Phasing Out the Use of Fossil Fuels for the Generation of Electricity

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Carbon-free electricity is an irreplaceable element of any effort to achieve deep reductions in greenhouse gas emissions. This would be true if our use of electricity were never to change, but it is even more clearly the case when the overall strategy relies on electrifying most current uses of fossil fuel.

Unless there is revolutionary growth in the deployment of carbon capture and sequestration technologies, we must eliminate virtually all use of fossil fuels to generate electricity. Since the buildout of active carbon capture and sequestration will always be constrained by added cost and limits to water resources, sequestration is not likely to enable the continued use of a significant quantity of fossil fuel.

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Regulators tend not to face head-on the need to phase out, and ultimately eliminate, the use of fossil fuel for power production. Instead, there seems to be a quiet hope that greater energy efficiency and the accelerated development of renewable generation will push coal and natural gas out of the way. However, the history of energy use in the United States does not support the assumption that events would unfold in this way. Rather, policymakers must actively plan for the phase-out of fossil fuels to place the nation's energy portfolio on a clear path to a cleaner future.

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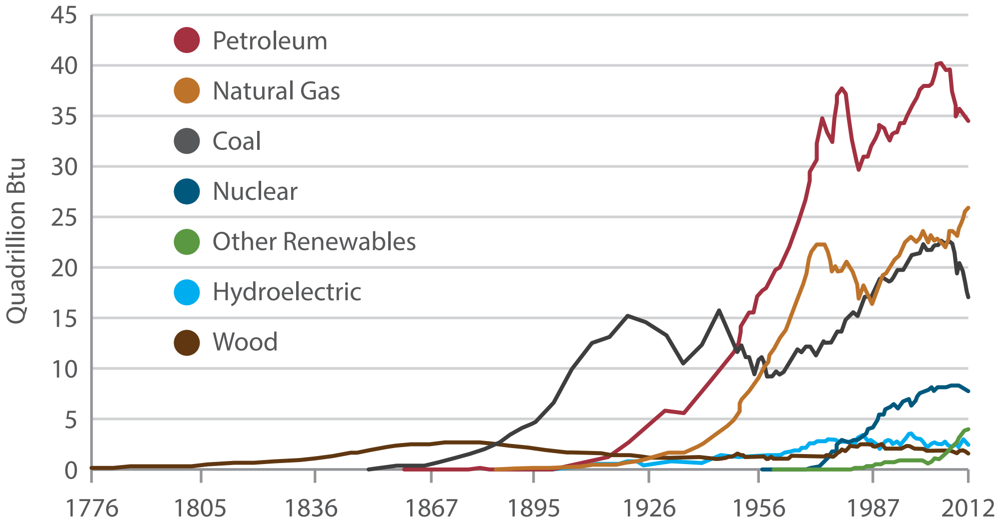
Figure 1: History of Energy Consumption in the United States (1776-2012)



The United States has undergone several energy transitions, well-documented in Figure 1, produced by the U.S. Energy Information Administration (EIA).

What began as almost exclusive reliance on wood for energy, yielded to the dominance of coal in the late 1800s. By the 1950s, petroleum was king, shadowed by its often coproduced sibling natural gas. Building slowly in the 1960s and hitting a modest crescendo in the 1980s, nuclear power came into the picture, although it has not attained a position of dominance as a fuel choice.

As the nation moved through the era of wood, to the era of coal followed by oil and gas, a disturbing pattern emerged. Although different fuels came to dominate the scene, none of the other fuels ever went away. In fact, as pointed out by at least one observer, the U.S. has used as much wood for fuel in recent years as it did during the Civil War. And even after oil and gas came to dominate, the use of coal continued to grow. As Kevin Bullis points out, "When oil is introduced, it seems to displace coal, but coal use quickly recovers. A similar drop occurs when natural-gas consumption starts to rise. But within a couple of decades coal use is growing again."[1] With the recession in 2008 and the availability of plentiful, cheap natural gas, the use of coal for domestic energy reversed direction and returned to the levels of consumption experienced in 1985.

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Does that mean that the use of coal in the United States is about to end? Not according to the U.S. EIA, which still shows a third of the nation's electricity coming from coal in 2040.[2] While we have seen a surge of coal plant retirements in the last few years, they have mostly involved smaller generating facilities. Almost half of the coal generators of a decade ago have shut down, but reductions in summer generating capacity are far less dramatic. In fact, from 2006 to 2011, capacity increased from 313 gigawatts to 317 gigawatts. With 25 gigawatts of capacity scheduled to retire from 2012 to 2015, almost 80 percent of the coal-fired generating capacity in existence in 2006 still remains available.[3]

In that same time period, overall coal plant annual output has been reduced from 1,990 gigawatt-hours to 1,356 gigawatt-hours. The common understanding is that this reduction has been driven by the low cost of natural gas. With most of the generating capacity still available, what happens when the cost of natural gas rises dramatically, as history suggests it will?

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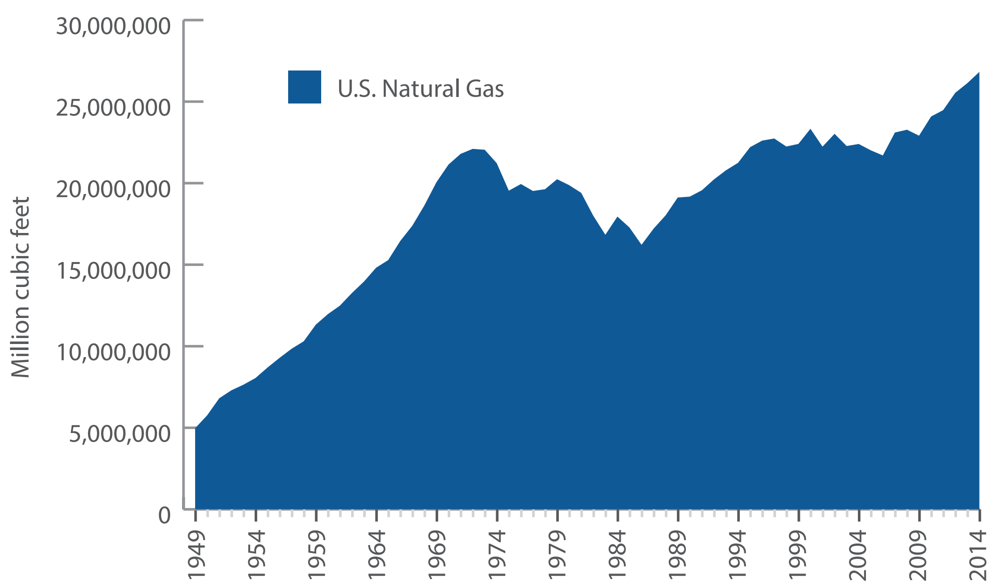
The nation's history with natural gas use has been one of almost constant growth. In 2014, businesses and individuals in the United States used five times the amount of natural gas used 65 years earlier (see Figure 2).

Figure 2: U.S. Natural Gas Total Consumption



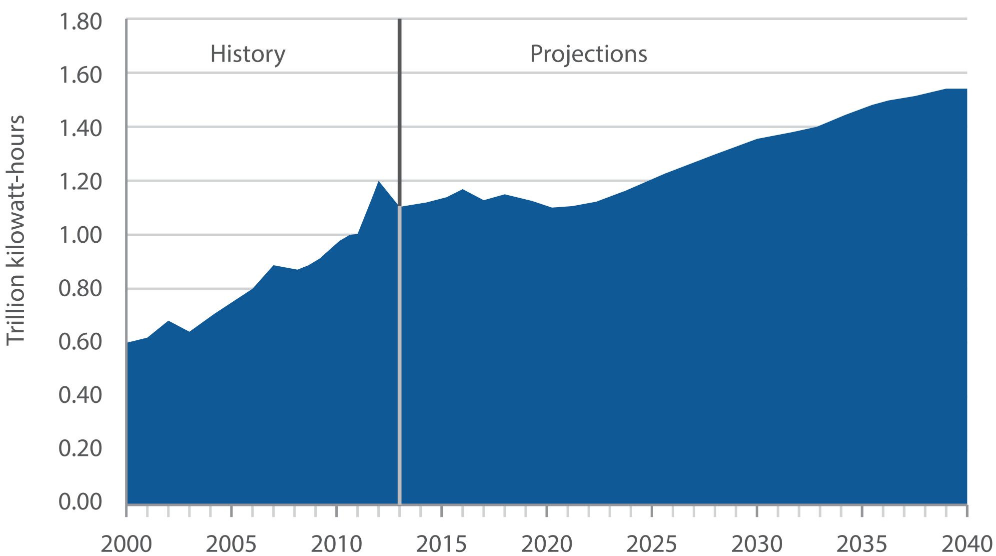
Data source: U.S. Energy Information Administration (EIA), 2015

On average, natural gas consumption grew 2.78 percent for each year between 1950 and 2014, despite the fact that there was a period of reduced demand from 1973-1986 (driven by a temporary natural gas shortage and a growing reliance on nuclear and coal-fired electric generation). The current rate of growth (2.65 percent per year) is consistent with the historical average.

Experts cannot identify a time when the growth of domestic demand for natural gas will be reversed. The large-scale introduction of hydraulic fracturing in the United States has dramatically increased domestic supplies, contributed to low prices and encouraged greater consumption. In the eight years from 2005 to 2013, the total dry natural gas production in the U.S. increased by 35 percent, with natural gas's share of total U.S. energy consumption rising from 23 percent to 28 percent. In 2013 alone, dry natural gas accounted for 30 percent of total U.S. energy production.[4]

The growth in natural gas consumption is in step with the dominant role that new natural gas generation has played in recent years. The majority of the electric generating capacity additions from (2000 to 2010) were natural gas-fired. At the end of 2010, natural gas-fired generators constituted 39 percent of the nation's total electric generation capacity of 1,042 gigawatts (GW). Nearly 237 GW of natural gas-fired generation capacity was added between 2000 and 2010, representing 81 percent of total generation capacity additions over that period.[5] The EIA projects continual growth in natural gas-fired generation at least through 2040 (see Figure 3).

Figure 3: Natural Gas Electricity Generation: EIA AE02015 Reference Case, 200-20240



Recently, two economists from the University of Chicago joined with a colleague from the Massachusetts Institute of Technology to ask, "Will we ever stop using fossil fuels?"[6] They concluded that "in the absence of substantial greenhouse gas policies, the U.S. and the global economy are unlikely to stop relying on fossil fuels as the primary source of energy. The physical supply of fossil fuel is highly unlikely to run out, especially if future technological change makes major new sources like oil shale and methane hydrates commercially viable. Alternative sources of clean energy like solar and wind power, which can be used both to generate electricity and to fuel electric vehicles, have seen substantial progress in reducing costs, but at least in the short- and middle-term, they are unlikely to play a major role in baseload electrical capacity or in replacing petroleum-fueled internal combustion engines. Thus, the current, business-as-usual combination of markets and policies doesn't seem likely to diminish greenhouse gases on their own."[7]

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If the objective would be to eliminate reliance on natural gas-fired generation by 2050, it may already be too late to add any new facilities. By way of example, the average age of retired natural gas power plants in California is about 35 years. And in California, 14 natural gas-fired power plants still in operation were built in the 1950s.[8] In the United States, more than 100,000 MW of natural gas capacity, or 27 percent of all natural gas capacity, is more than 30 years old.[9] Other natural gas infrastructure can also live a long revenue-producing life. For instance, a natural gas pipeline can continue to operate for at least 50 years.[10] On average, a new major gas-fired power plant proposed in 2016 for construction in California would still be operating until at least 2057.[11] With each passing year, investors will expect that new gas generating projects will continue to earn even farther beyond 2050.

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This pattern of continual investment in traditional energy sources and the resulting entrenchment of those fuel sources are sometimes referred to as a "carbon lock-in." As the Stockholm Environment Institute explains, "The essence of carbon lock-in is that, once certain carbon-intensive investments are made, and development pathways are chosen, fossil fuel dependence and associated carbon emissions can become 'locked in,' making it more difficult to move to lower-carbon pathways and thus reduce climate risks."[12] A contributing factor is that the growing introduction of renewable energy resources will put downward pressure on the price of fossil fuels (although the likely level of price effect is open to debate). This increases the likelihood that even with the greater deployment of renewable resources, fossil fuel use will continue to be an attractive choice.

Rather than simply hoping that renewables and efficiency gains will cause fossil-fueled generators to leave the grid, officials at all levels of government can take steps to force an orderly retreat.

First, Have a Plan

State regulators have, for some time, required utilities and other load-serving entities to create plans for resource development (often called integrated resource plans). Various states have formal legislative authority for requiring such plans, while others simply derive that authority from the well-understood responsibility to ensure that rates are just and reasonable. Planners, in this context, tend to look for least-cost approaches to delivering reliable electric service in a manner consistent with other state public policies. In recent years, adopted plans have tended to rely less on the development of new coal-fired power plants (due to the cost-competitiveness of natural gas generation and the increasingly tighter environmental restrictions on using coal). However, they have tended to rely more heavily on natural gas generation (due to the expected lower cost and a perception that supplies of natural gas will remain abundant for the foreseeable future). In states that look to competitive wholesale markets for most power, regulators have largely deferred to the marketplace to decide what kind of new power plants will be built.

What states could ask is how the role of coal and natural gas in the generation mix likely will change, or should change in the next several decades. The questions to answer could be straightforward:

- Assuming business-as-usual, what is the projected use of coal or natural gas for electric generation to meet in-state demand?

- How must the current or otherwise likely use of fossil fuels change, applying one or more different assumptions of greenhouse gas reduction targets that may be adopted on the state or federal level?
- What would be a reasonable pace of fossil fuel use reduction in order to meet a particular target?

By having in mind the answers to these questions, state officials can better understand the implications of approving new fossil-fuel infrastructure, or ratifying commitments for long-term power purchases. For instance, while the replacement of an existing coal-fired or older gas-fired plant with a yet-to-be-constructed natural gas-fired plant may lead to near-term greenhouse gas reductions (depending on assumptions about methane leakage), decision makers would have a clearer sense of the long-term implications of the new power plant investment if they have asked and answered the above questions.

States with explicit climate policies could insist that resource plans reflect a reasonable schedule for ramping down the use of fossil-fired generation. Other states could rely on their obligation to ensure that utility rates are just and reasonable to require that resource plans reflect stiffer greenhouse gas restrictions that may apply in the years ahead.

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Federal authority also reaches into the sphere of resource planning. There are at least two important examples. First, as a result of the Energy Policy Act of 2005, the U.S. Department of Energy (DOE) must identify National Interest Electric Transmission Corridors.[13] While it is the states that normally approve and site new electric transmission lines, proposed projects in corridors designated by DOE can be approved and sited by the Federal Energy Regulatory Commission (FERC) in limited circumstances. In consultation with effected states, DOE can take likely transitions in electric generating sources into account while designating national interest corridors. Corridors that would primarily facilitate access to fossil generation might not pass a national interest standard, while those needed to provide access to promising renewable energy zones might.

Second, with the issuance of its Order 1000,[14] FERC imposed on all public utility electric transmission providers the need to develop regional transmission plans. Those plans must consider nontransmission options as well as transmission options.[15] The plans can take into account transmission requirements stemming from state-adopted public policies. In addition, the planners are not prohibited "from choosing to plan for state public policy goals that have not yet been codified into state law, which they nonetheless consider to be important long-term planning considerations."[16] In addition, the order expressly states that it is not intended to interfere with an integrated resource planning requirement on the state level.[17]

Taken together, Order 1000 allows regional planners to consider climate policies adopted at the state level and policies that have yet to be adopted. This makes the regional planning process, as well as FERC's review of the adequacy of submitted plans, open to consideration of what it would take to phase out the use of fossil-fired generation and prepare to meet long-term greenhouse gas reduction goals. This might involve emphasizing new transmission lines that hold great promise of increasing renewable power deliver and de-emphasizing lines prompted by a desire to reduce transmission congestion related to fossil generation.

Regardless of other applicability, the development of plans that recognize patterns of fossil fuel use and identify a timeline for reducing reliance on those fuels for electricity generation can enable public officials to better understand and respond to the implications of new fossil-related infrastructure projects.

Declare Intentions – Creating Specific Prohibitions

State Limitations on New Coal-fired Power Plants

An individual state has the discretion to define the nature of power generated within its borders and to limit the sources of power purchased by its utilities and other load-serving entities. Any impacts of these restrictions on power generators located in other states must be consistent with the Commerce Clause of the U.S. Constitution as interpreted by the U.S. Supreme Court in a series of "dormant commerce clause" decisions. Cognizant of these limitations, a small number of states have enacted restrictions that serve to constrain reliance on coal-fired power plants. See, for instance, California's SB1368, passed in 2007, prohibiting any new long-term investment by a California load-serving entity in a generating facility with smokestack emissions exceeding a level to be jointly established by the California Energy Commission and California Public Utilities Commission,[18] and Washington's SB 6001, passed in 2009, which establishes a greenhouse gas performance standard for new in-state baseload electric power generation utilities at 1,100 pounds per megawatt-hour (consistent with the number used in California and other states).[19] These laws and policies are illustrative of what could be adopted more broadly to limit reliance on any kind of fossil fuel plant.

A smokestack restriction alone may push generators away from coal and toward natural gas, but it does not provide a realistic picture of the greenhouse gas emissions related to a given generation decision.

Just as other states would have the authority to create similar restrictions, any state could improve upon the existing examples. One way would be to impose an emissions limitation similar to the 1,100 pounds per megawatt-hour level used in several states, but to apply it on a life-cycle basis. Current restrictions focus solely on the smokestack. Yet greenhouse gas emissions also occur at the mine or during transit, at the wellhead, along the pipeline and in conjunction with storage. A smokestack restriction alone may push generators away from coal and toward natural gas, but it does not provide a realistic picture of the greenhouse gas emissions related to a given generation decision.

Beyond the inclusion of life-cycle emission criteria, more states could impose an outright ban on new coal-fired generation or a formal limit on new natural gas generation additions. The following section considers the legal pathway for a federal ban on fossil-fired generation.

Banning the Use of Fossil Fuels

Under existing federal law, could the Environmental Protection Agency (EPA) impose a ban on the use of fossil fuels in power plants? At least one scholar, Karl Coplan, argues that it can.[20] Regardless of the odds against the EPA adopting this approach in the next few years, it is worth considering the potential power of the law. What follows in the next three paragraphs is a summary of Coplan's argument.

Title I of the Clean Air Act[21] calls for the Environmental Protection Agency (EPA) to create National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. States are required to establish State Implementation Plans designed to enable the state to meet the standards. If a state fails to adopt a plan that would achieve compliance, the EPA can impose on the state a Federal Implementation Plan. Under Section 108, the EPA identifies criteria pollutants that require NAAQS.

As part of that process, the EPA must determine that a pollutant will "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare." The EPA has already made an endangerment finding related to greenhouse gases. As Copland points out, "In a 1976 case, NRDC v. Train, the Second Circuit held that …once the Administrator has made the endangerment finding for a pollutant under any other section of the Act, listing of that pollutant as a criteria pollutant becomes mandatory."[22] Regardless of a mandatory obligation, "the Administrator clearly has the discretionary authority under section 108 to list them based on the prior endangerment finding."[23]

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On this basis, the EPA can establish a primary NAAQS and require the states to reflect that standard in their State Implementation Plan. If the resulting standards are deemed insufficient, the EPA can establish a Federal Implementation Plan that could include a ban on the use of fossil fuels for various purposes, including the generation of electric power.

Coplan offers this plausible interpretation of existing law while acknowledging the political challenges of such an approach. However, if implemented by the EPA, this strategy could allow for just the type of orderly retreat anticipated earlier in this chapter. A plan to ban the use of fossil fuels for power generation could identify a reasonable level of greenhouse gas emissions, take into account the current feasibility of alternative responses to anticipated demand (responses that would include energy efficiency improvements, demand response programs, renewable power and energy storage) and set a reasonable schedule for the elimination of fossil generators from which greenhouse gas emissions are not successfully captured and securely sequestered.

As Coplan points out, although such a program imposed on the states would not on its own overcome the global challenge of excessive greenhouse gas emissions, the Supreme Court is unlikely to reject a rule on that basis.[24] And beyond the reliance on existing law, Congress could exercise its broad power over interstate commerce to create a similar ban through new legislation.

Placing a Limit on Greenhouse Gas Emissions

Congress or the states could put a limit on greenhouse gas emissions related to power generation and, if the allowable level of emissions is consistently reduced over time to a level that reflects scientific consensus of what is needed to stabilize climate change, generators would be forced to move away from the use of coal and natural gas. Congress has famously failed to pass legislation defining such a limit. Only some Northeastern states and California have imposed a limit of their own. However, the EPA has found in the language of Section 111(d) of the Clean Air Act the authority to regulate greenhouse gas emissions from existing power plants. It has enacted the Clean Power Plan to require states to plan for a specified level of reductions.[25] The plan is currently being contested in federal court, and a divided Supreme Court took the unprecedented step of enjoining enforcement of the plan while appeals are pending. Other options remain for the EPA, as they do for states that have already acted.to establish more ambitious reduction targets. In addition, other states have the option to adopt their own greenhouse gas emission limits.

Setting an Accurate Price for Carbon-based Generation

Direct Price Effects on the Federal Level

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The Federal Energy Regulatory Commission (FERC) is the agency that sets rates for wholesale power and most electric transmission service.[26] There is a strong argument that FERC has the authority to add a charge to wholesale power rates to reflect the greenhouse gas intensity of the power being sold. Its authority to do this is bound to its obligation, under the Federal Power Act, to ensure that wholesale rates are just and reasonable. Traditionally, it would do this by looking at the generator's underlying cost and then approving rates that would provide an opportunity to earn a reasonable return on capital investment. But with the push for deregulated energy markets starting in the 1990s, FERC concluded that power rates negotiated by participants in a competitive market would be presumed to be just and reasonable, eliminating the need to use a cost-based determination.

FERC has always acknowledged that it cannot rely on deregulated prices where there are market failures. Its focus, generally, is on the exercise of market power: if a seller can manipulate the price, rather than act as a "price taker," that is a market failure, and FERC's presumption doesn't apply. But there is another kind of market failure that is pervasive: the ability of polluting generators to avoid paying the cost of that pollution. How can rates be just if clean power producers must compete with dirtier ones that pollute for free? How can rates be reasonable if society as a whole is left to pay the price for the resulting damage?

FERC can at least partially restore balance by requiring that wholesale rates include a carbon adder. It could then determine an appropriate means of redistributing the excess revenue such as by returning it to wholesale purchasers in a manner not tied to that buyer's specific purchases. FERC has allowed sellers to over-collect in other circumstances, and then refund the excess. For instance, FERC allows transmission providers to charge a higher-than-average fee for power lost during transmission,[27] and the United States Court of Appeals for the District of Columbia Circuit has allowed that practice to stand.[28] A FERC-required carbon adder could complement EPA's power plant rules, or stand on its own.

Direct Price Effects on the State Level

Carbon Adder

Many businesses that are striving to reduce their greenhouse gas emissions impose an internal carbon adder for consideration as part of their development plans.[29] If properly priced, a carbon adder will change the apparent economic order of resource options. Similarly, state regulators can impose on utility planners the requirement of including a carbon adder for planning purposes. Several states have already done this.[30] Many of the states that have imposed such a requirement are in the western part of the United States. Among these is California, which concluded that the carbon adder was unnecessary once a cap-and-trade program was in place, creating its own likelihood of imposing carbon-related cost on the procurement of power.

Reduced Rates of Return

About half of the states have disaggregated or unbundled the charges that comprise the retail rate for electric service. In those states, utilities and other retail providers rely to a greater or lesser extent on the purchase of power from competitive generators and marketers. The price of the purchased power is then "passed through" in the retail rates, on a dollar-for-dollar basis. The other half of the states continue to rely on the traditional model of fully bundled, vertically integrated utility service, with one provider offering generation, transmission and distribution service. In those states, most of the power plants may still be owned by the retail utility and many of those utilities are, in turn, owned by private investors.

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An example for the use of such an incentive can be found in California which, during the 1990s, wanted to encourage its regulated utilities to sell their fossil-fueled power plants to wholesale power providers as part of the deregulation of power markets. Although regulators offered an opportunity for the utilities to recover the cost of "stranded investments" that they had not sold to others, they would be allowed recovery of those costs at a reduced rate of return. This was intended to motivate the utilities to sell the plants, which they did.[31]

Reducing the rate of return allowed for fossil plants could encourage greater investment in favored resources and discourage new capital additions to fossil plants that would be designed to extend their useful lives.

Internalizing Cost Through Environmental Compliance

Traditional statutory protections for water and air quality provide a mechanism for internalizing some of the environmental cost related to fossil generation, and many of these protections have become more stringent in recent years, adding to the incentive to retire some fossil-fired generators. Opportunities remain to tighten some of these protections. Following are examples of these statutory provisions and opportunities for enhancement.

Clean Water Act: Cooling Water and §316(b)

It is unlawful for anyone to pollute waters from a "point source" without first receiving from the state a National Pollutant Discharge Elimination System permit. Clean Water Act §402 authorizes the EPA, through the states, to issue NPDES permits. Clean Water Act §316(b) authorizes the EPA to protect aquatic organisms and ecosystems through the regulation of power plant cooling water intakes.[32] The EPA has found that power plant cooling water systems constitute an unreasonable hazard. In new rules adopted in 2014, the EPA identifies seven different ways for existing facilities to comply with cooling water restrictions, while finding that closed-cycle cooling towers provide the most efficient technology.[33] This flexibility allows for a case-by-case approach depending on the site, but creates added cost for state administrators. Each permit application requires additional work to validate the chosen technology. The rule applies to existing[34] facilities that withdraw more than 2 million gallons per day and use at least 25 percent of this water for cooling purposes.[35] As a result, the rule affects 544 power plants.[36]

States can adopt more stringent regulations. For example, California[37] and New York[38] respectively established the closed-cycle cooling tower as the §316(b) benchmark technology. This option is available to other states, as well. Separately, the EPA could choose to tighten its rules to require closed-cycles in more instances, or to apply the rules to a broader set of power plants. All of these options would improve the internalization of environmental costs.

Resource Conservation and Recovery Act (RCRA): Coal Combustion Residual Subtitle C

The EPA is authorized under Subtitle C of RCRA to regulate hazardous waste. In addition, under Subtitle D, the EPA can establish criteria, to be enforced by the states, for the regulation of nonhazardous waste at landfills and surface impoundments. The EPA has designated coal ash from power plants as nonhazardous solid waste under Subtitle D. This leaves it to the states to regulate in this area, subject to Solid Waste Management Plans written by the states and approved by the EPA. Reconsidering this designation, and creating more stringent Solid Waste Management Plans, are avenues for stiffening protections from pollution related to coal ash and for better internalizing the cost of that pollution.

Clean Air Act: the Mercury Rule

Regulating toxic pollutants emissions from coal- and oil-fired power plants will reduce premature deaths, asthma and heart attacks.

The EPA has exercised its authority under §112 of the Clean Air Act to create National Emission Standards for Hazardous Air Pollutants referred to as the Mercury Air Toxics Standards. Power plants are responsible for more mercury emissions than any other source.[39] Regulating toxic pollutants emissions from coal- and oil-fired power plants will reduce premature deaths, asthma and heart attacks.[40] Some new facilities have pollution control equipment, but it is not the majority. Therefore, the objective of the rule is to force modernization of the aging fleet of power plants through implementation of mercury and air toxics emission standards that require control technologies.

On December 21, 2011, EPA proposed the Mercury and Air Toxics Standards Rule (MATS) to limit mercury, acid gases and other toxic pollutants (referred as hazardous air pollutants or HAPs) from new and existing coal- and oil-fired power plants after finding that it is "appropriate and necessary" to regulate power plant emissions under section 112 of the CAA. On April 14, 2016, in response to a successful court challenge questioning the timing of the EPA's cost-benefit analysis, the EPA issued a final finding to comply with D.C. Circuit decision urging to consider costs and concluded that "it is appropriate and necessary to set standards for emissions of air toxics from coal- and oil-fired power plants." After conducting a cost-benefits analysis the EPA forecasted that for "every dollar spent to reduce toxic pollution from power plants, the American public would see up to $9 in health benefits."[41]

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The rule regulates HAPs emitted by coal- and oil-fired electric utility steam generating units (EGUs)[42] with a capacity of 25 MW or greater.[43] Existing sources will have three years to comply, with a possible one year extension.

The annual cost to comply with the regulation is forecasted to be $9.6 billion for the industry.[44] However, the EPA found that this cost represents only a small fraction of the annual revenue of the oil and coal sector – between 2.7 and 3.5 percent of annual revenue from electricity sales from 2000 to 2011.[45] In addition, the health benefits that the rule would provide are substantial enough to justify the regulation.[46] If the compliance costs of the MATS would not alone jeopardize the operation of oil- or coal-fired power plants, it will at least contribute to add cost of using coal and oil and force power producers to modernize their facilities to cap pollutant emissions or shift to a cleaner resource. In fact, EPA acknowledged that power producers may choose to cease operations of older, smaller or less efficient plants rather than bearing the cost of compliance.[47]

Several environmental groups have criticized the portion of the rule governing startup-shutdown.[48] The EPA used a "work practice standard" instead of a more stringent "numerical standard."

Essentially, the first four hours after generation begins are not bound by toxics emissions limits. By setting work practice standards, the EPA merely directs plant operators to use clean fuels during startup "to the maximum extent possible" and that control devices other than those used to control particulate matter be started "as expeditiously as possible."[49] Indeed, there is much less constraint on the generators with a work practice standard rather a numerical standard. Moreover, environmentalists point out that the initial version of the work practice standard was preferable as it required to burn exclusively clean fuel during startup.

The petition, which was submitted by environmental groups on January 20, 2015,[50] was denied by the EPA on July 29, 2016.[51]

Environmentalists argue that the EPA failed to give adequate reasons for choosing to establish "a four-hour exemption after generation during which the MATS numerical emission standards do not apply."[52] The petition challenges the EPA's justification that emissions cannot be measured during the first four hours[53] and asserts that the EPA's regulation is inconsistent with the court ruling that "there must be continuous section 112-compliant standards"[54] the first four hours and the first 24 hours after generation and throughout the entire year."[55]

Arguably, the challenges that might be faced in early hour operation of a coal plant should call into question the continued operation of the plants under such circumstances, rather than form the basis for an exemption. Removing this exemption would bring the regulatory cost of compliance more in line with environmental externalities.

Federal and State Environmental Review Processes for Factoring in Greenhouse Gas Impacts

A federal agency considering the issuance of a permit for the construction of a power plant or electric transmission line must conduct an environmental assessment under the National Environmental Policy Act (NEPA) (42 U.S.C. §4321 et seq.) before permitting transmission projects in national corridors. This provides another opportunity for a federal permitting agency to analyze the project's likely climate effects. A federal permit requirement is triggered when a project will be located on federal land or federal jurisdictional waters, when the federal government will own or operate the facility or when a project is otherwise delegated to a specific agency, such as FERC's limited siting authority related to electric transmission lines.

NEPA, section 102(2) (42 U.S.C. §4332(2)) requires federal agencies to prepare an Environmental Impact Statement (EIS) for all "major federal actions significantly affecting the quality of the human environment."[56] The EIS must include a discussion of the environmental impacts of the action, including any adverse impacts that cannot be avoided.[57] Additionally, the EIS also must identify alternative actions that would avoid or minimize the adverse impacts and/or otherwise improve environmental quality.[58] Regulations issued under NEPA (42 U.S.C. §4321) require agencies to "[r]igorously explore and objectively evaluate" all alternatives that are reasonable.[59] The courts have held that, in undertaking this analysis of alternatives, agencies must consider possible methods for mitigating the action's environmental impacts.[60] The agency may require adoption of mitigation methods that are consistent with existing legal authority. A power plant operating on fossil fuel will emit greenhouse gases, and an electric transmission project may facilitate the delivery of fossil-fueled power.

One way to internalize at least some of the climate-related cost of a power plant or transmission line is to require project mitigation to reduce greenhouse gas emissions.

In 2016, the White House issued guidelines for the consideration of greenhouse gas emissions by agencies implementing NEPA.[61] The guidance declares that "Climate change is a fundamental environmental issue, and its effects fall squarely within NEPA's purview."[62] The document goes on to discuss ways of quantifying the potential emissions and impacts and calls for the development of alternatives that would lead to reduced impacts.

One way to internalize at least some of the climate-related cost of a power plant or transmission line is to require project mitigation to reduce greenhouse gas emissions. Mitigation requirements may affect the economic viability of a project and potentially influence a project proponent's decision as to whether or not to move forward. In addition, NEPA requires the agency to identify viable alternatives to the proposed project. An agency may reasonably determine that a fossil-fueled plant or related transmission line could meet the project's objectives in a less environmentally intrusive manner and on that basis, deny a permit for the project.

At least 16 states, as well as the District of Columbia, have their own environmental review processes, often referred to as "Little NEPA" statutes.[63] To one extent or another, each of these laws provides an opportunity to identify and respond to climate-related impacts of a proposed project. In many jurisdictions, this can lead to project modifications that can affect project cost or rejection of the project.

Divesting Ownership In or Closing Government-owned Fossil Generators

A significant portion of the power plant fleet in the United States is owned by public entities such as federal agencies or municipal utilities. For instance, the Tennessee Valley Authority (TVA), which is a corporate agency of the federal government, owns and operates eight coal-fired power plants with a total of 35 generating units. TVA has expressed the intention to retire its older coal plants and replace them with cleaner facilities and has already retired several units. TVA could produce a definite, accelerated schedule for the retirement of the 35 remaining coal-fired generating units.

A similar opportunity exists for municipal utilities (those utilities owned and operated by city and county governments or an independent board elected by public vote). One example of such an approach is the initiative undertaken by the Los Angeles Department of Water and Power, which provides electric service to 1.4 million customers in the City of Los Angeles. As of 2013, 40 percent of its power was derived from coal-fired power plants.

LADWP developed a plan to divest from its coal-fired electricity investment in Arizona and begin a transition from its obligations in Utah. In order to do that, LADWP had to sell its 21 percent interest in the Arizona-based Navajo Generating Station[64] and reach an agreement with the owners of the Utah-based Intermountain Power Plant.[65] The latter plant is owned by a consortium of cities in Utah, and LADWP purchases more than 40 percent of the output from the 1,800-megawatt facility. LADWP sold its interest in the Navajo plant to the Salt River Project, a federal reclamation project located in central Arizona. The sale was approved in July 2015 and on July 1, 2016, LADWP officially stopped buying power from the Navajo plant.[66] According to LADWP, the divestment from Navajo will reduce its greenhouse gas emissions "by 5.39 million metric tons over the next three and a half years . . . and will reduce coal from 40 percent to 30 percent in the City's energy portfolio."[67]

Just selling off one utility's interest in an existing power plant does not ensure that the power plant will cease to operate and that greenhouse gas emissions will be reduced. However, as a result of the sale of LADWP's interest, it is expected that the remaining owners will be forced to shut down at least one unit of the coal plant.[68]

Just selling off one utility's interest in an existing power plant does not ensure that the power plant will cease to operate and that greenhouse gas emissions will be reduced.

LADWP's commitment to purchase power from Intermountain extends to 2027. The parties have now formed a new agreement to replace the existing coal-fired units with a smaller combined-cycled natural gas plant that would be built on the existing power plant site.[69] Because of California's prohibition on new long-term contracts with higher-emitting facilities, LADWP would have been precluded from extending its contract beyond 2027. The new agreement enables the facility owners to continue sales to LADWP while ensuring that the coal-fired units will be phased out.

Another option worth exploring would be a buyout of existing fossil-fuel power plants. Government, ratepayers or private foundations could pay utilities the remaining "book value" for utility-owned plants and negotiate prices with private plant owners to pay them to close greenhouse gas emitting facilities. Depending on the expected lifetime remaining output from the plant, this may be an economical way to buy greenhouse gas reductions. It is certainly an idea worth exploring further.

Conclusion

There are no natural forces in place that will drive a retreat from the use of fossil fuel for the generation of electricity. Throughout the nation's history, transitions in fuel choices have been additive – not subtractive. The nation still uses wood for energy, as it did in the middle 1800s. Since then, it has added the dominant use of coal, then oil and natural gas. The old fuels never go away. In this context, it is overly optimistic to assume that the introduction of renewable generation will push out fossil-fueled generators at a sufficient level to successfully decarbonize the grid. That will require affirmative steps by governments at the federal, state and local levels. This paper identifies and explains many of the most promising steps. It is up to elected officials and community leaders to acknowledge the challenge and begin to plan to phase out fossil-fueled generators. That, alone, may be the most significant action of all.

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1 Kevin Bullis, "How Energy Consumption Has Changed Since 1776," July 3, 2013 **https://www.technologyreview.com/s/516786/how-energy-consumption-has-changed-since-1776/**

2 Figure 31. Electricity generation by fuel in the reference case 2000-2040, based on U.S. Energy Information Administration AEO2015: available at **https://www.eia.gov/forecasts/aeo/section_elecgeneration.cfm**

3 Statistics for 2011 and beyond derived from U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report." For 2011 as cited by the U.S. Energy Information Administration at **http://www.eia.gov/todayinenergy/detail.cfm?id=7290**; generation data from **https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_1** and capacity statistics for 2006 derived from **http://www.eia.gov/electricity/capacity/xls/existing_gen_units_2006.xls**

4 Annual Energy Outlook 2015 (AEO2015): **http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf**

5 U.S. Energy Information Administration (EIA), **http://www.eia.gov/todayinenergy/detail.cfm?id=2070** July 5, 2011

6 Thomas Covert, Michael Greenstone, and Christopher R. Knittel, *Will We Ever Stop Using Fossil Fuels?* 30 Journal of Economic Perspectives 117 (2016)

7 Ibid. at 135

8 State of California, Energy Almanac 2015

9 EIA 2011.

10 See, for instance, the website of the Interstate Natural Gas Association of America, **http://www.ingaa.org/file.aspx?id=10929**

11 Steve Weissman, *Natural Gas as a Bridge Fuel – Measuring the Bridge* 2016, p.9

12 Stockholm Environment Institute *Discussion Brief: Carbon lock-in from fossil fuel supply infrastructure*, which includes a reference to Unruh, G.C. (2000). *Understanding carbon lock-in*. Energy Policy, 28(12), 812-830

13 16 U.S.C. 824p(a)

14 136 FERC ¶ 61,051

15 Ibid. Paragraph 155

16 Ibid. Footnote 193

17 Ibid. Paragraph 156

18 SB 1368, codified Cal. Pub. Util. Code, §8340

19 Wash. Rev. Code §80.80.040(3)(b) (2009) provides that "All baseload electric generation that commences operation after June 30, 2008, and is located in Washington, must comply with the greenhouse gases emissions performance standard established in subsection (1) of this section."

20 Karl S. Coplan, *Fossil Fuel Abolition: Legal and Social Issues*, 41 Columbia J. of Env. Law 223 (2016)

21 Clean Air Act Title I, Part A. Section 101-131

22 Coplan supra, at p.250

23 Ibid.

24 Ibid. at p.252

25 EPA, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 40 CFR Part 60, final rule, October 23, 2015. Available at **https://www.gpo.gov/fdsys/pkg/FR-2015-10-23/pdf/2015-22842.pdf**

26 That authority is limited to wholesale power sold in interstate commerce, as well as rates for interstate transmission lines. Because most of the lower 48 states are part of interstate grids, FERC asserts authority over most wholesale power transactions and unbundled transmission service. FERC also has authority related to natural gas sales and pipelines, and grants licenses for hydroelectric facilities.

27 Black Oak Energy, LLC v. PJM Interconnection, L.L.C.,122 FERC ¶ 61,208 (2008), rehearing granted in part, 125 FERC ¶ 61,042 (2008)

28 Black Oak Energy, LLC v. Fed. Energy Regulatory Commission, 725 F.3d 230 (D.C. Cir. 2013)

29 See, for instance, *Use of internal carbon price by companies as incentive and strategic planning tool*, CDP (December 2013) **big.assets.huffingtonpost.com/22Nov2013-CDP-InternalCarbonPriceReprt.pdf**

30 See, for instance, Galen Barbose, Ryan Wiser, Amol Phadke and Charles Goldman, *Reading the Tea Leaves: How Utilities in the West Are Managing Carbon Regulatory Risk in their Resource Plans*, Lawrence Berkeley National Laboratory LBNL-44E (2008) **http://eetd.lbl.gov/ea/EMS/EMS_pubs.html**

31 See, for instance, *How Electric Industry Change Will Effect You*, California Public Utilities Commission **http://www.cpuc.ca.gov/environment/info/esa/divest-pge-one/newpge/attacha.htm**

32 "Location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

33 40 CFR 125.94 (c)(1) through (7) available at **https://www.law.cornell.edu/cfr/text/40/125.94**

Summary of the available options **http://www.kleinschmidtgroup.com/files/3514/0173/6072/Summary_of_EPAs_Final_316b_Rule_for_Cooling_Water_Intake_Structures.pdf**

1. Operate a closed-cycle recirculating system;
2. Operate a cooling water intakes structure (CWIS) that has a maximum through-screen design intake velocity of 0.5 foot per second (fps);
3. Operate a CWIS that has a maximum through-screen intake velocity of 0.5 fps;
4. Operate an offshore velocity cap, an open intake designed to change the direction of water withdrawal from vertical to horizontal and located a minimum of 800 feet from the shoreline;
5. Operate a modified traveling screen that the EPA or state permitting authorities determine meets the Final Rule standard and is the BTA for impingement reduction;
6. Implement another combination of technologies, management practices and operation measures that the EPA or state permitting authorities determine is BTA for impingement reduction; or
7. Achieve the specified impingement mortality performance standard set forth in the Final Rule."

34 **https://www.law.cornell.edu/cfr/text/40/part-125/subpart-J**

35 https://www.epa.gov/cooling-water-intakes/cooling-water-intakes-final-2014-rule-existing-electric-generating-plants-and

36 Ibid.

37 **http://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/policy.shtml**

38 **http://www.dec.ny.gov/docs/fish_marine_pdf/btapolicyfinal.pdf**

39 According to EPA, 50 percent of the mercury emissions in the U.S. come from power plants. Other mercury emitters are medical waste incinerators, municipal waste combustors, cement production, steel manufacturing but their emissions had substantially declined over time.

40 EPA Fact Sheet "Final Consideration of Cost in the Appropriate and Necessary Finding for the Mercury and Air Toxics Standards for Power Plants", p.1, April 2016

41 EPA Fact Sheet "Final Consideration of Cost in the Appropriate and Necessary Finding for the Mercury and Air Toxics Standards for Power Plants", p.2, April 2016

42 It is considered as a "source category" under §112(c)

43 The rule does not apply to EGUs generating under 25 MW as NSPS applies. In addition, EGUs with capability to combust more than 25 MW of coal or oil but did not fire coal or oil for more than 10 percent of the average annual heat input during any three calendar year.

44 Federal Register/ Vol. 81, NO. 79/Monday, April 25, 2016/ Rule and Regulations, p. 24424

45 Federal Register/ Vol. 81, NO. 79/Monday, April 25, 2016/ Rule and Regulations, p. 24424

46 U.S. EPA-SAB, Peer Review of EPA's Draft National-Scale Mercury Risk Assessment (2011)

47 Memorandum on the EPA's Enforcement Response Policy for Use of CAA section 113(a) in relation to Electricity Reliability and the Mercury and Air Toxics Standard, December 16, 2011

48 The final action on reconsideration of startup and shutdown was published on the Federal register on November 19, 2014. Accessible at **https://www.federalregister.gov/articles/2014/11/19/2014-27125/reconsideration-of-certain-startupshutdown-issues-national-emission-standards-for-hazardous-air**

49 Petition for reconsideration of final action on startup and shutdown provisions in final national emissions standards for hazardous air pollutants from coal- and oil-fired electric utility steam generating units (MATS); EPA Docket ID No. EPA-HQ-OAR-2009-0234. Available at **http://www.regulations.gov/document?D=EPA-HQ-OAR-2009-0234-20461**; p.1.

50 Ibid note 15.

51 **http://www.law360.com/articles/825588/epa-won-t-review-power-plant-startup-shutdown-regs**. The denial of the petition for reconsideration can be find at **http://www.regulations.gov/document?D=EPA-HQ-OAR-2009-0234-20583** and the formal letter from the EPA addressed to Sierra Club, Chesapeake Climate Action Network and Environmental Integrity Project can be find at **http://www.regulations.gov/document?D=EPA-HQ-OAR-2009-0234-20581**.

52 79 Fed. Reg. at 68,779; 40 C.F.R. § 63.10042

53 Ibid. note 13, at p.2

54 Ibid. note 13, at p.3

55 Ibid. note 13, at p.4

56 40 C.F.R. § 1508.15 defines a "major federal action" to include "actions with effects that may be major and which are potentially subject to Federal control and responsibility." Under 40 C.F.R. § 1508.15, an action is considered to be "subject to Federal control" if it is undertaken by a federal agency or by a private party with the consent of a federal agency. Therefore, as the construction of interstate transmission lines requires FERC approval, it is a "federal action" for the purposes of NEPA.

57 National Environmental Policy Act § 102(2)(C)(i)-(ii); 42 U.S.C. § 4332(2)(C)(i)-(ii) (2014) (requiring federal agencies to prepare, for each major federal action significantly affecting the quality of the human environment, a detailed statement on the environmental impact of the proposed action and any adverse environmental effects which cannot be avoided should the proposal be implemented).

58 National Environmental Policy Act § 102(2)(C)(iii); 42 U.S.C. § 4332(2)(C)(iii) (2014) (requiring federal agencies to prepare, for each major federal action significantly affecting the quality of the human environment, a detailed statement of alternatives to the proposed action).

59 40 C.F.R. § 1502.14(a) (2014)

60 Calvert Cliffs' Coordinating Comm., Inc v. United States Atomic Energy Comm'n, 449 F.2d 1109 (1971) (finding that NEPA aims to "ensure that each agency decision maker has before him and takes into proper account all possible approaches to a particular project [including total abandonment of the project] which would alter the environmental impact").

61 Memorandum for Heads of Federal Departments and Agencies from Christina Goldfuss, Council on Environmental Quality, August 1, 2016, **https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf**

62 Ibid. p.2

63 California, Cal Pub. Res. Code Sections 21000-21177; Connecticut, Conn. Gen. State Ann Sections 22a-1 to 1i; District of Columbia, D.C. Stat. Sections8-109.01-109.11; Georgia, G.A. Code Ann. Sections 12-16-1 to -8; Hawaii, Haw.Rev.Stat. Sections 343-1 to -8; Indiana, Ind. Code Sections 13-12-4-1 to-10; Maryland, Md.Nat.Res. Sections 1-301 to -305; Massachusetts, Mass. Gen. Laws Ann. Ch.30, Sections 61-62H; Minnesota, Minn. Stat. Ann. Sections 116D.01 to -.11; Montana, Mont. Code Ann. Sections 75-1-101 to -324; New Jersey, Exec. Order No.215; New York, N.Y. Entl. Conserv. Sections 8-0101 to -0117; North Carolina, N.C. Gen Stat. Sections 113A-1 to -13; South Dakota, S.D. Codified Laws Sections 34-9-1 to -13; Virginia, VA. Code Ann. Sections 10.1-1188 to -1192; Washington, Wash. Rev. Code Ann. Sections 43.21C.010 to .914; Wisconsin, Wis. Stat. Ann. Section 1.11

64 LADWP owned 21 percent interest of the Navajo Generating Station and equal to 477 MW of coal-fired capacity.

65 **http://www.ladwpnews.com/go/doc/1475/1727379/LADWP-Takes-Historic-Action-Toward-Clean-Energy-Future-for-Los-Angeles**

66 **http://www.ladwpnews.com/go/doc/1475/2862170/**

67 Ibid.

68 **http://www.scpr.org/news/2016/07/07/62425/la-cuts-coal-use-by-25-percent-by-selling-share-in/**

69 For additional information on LADWP efforts to provide cleaner electricity see: **http://www.ladwpnews.com/external/content/document/1475/1727403/1/Navajo%20+%20IPP%20Coal%20Elimination%20Presentation%20031913.pdf**

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