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How the Premature Retirement of Coal-Fired Power Plants Affects Energy Reliability, Affordability

Isaac Orr and Fred Palmer*
First in a series

Introduction

More than 250 coal-fired power plants in the United States have been retired since 2010, taking more than 34,000 megawatts (34 gigawatts) of power generation capacity offline.¹ These retirements were the result of increasing competition from natural gas power plants and the

imposition of federal regulations, including rules limiting carbon dioxide (CO₂) emissions, that made operating coal-fired power plants more expensive than it otherwise would have been.² These regulatory changes are key to understanding why coal's share of the electricity generation market fell from 50 percent in 2008 to 31 percent in 2017.³

The premature retirement of coal-fired power plants poses a threat to the reliability and affordability of the country's electricity supply.

Some 88 percent of the coal plants retired between 2010 and 2015 were older, smaller units with a generation capacity of less than 250 megawatts; the largest coal plants have nearly ten times that capacity.⁴ However, many coal plants recently slated for retirement are newer, more efficient facilities with larger generating capacities. The premature retirement of these coal-fired units poses a threat to the reliability and affordability of the country's electricity supply.

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¹ Trevor House, *et al.*, ["Can Coal Make a Comeback?"](#) Center on Global Energy Policy, April 2017.

² Benjamin Storrow, ["Coal: Big, Younger Plants are Closing. Is it a New Trend?"](#) *E&E News* (website), April 27, 2017.

³ U.S. Energy Information Administration, ["Short Term Energy Outlook"](#) (website), September 12, 2017.

⁴ Benjamin Storrow, *supra* note 2.

Australia presents us with a cautionary tale. It has experienced severe reliability problems, rolling blackouts, and rising electricity prices because of government policies that forced coal-fired generation units into early retirement in favor of renewable energy. Australia's overreliance on renewables, especially intermittent wind power, has had significant negative impacts on the lives of Australians. The harm is exacerbated by Australian exports of liquefied natural gas, which fetch higher prices in Asian markets, leaving the domestic market undersupplied.⁵

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The United States will likely face similar economic harm in the future as state and federal policies force the premature retirement of coal-fired plants and mandate the use of renewable resources. Especially as the liquefied natural gas export industry in the United States grows

in response to foreign demand, government policies that cripple the coal industry will damage the country's electricity generating capacity and drive up electricity costs.

Public utilities should hedge their bets against possible price volatility in the natural gas sector. Prudence dictates that utilities diversify their portfolios of energy-generation sources. Natural gas and coal complement one another, ensuring families and industry benefit from the lowest energy prices possible. Policymakers should remove special incentives that promote overreliance on any single energy-generation source, including natural gas and renewable energy. Subsidies for renewables threaten to make energy both unreliable and high-priced.

Part 1 of this *Policy Study* is an in-depth analysis of Australia's experience with policies that forced coal-fired power plants into premature retirement and made large parts of the country dependent on unreliable and high-priced renewable energy, particularly wind power.

Part 2 examines the parallels between the United States and Australia and provides insights into the problems now faced by states that have already eliminated coal-fired electricity from their generation portfolios and aggressively promoted renewable energy.

Part 3 examines the concept of "prudence" and diversified energy portfolios for public utilities, along with their policy implications.

Part 4 provides a critique of a U.S. Department of Energy study that correctly identifies natural gas-fired power generators as a reason for coal plant retirements but fails to describe accurately the role played by renewable energy subsidies in those retirement decisions. Subsidies intended to promote renewable energy sources have undermined the wholesale electricity market and, therefore, threaten the long-term reliability and affordability of the electricity supply.⁶

Part 5 offers concluding insights.

⁵ Rachel Pannett, "[How Energy Rich Australia Exported its Way Into an Energy Crisis](#)," *The Wall Street Journal*, July 10, 2017.

⁶ U.S. Department of Energy, [Staff Report to the Secretary on Electricity Markets and Reliability](#), August 2017.

Part 1

Australia: A Cautionary Tale

Australia has the fourth-largest coal reserves in the world and is the fifth largest producer of coal. However, 90 percent of the coal mined in Australia is exported, making it the world's second-largest coal exporter, behind Indonesia.⁷ Despite having centuries of coal reserves, Australia has enacted climate and energy policies that have greatly reduced the use of coal in electricity generation and has aggressively promoted wind energy.⁸

Coal-fired power generation constituted more than 80 percent of Australia's electricity generation in 2000 (see Figure 1). Since then, coal's share of the electricity market has fallen by nearly 20 percent points, largely due to government regulations that made them more expensive to operate. (Coal's share of total electricity generation inched up by 3 percent points in the 2014-2015 period, the first time since 2010. This growth was attributed in part to the removal of an onerous carbon tax.)⁹

Despite having centuries of coal reserves, Australia has enacted climate and energy policies that have greatly reduced the use of coal in electricity generation and has aggressively promoted wind energy.

Most of the energy market share lost by coal generation since 2000 has been picked up by natural gas power plants, which provided about 21 percent of total electricity generation in the country in 2014. Renewable energy provided approximately 14 percent of electricity generation in 2014. Hydroelectric constitutes the single-largest segment of renewable electricity, providing 39 percent of all renewable electricity, and wind constitutes 33 percent of renewable electricity generation.¹⁰

Both the national and state governments in Australia set energy policy. Recent anti-coal, pro-renewables policies, especially at the state level, combined with liquefied natural gas exports, have had severe adverse consequences.

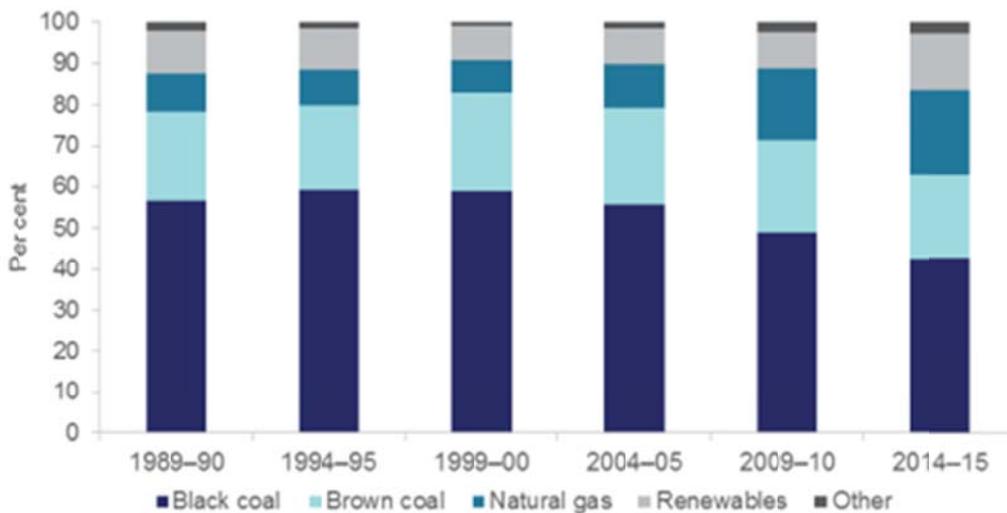
⁷ Mining Technology, "[Countries with the Biggest Coal Reserves](#)," Miningtechnology.com, November 21, 2013.

⁸ Ben Harvey and Tom Shepherd, "[Rolling Blackouts Ordered as Adelaide Swelters in Heatwave](#)," news.com.au, February 9, 2017.

⁹ Department of Industry, Innovation and Science, "[Australian Energy Update](#)," Australian Government, October 2016.

¹⁰ *Ibid.*

Figure 1
Australian Electricity Generation Fuel Mix



Coal use in Australia has fallen approximately 20 percent since the year 2000. Coal still constitutes the largest share of the electricity generation market, but growing reliance on natural gas and renewables has caused reliability issues. *Source:* Department of Industry, Innovation and Science, [Australian Energy Update](#), Australian Government, October 2016.

A. Rolling Blackouts and Repeated Outages

In 2016, South Australia’s electricity-generating facilities relied on renewables sources for 53 percent of their power output. South Australia also imported into its grid coal-generated power from Victoria, a neighboring state.

On September 28, 2016, South Australia was plunged into darkness after high-voltage power lines delivering that coal-generated power from Victoria were severed by a series of tornadoes, leaving 1.7 million people, approximately 7 percent of Australia’s population, without power.¹¹ Power was not fully restored for 12 days. Were such a storm to leave 7 percent of the U.S. population without power, 23 million people would be affected, more than the populations of every state except California and Texas.¹²

The September 28, 2016 blackout and blackouts in the months that followed were not isolated events caused merely by inclement weather. For example, an overreliance on renewable energy

¹¹ Charis Chang, “[Why South Australia’s Blackouts are a Problem for Us All](#),” news.com.au, February 10, 2017.

¹² [Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2016](#) (Excel spreadsheet), United States Census Bureau, accessed October 25, 2017.

sources, primarily wind, combined with the retirement of the last coal-fired power plant in South Australia in May 2016, resulted in another blackout in February 2017 as 90,000 households lost electricity due to “load shedding” at the end of a 107.7 degree F day.^{13,14} Load shedding is a utility-imposed blackout where electricity is shut off due to high demand and inadequate supply. If too many customers are trying to access electricity when not enough is being provided to the grid by power companies, the entire system could shut down. To prevent a system-wide blackout, utility companies themselves stop providing electricity to many customers.

Several more blackouts due to load shedding have occurred in South Australia. An investigation by the Australian Energy Market Operator (AEMO), the nation’s electric regulator, concluded South Australia’s reliance on renewables, a failure of backup systems to kick in, and the closure of wind farms for safety reasons all played a significant part in producing the outage.¹⁵

AEMO estimates the likelihood of blackouts due to an energy shortfall in Southern Australia for the summer of 2017–2018 is between 26 percent and 33 percent. In neighboring Victoria, the likelihood of blackouts is estimated between 39 percent and 43 percent. AEMO says those estimates would be lower if nine dual diesel- and gas-fired generators in Victoria, along with battery storage technology—at a cost of \$95 million for a 129 megawatt hour facility—are incorporated into the grid in South Australia.^{16,17}

Blackouts in Australia are projected to continue as electricity markets struggle to provide a reliable supply as coal-fired power plants are shut down and the grid becomes more reliant on intermittent resources and on natural gas.

AEMO also concludes the proposed closure in 2022 of the Lidell coal-fired power station—a 2,000 megawatt (MW) facility—will materially increase the risk of blackouts in the Australian state of New South Wales.¹⁸ Blackouts in Australia are projected to continue as electricity markets struggle to provide a reliable supply as coal-fired power plants are shut down and the grid becomes more reliant on intermittent resources and on natural gas.¹⁹

¹³ Giles Parkinson, “[Last Coal-Fired Power Generator in South Australia Switched Off](#),” *Renew Economy* (website), May 9, 2016.

¹⁴ Ben Harvey and Tom Shepherd, *supra* note 8.

¹⁵ Nick Harmsen, “[AEMO Releases Final Report into SA Blackout, Blames Wind Farm Settings For State-Wide Power Failure](#),” Australian Broadcasting Company, March 28, 2017.

¹⁶ Nick Harmsen, “[Energy Market Operator Issues Mixed Blackout Forecast for SA, Victoria During Summer](#),” Australian Broadcasting Company, September 5, 2017.

¹⁷ Sonali Paul, “[Tesla’s Big Battery Races to Keep South Australia’s Lights On](#),” Reuters, September 28, 2017.

¹⁸ Nick Harmsen, *supra* note 15.

¹⁹ Stephen Dziedzic, “[Electricity Markets Struggling as Coal-Fired Power Stations Shut Down, Regulator Says](#),” Australian Broadcasting Company, September 5, 2017.

B. South Australia's Renewable Energy Mandates to Blame

The blackout problem in South Australia is clearly the result of policies implemented by that state's government. It mandated a goal of generating 50 percent of its electricity from renewables by 2025. Yet South Australia is dependent upon electricity imports from Victoria, which provides backup power generated from brown coal in quantities equivalent to 25 percent of South Australia's peak demand.²⁰

The intermittent nature of wind and solar power have resulted in a situation where utility companies in South Australia must procure electricity from non-renewable sources on the spot market, which is often an expensive practice.

The intermittent nature of wind and solar power have resulted in a situation where utility companies in South Australia must procure electricity from non-renewable sources on the spot market, which is often an expensive practice. Electricity prices in the spot market are sometimes very high when wind generation is low, driving up prices for consumers. For example,

average spot power prices across Australia were between 98 percent and 360 percent higher in February 2017 than in February 2016.²¹

This problem is exacerbated in South Australia because wind and solar are given priority on the grid. The electricity generated by renewable facilities is purchased first by South Australian utilities, while coal and natural gas plants act as backup generators for the renewables. This system makes coal and natural gas uneconomic, for several reasons.

To begin with, coal and natural gas power plants receive payment only when they sell electricity to the grid, whereas wind and solar receive government subsidies in addition to revenue from the electricity they sell to the public utility.

When wind is abundant, that power is incorporated into the grid, meaning coal and natural gas plants sell less electricity and collect less revenue. However, coal and natural gas plants have large fixed costs—staff salaries, capital financing—that do not decrease based on how much electricity they sell. Further, when subsidized wind is abundant, wholesale power prices are depressed, meaning even less revenue for coal and natural gas plants. Those facilities in South Australia cannot operate profitably, which explains why the last coal-fired power plant in that state closed in May 2016, worsening power shortages when no wind-generated electricity is available, making more blackouts likely.

In reaction to blackouts and skyrocketing electricity prices, the Liberal Party in three Australian states—Queensland, South Australia, and Victoria—have called for the abolition of state-based renewable energy targets.²²

²⁰ World Nuclear Association, "[Australia's Electricity](#)," September 2016.

²¹ Angela Macdonald-Smith, "[Manufacturers Slugged by Power Price Hikes](#)," *Financial Review*, March 6, 2017.

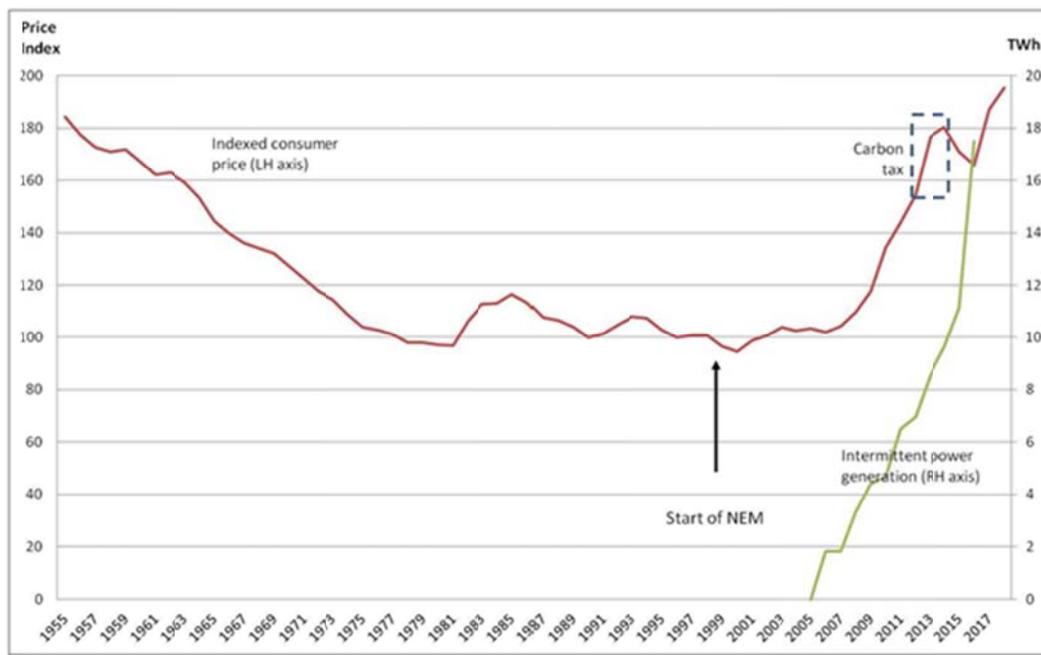
²² Katharine Murphy, "[Energy Policy: No Room for Partisan Politics, 18 Groups Tell Government](#)," *The Guardian*, February 12, 2017.

C. Rising Costs

Basic economics tell us that as electricity becomes scarcer, the limited remaining supplies become more expensive. Australia once had some of the least-expensive electricity in the world. But residential power prices nearly doubled in Australia from 2008 to 2014 because of pro-renewable, anti-fossil-fuel government policies. (See Figure 2.) As coal plants have been forced into retirement, utilities have had to spend more on additional network infrastructure, which was needed to connect states to one another in order maintain the supply of electricity as renewables were increasingly introduced into the energy mix.^{23,24}

Prices have risen most dramatically in South Australia where residential electricity prices are now the most expensive in the world (see Figure 3). The costs of electricity in South Australia are triple those in the United States and Victoria's are double American prices.

Figure 2
Indexed Real Consumer Electricity Prices: 1955–2018 (1990=100)



The National Electricity Markets (NEM) were established to introduce competitive elements to electricity markets in Australia and drive down prices. However, electricity prices in Australia have increased dramatically since 2005, when intermittent sources of electricity (wind and solar) were beginning to be incorporated into the national electricity supply. There is a strong correlation between increasing quantities of wind and solar and higher prices. *Source: Dr. Michael Crawford, "An Open Letter to Dr. Alan Finkel RE Review of Future Security of the National Electricity Market,"* June 23, 2017.

²³ Department of Industry, Innovation and Science, *supra* note 9.

²⁴ Charis Chang, *supra* note 11.

Figure 3
Retail Electricity Prices of NEM States, Including Taxes,
Compared to Selected Countries (¢ per kWh)



South Australia now has the most expensive in the world after utilities raised their prices in July 2017. Electricity prices for Australian households rose 16 to 20 percent, depending on the company supplying the energy. Prices are in Australian dollars. *Source:* Ben Potter and Andrew Tillett, "[Australian Households Pay Highest Power Prices in the World](#)," *Financial Review*, August 5, 2017.

To address rising electricity costs, Australia has implemented a system of concessions and rebates for low-income households. In a report published by The University of Sydney in 2013, Dr. Lynne Chester writes:

The dominant policy measure to assist low-income households with energy bills are rebates, concessions and temporary financial assistance provided by State and Territory governments, generally as an absolute amount (lump sum) rather than a proportion of a household energy bill as is the case only in Victoria. ...

At least 2.3 million low-income households are regularly receiving some form of State government concession or rebate on their electricity bill. Yet all States record a higher proportion of residential consumers being disconnected for non-payment of bills in 2011–12 compared to 2007–08 which strongly signals the increasing ineffectiveness of these measures.²⁵

Soaring electricity prices also have caused energy-intensive businesses, such as manufacturing, to reduce employment in Australia and refocus investment in the United States, where electricity is half as expensive.²⁶

D. Australian Liquefied Natural Gas Exports

Australia's electricity problems have been exacerbated by a lack of domestic natural gas supplies for generating electricity. This situation might seem counter-intuitive because Australia has significant natural gas resources and is the world's second-largest exporter of liquefied natural gas (LNG), behind only Qatar. Some 62 percent of gas production in Australia in 2016 was for export, especially to Asian countries where that resource fetches a higher price than in the Australian domestic market.²⁷

Exports in such circumstances are not an economic problem. Australians earn more revenue than they would if the LNG supplies were sold domestically, and the higher prices overseas are incentives for

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domestic producers of energy in Australia to increase their output. Australia's problem is not with exports. Rather, it is with government restrictions on energy generation from low-cost coal, which have resulted in closures of coal-fired power plants, and aggressive promotion of high-cost renewable energy.²⁸

As 90,000 homes in the South Australian city of Adelaide suffered through the February 2017 blackout, five ships left the port city of Gladstone carrying out 314,000 tons of LNG, enough to provide electricity for roughly 750,000 Australian homes for a year.²⁹

Politicians, including Australian Prime Minister Malcolm Turnbull, predictably blamed natural gas shortages and the blackout on previous decisions to issue too many gas export licenses,³⁰ ignoring the fact that but for government decisions to persecute coal and promote renewables, there likely would have been enough electricity generated to meet all Australians' needs.

²⁵ Dr. Lynne Chester, [The Impacts and Consequences for Low-Income Australian Households of Rising Energy Prices](#), The University of Sydney, October 2013, p. vii.

²⁶ Angela Macdonald-Smith, *supra* note 21.

²⁷ Rachel Pannett, *supra* note 5.

²⁸ *Ibid.*

²⁹ *Ibid.*

³⁰ *Ibid.*

Much of the LNG that is exported is extracted from coal seams. This gas is expensive to produce, and natural gas producers developed these resources not for domestic use, but with the intent of selling for higher prices in Asian markets. As gas production increased, coal-fueled plants were shut down without comprehensive plans for replacing them with other power sources.³¹

Increasing reliance on natural gas has caused Australian natural gas prices to fluctuate wildly.

Increasing reliance on natural gas has caused Australian natural gas prices to fluctuate wildly. On the spot market, gas prices have gone from below \$1 per million British thermal units (MMBtu) in

2014 to roughly \$7 per MMBtu in 2017—well above the roughly \$3 that prevails in the United States. The domestic natural gas shortages have caused prices for some smaller manufacturers to reach \$17 per MMBtu.³²

The shortage of natural gas resulted in the Australian government threatening to curb exports if producers did not make more natural gas available to the domestic market. Australian energy companies agreed to divert gas from exports to meet the needs of domestic markets.³³ This move will have serious negative consequences: Revenues from foreign customers will fall, harming Australian natural gas producers and endangering Australian jobs, and Australian consumers will face higher energy bills as they rely more on a resource much more costly than coal.

E. Conclusions from Down Under

Australia's energy policies—persecuting reliable, low-cost, abundant coal in the name of reducing CO₂ emissions while promoting unreliable high-cost renewables—have proved disastrous for Australians.

Once benefiting from some of the most affordable electricity in the world, Australians are now left with an expensive energy system that in the future will require even more investments in backup technology for renewable resources that will only add to the utility bills of Australian households.

Thankfully, it appears Australia may be coming to its senses on energy policy. Former Australian prime minister and opposition-party leader Tony Abbott has come up with a new slogan on energy policy, calling for a “100 per cent reliable energy target.” Abbott said he welcomed signs from Turnbull that the government is moving away from a clean energy target to a reliable energy target. “Frankly nothing less than a 100 per cent reliable energy target will do because we’ve got to keep the lights on all the time,” Abbott said in September 2017.³⁴

³¹ *Ibid.*

³² *Ibid.*

³³ Tom Westbrook and Sonali Paul, [“Australia’s East-Cost LNG Exporters Avert Export Curbs,”](#) Reuters, September 26, 2017.

³⁴ Katherine Murphy, [“Tony Abbott Calls for End to All Energy Subsidies, Including Coal,”](#) *The Guardian*, September 14, 2017.

Australian Senator Malcolm Roberts told ABC radio: “If we just went back to normal coal-fired operations we would have the reliability, the security, the stabilisation, and the lower cost that we used to have.”³⁵ Australian Senator Ron Boswell noted, “You can’t refine aluminum with windmill power.”³⁶

The United States would be wise to heed this advice and learn from this cautionary tale.

Part 2

Parallels Between America and Australia

Like Australia, the United States is a coal-rich country; it has the world’s largest easily accessible reserves, by one estimate enough to last for about 283 years.³⁷ However, like Australia, the share of electricity generated in the United States from coal has fallen significantly, from approximately 50 percent in 2000 to approximately 32 percent in 2016 (see Figure 4).

Key factors driving the retirements of coal-fired units in the United States are a series of Environmental Protection Agency (EPA) regulations and low natural gas prices that have resulted from hydraulic fracturing, making many coal-fired facilities unprofitable and encouraging many public utilities to switch from coal to natural gas as a principal source for electricity.³⁸

A. EPA Regulations

President Barack Obama pledged during his 2008 campaign to “bankrupt” any effort to build a coal-fired power plant.³⁹ His administration promulgated new rules and tightened older ones in an effort to strangle the coal industry. Those efforts included:

- Clean Power Plan;
- Cross-State Air Pollution Rule;
- Mercury and Air Toxics Standards;
- More stringent National Ambient Air Quality Standards (NAAQS) for particulate matter;

³⁵ Rachel Baxendale and Simone Fox Koob, “[Clean Energy Targets ‘Not a Tax on Coal,’](#)” *The Australian*, June 12, 2017.

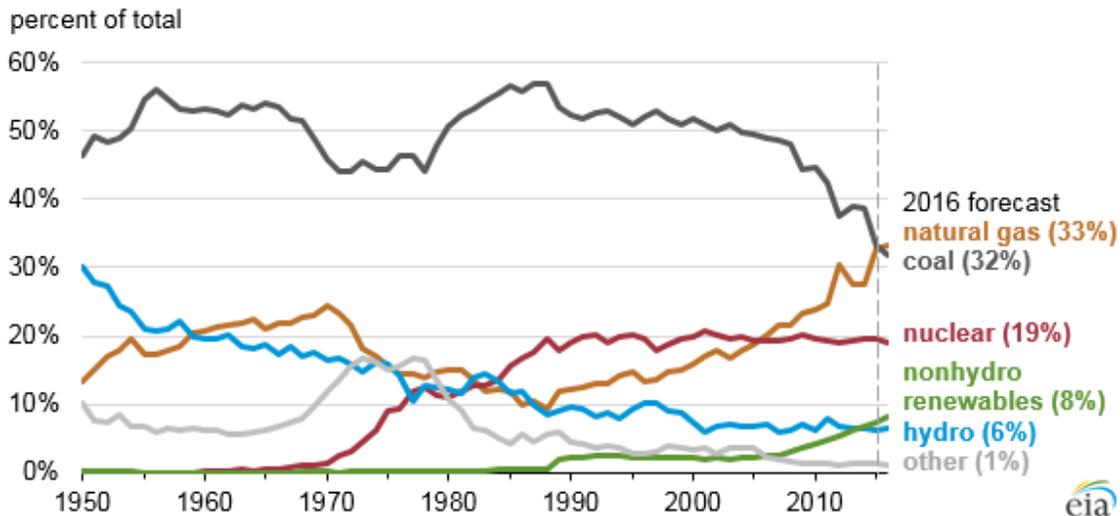
³⁶ Hon. Ron Boswell, “No Future for Manufacturing with Carbon Tax and Renewable Energy Costs,” address to the Institute of Public Affairs, Melbourne, Australia, September 28, 2011, p. 8.

³⁷ U.S. Energy Information Administration, “[How Much Coal is Left?](#)” *Energy Explained*, April 18, 2017.

³⁸ Energy Ventures Analysis Inc., [Outlook for Natural Gas Supply and Demand for 2016–2017 Winter](#), Natural Gas Supply Association, October 2016.

³⁹ Erica Martinson, “[Uttered in 2008, Still Haunting Obama,](#)” *Politico*, April 5, 2012.

Figure 4
Annual Share of Total U.S. Electricity Generation by Source
(1950–2016)



Coal was the largest provider of electricity in the United States from 1950 until 2016, when it was supplanted by natural gas as the chief fuel used to generate electricity. However, rising natural gas prices have caused coal to regain its role as the largest fuel source used for electricity generation in 2017. Source: U.S. Energy Information Administration, "[Natural Gas Expected to Surpass Coal in Mix of Fuel Used for U.S. Power Generation in 2016](#)," *Today in Energy* (website), March 16, 2016.

- Cooling Water Intake Rule;
- Coal Combustion Residuals Rule;
- Carbon Pollution Standards for New Plants;
- Effluent Limitations Guidelines;
- NAAQS for Ozone, one of the most costly regulations in U.S. history;
- Stream Protection Rule; and
- A Department of the Interior ban on mountaintop mining.⁴⁰

These regulations plus government subsidies to the wind and solar power industries are major reasons more than 34,000 megawatts (MW) of coal-fired electricity generating capacity in the United States have been retired prematurely in recent years. Energy Information Agency data indicate another 18,400 MW are scheduled to retire by 2028, for a total retired capacity of 52,400 MW.⁴¹ This is enough electricity generating capacity to power approximately

⁴⁰ Trevor House *et al.*, *supra* note 1.

⁴¹ U.S. Energy Information Administration, "[Planned U.S. Electric Generating Unit Retirements](#)," *Electric Power Monthly*, September 26, 2017.

42.5 million homes, which is equivalent to every household in California, Florida, New York, Pennsylvania, and Texas combined.⁴² These regulations will be discussed in greater detail in the second *Policy Study* in this series, while the impact of federal subsidies for wind and solar will be further discussed in the third *Policy Study* in the series.⁴³

B. The Consequences of Overregulation

The premature retirement of coal-fired power plants threatens to drive up electricity prices and cripple the reliability of the electricity grid in the United States.

Existing coal-fired power plants generate reliable electricity at a cost of \$39.9 per megawatt-hour (MWh) on average, while the cost of electricity generated by existing natural gas facilities is \$34.4 per MWh. Existing nuclear power plants produce electricity for \$29.1 per MWh, and hydroelectric resources, \$35.4 per MWh.

The premature retirement of coal-fired power plants threatens to drive up electricity prices and cripple the reliability of the electricity grid in the United States.

New natural gas facilities would generate electricity for \$55.3 per MWh, much higher than the \$34.4 per MWh for existing facilities.⁴⁴ This means that at a cost of \$39.9 per MWh, existing coal plants are able to generate electricity for approximately 39 percent less than new natural gas plants. Further, new wind facilities generate electricity at a cost of \$107.4 per MWh, meaning coal produces electricity at one-third of the cost. (See Figure 5.)

Thus, prematurely closing coal-fired power plants will make the United States more like Australia, with higher electricity prices.⁴⁵

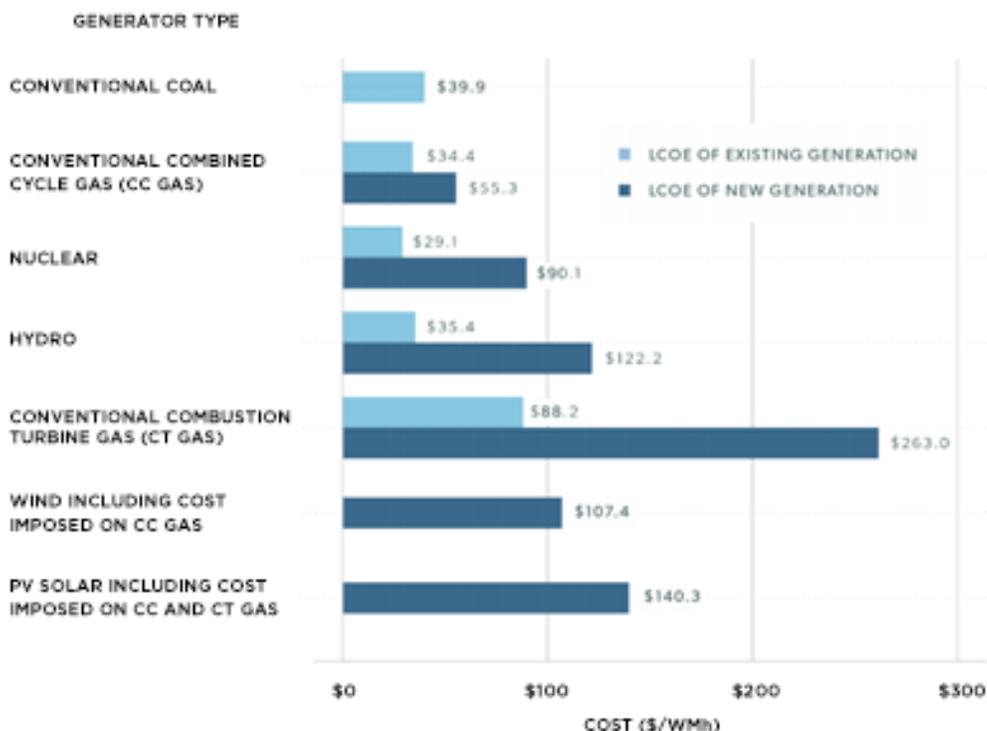
⁴² Statista, "[Number of Households in the United States in 2016, By State \(In Millions\)](#)" (website), accessed October 16, 2017.

⁴³ Isaac Orr and Fred Palmer, "How Obama-Era Regulations are Shutting Down Perfectly Good Power Plants," *Heartland Policy Study* No. 146, and "Public Policy and Coal-Fired Power Plants," *Heartland Policy Study* No. 147, The Heartland Institute, forthcoming November 2017.

⁴⁴ Tom Stacy and George Taylor, [The Levelized Cost of Electricity From Existing Generation Resources](#), Institute for Energy Research, July 2016.

⁴⁵ *Ibid.*

Figure 5
Levelized Cost of Electricity



Electricity generation from existing natural gas, coal, nuclear, and hydro power is significantly less expensive than new generating resources. In many cases, existing electricity resources can generate electricity for one-third of the cost of new wind power and one quarter of the cost of new solar. *Source:* Tom Stacy and George Taylor, [The Levelized Cost of Electricity From Existing Generation Resources](#), Institute for Energy Research, July 2016.

C. The California Model

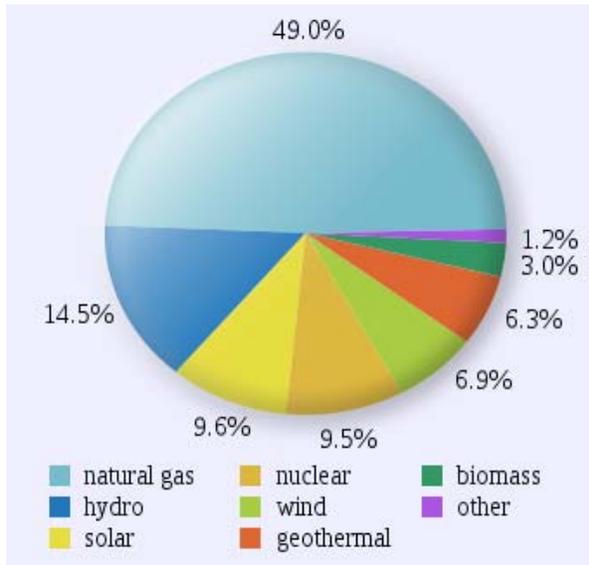
While many states resisted Obama’s federal regulations to cut CO₂ emissions by shuttering coal-fired power plants, others fully embraced them. California has gone beyond federal regulations, attempting to replace coal entirely in favor of natural gas and renewables.

California utilities are under a mandate to produce 50 percent of their electricity from “clean energy”—by which state policymakers mean greenhouse-gas-free energy⁴⁶—by 2030, and some

⁴⁶ Lauren Sommer, [“California Lawmakers Debate 100 Percent Clean Energy Mandate,”](#) NPR (website), September 14, 2017.

lawmakers want the mandate raised to 100 percent by 2045.⁴⁷ The state also places severe restrictions on CO₂ emissions and forces companies to buy permits to emit greenhouse gases into the air.

Figure 6
Sources of Electricity Generation in California (2016)



Electricity generated in California is primarily derived from natural gas due to its low cost, availability, and ability to quickly start generating electricity when intermittent sources such as wind and solar are not generating power. Data from California Energy Commission. *Source:* Tom Stacy and George Taylor, *The Levelized Cost of Electricity From Existing Generation Resources*, Institute for Energy Research, July 2016.

From 2006 through July 2016, 34,600 MW of capacity from imported and in-state coal-fired power plants were removed from California’s resource portfolio.⁴⁸

As shown in Figure 6, in 2016 the state produced nearly half of its electricity, 49 percent of its electricity from natural gas. California will shutter its last nuclear power plant, the Diablo Canyon facility, in 2025, and nuclear power’s share will fall from its current 9.5 percent as a result.

The 1.2 percent “other” category includes the 0.16 percent of generation derived from coal.⁴⁹ Electricity from in-state coal-fired facilities has been virtually eliminated. California still imports coal-fired electricity from neighboring states, much like South Australia imports power from Victoria. In 2016, imported coal-fired electricity accounted for 4.13 percent of total electricity consumption in California, less than the 6.9 percent share generated by in-state wind and 6.3 percent share generated by in-state geothermal.⁵⁰

The harm caused by California’s anti-coal, pro-wind, and pro-solar policies already is apparent. Electricity prices in the state have risen dramatically since 2010 and far exceed the national average.⁵¹ (See Figure 7.)⁵² This is due in part to poor planning, causing the state

⁴⁷ Makeda Easter and Ivan Penn, “[Elon Musk Said Tesla Could Build Australia a Power Storage System in 100 Days. Now We’ll See](#),” *The Los Angeles Times*, July 7, 2017.

⁴⁸ California Energy Commission, [Actual and Expected Energy From Coal in California](#), November 3, 2016.

⁴⁹ *Ibid.*

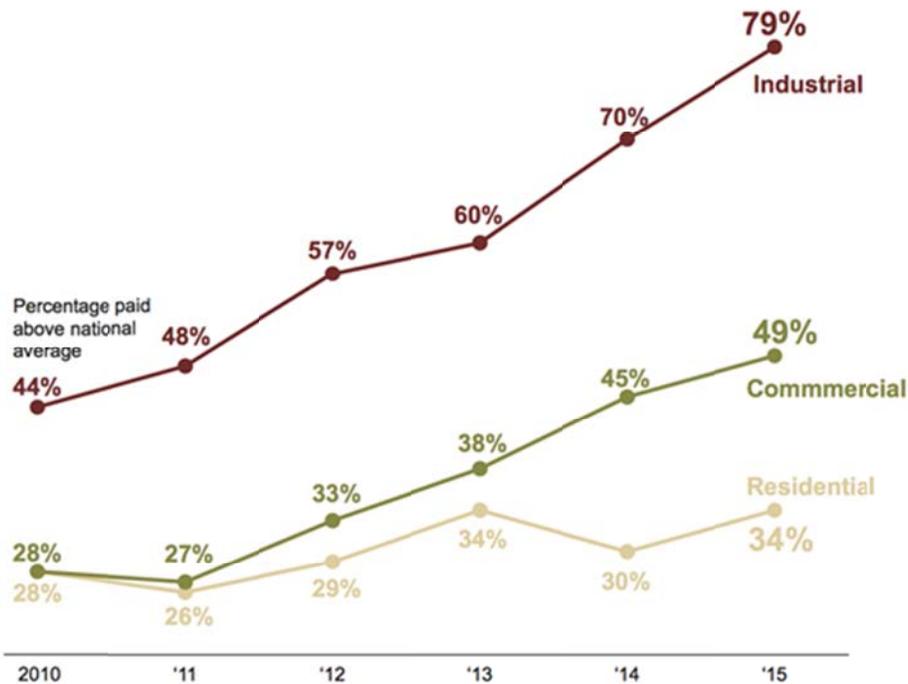
⁵⁰ *Ibid.*

⁵¹ Lawrence Hamlin, “[California’s Globally Irrelevant, Costly, Elitist Driven And Purely Political Climate Change Campaign](#),” *WattsUpWithThat* (blog), August 18, 2016.

⁵² U.S. Energy Information Administration, “[Average Price of Electricity to Ultimate Customers by End-Use Sector](#),” August 24, 2017.

to build too many power plants—500 power plants from 2001 to 2016—and in part to feed-in tariffs, subsidies that guarantee renewable energy resources are compensated at above-market rates. The higher costs associated with these feed-in tariffs are passed along to consumers.⁵³

Figure 7
California Electricity Cost Premiums Since 2010



Source: U.S. Energy Information Administration data, graphic created [by California Manufacturers & Technology Association](#), June 1, 2017.

California is projected to have 21 percent more electricity generating capacity than it needs to satisfy projected consumer demands by the year 2020. Continued investment in renewable generation continues to oversupply the California markets with electricity priced much higher than the rest of the country.⁵⁴

As Figure 7 shows, industry especially suffers from California’s policies, with electricity rates rocketing from 48 percent above the national average in 2010 to 79 percent above in 2015. These high prices will only exacerbate business flight from the state.⁵⁵

⁵³ U.S. Energy Information Administration, “[Feed-In Tariff: A Policy Tool Encouraging Deployment of Renewable Electricity Technology](#),” *Today in Energy* (website), May 30, 2013.

⁵⁴ Ivan Penn and Ryan Menezes, “[Californians Are Paying Billions For Power They Don’t Need](#),” *The Los Angeles Times*, February 5, 2017.

⁵⁵ Hans Bader, “[Nestlé, Other Businesses Flee California](#),” Competitive Enterprise Institute, February 2, 2017.

California has thus far not experienced blackouts, but those could be in the future as well. Electricity prices will continue to increase as the state becomes more reliant on intermittent renewable resources, which will leave the state oversupplied on windy or sunny days and undersupplied when the sun is not shining or the wind is not blowing.

California, like South Australia, provides policymakers with an example of “what not to do,” adopting policies that encourage the premature retirement of existing coal-fired power plants in favor of more expensive, less reliable renewable energy sources.

D. U.S. Liquefied Natural Gas Exports

Hydraulic fracturing has made the United States the largest producer of natural gas in the world. The country is expected to become a net natural gas exporter in late 2017, primarily due to surging volumes of natural gas exports via pipeline shipments to Mexico and liquefied natural gas (LNG) exports to countries around the world, particularly to nations in Asia, Europe, Latin America, and the Middle East.⁵⁶

Growing exports have the potential to put upward pressure on domestic natural gas prices. The United States is expected to have enough LNG capacity to export 8.6 billion cubic feet per day (Bcf/d) by 2020, roughly 10 percent to 15 percent of current natural gas production. This export capacity is expected to grow to 15.5 Bcf/d

If increasing LNG exports are not matched by corresponding increases in natural gas production, the increase in exports could put upward pressure on electricity prices in the future.

by 2030, roughly 17 percent to 18.5 percent of estimated production. At those volumes, the United States would become the world’s largest LNG exporter (see Figure 8).⁵⁷

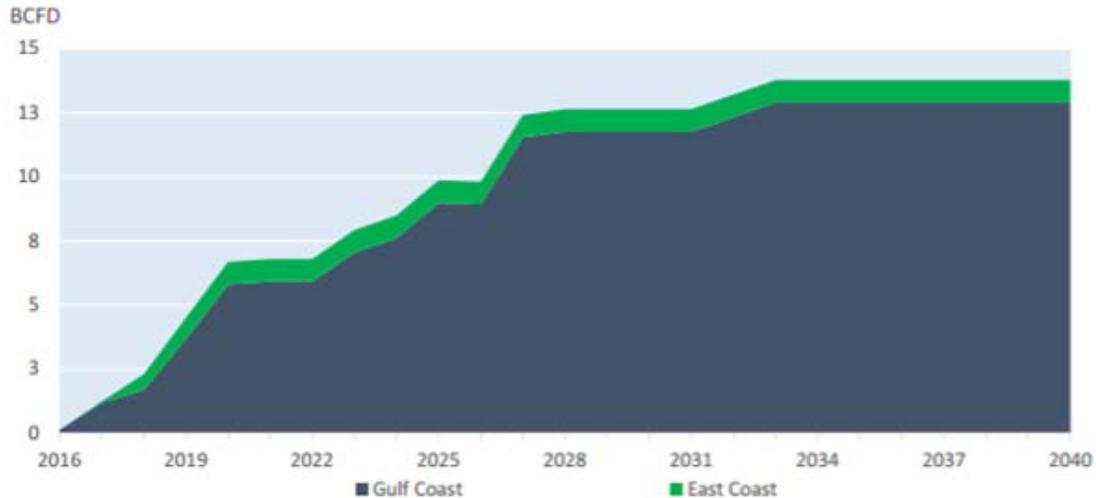
If increasing LNG exports are not matched by corresponding increases in natural gas production, the increase in exports could put upward pressure on electricity prices in the future.⁵⁸

⁵⁶ U.S. Energy Information Administration, “[United States Expected to Become a Net Exporter of Natural Gas this Year](#),” *Today in Energy* (website), August 9, 2017.

⁵⁷ Energy Ventures Analysis Inc., *supra* note 38.

⁵⁸ *Ibid.*

Figure 8
Projected Growth in U.S. LNG Exports
2016–2040



U.S. LNG exports are estimate to reach between 13 Bcf/d by 2020 and 15.5 Bcf/d by 2030. These volumes will represent approximately 11 and 17 percent of estimated natural gas production, respectively. Source: Energy Ventures Analysis Inc., [Outlook for Natural Gas Supply and Demand for 2016–2017 Winter](#), Natural Gas Supply Association, October 2016.

In its *2017 Annual Energy Outlook*, the Energy Information Administration calculates a “reference case” gas price increase of about \$5 per million British thermal units (MMBtu) by 2020. It also projects a price increase range of between \$4 per MMBtu to nearly \$10 MMBtu by 2030 (in constant 2016 dollars), depending on what happens with oil and natural gas resources and technology. (See Figure 9.)

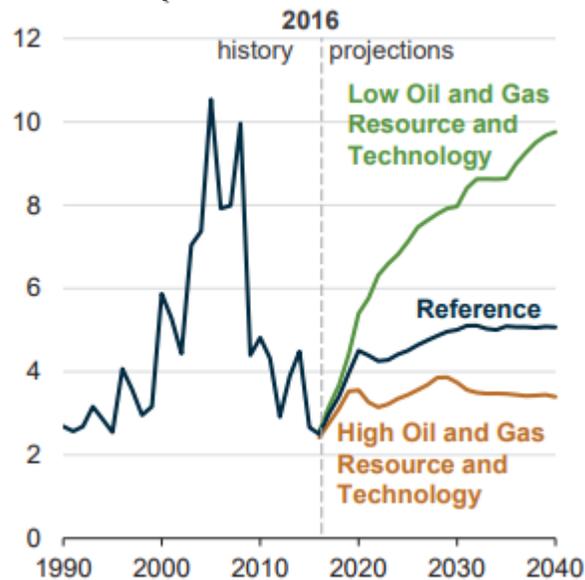
Even as the world's largest LNG exporter, the United States will experience less dramatic effects on its domestic market than what Australia experienced. This is primarily because the United States has a large natural gas pipeline infrastructure that allows it move its gas more effectively than Australia could.⁵⁹ LNG exports will likely cause U.S. consumers to experience higher natural gas prices, but not actual supply shortages.

However, significant natural gas price increases due to LNG exports could encourage utilities to switch from natural gas to coal. Some such shifting occurred in March 2017, when the price for natural gas reached \$3.36 per MMBtu compared with a price of \$2.08 per MMBtu for coal.⁶⁰ The Energy Information Administration forecasts that through 2050, natural gas costs to the utility sector (in real 2016 dollars) will rise at an

annual average rate of 2.1 percent while coal costs will increase annually by only 0.3 percent. In 2017, natural gas prices averaged around \$3.00 per MMBtu compared to costs ranging from \$0.66 to \$2.22 per MMBtu for coal; natural gas is, on average, 60 percent more expensive than coal, and by 2050, it is projected to be 260 percent as expensive as coal.^{61,62,63}

Permitting power generators to switch at their discretion to whichever fuel can generate electricity most cost effectively would benefit consumers and businesses alike. But such effective, efficient fuel switching will be possible only if regulators and public utility commissioners exercise prudence to ensure the United States continues to use all of its energy resources to benefit from electricity prices that among the lowest in the world.

Figure 9
Natural Gas Spot Price at Henry Hub
2016 dollars per million British thermal units



The EIA forecast a range of possible natural gas prices ranging from slightly under \$4 per MMBtu to slightly under \$10 per MMBtu in 2030. *Source:* U.S. Energy Information Administration, [Annual Energy Outlook 2017](#), January 5, 2017.

⁵⁹ Rachel Pannett, *supra* note 5.

⁶⁰ John Kemp, "[Column: U.S. Natural Gas Prices Tumble as Power Producers Switch Back to Coal](#)," *Reuters*, June 5, 2017.

⁶¹ U.S. Energy Information Administration, "[Natural Gas](#)" (website), October 18, 2017.

⁶² U.S. Energy Information Administration, "[Coal Markets](#)" (website), October 23, 2017.

⁶³ Management Information Services Incorporated, "[Analyzing and Estimating the Economic and Job Benefits of U.S. Coal](#)," prepared for the U.S. Department of Energy, September 2017.

Part Three

Prudence in Utility Regulation

In the public utility sector, with all the volatility and policy uncertainties, a concept referred to as “prudence” has emerged as a principle central to the theory and practice of utility regulation.⁶⁴ At its core, prudence means utilities should maintain a diversified portfolio of energy resources, just as prudent individuals maintain diversified investments in their retirement portfolios. Don’t put all your eggs in one basket!

Prudence means utilities should maintain a diversified portfolio of energy resources, just as prudent individuals maintain diversified investments in their retirement portfolios.

Regulators at the state and local level are charged with ensuring the efficient and economic management of electric utilities. Prudence guides them in achieving those goals.⁶⁵ Prudence means balancing risks and costs. It directs public utilities in their resource planning and energy generation choices to ensure they can deliver reliable

and low-cost electricity to consumers.⁶⁶ Prudence requires maintaining the diversity of dependable electricity generation sources such as coal and nuclear power. The anti-coal policies of California and South Australia are textbook examples of what happens when prudence is ignored.

It is important not to confuse “prudence” with the so-called “precautionary principle.” The latter is the notion that if products or technologies pose any imaginable risks—often highly speculative or vague ones unsupported by any sound science—then such products or technologies should be severely restricted, regulated, or banned. “Precaution” is “never try anything for the first time.” The burden is placed on innovators to prove no harm to humans will result from their innovations.

“Prudence” is progressive and responsible. “Precaution” is regressive and highly irresponsible in not accounting for the damage done by restraint, for example, by eliminating coal from the energy mix.

A. Dealing with Volatility

The widespread use of coal-fired power plants was the result of prudent planning in the 1970s. During that decade, the United States was using an increasing amount of oil, including oil

⁶⁴ Janice A. Beecher, [“The Prudent Regulator: Politics, Independence, Ethics, and The Public Interest,”](#) *Energy Law Journal*, November 2, 2008; Frank C. Graves, James A. Read, and Joseph B. Wharton, [Resource Planning and Procurement In Evolving Electricity Markets](#), Edison Electric Institute, January 31, 2004.

⁶⁵ Karl McDermott, [Cost of Service Regulation in the Investor-Owned Electric Utility Industry](#), Edison Electric Institute, June 2012.

⁶⁶ Scott Hempling, [“Prudence: Who’s Minding the Store?”](#) *Effective Regulation of Public Utilities*, January 2011.

imported from foreign countries, to generate electricity to meet rapidly growing demand. The share of electricity generated from oil peaked in the late 1970s at more than 20 percent of the share of electricity generated using fossil fuels.⁶⁷ (See Figure 10.) The Arab oil embargos and international political volatility during that decade led to shortages at gas pumps and price spikes and swings for all uses of oil, including for electricity generation.

Figure 10
Annual Share of Fossil-Fuel-Fired Electric Power Generation
1950–2012

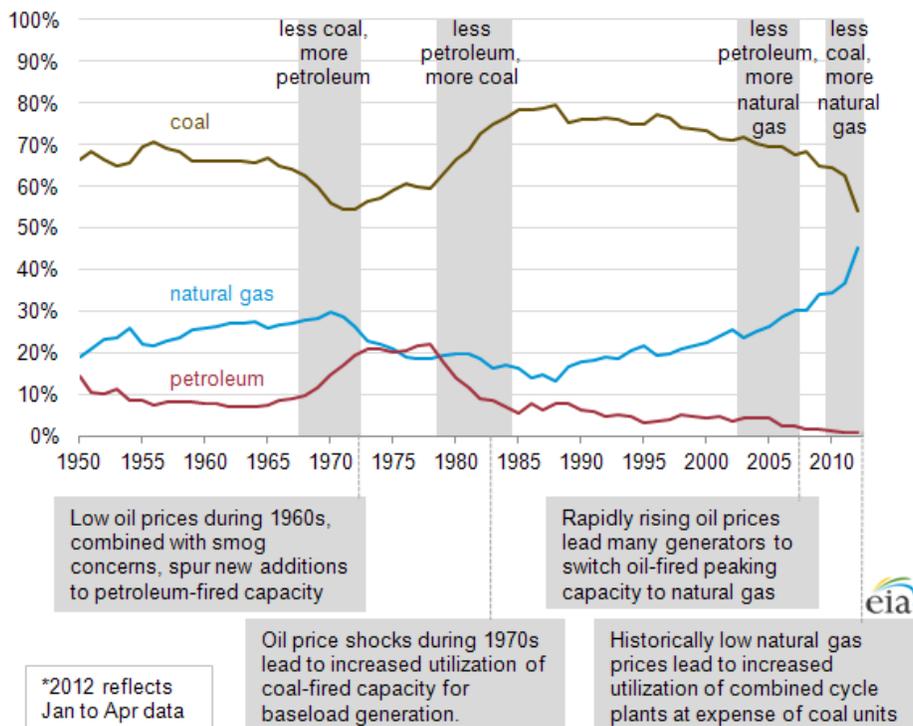


Figure 10 shows the percentage of fossil fuels used to generate electricity since 1950, but does not show all sources such as nuclear. The use of coal, oil, and natural gas for electricity generation has fluctuated over time in response to price signals and pollution concerns. Oil constituted a significant portion of the electricity generation market until the Arab Oil Embargo incentivized the construction of more coal-fired power plants. *Source:* U.S. Energy Information Administration, [“Competition Among Fuels for Power Generation Driven by Changes in Fuel Prices,”](#) *Today in Energy*, July 13, 2012.

The turmoil and economic damage caused by a growing dependence on foreign oil led U.S. policymakers to conclude the domestic electricity supply should not be subject to the whims of foreign oil ministers. In response, they implemented policies that made possible increased utilization of the country’s abundant coal resources.

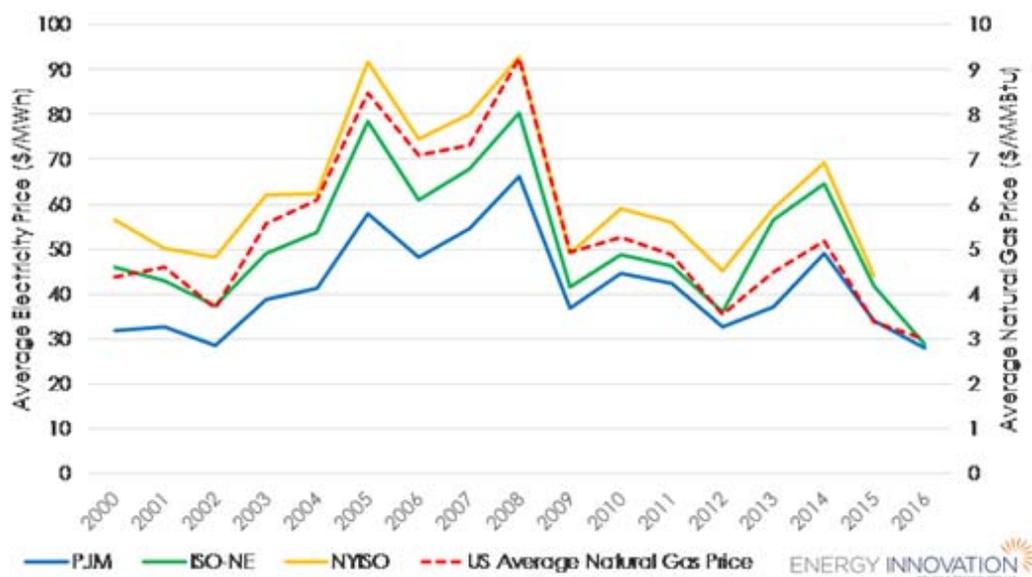
⁶⁷ U.S. Energy Information Administration, [“Competition Among Fuels for Power Generation Driven by Changes in Fuel Prices,”](#) *Today in Energy* (website), July 13, 2012.

As Figure 10 shows, the share of electricity generated by coal peaked at 56 percent in the late 1980s. With coal playing the major role in the U.S. power generation mix, industry and consumers had access to low-cost electricity not subject to international political threats.

B. The Role of Natural Gas

The U.S. electricity market has changed over the past two decades. Natural gas prices have been a primary driver of the country’s average annual electricity prices since 2000. Figure 11 shows various electricity price indices, all demonstrating electricity prices closely mirror natural gas prices. Notice the Independent Systems Operator (ISO-NE) index, which represents wholesale electricity markets in New England states, and NYISO, which represents wholesale electricity markets in New York, have higher electricity prices than PJM, a 13-state wholesale electricity market.⁶⁸ This is because New York and New England have virtually eliminated coal from their generation mixes, whereas PJM has a diverse fuel supply.

Figure 11
Natural Gas Prices Are Primary Driver of Average Annual Electricity Price



Electricity prices are heavily influenced by the price of natural gas. However, states with a higher dependency on natural gas have experienced higher electricity prices than those with a generation portfolio that also contains coal. The yellow line indicates electricity prices in NYISO, the red, dotted line indicates natural gas prices, the green line shows electricity prices in New England, and the blue line shows electricity prices in PJM. Source: Robbie Orvis, “[The State of the US Wholesale Power Markets: Is Reliability at Risk From Low Prices?](#)” *Utility Dive* (website), May 22, 2017.

⁶⁸ Robbie Orvis, “[The State of the US Wholesale Power Markets: Is Reliability at Risk From Low Prices?](#)” *Utility Dive* (website), May 22, 2017.

Natural gas-dependent states have seen electricity prices fall as natural gas supplies have become less expensive and more plentiful as a result of hydraulic fracturing. That is likely to change as demand catches up with supply. Allan S. Armstrong, CEO of Williams, a major natural gas pipeline company, forecasts U.S. natural gas demand will grow by 20 bcf/day between 2016 and 2021, an increase of approximately 26.5 percent.⁶⁹

With that increase in demand, natural gas prices may not stay below \$3 per thousand cubic feet (mcf) in the coming years. In addition, as demand increases supplies may taper off: On average, natural gas production from new wells falls by as much as 70 percent within 18 months. That means more wells will need to be drilled to maintain output, requiring more capital and putting upward pressure on future prices.

Armstrong predicts the break-even cost for extracting gas from shale will approach \$4 per mcf. Full costs, including capital and return on investment, will approach \$5 per mcf. At current pricing levels of \$3 per mcf, new natural gas electric generating units look attractive. At \$5 per mcf, they are not, and electric prices can be expected to rise. With rising prices for natural gas, prudent public utilities will look to less costly sources of electricity for their energy mix. Inexpensive coal would be a first choice if governments allow utilities to choose coal.

With rising prices for natural gas, prudent public utilities will look to less costly sources of electricity for their energy mix. Inexpensive coal would be a first choice if governments allow utilities to choose coal.

Prudent utilities and policymakers will also consider the effects of LNG exports on domestic natural gas markets. Armstrong projects natural gas exports will increase to 2.3 tcf/year from 2016 to 2021, an amount representing approximately 8.3 percent of current gas domestic consumption.⁷⁰

Such exports are a manifestation of the health of the U.S. natural gas sector, which employs American workers and makes America a driving force in international energy markets. But many large domestic natural gas users in the chemical and refining industries fear exports could mean natural gas price hikes from \$1/mcf to \$10/mcf within the next decade.⁷¹ The prospect of such price hikes clearly should inform utility electricity-sourcing decisions and highlights the need for access to coal-generated electricity.

⁶⁹ Alan Armstrong, [Strategy and Principles Foundation for Natural Gas Infrastructure Leadership](#), Barclays CEO Energy-Power Conference, September 6, 2017.

⁷⁰ *Ibid.*

⁷¹ Robert Walton, ["U.S. Poised to Become Leader in Gas Exports, But Some Fear Price Impacts,"](#) *Utility Dive* (website), August 11, 2017.

C. China and Carbon Dioxide

When tempted to shut down the domestic coal sector in the name of reducing carbon dioxide, U.S. policymakers should pay attention to China's energy policies. Chinese companies are building or planning to build more than 700 new coal-fired power plants over the next decade.⁷² Most of the plants will be built in China, but about one-fifth will be built in other countries. All told, some 1,600 coal plants are planned or under construction in 62 countries worldwide.⁷³

Driving coal-generated electricity out of the market, and thus relying too heavily on natural gas and intermittent renewable sources, will make the electricity supply less reliable and increase energy costs for consumers.

The CO₂ emitted by these new facilities will dwarf any reductions in emissions resulting from closing coal-fired power plants in the United States. Chinese CO₂ emissions are expected to peak sometime around 2030.⁷⁴ Even if CO₂ emissions are a concern,⁷⁵ it is imprudent for the United States to shutter its coal-fired power plants when China and India are rapidly

expanding coal-fired generation. Doing so would threaten the reliability and affordability of the U.S. electricity supply while providing no environmental benefit.

Driving coal-generated electricity out of the market, and thus relying too heavily on natural gas and intermittent renewable sources, will make the electricity supply less reliable and increase energy costs for consumers. Increasing electricity costs disproportionately harm low-income households⁷⁶ and increase the costs for schools, hospitals, and businesses.

Part Four Analysis of the Department of Energy Study

The U.S. Department of Energy (DOE) released a study in August 2017 examining electricity markets and the reliability of the nation's power grid.⁷⁷ The study sought to determine factors affecting the closure of baseload coal-fired and nuclear power plants, specifically how federal policy interventions and changing fuel mixes have affected wholesale power markets.

⁷² Hiroko Tabuchi, "[As Beijing Joins Climate Fight, Chinese Coal Companies Build Coal Plants](#)," *The New York Times*, July 1, 2017.

⁷³ *Ibid.*

⁷⁴ "[China CO₂ Emissions to Rise by One Third Before 2030 Peak – Study](#)," Reuters, November 14, 2014.

⁷⁵ There are plenty of reasons to believe carbon dioxide emissions into the atmosphere are not something policymakers should be concerned about. See, for example, Pat Michaels and Chip Knappenberger, "[Climate Models Versus Climate Reality](#)," *Climate Etc.* (blog), December 17, 2015; and John C. Fyfe *et al.*, "[Making Sense of the Early-2000s Warming Slowdown](#)," *Nature Climate Change*, February 24, 2016.

⁷⁶ Adam Chandler, "[Where the Poor Spend More Than 10 Percent of Their Income on Energy](#)," *The Atlantic*, June 8, 2016.

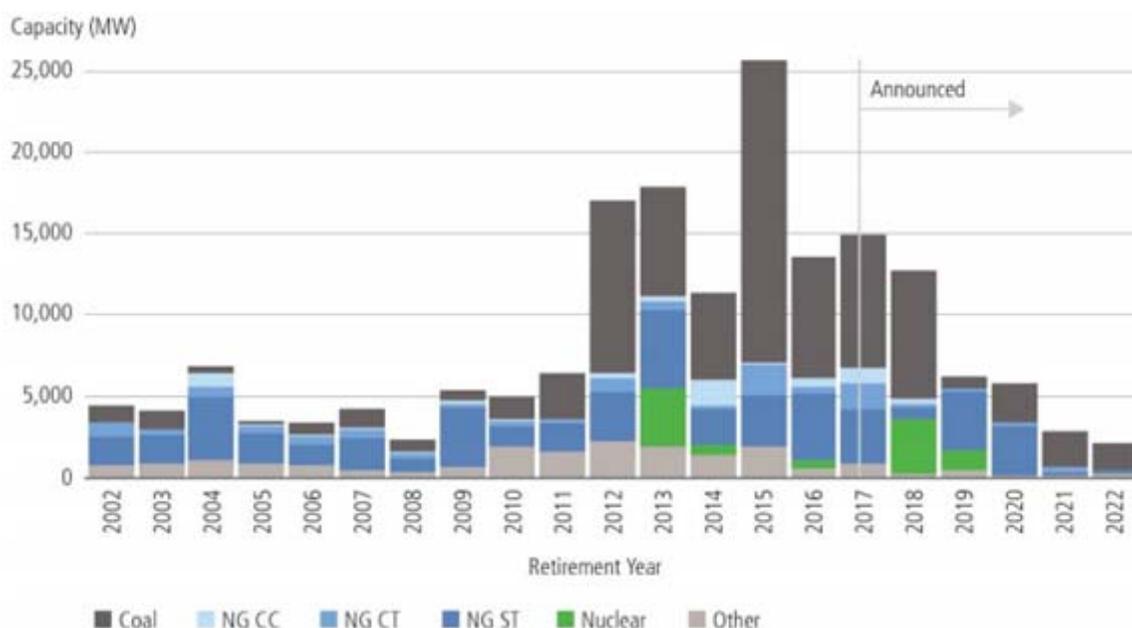
⁷⁷ U.S. Department of Energy, *supra* note 6.

The DOE study found low natural gas prices and flat power demand were the primary drivers of nuclear and coal-fired power plant retirements. Those factors resulted largely from changing market forces and are not primarily due to government policy. However, the study also concluded Obama-era regulations on coal-fired power plants and subsidies provided to intermittent sources of energy such as wind and solar have played a large role in the retirement of baseload power plants.

A. Role of Regulations

According to the study, the largest number of coal plant retirements occurred in 2015—the deadline year for coal- and oil-fired power plants to add pollution control equipment for compliance with the Mercury and Air Toxics Standard (MATS) (see Figure 12). MATS was struck down by the U.S. Supreme Court as too costly⁷⁸ but later reissued by EPA.

Figure 12
Retirements of Coal, Natural Gas, Nuclear, and Other Generating Units
2002–2022



The rate of retirement for coal unit closures has dramatically increased since 2012. These closures reached their highest level in 2015 in response to the implementation of Mercury Air Toxics Rule (which was ultimately struck down by the courts as too costly but was reissued by EPA) and the Clean Power Plan. *Source:* U.S Department of Energy, [Staff Report to the Secretary on Electricity Markets and Reliability](#), August 2017.

⁷⁸ Aaron Larson, "[Supreme Court Strikes Down EPA's MATS Rule](#)," *Power Magazine* (website), June 29, 2015.

Also in 2015, EPA finalized its Clean Power Plan, which, if fully implemented, would place additional pressure on coal-fired generation.⁷⁹

The DOE study recommended changes and encouraged EPA to allow coal-fired power plants to improve efficiency and reliability without triggering new regulatory approvals and associated costs.

B. Federal Subsidies for Wind and Solar Depress Wholesale Electricity Markets

In a cover letter accompanying the DOE report, Secretary of Energy Rick Perry wrote, “It is apparent that in today’s competitive markets certain regulations and subsidies are having a large impact on the functioning of markets, and thereby challenging our power generation mix.”⁸⁰ The report pulls up short of issuing policy recommendations based on those findings, essentially “punting” on this important issue.

A competitive wholesale electricity market essentially is an auction in which utilities select electricity generators to receive payments for generating electricity at a future date.⁸¹ Different

Heavily subsidized power generators, such as wind and solar, are able to submit bids that are artificially low, ensuring they will gain market share at the expense of low-cost nuclear and coal-fired power plants.

generators, which often have different generation methods, submit bids to win these contracts. In this way, wholesale power markets are designed to facilitate competition among electricity generators and shift the risk of overpaying for capacity or over-procuring capacity from electricity customers to independent power producers.⁸²

Generators bid based on the amount of revenue they expect to need to make their operations economic. Heavily subsidized power generators, such as wind and solar, are able to submit bids that are artificially low: They count subsidies as revenue, so they need less revenue from the sale of the electricity. Those artificially low bids ensure the providers of intermittent energy will gain market share, at the expense of low-cost nuclear and coal-fired power plants.

Subsidies for wind and solar power mean nuclear and coal-fired power plants run fewer hours, which significantly reduces their revenue over time, prompting the early retirement of those plants. In other cases, low wholesale power prices have caused many power companies to leave

⁷⁹ Abby Harvey, [“DOE Grid Study Points Finger at Natural Gas,”](#) *Power Magazine* (website), August 24, 2017.

⁸⁰ Rick Perry, [letter accompanying Department of Energy report](#), August 23, 2017.

⁸¹ Robbie Orvis and Eric Gimon, [“The State of Wholesale Power Markets: What’s Wrong with Proposed Changes in Eastern RTO’s,”](#) *Utility Dive* (website), June 20, 2017. See also Isaac Orr and Fred Palmer, “Public Policy and Coal-Fired Power Plants,” *Heartland Policy Study* No. 147, The Heartland Institute, forthcoming November 2017.

⁸² *Ibid.*

their coal facilities idle for large portions of the year. The Energy Information Administration estimates U.S. coal plant run times averaged 52 percent in 2016, down from almost 60 percent in 2013.⁸³

Lower run times adversely affect coal facilities because they generally shoulder high fixed operating costs, including large payrolls, maintenance, and fuel supply bills. Those fixed costs are generally manageable when wholesale electricity prices are driven by market forces and coal plants can sell electricity to willing customers. But when wholesale prices are artificially low, unsubsidized coal facilities cannot compete with subsidized renewables. The coal facilities will be shuttered for long periods of time or closed completely, causing their capacity to exit the market. (The effect of federal subsidies and state renewable energy mandates is discussed further in *Heartland Policy Study* No. 147, “Public Policy and Coal-Fired Power Plants.”)

The retirement of these coal-fired units will reduce the current overcapacity, and electricity prices will rise as the market “rebalances.”⁸⁴ At that time, because baseload coal generation units will have been forced out of the market, the only remaining generating units will be natural gas and intermittent sources such as wind

With every coal plant that retires because of regulations, the risk to human health and welfare increases as the capacity of public utilities to provide low cost electricity at affordable prices decreases.

and solar. The market will see increasing electricity prices because new natural gas, wind, and solar are, on average, more expensive to operate than existing coal-fired power plants. Moreover, as experienced in Australia, the intermittency of these sources can cause electricity prices to spike, putting at great risk the future affordability and reliability of the power grid.

The week after the DOE study was issued, Xcel announced the retirement of two coal plants in Colorado, to be replaced with renewables and natural gas.⁸⁵ In Illinois, the chairman of the Lake County Board of Commissioners recently announced an alliance with the Sierra Club to force NRG, one of the largest power companies in the United States, to shut a coal plant in the county.⁸⁶ Those plant retirements were not anticipated.

While the DOE study does offer useful recommendations for the Federal Energy Regulatory Commission to enhance the value of existing coal plants, the report largely blesses the status quo with respect to current generation and the closures underway. While it acknowledged problems with the current situation, it demonstrated no sense of urgency for dealing with them. DOE appeared not to take into account a 150-page report issued in May 2014 by the National Coal Council, which offered an assessment of measures to “improve reliability and efficiency” of the nation’s energy supply while reducing emissions from coal-fired power plants.⁸⁷

⁸³ Benjamin Storrow, *supra* note 2.

⁸⁴ Robbie Orvis and Eric Gimon, *supra* note 81.

⁸⁵ William Yeatman and Amy Oliver Cooke, “[The Math Behind Xcel ‘Colorado Energy Plan’ Defies Reality and History](#),” *The Greely Tribune*, September 19, 2017.

⁸⁶ Emily Coleman, “Lake County Chairman Set Goals To Address Climate Change, Urges Retiring Waukegan Coal Plant,” [Chicago Tribune](#), August 25, 2017.

⁸⁷ The National Coal Council, [Reliable & Resilient: The Value of Our Existing Coal Fleet](#), May 2014.

DOE's first look at how to preserve baseload generators, including coal-fired power plants, left much to be desired. The country might not face an immediate energy emergency, but public policy is creating one. With every coal plant that retires because of regulations, the risk to human health and welfare increases as the capacity of public utilities to provide low cost electricity at affordable prices decreases.

Part Five Concluding Insights

More than 250 coal-fired power plants have retired since 2010 due to EPA regulations and competition from low-cost natural gas. While most were older, smaller units, more of those scheduled for retirement in the future are newer, more efficient facilities that could still be providing low-cost, reliable electricity to consumers, businesses, and industries alike, but for government policies meant to shut them down.

Government subsidies and policies to promote renewable energy such as wind and solar are rationalized as ways to reduce CO₂ emissions in order to head off global warming. Yet the science behind the global warming fears is anything but settled and the reductions will be inconsequential in the context of construction of new coal-fired facilities overseas.

Unlike the asserted threat of global warming, the threat to the country's energy supply posed by the premature retirement of coal-fired power plants is certain.

Unlike the asserted threat of global warming, the threat to the country's energy supply posed by the premature retirement of coal-fired power plants is certain. Renewable sources of electricity are costly and less reliable than fossil fuels, especially coal. Moreover, the growth of U.S. natural gas supplies, as

beneficial as this is, does not obviate the need for coal, America's most abundant energy resource.

The damage is being done and will only grow in the future if the war on coal continues. The damage is real, with millions of real individuals being harmed. Policymakers who truly have the well-being of the citizens in mind must systematically identify and eliminate the federal as well and state and local regulations, subsidies, and mandates that stand in the way of a bright energy future. Future *Policy Studies* in this series will help.

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About the Authors

Isaac Orr is a research fellow for energy and environment policy at The Heartland Institute. Orr is a speaker, researcher, and writer specializing in hydraulic fracturing, frac sand mining, agricultural, and environmental policy issues. He graduated from the University of Wisconsin Eau Claire with studies in political science and geology, winning awards for his undergraduate geology research before taking a position as an aide in the Wisconsin State Senate, where he served as lead-office writer and as a policy advisor on frac sand mining and agricultural issues.

Since joining Heartland, Orr has written a *Heartland Policy Study* on fracking titled “[Hydraulic Fracturing: A Game-Changer for U.S. Energy and Economies](#)” and has coauthored multiple policy studies on frac sand mining, including “[Environmental Impacts of Industrial Silica Sand \(Frac Sand\) Mining](#)” and “[Economic Impacts of Industrial Silica Sand \(Frac Sand\) Mining](#).”

Orr’s writing has appeared in *The Wall Street Journal*, *USA Today*, the *New York Post*, *The Hill*, *Orange County Register*, and *Washington Times*. His work on fracking is also featured in *Alternative Energy and Shale Gas Encyclopedia*, published by John Wiley & Sons, Inc. He has recorded dozens of podcasts on energy and environment topics for Heartland.

Frederick D. Palmer is a senior fellow for energy and climate at The Heartland Institute. He served from 2001 through June 2015 as Peabody Energy’s senior vice president of government relations. He was Peabody’s representative on the Board of Directors of the World Coal Association and served as its chairman from November 2010 to November 2012. He also represented Peabody on the Board of the FutureGen Alliance from its formation until June 2015.

Prior to joining Peabody Energy, Palmer served as general counsel and chief executive officer of Western Fuels Association, Inc. He served on the Board of Directors of the National Mining Association and served as chair of the NMA Legal Committee. He began his career in 1969 in Washington, DC on the staff of Arizona Congressman Morris K. Udall and was a partner in a Washington, DC-based law firm. He was the 2004 recipient of the Erskine Ramsay Medal Award from the Society for Mining, Metallurgy and Exploration. He is a member of the National Coal Council, Executive Committee, and chairman of the Coal Policy Committee. He is a member of the California and DC Bar Associations.

Palmer attended the University of Arizona, where he earned a Bachelor of Arts degree in 1966 and Juris Doctorate with honors in 1969. He was inducted into the Order of the Coif honor society there in 1969 and served as Symposium Editor of the *Arizona Law Review*.

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