 1990, many players are not in today's markets – especially retail customers, except the big guys. Plenty of people offer energy services to smaller end users, but their interests are seldom reflected in the market – there's just no real mechanism for it. Especially with the advent of electric vehicles, that needs to change.
3. And EVs will also begin uniting the separate continents of electricity and petroleum as perhaps never before. Sort of an energy version of the Columbian exchange after 1492. Consider a simple thing like gas stations. Perhaps they begin to advertise electric power prices for recharge. How would that change the way everyone thinks about retail electric prices?

So the future ecosystem around electricity will need to change what it focuses on, become a good deal more complex and occupy a larger landscape. If we're living in a hardwood forest today, we're moving toward life in a tropical rain forest. Enjoy the ride!