ON MATTERS THAT MATTER

U.S. Energy Production Subsidies: A Distorted Playing Field

November 2015

An Occasional Essay on Matters that Matter

U.S. Energy Production Subsidies: A Distorted Playing Field

As private equity investors in selected environmental markets in North America, NewWorld Capital Group publishes occasional essays on matters that matter in our investment strategy. We seek to present an analysis of the forces at work shaping investment opportunities and risks in our target markets and in the broader environmental opportunities sector.

Throughout the 1900s and into the 21st century, energy production subsidies have occupied a prominent place in U.S. industrial policy, whether for fossil fuels, nuclear, or renewables. So too have consumer subsidies for energy long held sway in America, as they do in many other parts of the world.[1] U.S. government subsidies for traditional energy production—oil, natural gas, coal, and nuclear—are still enshrined in the tax code and drive other policies, even after roughly 100 years of industrial development. Since the early 20th century, U.S. subsidies for oil, natural gas, coal, and nuclear have added up over time to total hundreds of billions of dollars in taxpayer-funded support.

While there is widespread commentary and discussion on the relative financial support provided to traditional energy production versus renewables, the level of financial support enjoyed by the fossil fuel industry in any given year matters far less than considering the cumulative effect of these subsidies on America's energy base over the longer term. Indeed, subsidized energy production—historically, fossil fuels—has shaped today's economy, particularly with respect to electricity.[2] An entire economic system has arisen on top of longstanding traditional energy production subsidies, powering America's electricity and transportation sectors while encouraging continued dependence on carbon-intensive fossil fuels.

[1] In this essay, we focus on producer subsidies and exclude consideration of consumer subsidies. Energy subsidies may be divided into consumer and producer subsidies, but their net effect is similar. Indeed, the majority of fossil fuel subsidies affect the end user price and, therefore, the quantity consumed through their impact on the demand and supply of different fossil fuels. See, for example, Ambrus Bárány and Dalia Grigonytė, "Measuring Fossil Fuel Subsidies," *ECFIN Brief* 40, March 2015, http://ec.europa.eu/economy_finance/publications/economic_briefs/2015/pdf/eb40_en.pdf.

[2] In this essay, we define traditional energy production as fossil fuels (oil, natural gas, coal) as well as nuclear, as all these industries received—and continue to implicitly or explicitly receive—massive government support, relative to renewables like wind and solar. Though still an important part of today's electricity mix in the United States, nuclear energy was largely a government activity in the post-World War II era and throughout the Cold War. It received substantial government financial support, but is not a growing industry today in the United States.

Electricity production in the United States is an uneven playing field, where preferences for incumbent energy production technologies have become deeply institutionalized. Whether through artificially low hydrocarbon fuel costs, existing infrastructure that promotes centralized electricity generation, or other regulatory regimes that reduce the cost of deploying traditional means of electricity production, the electricity grid has evolved to advantage non-renewable power generation. Today's electric grid is a natural monopoly, for it would be prohibitively expensive to have multiple overlapping grids in any region.[3]

Alternative forms of energy production, such as renewable power generation from wind and solar[4], thus face systemic disadvantages, many of which are due to historical government support for traditional energy production like fossil fuels or nuclear power. Like other forms of energy production, renewables have received critical government support through tax measures and other subsidies, particularly as the still-nascent industry has developed over the past few decades. Beginning in the mid-2000s, the cost of energy tax incentives for renewables began to rise,[5] and with it, renewables have begun to emerge as a significant force. But there are at least two key differences about government support for the renewable energy industry relative to other forms of traditional energy production: the support they have so far received is over a relatively short time period, and they are at a far earlier stage of industrial development.

Though many segments of the renewable energy market has seen rapid growth, renewables continue to face serious market barriers, including commercialization barriers such as competition with mature technologies, price distortions from existing subsidies and unequal tax burdens, and market barriers such as lack of access to sufficient capital. Further, although increased deployment of renewable energy is tied to further advances in technology, there are many social barriers that can affect renewable energy deployment, particularly after decades of underpriced fossil fuel energy and electricity. In addition, the failure of the market to value the public benefits of renewables persists.

Examining renewable energy subsidies in the context of fossil fuel subsidies thus yields insight into how smart subsidies should be tailored in at least four areas, as follows:

- Subsidies should be aimed at encouraging the development and scaling of emergent industries that are fundamentally important to the American economy.
- Subsidies should provide certainty over a reasonably long period of time in order to support long-dated corporate/investment decision-making.
- Energy production subsidies should be tied to certain market scaling targets, such as cost reductions or technology improvement.
- Subsidies should be designed with reasonable "sunsets" in order to encourage the achievement of desired objectives.

[3] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.

[4] In this analysis, we define renewables as wind and solar. Some states, such as Maine or Vermont, have a substantial portion of electricity generated from biomass facilities. Likewise, hydroelectric power is a large portion of renewable power in many places around the United States. Unlike wind and solar and similar to nuclear, hydroelectric power was largely a government activity: indeed, there was massive government investment into hydroelectric facilities in the mid-1900s (the TVA and the Bonneville Power Authority). But both hydroelectric power and biomass power—like nuclear—are types of power generation facilities that are typically baseloaded (they run nearly all the time) and are not intermittent resources in the same manner that generates concern about other renewable resources such as wind or solar.

[5] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.

Without these dimensions, energy production subsidies are likely to prove insufficiently effective—or perhaps too effective, as in the case of traditional energy production—and outlive their usefulness, leading to inefficient outcomes and entrenched behavior as industries become accustomed to low-cost energy; companies become less innovative; and investment into alternative industries is discouraged because competition is disadvantaged. The environment, society, and people pay the ultimate price.

Public policies supporting critical industries should be designed to promote innovation—or at very least, confer less disadvantage to new entrants—and should aim to tear down, not reinforce, barriers to entry, particularly when larger societal goals are at stake. Fossil fuel subsidies are an exemplary cautionary tale, though renewables have begun to make up some ground, thanks in part to U.S. government support that has attracted growing amounts of private capital.

There will always be a time and a place for U.S. government industrial policy to promote certain societal behavior, build out nascent industries, and achieve public objectives. But it is clear that, after more than a century of subsidies, various methods of producing energy in the United States do not compete on even ground. As the Department of Energy's Battelle Pacific Northwest National Laboratory concluded in 1981, "The costs of energy production have been underwritten unevenly among energy resources by the Federal Government."[6]

When evaluating the utility and efficacy of any subsidy, whether it be fossil fuel- or renewable energy-related, it is important to do so with one central point in mind: if subsidies are properly designed and appropriately targeted, at some point they should be rendered unnecessary, no longer required for markets to properly function and private capital to flow successfully. When viewed in this context, therefore, two main conclusions are unavoidable: first, renewables need subsidies largely because hydrocarbon energy production has enjoyed such permanent, institutionalized support. Second, the fact that the U.S. renewable industry has already achieved the degree of success it has is striking, speaking to the effectiveness of the subsidies it has received to date.

Even without considering the polluting effects of fossil fuels and the activities their use encourages, renewables still have a lot of ground to make up in an entrenched U.S. electricity production system. Using smart subsidies, intelligent energy policy must correct that as the United States begins the journey toward a cleaner economy.

Introduction

Energy production has long been heavily supported and subsidized by governments and, ultimately, citizens around the world. The Organization for Economic Co-operation and Development (OECD) defines a subsidy as "any measure that keeps prices for consumers below market levels, or for producers above market levels or that reduces costs for consumers or producers."[7] Many definitions of subsidies include direct government support, spending, or tax relief (essentially, foregone revenue).[8] They also generally include the provision of government

[6] As quoted and cited in Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.
[7] OECD 1996. As cited in *Environmentally Harmful Subsidies Challenges for Reform: Challenges for Reform* (Paris: OECD Publishing, 2005), 114.
[8] Gerasimchuk (2014). As described in "The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation," Global Subsidies Initiative and International Institute for Sustainable Development, December 9, 2014, https://www.iisd.org/gsi/impact-fossil-fuel-subsidies-renewable-energy; *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

services at below market rates and with price supports. [9] It is also worth noting that, typically, definitions of government subsidies do not include the underpricing—if at all—of societal or environmental externalities.[10]

Table 1. Sample Direct and Indirect Government Subsidies

Budgetary spending and/or tax relief	Direct, Indirect
Provision of services below market rates (*e.g.*, land, water, infrastructure, leases, permissions)	Direct, Indirect
Market price support and market transfers (*e.g.*, purchase obligations, tariffs, mandates)	Direct, Indirect
Nonpricing or underpricing of environmental/social externalities	Indirect

Source: Adapted from Gerasimchuk (2014). As described in *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

Energy subsidies may be divided into consumer and producer subsidies, but their net effect is similar. Indeed, the majority of fossil fuels subsidies affect the end user price and, therefore, the quantity consumed through their impact on the demand and supply of different fossil fuels.[11] Many countries, the United States included, have consumer-end energy subsidies. Consumer subsidies typically artificially lower the retail price of fuels or electricity that citizens have to pay, often significantly below market rates.

A second type of subsidy for energy is on the producer end rather than at the retail level. Producer-level subsidies tend to be even more difficult to quantify than consumer subsidies, as they are not a (relatively) straightforward matter of comparing retail prices for fuel in one country to a 'free market' price. Producer subsidies in the energy space take the form of preferential government policy for selected companies or industries (such as national oil companies), or even selected products or sectors where there is international competition.[12] The Global Subsidy Initiative has found that producer subsidies most often come in the form of foregone government revenues, such as reduced taxes for goods and services, allowances for accelerated depreciation, or reduced royalty payments.[13]

Though subsidies may be traditionally thought of as direct interventions (policies or provisions that are targeted to benefit a specific industry, such as fossil fuels), important subsidies may be indirect (policies or provisions that are not specifically targeted to promote fossil fuels or that are

[9] Gerasimchuk (2014). As described in "The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation," Global Subsidies Initiative and International Institute for Sustainable Development, December 9, 2014, https://www.iisd.org/gsi/impact-fossil-fuel-subsidies-renewable-energy; *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

[10] Gerasimchuk (2014). As described in "The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation," Global Subsidies Initiative and International Institute for Sustainable Development, December 9, 2014, https://www.iisd.org/gsi/impact-fossil-fuel-subsidies-renewable-energy; *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

[11] Ambrus Bárány and Dalia Grigonytė, "Measuring Fossil Fuel Subsidies," *ECFIN Brief* 40 (March 2015), http://ec.europa.eu/economy_finance/publications/economic_briefs/2015/pdf/eb40_en.pdf.

[12] Shelagh Whitley, *Time to change the game: Fossil fuel subsidies and climate*, Overseas Development Institute, November 2013.

[13] GSI, 2010. As cited in Shelagh Whitley, *Time to change the game: Fossil fuel subsidies and climate*, Overseas Development Institute, November 2013.

available broadly to all industries, including the fossil fuel industry), particularly if a specific industry or sector is the overwhelming recipient of the conferred benefits of the subsidy.

For example, the U.S. energy sector benefits from a number of tax provisions that are not explicitly targeted at energy, such as the domestic manufacturing deduction for production activities (termed Section 199 deduction), which benefits all domestic manufacturers. Extracting oil and gas has been classified as a "manufacturing activity."[14] Fossil fuel-related activities may also benefit from other tax incentives that are available to non-energy industries, such as the ability to issue tax-exempt debt and the ability to structure as a master limited partnership (MLPs), while renewables do not.[15] Other forms of implicit subsidy or government support are also important to keep in mind, particularly those that tend to reinforce other, more direct subsidies, such as the development of today's electricity industry on the basis of underpriced fossil fuel energy. Even more generally, other regulation that exempts incumbents through grandfathering provisions generate other barriers to entry that discourage entrepreneurship or new entrants.[16]

Energy Production Subsidies in the United States

In the United States, energy production is supported by a range of policies, including research and development (R&D), mandates, and direct financial support in the form of tax incentives or loan guarantees.[17] Subsidies to produce oil, gas, and coal have been around nearly as long as the extractive industries themselves, over the entirety of the 20th Century and continuing into the 21st Century, while nuclear energy subsidies emerged later, followed more recently by subsidies to renewable energy.

Today, many forms of energy production are subsidized by the U.S. government, both at the federal and state-level. With respect to electricity production, it is useful to think about subsidies in terms of traditional energy production and renewable energy production.

Given the range of negative economic, social, and environmental consequences, the question of fossil fuel subsidies in the United States has long been a matter of public interest, both inside and outside government. Keeping the costs of fossil fuel consumption artificially low contributes to inefficient or over-use and is a major contributor to greenhouse gas emissions.

Government support has played a major role in the fossil fuel industry's development over time, whether through direct spending such as R&D or through tax preferences. For energy in the United States, most government investment happens through the tax code.[18] In the United States, tax expenditures—government spending programs that deliver subsidies through the tax code via special tax credits, deductions, exclusions, exemptions, and preferential rates—are the

[14] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[15] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[16] Daniel F. Spulber, *The Innovative Entrepreneur* (New York: Cambridge University Press, 2014) , p. 302.
[17] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[18] Richard W. Caperton and Sima J. Gandh, "America's Hidden Power Bill: Examining Federal Energy Tax Expenditures," Center for American Progress, April 13, 2010, https://www.americanprogress.org/issues/tax-reform/report/2010/04/13/7563/americas-hidden-power-bill/.

dominant type of federal support for the energy industry. Altogether, these spending programs amount to 60 percent of the government's total support to the industry.[19]

Table 2. Various Types of U.S. Subsidies

Tax Policy	Preferences related to the tax code, either federal or state; MLPs
Regulation	Regulations contribute to public confidence in, and acceptance of, facilities and devices employing a new or potentially hazardous technology, and also can directly influence the price paid for a particular type of energy
Research and Development	Federal funding for research, development and demonstration programs
Market Activity	Direct federal government involvement in the marketplace. purchase obligations, tariffs, mandates
Government Services	U.S. government policy is to provide ports and inland waterways as free public highways. Oil tankers usually are the primary reason for deepening channels.
Disbursements	Subsidies for the construction and operating costs of oil tankers

Source: Adapted from Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.

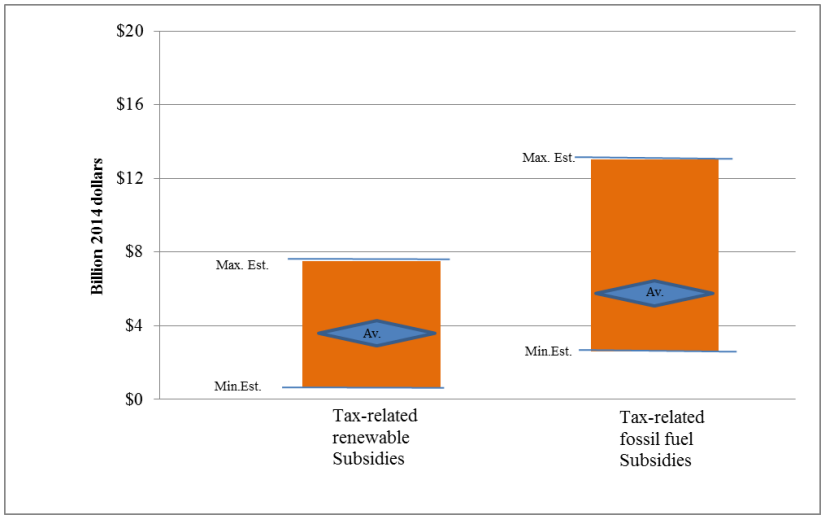
These tax expenditures are functionally equivalent to direct spending, but they are often subject to less scrutiny."[20] The Tax Code is just the beginning of the subsidy investigation in the United States—and disentangling the fossil fuel measures is anything but straightforward. A number of subsidies in the United States are laid out in Table 2, providing a sense of other important subsidies beyond preferential tax treatment that governments provide.

Our survey reveals a range of subsidy estimates and gives a reasonable sense of the size and scale of government support to both traditional energy production and renewables. We found that from preferential federal tax provisions alone, American taxpayers provided $5.4 billion in subsidies for oil, gas, and coal production (in 2014 dollars, annual average), while renewables saw only $3.7 billion of subsidies.

[19] Richard W. Caperton and Sima J. Gandh, "America's Hidden Power Bill: Examining Federal Energy Tax Expenditures," Center for American Progress, April 13, 2010, https://www.americanprogress.org/issues/tax-reform/report/2010/04/13/7563/americas-hidden-power-bill/.

[20] Richard W. Caperton and Sima J. Gandh, "America's Hidden Power Bill: Examining Federal Energy Tax Expenditures," Center for American Progress, April 13, 2010, https://www.americanprogress.org/issues/tax-reform/report/2010/04/13/7563/americas-hidden-power-bill/.

Figure 1. A Survey of U.S. Federal Tax Provisions Supporting Traditional and Non-Traditional Energy Production (Average Annual Estimate, in 2014 dollars)



Source: NewWorld calculations, based on data on Congressional Budget Office, OECD, Joint Committee on Taxation, EarthTrack and Oil Change International, The Administration's Budget Proposal for FY2011, U.S. Energy Information Administration, Congressional Budget Office, Congressional Research Service, EarthTrack, and DBL Investors.

According to our survey, the fossil fuel industry overall in the United States received federal subsidies to the tune of roughly $15 billion annually (in 2014 dollars). Looking at federal tax provisions that support exploration and production of fossil fuels alone, the oil, gas, and coal industry received over $5 billion (average estimate, in 2014 dollars).

In addition, the fossil fuel industry receives extensive subsidies and other benefits at the state level. To take one example, the coal industry in Kentucky receives close to $2 billion annually in support from that state alone (in 2014 dollars). In Texas, the state Comptroller's Office says fossil fuels account for over 99 percent of state subsidies in the form of tax exemptions, saving the traditional energy industry billions of dollars.[21] It is worth observing that despite the favorable fossil fuel energy environment in Texas, the state is a leader in wind energy, with double-digit market penetration.[22]

Renewables likewise receive government support at the federal and state levels, particularly in recent years. Looking at federal tax provisions that development and production of renewable energy, non-traditional energy production saw $5 billion of subsidies (average estimate, in 2014 dollars). However, it is also worth noting that a large portion of the increase in support for renewables came from a one-time measure: the American Reinvestment and Recovery Act of 2009 (ARRA). Indeed, roughly a third of total spending on clean energy from 2009-2014 originated from one-time ARRA-funded federal stimulus programs.[23]

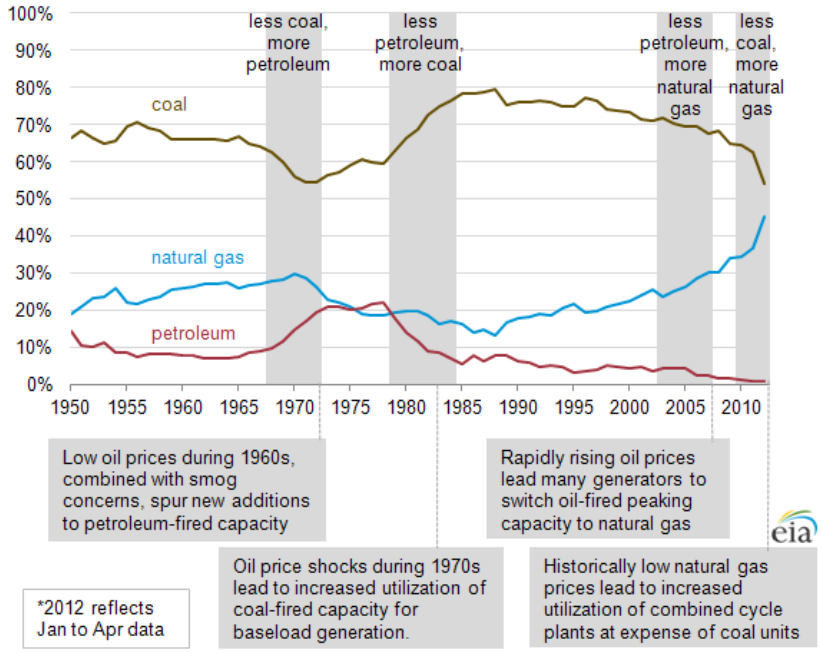
[21] "Chapter 28: Government Financial Subsidies," in Texas Comptroller of Public Accounts, *The Energy Report*, May 2008, http://comptroller.texas.gov/specialrpt/energy/pdf/28-GovernmentFinancialSubsidies.pdf.
[22] Lorne Matalon, "Texas Wind: Too Much Of A Good Thing?," *Inside Energy*, June 19, 2015, http://insideenergy.org/2015/06/19/texas-wind-too-much-of-a-good-thing/.
[23] Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

Electricity in the United States

In many industries with vast historical— and ongoing—government support and involvement, such as railroads, airlines, and telecommunications, federal policy was substantially reformed after 1970 to reflect market realities. In contrast, the federal policies established in the 1930s and even earlier still play a central role in the electric power sector, with the federal government adding new policies on top of old ones, leaving ancient preferences in place.[24]

Today's electricity industry has arisen in the context of traditional energy production subsidies, predominantly fossil fuels. Historically, coal and nuclear electricity generation supplied most of the baseload power demand in the United States, partly because of their low fuel-related operating costs.[25] Fossil fuels generally—coal, natural gas, and petroleum—supplied roughly 70% of total electric power generation since 1950, with that share rising to 82% in 1970, and falling back to 70% by 2010.[26] Other forms of traditional power generation (nuclear and hydro) made up the vast majority of the remainder.

Figure 2. Annual Share of Fossil-fired Electric Power Generation, 1950-2012



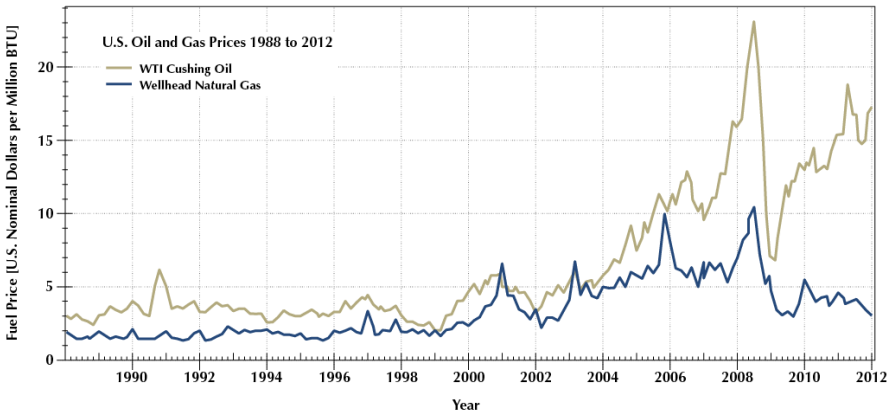
Source: Reproduced from U.S. Energy Information Administration, "Competition among fuels for power generation driven by changes in fuel prices," July 13, 2012, http://www.eia.gov/todayinenergy/detail.cfm?id=7090.

Though oil is generally not used to produce electricity in the United States, subsidies to oil production are important to consider because of the relationship between natural gas and oil. For example, natural gas in the United States is often associated with oil wells, as a component of

[24] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.
[25] In some areas of the country, abundant hydropower capacity has supplied both baseload and peaking generation. U.S. Energy Information Administration, "Competition among fuels for power generation driven by changes in fuel prices," July 13, 2012, http://www.eia.gov/todayinenergy/detail.cfm?id=7090.
[26] U.S. Energy Information Administration, "Competition among fuels for power generation driven by changes in fuel prices," July 13, 2012, http://www.eia.gov/todayinenergy/detail.cfm?id=7090.

coal and oil formations.[27] Prices for natural gas and oil have likewise tended to move together. Thus, subsidies that support oil historically are still important to consider in the electricity context.

Figure 3. U.S. Oil and Natural Gas Prices, 1988-2012



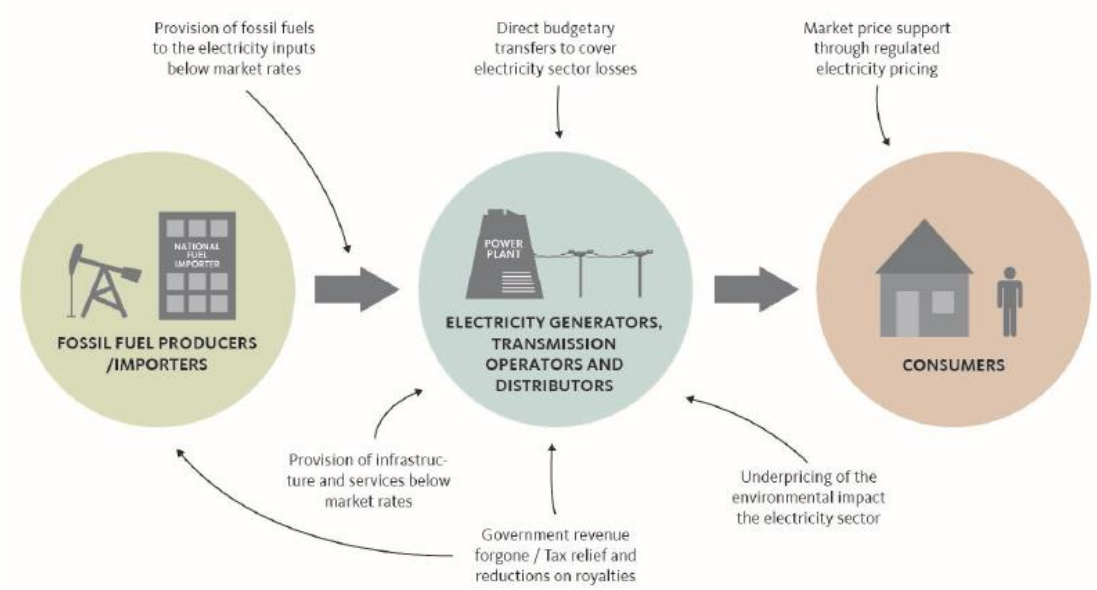
Source: U.S. Energy Information Administration, U.S. Natural Gas Prices, April 2, 2012, http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm.

The U.S. does not have a comprehensive national electricity policy. At the non-federal level, there is also much policy variation. Even though state boundaries do not affect the flow of electricity and thus have no natural role in the design or operation of the electric power sector, state regulators retain considerable authority. Regulatory regimes differ substantially among states, resulting in substantial regional differences. For example, organized wholesale markets for power are central in some areas and nonexistent in others, while subsidies of various sorts for public and cooperative entities are important in some regions but not at all in others.[28]

Traditional energy production subsidies continue to shape how electricity is produced and how electricity is used, from the provision of infrastructure and services below market rates, to government tax relief or other preferential support, to how the sector is regulated and compensated. Figure 4 provides an illustration of some of the ways traditional energy production subsidies operate in today's fossil fuel economy.

[27] American Petroleum Institute, "Facts About Fossil Fuels," http://www.api.org/oil-and-natural-gas-overview/classroom-tools/teaching-tools/facts-fossil-fuels. Accessed November 2015.
[28] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.

Figure 4. Traditional Energy Production Subsidies in the Electricity Sector



Source: Reproduced from *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

The electricity grid entails a range of what are now inherent subsidies, thanks to various policies and regulatory regimes. For example, everyone has access to electricity, whether in the city or far-out in the wilderness, thanks to New Deal era policies to electrify the nation: "The Rural Electrification Act of 1936 established the Rural Electrification Administration to provide loans and assistance to organizations (mainly rural electric cooperatives) that would provide electricity to rural areas".[29]

There are other subsidies built into the U.S. electricity grid that affect the comparative advantages of traditional energy relative to newer entrants like renewables. The U.S. electricricity grid is a natural monopoly, as it would be prohibitively expensive to have multiple overlapping grids in any region.[30] In some areas of the country, such as the Pacific Northwest, municipally owned and cooperative utilities benefit from preferred access to low-cost power from federal projects.[31] Moreover, there are resulting physical restrictions to current infrastructure, such as transmission lines' thermal and stability constraints and limitations on generating units' output power and ramp rates, while other constraints on the basis of security and reliability mandates include transmission line reserve capacity and generation reserve requirements.[32] Challenges related to rights of way and other interstate transmission also contribute to traditional energy production and incumbents' dominance in the electric power industry.

[29] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.
[30] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.
[31] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.
[32] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An MIT Interdisciplinary Study, 2011.

Consequences of Subsidies

Traditional energy production subsidies have a range of negative economic, social, and environmental consequences, particularly with respect to the electricity industry.

In general, many academics contend that subsidies have an adverse impact on fiscal balances and public debt levels.[33] Subsidies tend to aggravate fiscal imbalances, crowding out priority public spending and private investment.[34] Energy subsidies impose large fiscal costs that somehow need to be financed (whether through more public debt, higher taxes, or at the expense of other productive public spending such as health, education, or infrastructure), which can be a drag on economic growth through other pathways.[35] According to the IMF, "Some countries spend more on energy subsidies than on public health and education."[36]

At a sector or industry level, subsidies provide deep advantages to incumbent companies, inhibiting competition, and dampening market signals if made permanent. For example, "Public policies that subsidize incumbents also generate barriers to entry…Policies that protect existing firms from entry diminish incentives to innovate for both incumbents and entrants."[37] Alarmingly, the IMF has found that "Subsidies diminish the competitiveness of the private sector over the longer term"[38] Permanent investment subsidies, like accelerated depreciation measures enjoyed by traditional energy producers, may distort the allocation of capital in the long run.[39]

Fossil fuel subsidies make the costs of natural resource depletion artificially low, encouraging overconsumption and discouraging substitutes or alternatives. Since fossil fuels and products are used throughout the U.S. economy, this has wide-ranging, but pervasive, effects. Indeed, there are many direct and indirect pathways overconsumption effects can encourage. Underpriced fossil fuel energy tends to distort resource allocation by encouraging excessive energy consumption, artificially promoting capital-intensive industries and accelerating natural resources depletion.[40] For example, the subsidization of diesel promotes the overuse of irrigation pumps, resulting in excessive cultivation of water-intensive crops and depletion of groundwater.[41] High levels of vehicle traffic that are encouraged by subsidized fuels also have negative externalities in the form of traffic congestion, higher rates of accidents, and road and infrastructure degradation.[42]

The subsidization of electricity also creates indirect effects on global warming and pollution, depending on the composition of energy sources for electricity generation.[43] Traditional energy

[33] See for example Rogoff and Reinhart, 2010; Kumar and Woo, 2010. As described in International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013, http://www.imf.org/external/np/pp/eng/2013/012813.pdf.
[34] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013, http://www.imf.org/external/np/pp/eng/2013/012813.pdf.
[35] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015; see also International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[36] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[37] Daniel F. Spulber, *The Innovative Entrepreneur* (New York: Cambridge University Press, 2014) , p. 302.
[38] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[39] Congressional Research Service, *Committee Print on Tax Expenditures*, 2012 Edition (2012), 123, http://www.budget.senate.gov/democratic/public/_cache/files/d481f456-b175-4c2d-9b07-0045317e585d/taxcompendium.pdf.
[40] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[41] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[42] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[43] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.

production subsidies also increase the economy's vulnerability to increasingly volatile fossil fuel prices.[44]

Traditional energy subsidies also tend to be highly inefficient in providing support to lower-income populations, since most benefits are captured by higher-income groups.[45] Even future generations are affected by subsidies through reduced availability of key inputs for growth and the damaging effects of increased energy consumption on greenhouse gas emissions and global warming.[46] Over-consumption of artificially low-cost fossil fuel energy aggravates global warming and worsens local pollution, exacerbating congestion and other adverse side effects of vehicle use, and increasing atmospheric greenhouse-gas concentrations.[47]

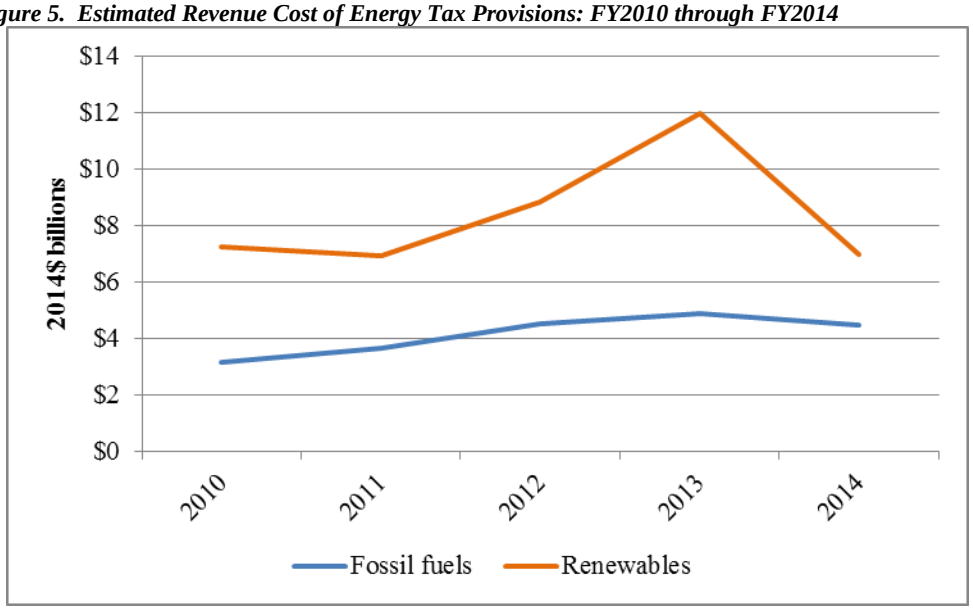
Evaluating Relative Subsidies for Energy Production

It is important to view today's energy subsidies in this historical context with respect to the electricity industry, whether traditional energy or renewables, because it provides a fuller sense of the advantages due to incumbent players relative to emergent clean energy industries.

Comparing government support for traditional energy production versus renewable energy production is difficult, given data challenges combined with the complexity of assessing subsidies comprehensively. Take Figure 5 below, which shows federal subsidies for traditional energy versus renewable energy through tax provisions in recent years. At first glance, the financial support to renewables seems to outweigh that provided to fossil fuels.

[44] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015.
[45] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015.
[46] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.
[47] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015.

Figure 5. Estimated Revenue Cost of Energy Tax Provisions: FY2010 through FY2014



Source: NewWorld calculations based on data reported by Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.

But what Figure 5 does not effectively illustrate is the stage of industrial development of traditional energy versus renewables (*i.e.*, are they mature or developing industries?), nor does it provide a sense of governmental support over the longer term.

Likewise, while subsidy per unit of production or subsidy relative to production level calculations may be one starting point for evaluating subsidies, it is also worth considering why the level of federal financial support differs across various energy technologies. [48] Tax incentives for energy may support various environmental or economic objectives, such as tax incentives designed to reduce reliance on imported petroleum in order to further energy security goals, while tax incentives that promote renewable energy resources aim to further other economic or environmental objectives.[49]

The levels of subsidy on an annual basis matter less than, for example, their cumulative effects over time or the ways in which they facilitate or inhibit competition. In addition, to understand the true impact of this distorted playing field, it is important to think through how different kinds of subsidy can affect investment decisions in specific energy sectors.[50] By looking beyond comparisons of single-year dollar amounts, the extent to which U.S. renewables have ground to make up is revealed.

Renewable and traditional energy production subsidies must be evaluated in the context of at least two important dimensions: stage of industrial development, and historical levels of support.

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[48] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[49] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[50] *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

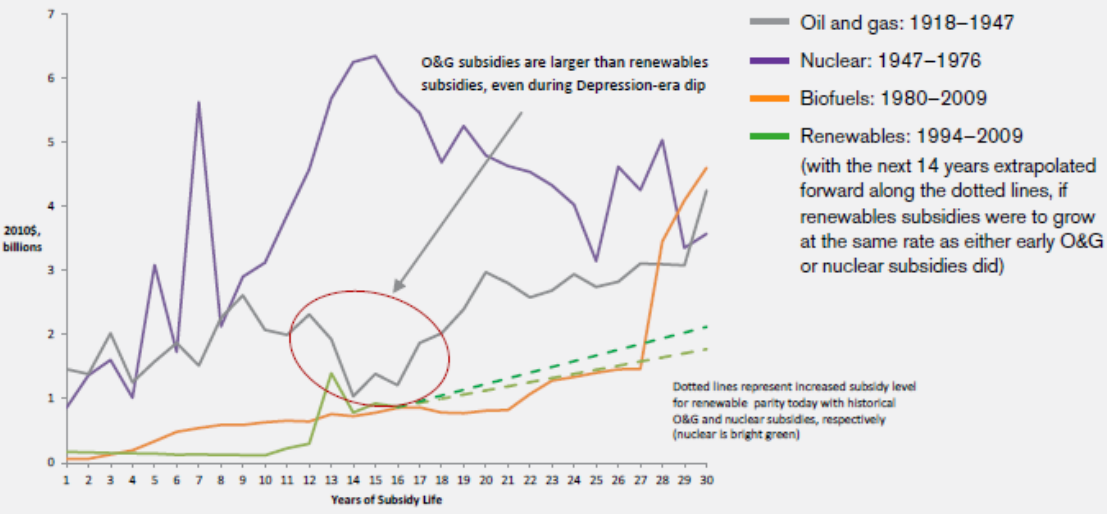
Stage of Industrial Development

Subsidies can play a productive role in the development of new industries, particularly capital-intensive industries. Research has shown that the first 15 years in an industry's development is the most crucial.[51] For renewables, this is no different.

Traditional forms of energy production in the United States have received government support and subsidies for at least a century. Particularly as the nascent fossil fuel industry was developing in the early 20th Century, government support played a critical role. Beginning in the late 1700s, the U.S. Congress put in place protections for domestic coal by enacting a federal tariff on imports, giving U.S. producers a major cost advantage over British merchants who had previously enjoyed transporting coal to American ports free-of-charge.[52] U.S. states soon followed suit, enacting provisions that excluded coal from taxation (Pennsylvania), surveyed land to find coal resources (North Carolina) and generally paved the way for the industry to strongly grow through other support and subsidies.[53] Expanding rail transportation and transitioning from wood to coal throughout the 1800s found the U.S. coal industry rising at a rapid rate as demand soared.

The oil industry's early development followed coal, as well as nuclear energy and natural gas, all subsidized at the federal and state levels in a variety of ways. Various government support reflected the uncertainty of these sectors. Indeed, drilling for oil was very risky a century ago, with high start-up costs and high uncertainty of success, as prospectors could not be sure they would find crude.[54]

Figure 6. Comparison of Early Federal Subsidies to Traditional and Non-Traditional Energy



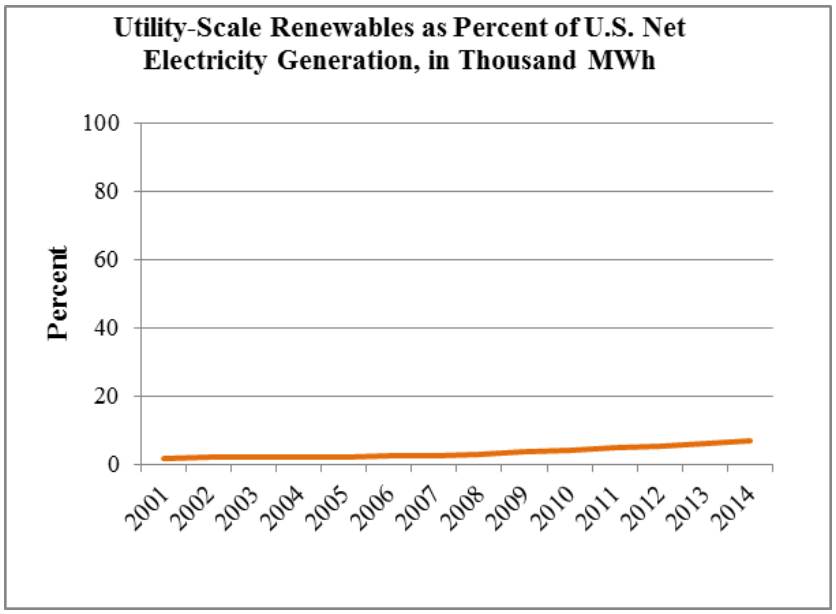
Source: Reproduced from Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.

[51] Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.
[52] Sean Patrick Adams, "Promotion, Competition, Captivity: The Political Economy of Coal," *Policy History* 18, No. 1 (2006). As cited in Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.
[53] From Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.
[54] Andy Kroll, "Triumph of the Drill," *Mother Jones*, April 14, 2014, http://www.motherjones.com/politics/2014/04/oil-subsidies-renewable-energy-tax-breaks.

But oil and gas subsidies, including tax breaks and government spending, were about five times as much an aid as compared to renewables during their first 15 years of development.[55] Similarly, nuclear received 10 times as much support.[56]

Today, the renewable energy industry is still in its infancy. Indeed, the renewable industry began to emerge on the electricity scene in earnest only in the early 1990s. Beginning in the mid-2000s, government incentives for renewable power generation began to increase,[57] and with it, renewables have begun to emerge as a significant industry. But renewables remain relatively early in its development within the broader electricity industry, still playing a modest role in the overall U.S. energy mix.

Figure 7. Renewables in the U.S. Power Generation Context



Source: NewWorld calculations, based on data from the U.S. Energy Information Administration.

As of 2013, wind made up only 1.9% of primary energy in the United States, while solar made up a mere 0.4%.[58] In 2014, renewables made up roughly 7% of net electricity generation, according to U.S. Energy Information Administration (EIA) data.[59] Although states like Iowa, Kansas, and South Dakota supplied around a quarter of their in-state electricity from wind

[55] Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.
[56] Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.
[57] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[58] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[59] Excluding hydroelectric power. U.S. Energy Information Administration, "Net generation from electricity plants for all sectors annual," Electricity Data Browser, http://www.eia.gov/electricity/data/browser/#/topic/0?agg=2. Accessed September 2015.

power[60] and Texas has achieved double-digit grid-system penetration of renewables[61], these states tend to be the exception.

Path Dependence through Historical Support

It follows that younger industries have traditionally received less cumulative support relative to mature industries. Compared to the massive support provided to the U.S. fossil fuel industry from all levels of government for decades upon decades, government incentives to promote development of renewable energy has been a drop in the pejorative (oil) bucket.

However, with electricity production in the United States, what matters is not just the cumulative effect of the annual subsidies provided to traditional energy production versus renewables. Rather, it is what the traditional energy production subsidies have facilitated. The U.S. electricity industry tends to be characterized by path dependence and lock-in on multiple levels. Path dependence occurs when initial conditions are followed by a series of contingent events or developments. Once a path has been "contingently" determined, various mechanisms and other developments can lead to its self-reinforcement, such as sunk costs, lower transaction costs, or other chance events, and it becomes progressively more difficult to return to a place where multiple alternatives are available without substantial disruption.[62]

Subsidies to traditional energy production in the United States play a major role, from the decision of the government to support coal and natural gas production and the determination that the electricity industry's activities should be controlled by the state due to their "public interest" endowment, to the Great Depression followed by the New Deal regulation that aimed to electrify the nation, to the post-war era where the pressurized water reactor dominated nuclear power, to deregulation of electricity in system that had evolved on the back of heavily subsidized traditional energy and power production.[63]

Path dependence helps explain the stickiness of institutions and the inefficacy of systems.[64] Because of path dependence, "Change is bounded until something erodes or swamps the mechanisms of reproduction that generate institutional continuity."[65] The U.S. electricity industry illustrates many elements of path dependence, which suggests the degree to which alternative forms of energy production have been and are disadvantaged.

Traditional energy production subsidies also discourage investment in alternative energy, energy efficiency, and energy infrastructure.[66] These subsidies have at least four main pathways:

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[60] U.S. Department of Energy, "EERE 2014 Wind Technologies Market Report Finds Wind Power at Record Low Prices," Energy.gov, August 10, 2015, http://www.energy.gov/eere/articles/eere-2014-wind-technologies-market-report-finds-wind-power-record-low-prices.

[61] David Roberts, "The economic limitations of wind and solar power," *Vox*, June 24, 2015, http://www.vox.com/2015/6/24/8837293/economic-limitations-wind-solar.

[62] Steve Isser, *Electricity Restructuring in the United States: Markets and Policy from the 1978 Energy Act to the Present*, Cambridge University Press, Apr 16, 2015, pp 3-5.

[63] Steve Isser, *Electricity Restructuring in the United States: Markets and Policy from the 1978 Energy Act to the Present*, Cambridge University Press, Apr 16, 2015, pp 3-5.

[64] Steve Isser, *Electricity Restructuring in the United States: Markets and Policy from the 1978 Energy Act to the Present*, Cambridge University Press, Apr 16, 2015, p 5.

[65] Douglas North, "Economic Performance through Time," *American Economic Review* 1994: 360. As cited in Steve Isser, *Electricity Restructuring in the United States: Markets and Policy from the 1978 Energy Act to the Present*, Cambridge University Press, Apr 16, 2015, p. 5.

[66] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015.

- Fossil-fuel subsidies impair the relative cost competitiveness of renewable energy by reducing the cost of fossil-fuel-based alternatives.
- Since many electricity systems are based on fossil-fuel generation, fossil-fuel subsidies act to lock in and reinforce incumbent generation technologies, thereby imposing entry barriers for new entrants attempting to develop renewable technologies.
- A shift to an electricity system that includes a greater role for renewable energy requires significant investment, which is undermined by fossil-fuel subsidies that enhance the attractiveness of fossil-fuel technologies compared to renewable energy.
- The underpricing of environmental and social externalities means that prices do not reflect the true cost of energy to society.[67]

The combined effect in the United States is that "fossil-fuel subsidies act to prevent the electricity sector from moving away from established, predominantly fossil-fuel-based, modes of operation and supporting a transition to a system in which renewable energy plays a major part."[68] Traditional energy subsidies have created a system that sends investors the wrong signals, dampening private investment in energy efficiency and clean energy.[69]

In this context, though renewable subsidies might approach—even surpass—fossil fuel subsidies in magnitude on an annual basis or even cumulative basis in the future, it is arguably entirely appropriate, given the stage of the industry's development and the context in which it is operating.

Whither Traditional Energy Subsidies?

The challenge is not simply a matter of repealing or cutting back on fossil fuel subsidies. Even if traditional energy production subsidies were fully removed, it is likely the fossil fuel players would still be highly profitable. The fossil fuel system built on top of a century of subsidies would remain, which creates distinct challenges when contemplating how to encourage the development of alternative cleaner energy industries. Without appropriate support over time to the renewable energy industry, the uneven playing field in electricity would remain.

Further, subsidies to traditional energy production not only create substantial disadvantages to new entrants, but they also can prevent better governance. Indeed, historical subsidies inhibit the ability of regulators to design policy and smarter subsidies because the true extent of incumbents' costs and advantages is obscured by the substantial government support. Thanks to incomplete information, subsidies can be used to convey or conceal information and thus deter new entry into the industry. [70] Incomplete information from historical traditional energy production subsidies also affects the ability of regulators to govern the electric power industry and, indeed, the economy more broadly.

[67] *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.
[68] *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.
[69] Whitley, 2013. As cited in Shelagh Whitley, *Time to change the game: Fossil fuel subsidies and climate*, Overseas Development Institute, November 2013.
[70] Felix MuÒoz-GarcÌa and Ana EspÌnola-Arredondo, "The Signaling Role of Subsidies," Working Paper, June 24, 2014, http://faculty.ses.wsu.edu/Munoz/Research/Monopolies_and_Subsidies.pdf.

Smart Energy Production Subsidies

Subsidies and other supportive measures should be designed to promote innovation and provide encouragement to new entrants by reducing or removing barriers to entry—or at a minimum confer less disadvantage to new entrants. Nowhere is this more true—or critical—than in the energy and electricity industries in the United States.

Examining renewable energy subsidies in the context of traditional energy production subsidies yields insight into how smart subsidies should be tailored in at least four areas.

1. De-Risk Early Stage Strategic Industries

One of the primary roles of government should be to de-risk capital-intensive technologies of national strategic importance by underwriting risks before the private sector can bear them. To further develop renewable power generation, particularly given the environmental and social costs associated with traditional hydrocarbon energy production, subsidies from the government are well-warranted.

With the introduction of the federal Investment Tax Credit (ITC) in 2006, private investment in renewable energy projects, particularly in solar projects, began to increase as well. The supportive policy environment at the federal level, along with state-level developments, drove the development of financing mechanisms to take advantage of favorable tax credits. The residential and commercial solar ITC has helped solar installations grow by over 3,000% since the policy was implemented in 2006, and contributed to large reductions in both average solar system prices—falling 60% since 2006—and in the cost of solar panels[71] as well as other components of the solar supply chain.[72]

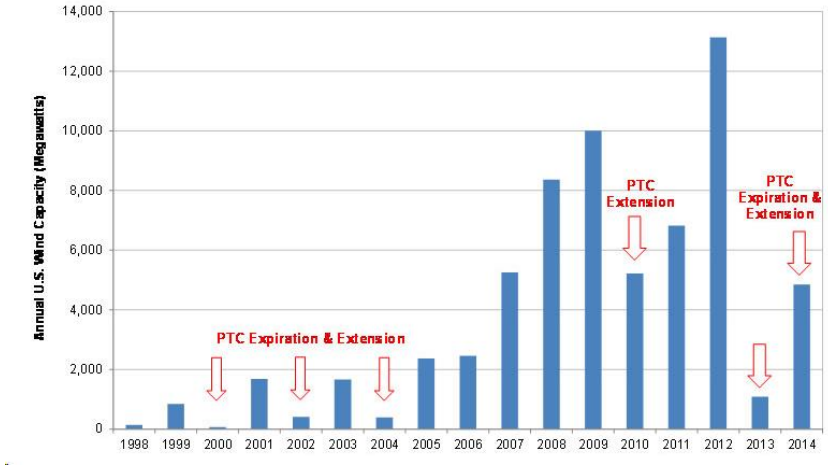
2. Provide Long-term Investment Certainty

Long-dated investment commitments cannot rationally be made by relying on short-term subsidies that are subject to legislative whim. Smart subsidies should thus be put in place with a time horizon that is tied to a target investment return for innovators, so as to promote the involvement of the private sector and attract capital into making needed investments as soon as possible. With the electricity industry and renewable power generation, this step is particularly important, as illustrated by the Production Tax Credit (PTC) and the wind industry.

Energy policy at the federal level, such as the Production Tax Credit (PTC), was effective, in spurring broader sector development by improving investment economics and thus encouraging the development of mid-sized wind projects into the early-2000s. But the PTC has experienced expiration and last minute legislative renewal many times, and the wind energy market has suffered as a result. Indeed, the short-term variability and longer-term uncertainty has not only harmed supply chains in the United States and across the world, but it has also damaged the attractiveness of the wind sector—and renewable power overall by association—in the eyes of many investors.

[71] Wholesale module prices from top tier manufacturers have declined from an average of $4/W in 2007 to $0.70/W in 2014.
[72] American Council On Renewable Energy, *The Outlook for Renewable Energy in America: 2014*, March 2014. As cited in U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

Figure 8. Impact of Production Tax Credit Expiration and Extension on U.S. Annual Installed Wind Capacity



Source: Reproduced from Union of Concerned Scientists, "Production Tax Credit for Renewable Energy," http://www.ucsusa.org/clean_energy/smart-energy-solutions/increase-renewables/production-tax-credit-for.html#.Vk98B3arS70. Accessed November 2015.

As another example, accelerated depreciation has been an essential driver of private investment into renewables. The 2008 economic stimulus included a 50% first-year "bonus depreciation" provision for eligible renewable-energy systems, which has since been extended and modified several times.[73] Most recently in December 2014, legislation extending bonus depreciation was passed by Congress and signed into law, extending the 50% first-year bonus depreciation for renewable projects by one year through the end of 2014.[74]

There is uncertainly at the state-level as well, which is harmful to investment in renewables. Take, for example, Texas, where the same kinds of support that oil and gas have long had in the state is needed for renewables: "Our competitors have long term certainty in the tax code… They have long term certainty in their subsidies. They have long term certainty in their access to capital on Wall Street. We [wind and solar] have none of those things. What we need is long term certainty."[75] Indeed, investors all over the world were looking at Texas, asking "Are the policies going to change? Is long-term investing and planning still a sound choice in Texas?"[76]

Traditional hydrocarbon energy production subsidies enjoy long-term certainty: indeed, many are permanently written into the tax code. Not so for renewables.

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[73] Database of State Incentives for Renewables and Efficiency, "Modified Accelerated Cost-Recovery System (MACRS)," January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F.

[74] Office of the Press Secretary, "Statement by the Press Secretary on Statement by the Press Secretary on H.R. 1068, H.R. 2754, H.R. 2901, H.R. 3608, H.R. 3979, H.R. 4030, H.R. 4681, H.R. 5462, H.R. 5771, and S. 2673," The White House, December 19, 2014. See also Akin Gump Strauss Hauer & Feld LLP, "House Passes PTC Extension Through End of 2014," Renewable Energy Alert, December 4, 2014, http://www.akingump.com/en/news-publications/house-passes-ptc-extension-through-end-of-2014-2.html; and Database of State Incentives for Renewables and Efficiency, "Modified Accelerated Cost-Recovery System (MACRS)," January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F.

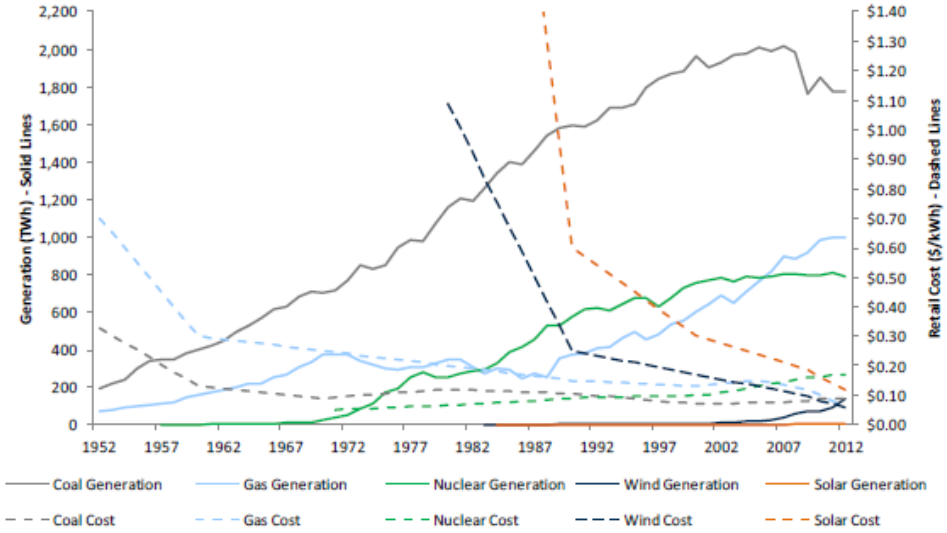
[75] As quoted in Lorne Matalon, "Texas Wind: Too Much Of A Good Thing?," *Inside Energy*, June 19, 2015, http://insideenergy.org/2015/06/19/texas-wind-too-much-of-a-good-thing/.

[76] Lorne Matalon, "Texas Wind: Too Much Of A Good Thing?," *Inside Energy*, June 19, 2015, http://insideenergy.org/2015/06/19/texas-wind-too-much-of-a-good-thing/.

3. Tied to Achieving Developmental Milestones

Subsidy levels should be tied to the scale and time needed for a capital-intensive industry of national strategic importance to reach commercial efficiency in terms of volume and experience/learning curve benefits. Energy production subsidies should relate to specific market scaling goals/industrial scaling development targets (such as technology cost goals, price points, or market penetration levels).

Figure 9. Energy Technology Versus Technology Cost, 1952-2012



Source: Hudson Clean Energy Partners Analysis. As cited in U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

Federal clean energy policies should reward firms for continually improving the performance and reducing the cost of their technologies, or for inventing and commercializing next-generation, advanced energy technologies, not simply for deploying current-generation technologies without advancing them towards subsidy independence.[77]

The level of commercial scale needed for renewables to reach economic efficiency depends on the specific energy technology in question, but attaining efficient commercial scale for any specific energy technology should be the point at which subsidy fadeout should begin. In addition, the fadeout should also depend on policy intent, with respect to pace of market formation. In the case of renewables and fossil fuels, the objective to facilitate a transition to a cleaner electric power sector in light of climate change threats and the desire to achieve energy security should prevail.

4. Point toward Sunsets

Subsidies should be designed with explicit sunsets to reinforce longer-term certainty and to incent the achievement of desired objectives, based on clear goals and milestones. Once they have properly accomplished their objectives, subsidies should be scaled back and allowed to fade

[77] Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

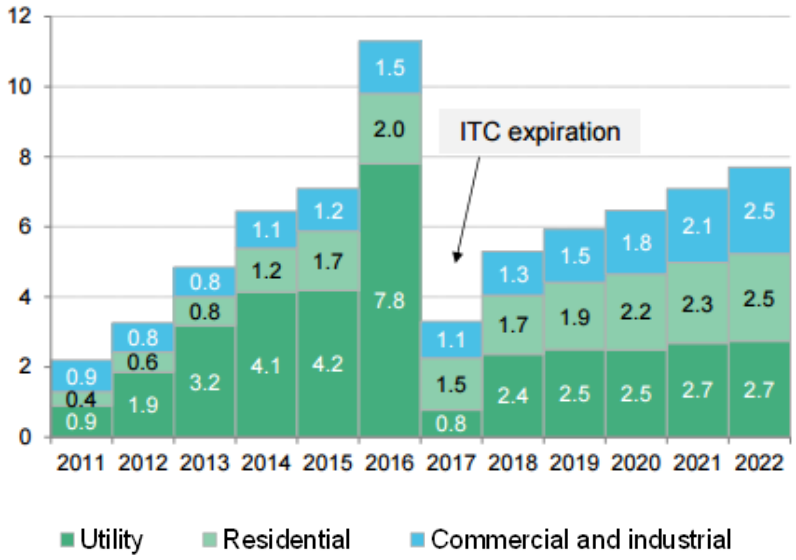
out, not allowed to be permanent. Indeed, deploying subsidies with reasonable sunsets is arguably one of the most effective ways to help markets scale while providing policy certainty.

As noted earlier, many traditional energy production subsidies have become permanent fixtures in U.S. law. For example, to encourage the nascent industry, in 1916 Congress approved the expensing of "intangible drilling costs"—pretty much any equipment used or work done—in the first year of a well's life. Today, prospectors rarely hit dry holes, but the century-old tax break remains a gusher."[78] Similarly, when oil wells were drilled 90 years ago, it was not well known how much a well would yield or for how long, and so in 1926, Congress introduced the "excess of percentage over cost depletion deferral," a.k.a. the depletion allowance. [79] Though since 1975, only small companies may claim it, the price tag is still big: under the allowance, an oil producer may deduct 15 percent (originally 27.5 percent) of any gross income from a well. Unlike normal depreciation, this deduction may be claimed indefinitely for the life of a project.[80]

In contrast, the temporary nature of the main renewable energy subsidies—the Investment Tax Credit (ITC), the 1603 Cash grants[81], and the Production Tax Credit (PTC[82])—is indicated by their very names: tax extenders. Recall also that about roughly a third of total clean energy spending from 2009-2014 originated from one-time ARRA-funded federal stimulus programs.[83] Although surely too short in duration, these renewable energy production subsidies were designed with explicit sunsets, and market actors have proceeded accordingly, using the expiration as incentives. For example, consider one of the main renewable subsidies over the past few years, the ITC, which has successfully helped scale the renewable energy market in the United States by driving down costs, attracting private capital and growing at a rapid pace in recent years. Initiated in 2005, the ITC will ramp down in 2017, essentially including a sunset. By doing so, the ITC anticipated its own success with a scheduled fade-out, letting developed market dynamics drive further growth. Whether this expiration date is too early vs. need and opportunity will be known through time but if the policy goal is to move strongly toward renewable energy and turn back greenhouse gas emissions in the U.S. the expiration date is likely way too soon.

[78] Andy Kroll, "Triumph of the Drill," *Mother Jones*, April 14, 2014, http://www.motherjones.com/politics/2014/04/oil-subsidies-renewable-energy-tax-breaks.
[79] Andy Kroll, "Triumph of the Drill," *Mother Jones*, April 14, 2014, http://www.motherjones.com/politics/2014/04/oil-subsidies-renewable-energy-tax-breaks.
[80] Andy Kroll, "Triumph of the Drill," *Mother Jones*, April 14, 2014, http://www.motherjones.com/politics/2014/04/oil-subsidies-renewable-energy-tax-breaks.
[81] The Section 1603 grant program was created as part of the American Recovery and Reinvestment Act of 2009 (P.L. 111-5) and has since been allowed to expire. The program provided cash grant incentives for renewable energy projects. For more information related to the Section 1603 grants program see CRS Report R41635, ARRA Section 1603 Grants in Lieu of Tax Credits for Renewable Energy: Overview, Analysis, and Policy Options, by Phillip Brown and Molly F. Sherlock.
[82] The federal renewable electricity production tax credit (PTC) is an inflation-adjusted per-kilowatt-hour (kWh) tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. Originally enacted in 1992, the PTC has been renewed and expanded numerous times, most recently by the American Recovery and Reinvestment Act of 2009 (H.R. 1 Div. B, Section 1101 & 1102) in February 2009 (often referred to as "ARRA"), the American Taxpayer Relief Act of 2012 (H.R. 8, Sec. 407) in January 2013, and the Tax Increase Prevention Act of 2014 (H.R. 5771, Sec. 155) in December 2014. U.S. Department of Energy, "Renewable electricity production tax credit (PTC)," Energy.Gov, http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc. Accessed November 2015.
[83] Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

Figure 10. U.S. Solar Build-Out Under Current Policy



Source: Bloomberg New Energy Finance, "How extending the investment tax credit would affect US solar build?," *White Paper*, September 15, 2015.

The 1603 grant program in particular was designed with a straightforward sunset to encourage use, and from 2009 onwards the increased costs associated with incentives for renewable electricity are largely attributable to the Section 1603 grants in lieu of tax credit program.[84] The Section 1603 grant option is no longer active and was not available for projects that began construction after December 31, 2011.[85]

Permanent subsidies invariably mean inefficient market outcomes. According to the Congressional Research Service (CRS), "Permanent investment subsidies, such as accelerated depreciation, may distort the allocation of capital in the long run."[86] Subsidies should be designed with sunsets to reinforce longer-term certainty and to incent the achievement of desired objectives. As noted, once they have properly accomplished their objectives, smart subsidies should be faded out, not allowed to become permanent. Ultimately, renewable energy subsidies should be phased out as markets mature, as they should have been targeted to drive the maturation and improvement of emerging technologies. Indeed, deploying subsidies with reasonable sunsets is arguably one of the most effective ways to help markets scale while providing policy certainty.

Encouraging Energy Efficiency and Conservation

Subsidies in favor of energy efficiency merit serious consideration, along with renewable energy support. Due to mispricing (underpricing) of traditional energy and electricity, consumption of electricity has grown steadily in the United States, and there are entrenched behaviors that

[84] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[85] Molly F. Sherlock and Jeffrey Stupack, *Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources*, Congressional Research Service, March 19, 2015.
[86] Congressional Research Service, *Committee Print on Tax Expenditures*, 2012 Edition (2012), 123, http://www.budget.senate.gov/democratic/public/_cache/files/d481f456-b175-4c2d-9b07-0045317e585d/taxcompendium.pdf.

encourage overconsumption of electrons that have been facilitated by traditional energy production subsidies. Smart subsidies should take aim by promoting market adoption of energy efficiency, encouraging more efficient use or conservation of energy and electricity. This is particularly important with respect to federal—and many state—energy goals, as energy efficiency helps achieve the public goals of reduced greenhouse gas emissions, improved energy security, and enhanced quality of life through savings and health.

Benefits of Creating Smarter Subsidies

The non-traditional energy industry in the United States (renewables) has suffered market booms and busts for decades, with the same root cause: the higher costs and risks of emerging scale-dependent U.S. clean energy products relative to the advantages of either incumbent fossil energy technologies or lower-cost international competitors.[87]

Without the dimensions noted above, energy production subsidies are likely to outlive their usefulness, leading to inefficient outcomes and entrenched behavior as industries become accustomed to excessive government support; companies become less innovative as innovation is inhibited; and investment into alternative industries is discouraged because competition is disadvantaged. The environment, society, and people pay the ultimate price. Fossil fuel subsidies are an exemplary cautionary tale, though renewables have begun to make up some ground in recent years, thanks in part to U.S. government support that has attracted private capital.

But smart, well-designed policies that successfully drive innovation and industry maturation could advance the U.S. economy even further towards both subsidy independence and long-term international competitiveness.[88] Indeed, given the advances of the renewable energy industry in the United States, there is an opportunity to implement smart subsidies to drive progress further while avoiding a potential "clean tech crash"—and along the way accelerate technological progress and use taxpayer resources more effectively. [89]

Just as subsidies for renewable energy sectors should phase out as these sectors mature, it is long-past time to wind down subsidies for established fossil energy production methods and technologies as well.[90] Benefits from both reforming traditional energy production subsidies while supporting renewables hold great potential with respect to improved fiscal, environmental, and social outcomes. Today, the U.S. government effectively transfers billions of dollars annually from taxpayers to traditional hydrocarbon energy producers (primarily oil and gas firms), the effect of which is magnified to the extent that the current system dampens further renewable energy development.[91]

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[87] Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

[88] For an excellent exposition of this point, please see Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

[89] Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

[90] Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney and Alex Trembath, "Beyond Boom and Bust: Putting Clean Tech On a Path To Subsidy Independence," Brookings Institution, 2012.

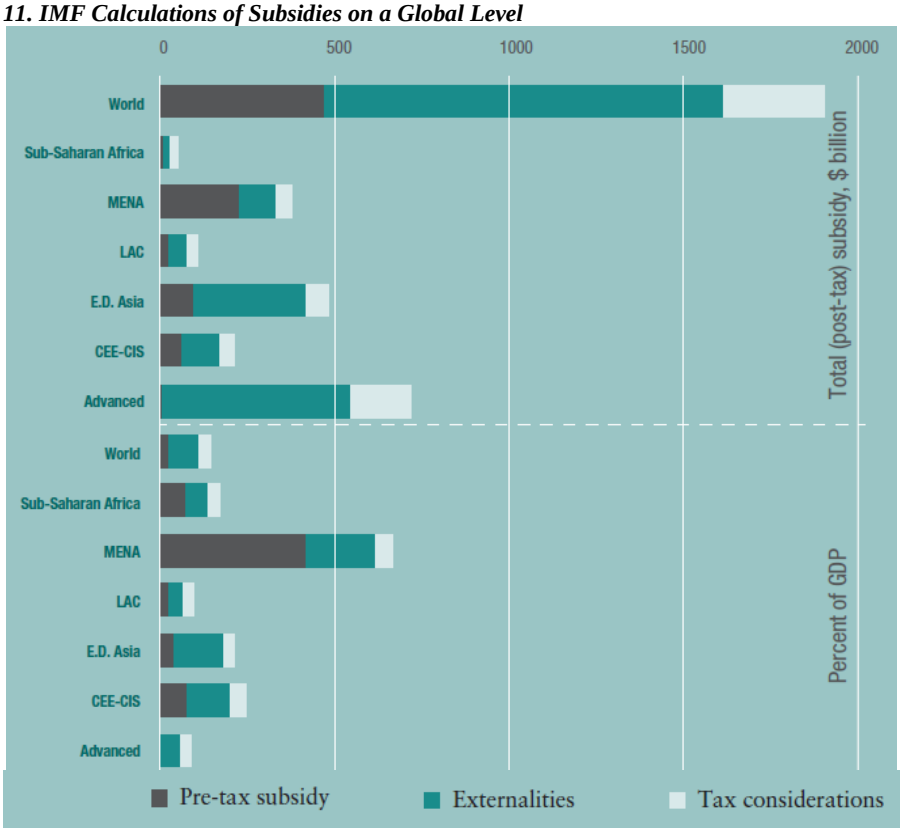
[91] Joseph E. Aldy, *Eliminating Fossil Fuel Subsidies*, The Hamilton Project (2013).

At a basic level, reforming fossil fuel subsidies would contribute to substantial deficit reduction effects, in addition to broader benefits, such as leveling the playing field among fossil fuel producers and relative to other energy investments, and potentially lower global fuel prices by providing the United States with increased leverage in negotiations to reduce or eliminate fossil fuel subsidies in the developing world.[92] Without a doubt, the largest distortion in global energy markets is fossil fuel subsidies. The IMF estimates these at $5.3 trillion per year—more than six percent of the global economy.[93]

The potential fiscal, environmental, and welfare impacts of energy subsidy reform are substantial.[94] Fossil fuel subsidies undermine efforts to deal with the threat of climate change, impede investment in clean energy sources, represent a drain on national budgets, reduce energy security, and fail to benefit the poorest populations who need the most help.[95] Further, the continued subsidy structure benefitting fossil fuels in the United States undercuts the nation's calls for subsidy reform around the world.[96] This stance not only comes at a huge cost to the world and the environment, but also to the American taxpayer.

[92] Joseph E. Aldy, *Eliminating Fossil Fuel Subsidies*, The Hamilton Project (2013).
[93] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015.
[94] David Coady, Ian Parry, Louis Sears, and Baoping Shang, "How Large Are Global Energy Subsidies?", *IMF Working Paper*, International Monetary Fund, May 2015; IMF 2013 http://www.imf.org/external/np/pp/eng/2013/012813.pdf
[95] G20, 2009. As described and cited in Shelagh Whitley, *Time to change the game: Fossil fuel subsidies and climate*, Overseas Development Institute, November 2013.
[96] "Fuel Subsidy Reform", Insights from a CFR Workshop, Center for Geoconomic Studies, Council on Foreign Relations, May 26, 2015.

Figure 11. IMF Calculations of Subsidies on a Global Level



Source: International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013; reproduced from Shelagh Whitley, *Time to change the game: Fossil fuel subsidies and climate*, Overseas Development Institute, November 2013.

According to the IMF, although subsidy reform would likely result in some short-term economic disruption, over the longer term there would be a reallocation of resources to activities that are less energy- and capital-intensive and thus more efficient. The effect would be to help spur growth of employment and drive stronger economic growth, curtail the availability of non-renewable energy resources, strengthen incentives for R&D in energy-saving and alternative technologies, and encourage more competitive private investment, all of which should benefit economic growth over the longer term.[97]

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There is surely a case for subsidies to be used as tools to drive specific industries and business sectors to achieve certain public benefit goals. But subsidies should be designed to drive business scaling and market development, not prolong undue advantage. Otherwise, negative consequences can quickly overwhelm any initial positive effects from the subsidizing policies, dampening their effectiveness as a tool of industrial development and government policy.

Given historical support to traditional hydrocarbon energy production, subsidies to renewables and energy efficiency initiatives are now needed to help level the playing field. Indeed, renewable energy production needs subsidies largely because hydrocarbon energy production has

[97] International Monetary Fund, *Energy subsidy reform: Lessons and implications*, January 28, 2013.

enjoyed such permanent, institutionalized support—before even considering the environmental costs and polluting effects from fossil fuels.

Some energy tax expenditures for the oil-and-gas industry have existed for more than a century and have no continuing demonstrable benefits for Americans. Such tax breaks simply provide windfall benefits to these mature industries at taxpayer expense.[98] Once used in the United States to encourage the development of nascent domestic industries, the oil, gas, and coal industries have outgrown their need for such levels of support many times over, to the detriment of U.S. fiscal health and the American taxpayer. Considering the U.S. fossil fuel industry's historical success and the negative effects from such continued governmental support, it is clear that subsidies for oil, gas, and coal government have outlived their usefulness in today's economy—and are indeed detrimental to the U.S. economy, as well as the global economy, going forward in a number of important ways.

The combined effect from fossil fuel subsidies in the United States is that they act to prevent the electricity sector from moving away from a predominantly fossil-fuel-based economy and transitioning to a system driven by cleaner energy and practices.[99] Largely because of subsidies that remain in place after decades, the renewables industry encompasses a relatively emergent set of technologies that are competing against often fully depreciated fossil fuel technologies facilities—all of which had also been subsidized for decades—on a grid controlled by incumbent players and a system that is not designed to welcome or encourage new entrants.[100] With that context in mind, the fact that renewables like wind and solar have performed even half as well as natural gas on a cost basis should impress observers.[101] Further, given their rapid improvement and strong growth, it is clear that, despite the uneven ground that persists, renewables are here to stay.

Today, U.S. government subsidies flow strongly to benefit old energy and away from helping new energy reach efficient competitive scale. Renewable sources of energy have a lot of ground to make up in an entrenched electricity production system, while producing many benefits not available to hydrocarbon production, such as avoided greenhouse gas emissions and no feedstock pricing volatility. Government policy must address the unfair advantages of hydrocarbon subsidies and the societal advantages of renewables subsidies. A new era of intelligent energy policy must correct these problems if the United States is to move toward a cleaner economy.

There will always be a time and place for U.S. government industrial policy to promote certain societal behavior, support the development of nascent industries, and achieve other public objectives. Given the historical support to traditional energy production, subsidies now are needed to help level the playing field versus hydrocarbon energy. Indeed, renewable energy production needs subsidies largely because hydrocarbon energy production has enjoyed such permanent institutionalized support in the past—before even considering the environmental costs and polluting effects of fossil fuels.

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[98] Richard W. Caperton and Sima J. Gandh, "America's Hidden Power Bill: Examining Federal Energy Tax Expenditures," Center for American Progress, April 13, 2010, https://www.americanprogress.org/issues/tax-reform/report/2010/04/13/7563/americas-hidden-power-bill/.

[99] *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*, Global Subsidies Institute and International Institute for Sustainable Development, December 2014.

[100] Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.

[101] Nancy Pfund and Ben Healey, *What Would Jefferson Do?*, DBL Investors, September 2011.

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Profit in Moving Toward a Clean Economy

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