Speeches

Climate Progress in the Energy Sector: Room for (Cautious) Optimism?*

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I want to join others in thanking Alice Madden, Shaun LaBarre, the Getches-Wilkinson Center and the sponsors for making this conference possible. It is just exactly the kind of conference I love to attend where people from different perspectives and different disciplines talk about these issues in a more sophisticated way than they're usually talked about.

There is some optimism in the title of my talk today. I will focus on the electricity sector today, but a lot of what I say is more generally applicable to the oil and gas sector as well. I really want to focus on the reasons why we might be a little optimistic about environmental progress, and particularly, climate progress. I am also going to try to talk a little about the larger political and social context in which a lot of these debates happen, and the effects of partisan polarization on the energy policy debate.

I have divided my talk into three parts. One focuses on the ways in which markets and law (or markets and regulation) are interdependent. I think we sometimes lose sight of that interdependence. We can all agree that this is true conceptually, but depending upon the frames we impose on energy law or an environmental problem, we can easily lose sight of that fact. Some people think of these problems from the top-down. Bill McKibben, for example starts with the proposition that we must not

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exceed two degrees centigrade warming, and then reasons his way backward to determine what we as a society have to do. That's a top-down view. Other people take a bottom-up view. Economists think about the market and about individuals and ask, "What are individuals likely to do?" That is the starting point from which they deduce their policy prescriptions. Those frames clash at times, and they talk past each other at times, and I want to explore why that is.

Second, I think that this "clashing frames" problem is much worse today than it used to be, because of political polarization. So I want to talk a little bit about ideological polarization between the political parties and how it strains our system in ways that it didn't way back when. The first panel this morning was like a walk down memory lane for those of us of a certain age. "Why are we so adversarial? Why can't environmental groups and business work together?" Those were the problems that were consuming the Clinton EPA, particularly in the second Clinton administration, and they came up with programs like project XL and the Environmental Leadership Program that were designed to bring opposing sides together. We're still hearing the same lament about adversarialism, but getting past it is more difficult now that we're so ideologically polarized

And third, I think there are reasons for optimism here; there are good things happening in the energy sector, particularly the electricity sector. Some of them are market phenomena, and some come from state and local policies. And these effects are important, perhaps even more important than federal policy.

The Evolution of Energy Regulation

I hardly ever give a talk without showing the slide depicted in Figure 1 (see the Appendix), and I am sure many of you have seen it before. It is what engineers would call a "Sankey Diagram," one put out by the Lawrence Livermore National Laboratory ("LLNL") every year. It's a picture of how energy flows through our economy. On the left-hand side are the primary source fuels, on the far right you have the end-uses of energy, and in between you see that some of those primary source fuels are used for electricity generation. These diagrams are a useful way of illustrating visually that all of these fuels compete with one another in the market. As someone said this morning—and again it seems like an obvious point but we sometimes lose sight of it—our energy infrastructure comes from private investment. Holders of private capital invest in generating facilities, transmission lines, etc. So, if nobody is willing to put up the money to build a new wind farm, a new solar farm, or a transmission line to get that clean power back to market, then it's not

going to be built. These fuels and technologies are competing with one another over time—each constantly working to out compete the other one on price.

Of course we regulate this market. We regulate entry into the market through permitting proceedings. We regulate the extraction of fuels, we regulate electric generation, and we regulate transportation and other parts of the market. Our government doesn't dictate which kinds of facilities will be built, or force people to build them in particular locations. Rather, we regulate by requiring a license to build a new power plant, or a new power line. Generally, we grant regulatory agencies broad latitude to decide when or if to grant permission, and if so under what conditions. The regulatory agency's charge is to serve the public interest, and to determine what the public interest requires in any given circumstance. Over time, it has come to mean balancing three sets of concerns in energy regulation: reliability, affordability, and the environmental impact of energy.

Reliability is many things. It's whether a generating plant is going to give you electricity when you need it. It's resiliency—the ability to get a plant back up and running again after a forced outage. It's flexibility—how fast can a plant ramp up and down. These are all elements of reliability, and we want our electric system to be reliable.

Perhaps it is obvious what affordability means. We want our energy to be provided at a price that people can afford. If energy is expensive, people are unhappy. And affordability is a relative term, one that probably depends upon one's ability to pay. What seems affordable to you may not seem affordable to me.

Lastly, environmental performance. We want our energy to be clean, all else equal. Environmental performance is not just about climate change. Traditionally our energy system has produced emissions of sulfur dioxide, particulate matter, nitrogen oxides and other deadly pollutants that tend to dominate the EPA's estimates of the benefits of reducing pollution from fossil fuel combustion. Whereas climate effects are long term, global, and potentially existential, the impacts of other pollutants tend to be more localized and more easily traceable to well-understood (and serious) health impacts.

These three attributes of the energy system—reliability, affordability and environmental performance—are in tension with one another. The more we seek any one goal, the more costly it becomes in terms of the other two. The cheapest possible energy system would be dirty and unreliable. The cleanest possible system would be expensive and unreliable. And so on. In practice, we each apply our own weighting to these attributes: we each strike a balance between them in our own

way. People in my home town of Austin and here in Boulder may have weightings that are pretty similar, but they may be very different from those of the average resident of Lubbock or Grand Junction. It is the regulatory agency's job to recognize all those competing views and to decide what the public interest requires.

Energy regulatory agencies did not worry much about environmental issues until relatively recently. They focused on the affordability and reliability of the energy system. It wasn't until the latter part of the twentieth century that environmental concerns were more fully integrated into regulatory decision-making. Now these agencies make this three-sided public interest determination when deciding whether to approve new energy infrastructure; but even now, the relative weights regulators attach to these attributes change over time. In the late seventies we were starting to think about environmental issues, but we also thought we were running out of energy, so energy security was a really big deal. Now we are awash in domestic energy sources, and energy security concerns don't loom quite as large.

So in this way the market and regulation are one, interdependent system. The regulatory system doesn't dictate energy investments; rather, it tries to channel or steer them. We are not China: the government doesn't dictate which plants to build, nor does the government build plants itself, usually. With my students, I often use the metaphor of tugboats. The tanker is the economy and the tugboat is regulation. With regulation and policy, we are steering private decisions—decisions that are otherwise made on economic, least costs basis—toward particular outcomes.

The Effects of Political Polarization

Polarization has changed and distorted the way this regulatory system works. Political scientists measure polarization, and have documented the ideological divergence of the two parties in Congress. In Figure 2, the blue line represents the median Republican in Congress. The brown line is the average Democrat. The vertical axis measures ideological conservatism. You can see that polarization has gotten a lot worse in the modern regulatory era, particularly in the last twenty-five years or so. It is evident from this figure that the parties have been diverging and the effect is not symmetrical. Most of the movement is attributable to the Republican Party becoming more conservative, though the Democratic Party has become slightly more liberal over that same period.

So what this means is that parties' respective visions of the "good" are diverging. In the energy world, the ways in which each party would balance reliability, affordability, and environmental performance to arrive at a definition of the public interest are more dissimilar than ever. Consequently, each vision seems more unacceptable to the other side than ever before. We worry more about the other side coming to power and pursing a vision of the future that seems really, really unacceptable to us. Polarization also contributes to congressional gridlock. Neither party has a big enough majority to really fully pursue its agenda, and when it tries to it triggers intense opposition. The result is gridlock in Congress. Therefore, when new problems arise in energy policy, Congress often cannot intervene. For example, members can't agree to oppose efforts to pursue greenhouse gas emission reductions, and they can't agree to endorse them. All of which leaves room for initiative by states, local governments, and the market.

Polarization also feeds and amplifies our biases. If we are worried and emotionally upset about the agenda of the other party, it affects how we behave in the pursuit of our own agenda, our own goals. It affects what we believe and how we process new information—about risk, for example. Studies being done at the Yale Cultural Cognition Project demonstrate that we tend to filter out the information that we don't like, information that doesn't confirm our initial biases or presumptions, or that doesn't fit nicely with what our friends believe. Conversely, we accept information more readily that does confirm our beliefs and fit our worldviews. Not only do we filter risk information in this way, we do so more quickly and efficiently in the digital age, which in turn magnifies the problem of polarization. It's not just that we have different values about how to balance these different attributes of the energy system, it's that we actually believe different facts about each of these things. "Is nuclear power safe?" "Is climate science a hoax?" "Is Robert Mueller a loyal patriot trying to discharge his duties? Or is he a partisan hack?" Not only that, we are constantly bombarded with information and appeals from interest groups and others who invite us to believe the set of facts that serve their interests. These appeals are sophisticated, as the last presidential election showed. It takes a kind of constant vigilance to avoid falling prey to them.

And it's not just that others are doing it to us, we also do it to ourselves. We train our Facebook feeds to do this automatically. It's a feedback loop. (I am not to the "optimistic" part of my talk yet, but I am getting there, I promise.) This feedback loop makes the bias problem worse and worse. I think that is why we heard panelists talking plaintively this morning about passion and emotion in energy debates, as a kind of lament. Passion and emotion can be good things, but when

combined with these psychological biases and the ability to filter information ever more efficiently, we find ourselves where we are now (politically).

Somewhat reassuringly, this phenomenon is something the American Founders were aware of. In the Federalist Papers, James Madison said that our passions and opinions have reciprocal influence on one another. He was foreshadowing the idea of "confirmation bias," the idea that if we really need something to be true and we wish it to be true, we are more likely to believe it to be true. And recently, commentators have taken to quoting George Washington's Farewell Address, and its warnings about tribal populism and the decline of the rule of law. We are seeing some of that right now, and it is easy to despair about this. In energy policy it has gotten a bit ridiculous. The speakers in the second panel were very polite in the way they were talking about what the EPA is trying to do now. In my energy newsfeed the other day, I received a story the first sentence of which reads, "U.S. EPA is not releasing details of its plan to make science at the agency more transparent."[1] Think about that for a moment.

Reason for Optimism?

So yes, right now there seems to be not much room for optimism about *federal* policy on environmental protection and climate change. The ideological extremism and populism that we are experiencing in this policy area is at least partly the product of the biasing phenomenon I described. But not all the news is bad. There is good news associated with things that are happening in the market. For the first time ever, renewable electricity generation—at least at utility scale—is cheaper than the alternatives. That is amazing. I have been involved in energy policy for thirty-five years, and I simply did not think that was going to happen in my lifetime. Figure 3 shows estimates of the levelized costs of energy—the amount of money a new electric generating plant would have to earn (on a per megawatt-hour basis) over its lifetime to be profitable—for different electric generating technologies. These estimates come from a company called Lazard, and they offer one way of comparing costs across different generators. As the figure shows, utility-scale solar and utility-scale wind are now cost competitive with conventional generators, on average, without subsidies. Again, that is an amazing development.

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[1] Scott Waldman, *Details Lacking as Pruitt Attacks 'Secret Science,'* E&E NEWS: GREENWIRE (Mar. 2018), https://www.eenews.net/stories/1060076849.

What this means is that in a least-cost world where economics are driving decisions, we are going to see more and more renewable resources being built. People want them not just because they are green but because they are cheapest. In Texas, where we have a lot of wind, we are seeing demand for green power from companies outside of Texas in the Southeast, where environmental protection policies are relatively weak. Nevertheless, their electric consumers want cheap, renewable power so badly that their demand is spurring the development of a transmission project that would take renewable power out of Texas and into the Entergy service area in Louisiana and elsewhere in the Southeast, into states that don't have renewable portfolio standards. There is no top-down pressure to do this; rather, it's the market and customers (mainly big companies that consume a lot of energy) who want cheap renewable power. Indeed, public utility commissions that stand in the way of new renewable plants are going to have to answer to their constituents' question, "Why don't you let us buy the cheapest power?" For those interested in greening the electricity sector, all of that is a really good sign.

As a byproduct of all this, we see that coal-fired power is on the decline. Environmentally, this is good news because the health and environmental harm done by coal generation dwarfs that of any other electricity source. Figure 4 shows a picture of the shares of electric generation by fuel type over time. The top black line is coal. The non-hydro renewables line is the green line at the bottom. It looks pretty small and it is, but it's growing very quickly. Natural gas has already surpassed coal, and renewables will too in the not-too-distant future.

The other bit of good news comes from the states. The states are doing things to promote cleaner energy. First of all, as Figure 5 demonstrates, renewable portfolio standards ("RPSs") are popular not just in blue states but in some red states as well. About thirty states have mandates that require utilities to sell a certain percentage of electricity from renewable sources. These policies are popular, and resistant to conservatives' attempts to weaken or abolish them. The American Legislative Exchange Council has been trying to kill these RPSs or scale them back. Their efforts over the last five years have been an abject failure. People like renewable power and they like renewable portfolio standards. RPSs seem to be here to stay and are getting stricter in some places.

Let's take a closer look at what is happening in three states: California, Texas, and New York. California, as everybody probably knows, is a leader in pushing renewables, pushing for a cleaner energy mix, and for decarbonization of their energy mix. California has a very aggressive renewable portfolio standard. It has a renewable fuel standard.

It is pushing battery storage onto the electric grid by mandate—that could be an expensive proposition for California ratepayers, but it is good for the rest of us, as those investments will help bring costs down (i.e., more development of battery technology, etc.). By contrast, in Texas there is no top-down pressure for green power, yet that state has more wind than any other state, and more wind than the next three states combined (in total generating capacity). Texas has about seventy-five gigawatts of generating capacity, and more than twenty gigawatts is wind; and in the next few years, wind and solar power will comprise more than twenty-five gigawatts of capacity. New York is going yet a different way. It is trying to push toward a more decentralized market in which distributed energy resources, like rooftop solar units and "behind the meter" technologies, play a much larger role in energy supply. The Brooklyn Microgrid is famous example of this—it is an experiment in transactive energy, or decentralized energy trading among customers who produce and consume energy together.

These state initiatives are bearing some fruit. In these states and others, renewables are commanding an ever-larger share of the generation. The other day in the Southwest Power Pool, which is just north of Texas, they generated sixty-six percent of their energy from wind for a portion of the day. Similar records are being broken in many parts of the country.

Cautious *Optimism*

Now, the news isn't all good. The title of this talk uses the phrase "*cautious* optimism." Caution is warranted for reasons articulated by Stephen Spielberg's fictional Abraham Lincoln, played by Daniel Day-Lewis. Responding to advisers urging him to act on principle, and to move more boldly and directly toward his political goal, Spielberg's Lincoln says that "[a] compass [will] point you true north from where you're standing, but it's got no advice about the swamps, deserts and chasms that you'll encounter along the way." So it is with the decarbonization project. It is wonderful to have passion and belief in a goal, but one must also understand the consequences of the steps you take toward that goal. As we move toward a cleaner energy mix, we must be aware to move with our eyes open about the consequences of individual steps we take along the way—to continue to mind the tradeoffs between affordability, reliability, and environmental performance.

And here I am going to talk about biases one more time. We all succumb to them. It's easy to see them in others, but we generally don't see them in ourselves. So, if we think about energy policy as a war or

crusade, and we see the other side's objectives as evil or wrong, we are going to make mistakes too. We are less likely to treat the truth with the respect that it deserves. We will look for the information that confirms our beliefs. We will build our own "filter bubbles." This happens on both sides of the ideological and political aisle.

Let me close with a few current examples how people misunderstand, fail to appreciate, or downplay energy tradeoffs—and in so doing feed polarization of the energy debate. First example: more and more cities have pledged to consume only "one hundred percent renewable" electricity. Here in Colorado, Aspen is one such city; in my home state of Texas the City of Georgetown is another. These cities have entered into contracts to purchase amounts of renewable electricity that equal their total consumption. But they don't actually receive only renewable electricity. Most of these cities remain connected to the grid. So at night when the sun isn't shining, or on still, cloudy days, they are getting electricity from somewhere else—a gas-fired plant, a hydroelectric plant, or a nuclear plant, or perhaps all three. For now we can keep adding more cities to the "one hundred percent renewable" club in this way without posing problems for reliability. Indeed, we are finding that the grid can integrate much more renewable energy than we ever thought possible. But not every city, county and town can go one hundred percent renewable, because we have to have nonrenewable generation backing up the renewable power (for those cloudy, still days and weeks). When we call them "one hundred percent renewable" cities, we leave people with the impression that it is possible to have affordable, reliable, one hundred percent renewable electricity, and it is not—at least not yet.

Another example of the tension between environmental performance and reliability: Figure 6 is a picture of the so-called "duck curve" with which many of you are familiar. It is a picture of "net load" in California, meaning the demand that has to be served by generators *other than* renewable generators. In California, there's a lot of solar generation, and it is great at satisfying the afternoon peak demand; but the peak continues into the early evening, after the sun goes down. At sundown you suddenly need a lot of generation; you need a lot of *something*. In Southern California, it's natural gas-fired power. If California aspires to get rid of its natural gas-fired generators, it will have to satisfy that demand some other way.

I can tell you right now, no matter what you have heard, "solar plus battery storage"—storage that will provide enough power to cover the kinds of wind and solar droughts we now experience—is too expensive, much more expensive than natural gas. That could change, but right now it is too expensive. These are the kinds of things that regulators and grid

operators worry about. The rapid increase in solar power might have something to do with why California wants to join its electricity market to those of neighboring states; it may want to use those other states' generators as supply in times of need.

In Texas, we have a different sort of trade-off problem. Our electricity is very affordably priced. Sometimes the price of electricity goes negative in West Texas at night, because there is so much wind and so little demand, and because of the production tax credit that generators are receiving; they are willing to pay consumers to take their power. That means the average cost of electricity on the grid is low, which is great for consumers but bad for producers. So in Texas, we are worrying about whether there is enough incentive in the price signal itself to get people to build those generators that will be there when the wind isn't blowing. Other states compensate plant owners just to be available when needed; Texas does not, at least not yet. Consequently, our generation reserves are declining. That is becoming "the pressing issue" in Texas right now—another one of these tradeoffs.

Some forms of green energy pose an affordability tradeoff: such is the case with rooftop solar power. Looking at the levelized cost of electricity data from Lazard in Figure 3, we see that the low-end estimate for rooftop solar is $187 per megawatt-hour compared to $43 per megawatt-hour for utility-scale solar. To the extent that rooftop solar development deters investment in utility-scale solar (by reducing the profitability of serving afternoon peak demand), jurisdictions that choose to encourage rooftop solar choose the more expensive alternative.

And since we are talking about the need for reliable electricity, let me just say one other thing about fossil fuels. It is worth remembering that climate change is not the only environmental value. The best-kept secret in environmental policy is that coal-fired generation kills roughly ten thousand Americans prematurely each year. No other source of electricity is nearly as deadly. By driving coal-fired power out of the market, cheap natural gas has saved lives. Now, in many places there isn't any coal-fired power left: in New England, in New York, in California. Therefore, this effect of natural gas prices on coal is not important in those places. However, there are places where it still is important. It's important in Texas. It's important in the PJM area (the middle part of the country). And it's important here in Colorado. All of these places still rely on coal-fired power. Indeed, Colorado relies most heavily on coal—about twice as much as the next largest fuel source. In places that still have a lot of coal-fired power, we have to be careful about phasing out natural gas, because doing so might work to the benefit of coal. Indeed, there are some who think that Germany's policy of heavily subsidizing renewables *while* rejecting both nuclear and

natural gas-fired power is still keeping coal-fired generation alive in Germany.

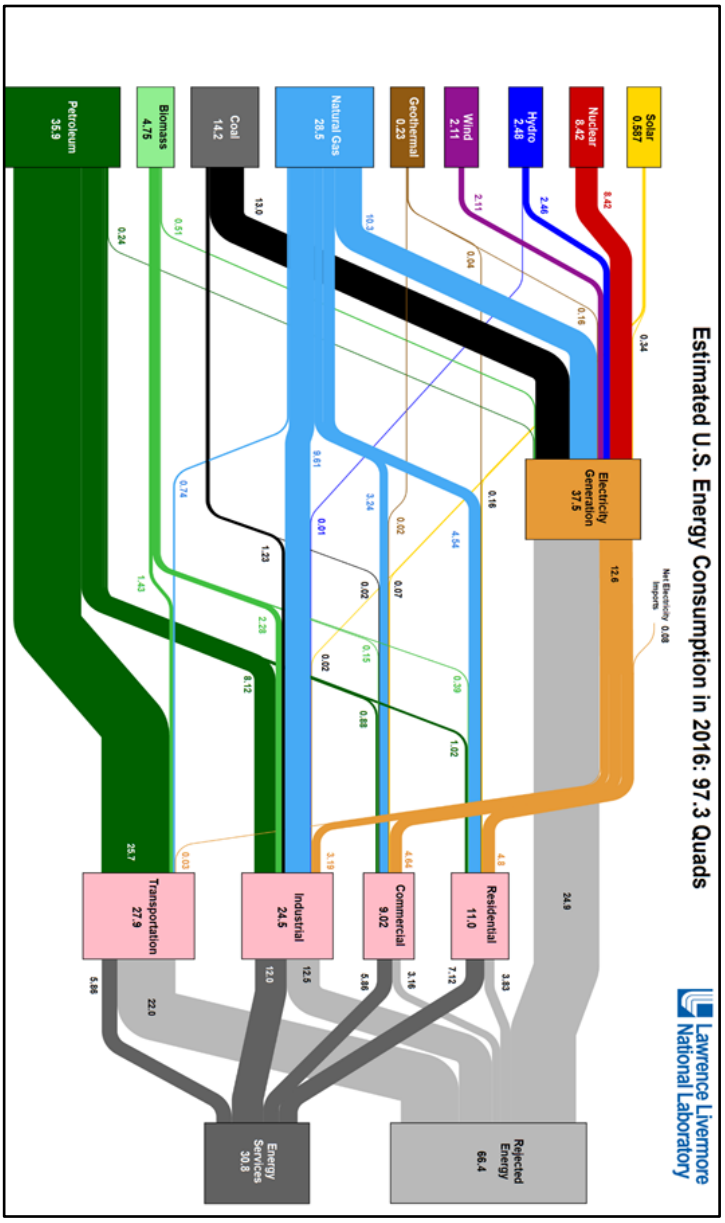
So tensions and tradeoffs remain at the heart of energy policy. My hope is that we all leave here today and remind ourselves not to tolerate the hyperbole, the misstatements of fact, and the narrative frames that obscure these truths. It sometimes seems opportunistic or expedient to shade the truth in the heat of policy battles. But it does harm in the long run. For years at oil and gas conferences it was common to hear somebody say, "We have performed a million frack jobs in this country and never has a single one ever contaminated groundwater." That wasn't true then, and it isn't true now. Invariably those who made the claim were motivated to rebut the ways risks to groundwater that were being horribly exaggerated by movies like "Gasland," and that's true. But, it is also not true to say there was never any risk to groundwater.

Why does it matter if we spin the truth in energy policy debates, especially if we do so in service of a worthy cause like mitigating climate change? I think the reason this matters is because we just came off of an election that was viewed as a right-wing populist revolt against "elites." We Austin and Boulder elites ought not to simply seek to impose our view of the right balance between environmental performance, affordability and reliability, to define that balance as the only correct one, or to dismiss others' views of that balance. In the long run, that attitude is going to feed polarization and make finding solutions a lot more difficult. So let's not do it. Let's treat the truth respectfully.

Thank you.

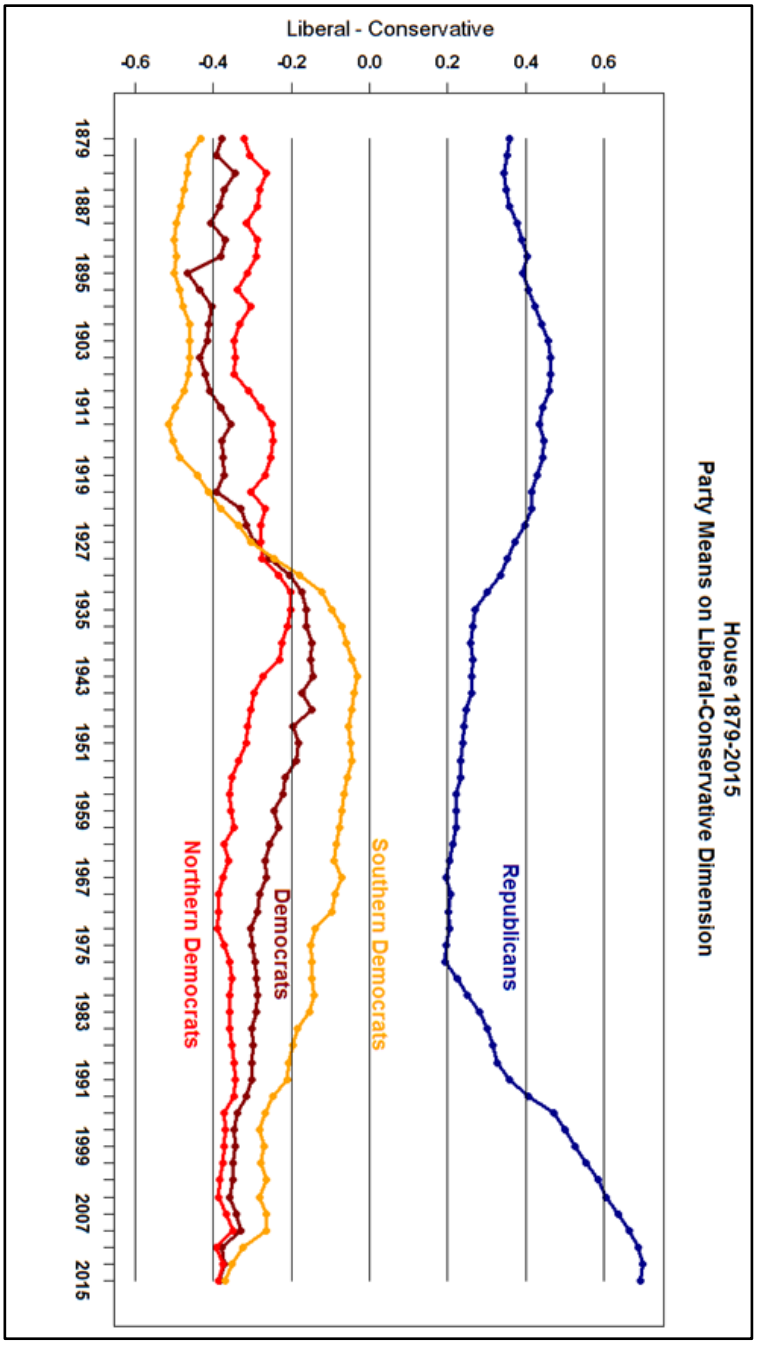
Appendix

Figure 1.[2]



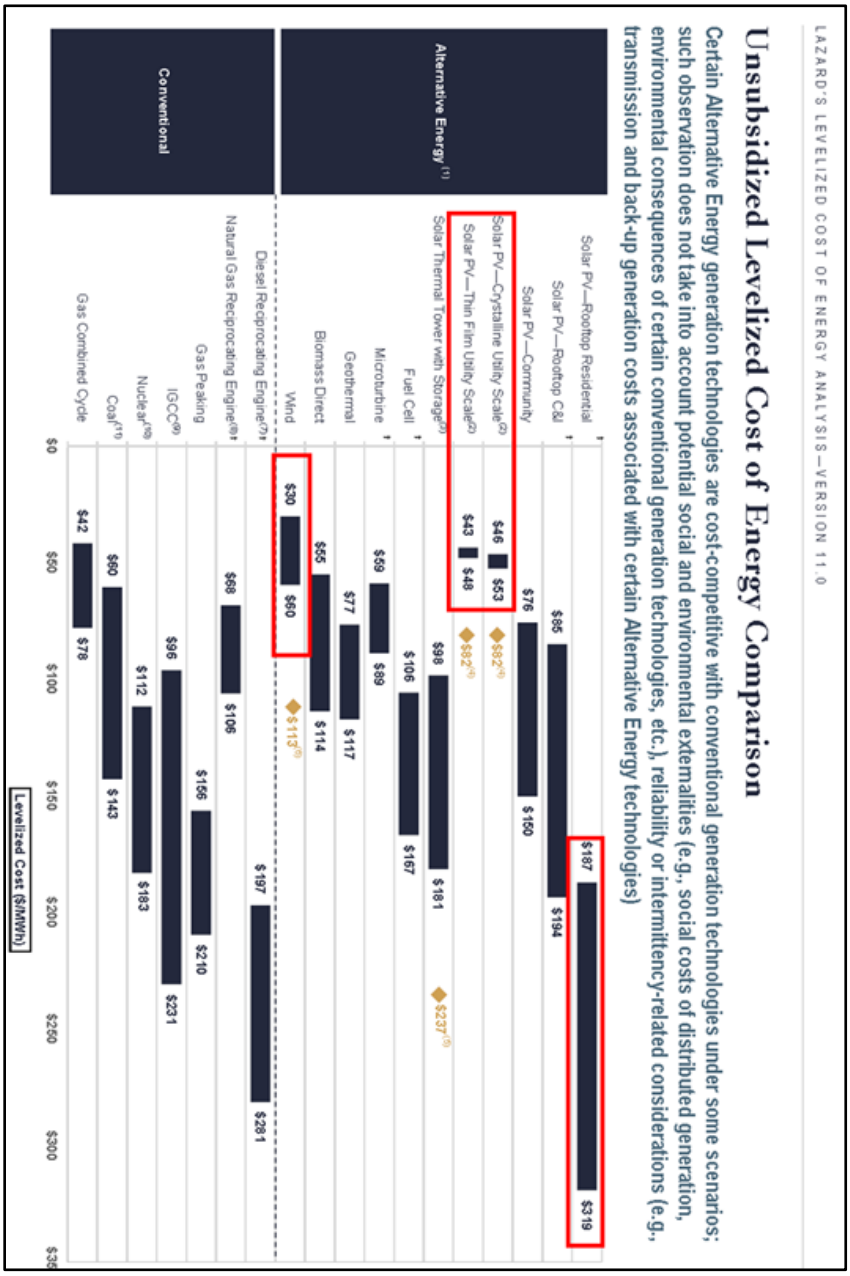
[2] *Estimated U.S. Energy Consumption in 2016: 97.3 Quads*, LAWRENCE LIVERMORE NAT'L LABORATORY, https://flowcharts.llnl.gov/content/assets/images/charts/Energy/Energy_2016_United-States.png (last visited May 15, 2018).

Figure 2.[3]



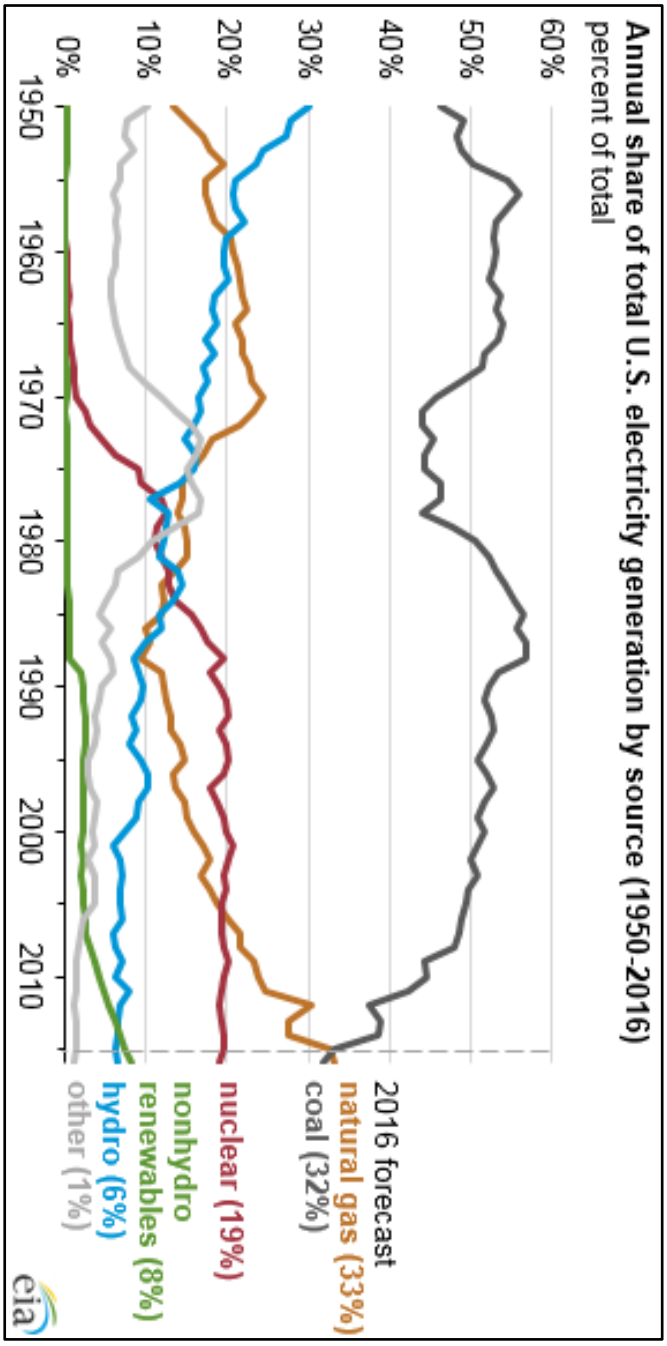
[3] *The Polarization of the Congressional Parties*, K7MOA, http://k7moa.com/political_polarization_2015.htm (last updated Jan. 30, 2016).

Figure 3.[4]



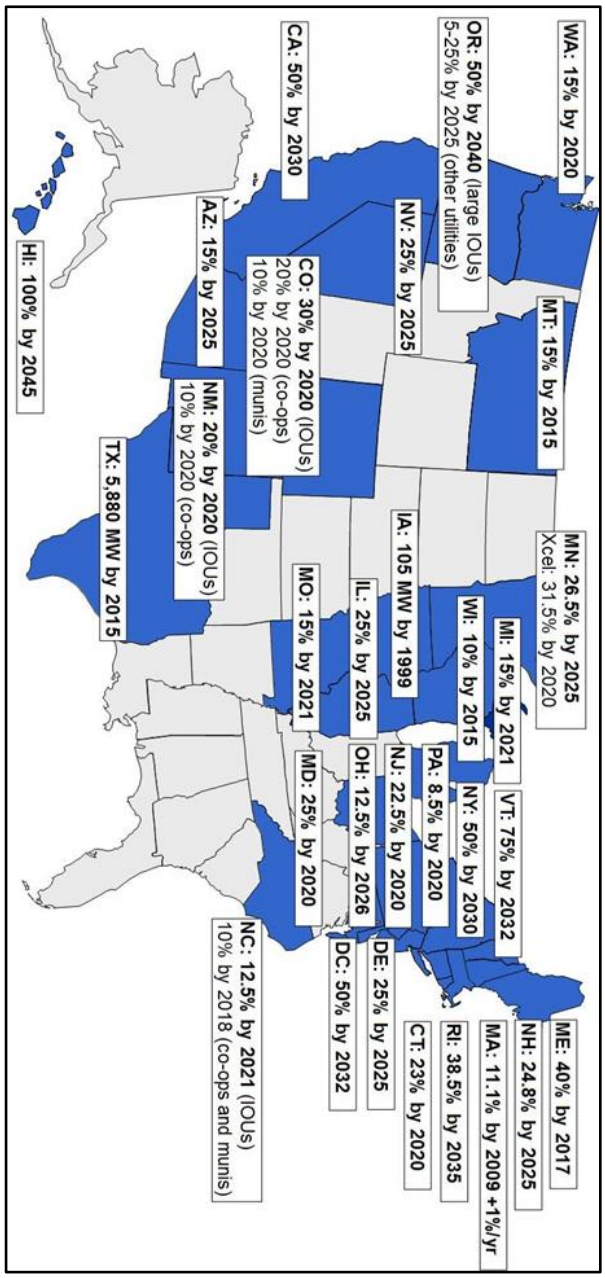
[4] LAZARD, LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 11.0 at 2 (2017), https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf (red rectangles added for emphasis).

Figure 4.[5]



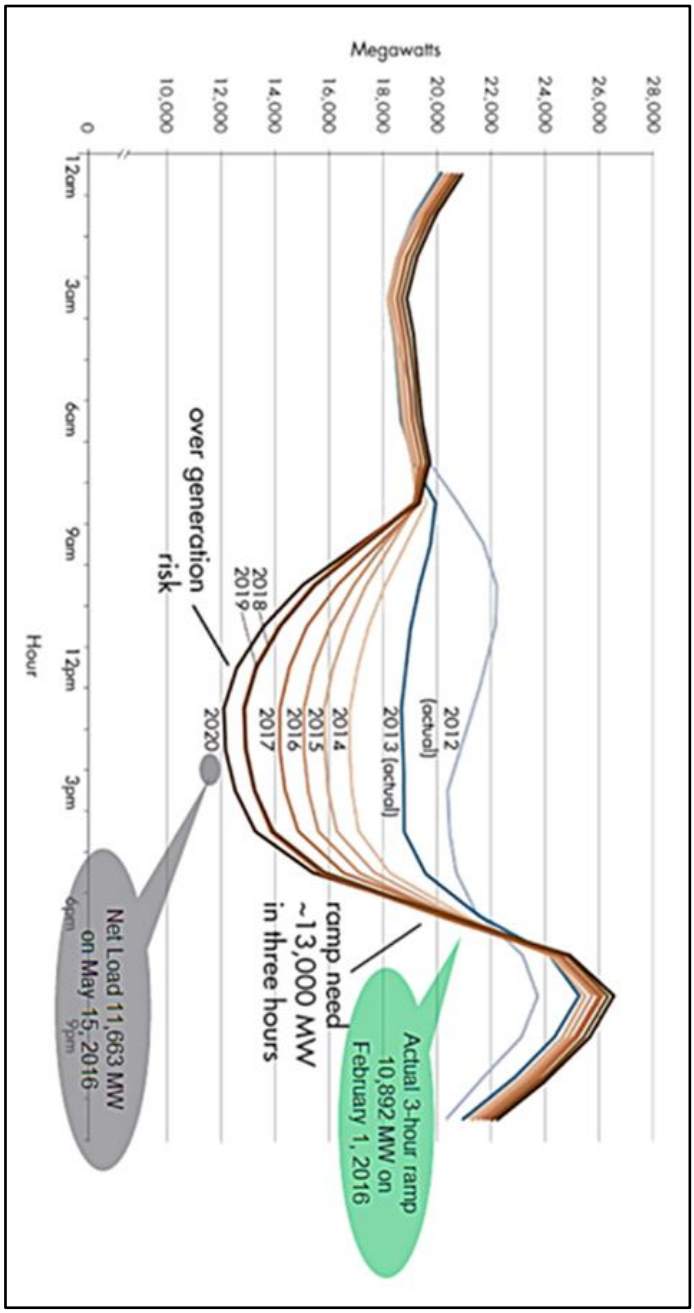
[5] *See Today in Energy*, U.S. ENERGY INFO. ADMIN. (Mar. 16, 2016), https://www.eia.gov/todayinenergy/detail.php?id=25392.

Figure 5.[6] **States with Renewables Portfolio Standards.**



[6] *See* GALEN BARBOSE, LAWRENCE BERKELEY NAT'L LABORATORY, U.S. RENEWABLES PORTFOLIO STANDARDS: 2017 ANNUAL STATUS REPORT 6 (2017), http://eta-publications.lbl.gov/sites/default/files/2017-annual-rps-summary-report.pdf.

Figure 6.[7]



[7] *See* CAL INDEP. SYS. OPERATOR, WHAT THE DUCK CURVE TELLS US ABOUT MANAGING A GREEN GRID 3 (2016), https://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf.