



THE UNSEEN COSTS OF COAL-GENERATED ELECTRICITY

Megan E. Hansen, BS, Strata Policy

Randy T Simmons, PhD, Utah State University

Ryan M. Yonk, PhD, Utah State University

INSTITUTE *of*
POLITICAL ECONOMY
UtahStateUniversity

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THE UNSEEN COSTS OF COAL-GENERATED ELECTRICITY

When governments interfere with markets, they often impose costs on producers, consumers and taxpayers. In this report, the Institute of Political Economy examined different factors that affect the cost of electricity, including government policies. The report is not an attempt to quantify how much each factor affects the cost of electricity, rather to identify and analyze factors that are often overlooked. Coal-generated electricity has both explicit and implicit costs. The explicit, or seen costs of coal-fired electricity, include cost components such as power plant development and construction, operation & maintenance, and transmission infrastructure costs. Often overlooked, however, are the implicit costs of coal-fired electricity, caused by pollution, government subsidies, mandates, and regulations that distort the electricity market.

In 1980, the United States generated about 50 percent of its electricity from burning coal, more than from any other energy source.¹ Today electricity from coal makes up an ever smaller portion of US electricity due to stringent regulations, competition from natural gas, and political disfavor.² In 2014, only 39 percent of US electricity came from coal.³

Coal-fired electricity has social and environmental costs, and policymakers have enacted federal regulations intended to minimize those impacts. Many policies discourage the use of coal, but just like other forms of electricity generation, coal receives federal support in the form of tax credits and subsidies. These forms of support distort the energy market.

¹ The Shift Project. n.d. "Breakdown of Electricity Generation by Source." Retrieved from: <http://www.tsp-data-portal.org/Breakdown-of-Electricity-Generation-by-Energy-Source#tspQvChart>

² Energy Information Administration (EIA). 2015, March. "Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013." Pg. xix and xxi. Retrieved from: <http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf>

³ Martinson, E. 2015, April 16. "The Fall of Coal." Politico. Retrieved from: <http://www.politico.com/story/2015/04/coal->

Policymakers often overlook the economic consequences of policies intended to both encourage and discourage coal use. Federal interference increases the tax burden on US citizens and disguises the actual cost of coal-generated electricity. In estimating the cost of generating electricity from coal, policymakers should consider the unseen costs and unintended consequences of federal support.

EXPLICIT (SEEN) COSTS

A common metric for comparing the cost of electricity from different technologies and fuels is the levelized cost of electricity (LCOE). The LCOE is the sum of estimated lifetime capital costs, operations and maintenance costs, and transmission investment. The explicit costs of coal are the four main components of its LCOE. These costs are distributed over the estimated lifetime of an energy plant and are related in terms of dollars per megawatt-hour.⁴

Capital costs and operations and maintenance (O&M) costs are the largest cost components of generating electricity from coal. The third is coal's capacity factor, which is a measurement of how much electricity a coal plant generates as a percentage of its maximum output capacity.⁵ Finally, the cost of electricity generated from coal is also affected by transmission costs.

Electricity generated from dispatchable and non-dispatchable sources is not directly comparable. Production from dispatchable sources, such as coal and natural gas, can be scaled up or down to meet demand. Production from non-dispatchable energy sources, such as wind and solar, cannot be increased relative to demand. Therefore, as the Energy Information Administration (EIA) notes in the *AEO* report, the

[power-plants-epa-regulations-117011.html](http://www.eia.gov/power-plants-epa-regulations-117011.html)

⁴ U.S. Energy Information Administration. 2015, June 3. "Annual Energy Outlook 2015: Levelized cost and levelized avoided cost of new generation resources in the Annual Energy Outlook 2015." Retrieved from:

http://www.eia.gov/forecasts/aeo/electricity_generation.cfm

⁵ The capacity factor used in calculating cost estimates has a strong effect on how affordable a given energy technology appears to be.

levelized costs of dispatchable and non-dispatchable technologies are not comparable.⁶

IMPLICIT (UNSEEN) COSTS

Implicit costs are costs that are not included in explicit cost factors. As stated earlier, implicit costs include pollution, government subsidies, mandates, and regulations.

SOCIAL AND ENVIRONMENTAL COSTS

One of the key justifications for government intervention in the energy market is to address social and environmental costs. An accurate estimate of the cost of producing electricity should include health and environmental costs imposed on society that are not borne by producers or consumers, often known as externalities. Social and environmental costs include potential health problems that power plants create for the nearby population, negative effects of energy production on the environment, and effects on global climate change.

Coal-fired power plants produce several airborne pollutants proven to be harmful to human health, including sulfur dioxide (SO₂) and nitrogen oxides (NO_x).⁷ These gases are not only harmful on their own, they can also react with other gases and chemicals in the atmosphere to act as an additional source of

particulate matter, which is also harmful to human health.⁸ The Environmental Protection Agency (EPA) has regulated these emissions since the Clean Air Act was passed in 1970, and continues to enforce regulations dictating the amount of these emissions coal plants can produce. Both the costs of the pollution, and the regulation to control it, are implicit costs that can increase the cost of coal.

THE CLEAN POWER PLAN

The EPA has set carbon emission standards for all coal-fired power plants. Known as the Clean Power Plan (CPP), these standards will require electric utilities to reduce carbon emissions to 32 percent below the recorded levels from the year 2005 by 2030. The EPA cites global climate change as its justification for regulating CO₂ emissions, claiming that the CPP will not only mitigate environmental costs, but also create economic benefits.¹⁰ This is a contentious issue, and different assumptions lead to different estimates of the costs or benefits of the CPP, including estimates that project massive costs.

Widely cited cost estimates of the draft CPP showcase the radical divergence in the CPP's expected effects, with estimates ranging from \$53 billion in benefits, to \$479 billion in costs. The wide range in findings of these studies demonstrate the high level of uncertainty regarding what the effects of the CPP will actually be.

⁶ The levelized fixed costs assigned to non-dispatchable technologies are not 1:1 substitutes for the levelized fixed cost of dispatchable technologies. Rather, the more non-dispatchable electricity that is produced, the higher the levelized fixed cost of the dispatchable sources from which the non-dispatchable sources derive market share; U.S. Energy Information Administration. 2015, June 3. "Annual Energy Outlook 2015: Levelized cost and levelized avoided cost of new generation resources in the Annual Energy Outlook 2015." Retrieved from: http://www.eia.gov/forecasts/aeo/electricity_generation.cfm

⁷ U.S. Energy Information Administration. 2013, February 27. "Power plant emissions of sulfur dioxide and nitrogen oxides continue to decline in 2012" Retrieved from: <http://www.eia.gov/todayinenergy/detail.cfm?id=10151>

⁸ Environmental Protection Agency (EPA). 2015. "Air Trends: Basic Information." Retrieved from: <http://www.epa.gov/airtrends/sixpoll.html>

⁹ Environmental Protection Agency. 2015, August 3. "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units." Pg. 16. Retrieved from:

<http://www2.epa.gov/sites/production/files/2015-08/documents/cpp-final-rule.pdf>

¹⁰ EPA. 2014. "Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants". p. ES-18 to ES-19 Retrieved from: <http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf>

¹¹ Natural Resources Defense Council (NRDC). 2014, March. "Cleaner and Cheaper: Using the Clean Air Act to Sharply Reduce Carbon Pollution from Existing Power Plants, Delivering Health, Environmental, and Economic Benefits." Pg. 2. Retrieved from: <http://www.nrdc.org/air/pollution-standards/files/pollution-standards-IB-update.pdf>; NERA Economic Consulting. 2014, October. "Potential Energy Impacts of the EPA Proposed Clean Power Plan." Pg. S-7. Retrieved from: http://www.nera.com/content/dam/nera/publications/2014/NERA_ACCCE_CPP_Final_10.17.2014.pdf

Analysts have attempted to price carbon emissions based on their social and environmental effects. Estimates for the proper tax on carbon emissions vary widely—from \$5 to \$100 per ton—while estimates for the damages caused by carbon dioxide range from \$5 to \$35 per ton.¹² The high degree of uncertainty involved in the calculation of social and environmental costs of carbon makes them difficult to precisely quantify. However, the difficulty and imprecision of quantifying the cost does not imply that there is no cost, just that we do not know what that cost is.¹³

THE EFFECT OF REGULATION

Regulations and subsidies increase the cost of coal-generated electricity. Regulation often forces coal-fueled power plants to adopt stringent environmental standards, the cost of which is passed on to electricity consumers. Plants that are not capable of adapting must close, reducing the supply of electricity from existing plants.

Adapting a coal plant to meet goals for carbon capture—the process of removing carbon from the atmosphere and preventing it from entering the atmosphere—is expensive. A 2010 report from the US Department of Energy estimated carbon capture and storage could increase the cost of electricity for conventional coal production by 80 percent.¹⁴ These additional costs of carbon capture represent unseen or implicit costs that should be included in the cost of coal-generated electricity.

Because of costs imposed by federal and state environmental regulations, coal plants are being closed years before their lifecycles would normally conclude. A Politico analysis of data from the EIA found that from 2012 to 2015 at least 58 coal plants had either fully or partially shut down, taking 16,000

megawatts of capacity off the grid.¹⁵ That same analysis estimates that in the next eight years, 76 more plants are expected to close, taking 28,000 megawatts of capacity with them.¹⁶

Increasingly stringent regulation of coal-generated electricity, such as the Clean Power Plan, increases the cost of new coal to the point where it is so expensive that almost no new coal capacity is expected to be built in the next decade.¹⁷ When regulations force coal power out of the market to be replaced with natural gas, coal, or wind, the added costs of building new generation capabilities are passed on to consumers and represent a hidden cost of generating electricity from coal.

FEDERAL SUPPORT

The cost of federal policies that favor specific industries represents another implicit cost. The electricity sector receives two general forms of support from the federal government: tax expenditures, which reduce the amount of taxes an organization or individual pays, and direct expenditures, which provide direct cash outlays to energy producers and consumers. Although modern coal production receives less federal support than renewable energies, this support should still be included in an accurate estimate of the cost of coal-generated electricity.

The coal industry has a long history of receiving support from the federal government. Taxpayers for Common Sense, a non-profit research organization, calculates that from 1950 to 2008, around \$72 billion, measured in constant 2007 dollars, in federal support was awarded to the coal industry from the federal government. The \$72 billion was a combination of tax expenditures, research and development grants, and direct expenditures.¹⁸ Since 2010, support for fossil

¹² Litterman, B. 2013. "What Is the Right Price for Carbon Emissions?" CATO; Regulation: Energy & Environment. Pg. 38. Retrieved from: <http://object.cato.org/sites/cato.org/files/serials/files/regulation/2013/6/regulation-v36n2-1-1.pdf>

¹³ Establishing an accurate measure of the social cost of carbon, while important, is outside the scope of this report; *Ibid*.

¹⁴ U.S. Department of Energy (DOE) and U.S. National Energy Technology Laboratory (NETL). 2010. "DOE/NETL Carbon Dioxide Capture and Storage RD&D Roadmap." Pg. 3. Retrieved from: <http://www.netl.doe.gov/File%20Library/Research/Carbon%20Se>

<q/Reference%20Shelf/CCSRoadmap.pdf>

¹⁵ Martinson, E. 2015. April 16. "The Fall of Coal." Politico. Retrieved from: <http://www.politico.com/story/2015/04/coal-power-plants-epa-regulations-117011.html>

¹⁶ Martinson, E. 2015. April 16. "The Fall of Coal." Politico. Retrieved from: <http://www.politico.com/story/2015/04/coal-power-plants-epa-regulations-117011.html>

¹⁷ Martinson, E. 2015. April 16. "The Fall of Coal." Politico. Retrieved from: <http://www.politico.com/story/2015/04/coal-power-plants-epa-regulations-117011.html>

¹⁸ Taxpayers for Common Sense. 2009. "Coal: A Long History of

fuels has slightly decreased while support for renewable energy has grown.¹⁹

TAX EXPENDITURES

Tax expenditures make up the largest type of federal support for coal electricity, at \$779 million in fiscal year 2013.²⁰ Some modern subsidies and tax breaks for coal are aimed at minimizing the environmental impact of using coal for electricity production. For example, Clean Coal Tax Credits--which incentivize coal producers to invest in clean coal technology--accounted for \$3.4 billion in subsidies for the coal industry in 2009.²¹

Tax expenditures typically take the form of either a tax deduction or tax credit, each of which artificially lowers the cost of production. Tax deductions are special exemptions and accounting measures that lessen a company's tax burden by reducing the amount they must pay if they meet specific standards, such as implementing clean coal technology. Deductions allow companies to retain possession of a larger portion of their profits, creating a net revenue loss for the government, and ultimately taxpayers.²²

The Energy Policy Act of 2005 (EPAAct) uses both tax deductions and tax credits to encourage the coal industry to invest in technologies that reduce the negative environmental impacts of coal-generated electricity. Under the EPAAct, companies can amortize--or gradually write off the initial cost of--mandated pollution control equipment through a tax deduction, and also gain tax credits for investments in clean coal facilities. Of the total \$779 million 2013 tax

expenditures on coal, the amortization of pollution control equipment accounted for \$400 million.²³

GRANTS

Grants given to the coal industry are designed to incentivize the research and development of cleaner and more efficient methods of generating electricity from coal. These grants encourage coal companies to invest in researching clean technology when they may otherwise be reluctant to do so. Research and development have historically made up the largest share of grants received by the coal industry. From 1950 to 2009, the federal government granted almost \$34 billion in research and development.²⁴

STATE POLICIES

States have also enacted policies that encourage or discourage the production of electricity from coal. These policies represent another implicit, or unseen, cost that should be considered by policymakers. There is no uniform trend among state-level coal policies. In some states, coal generates most of the state's electricity and employs a large portion of the state's workforce. These states tend to enact coal-friendly policies.

Other states, usually those that generate low amounts electricity from coal, can pass anti-coal policies with little political cost and great political gain, often citing the negative environmental consequences of mining and burning coal as justification. These states often enact regulations and subsidies for renewables, including renewable portfolio standards, that are meant to replace coal. In these states coal's use is

Subsidies." Retrieved from:

http://www.taxpayer.net/images/uploads/downloads/Coal_subsidies_factsheet_2009.pdf

¹⁹ U.S. Energy Information Administration (EIA). 2015, March 13.

"Total energy subsidies decline since 2010, with changes in support across fuel types." Retrieved from:

<http://www.eia.gov/todayinenergy/detail.cfm?id=20352>

²⁰ Energy Information Administration (EIA). 2015, March 23.

"Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2015." Pg. 11, Retrieved from:

<http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf>

²¹ Taxpayers for Common Sense. 2009. "Coal: A Long History of Subsidies." Retrieved from:

http://www.taxpayer.net/images/uploads/downloads/Coal_subsidies_factsheet_2009.pdf

[dies_factsheet_2009.pdf](#)

²² Batchelder, L. 2009, July 17. "Tax Expenditures: What are they and how are they structured?" Tax Policy Center (TPC). Retrieved from: <http://www.taxpolicycenter.org/briefing-book/background/shelters/expenditures.cfm>

²³ Energy Information Administration (EIA). 2013, March. "Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013." Pg. 11-12. Retrieved from:

<http://199.36.140.204/analysis/requests/subsidy/pdf/subsidy.pdf>

²⁴ Taxpayers for Common Sense. 2009. "Coal: A Long History of Subsidies." Pg. 2. Retrieved from:

http://www.taxpayer.net/images/uploads/downloads/Coal_subsidies_factsheet_2009.pdf

being restricted, driving up the cost of producing electricity from coal. Both policies that encourage the use of coal, as well as those that discourage it should be included as unseen costs of coal-generated electricity.

CONCLUSION

Coal is one of the least expensive and most reliable methods of generating electricity today. Because of the environmental impacts of generating electricity from coal, federal and state governments have enacted regulations, subsidies, and mandates that seek to reduce the amount of electricity generated from coal in favor of renewables. These renewable alternatives, however, are often more expensive and less reliable sources of energy.

Government intervention increases the unseen costs of generating electricity from coal. Because these costs are often unseen, this limits the ability of individual consumers to make decisions about electricity. Subsidies, mandates, and regulations burden US taxpayers and electricity consumers with unwanted costs, and discourage innovation in energy technology. If US policymakers were to leave financial resources to market forces instead of attempting to anticipate America's energy needs, taxpayers and electricity consumers alike would benefit.

Capital Costs		Subsidies	
O & M		Regulations	
Capacity Factor		Mandates	
Transmission Costs		Less Reliable Alternatives	
		Social and Environmental Costs	
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Explicit Costs	+	Implicit Costs	= The Overall Cost of Coal