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.
"Energy Tax Expenditures: Worthy Goals, Competing Priorities, and Flawed Institutional Design"

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Time: 4:00-5:50 p.m.
Number 13

<u>SCHEDULE FOR 2015 NYU TAX POLICY COLLOQUIUM</u>

(All sessions meet on Tuesdays from 4-5:50 pm in Vanderbilt 208, NYU Law School)

1. January 20 – Brigitte C. Madrian, Harvard Kennedy School.
   "Does Front-Loading Taxation Increase Savings? Evidence from Roth 401(k) Introductions."

2. January 27 – David Kamin, NYU Law School. "In Good Times and Bad: Designing Legislation That Responds to Fiscal Uncertainty."

3. February 3 – Kimberly Blanchard, Weil, Gotshal & Manges. "The Tax Significance of Legal Personality: A U.S. View."

4. February 10 – Eric Toder, Urban Institute. "What the United States Can Learn From Other Countries' Territorial Tax Systems."

5. February 24 - Linda Sugin, Fordham University, School of Law. "Invisible Taxpayers."

6. March 3 – Ruth Mason, University of Virginia Law School. "Citizenship Taxation."

7. March 10 – George Yin, University of Virginia Law School. "Protecting Taxpayers from Congressional Lawbreaking."

8. March 24 – Leigh Osofsky, University of Miami School of Law, "The Case for Categorical Nonenforcement."

9. March 31 – Shu-Yi Oei, Tulane University Law School. "Can Sharing Be Taxed?"

10. April 7 – Lillian Mills, University of Texas Business School. "Managerial Characteristics and Corporate Taxes."

11. April 14 – Lawrence Zelenak, Duke University School of Law. "For Better *And* Worse: The Differing Income Tax Treatments of Marriage at Different Income Levels."

12. April 21 – David Albouy, University of Illinois and NBER
    "Should we be Taxed Out of Our Homes? The Optimal Taxation of Housing Consumption."

13. **April 28 – David Schizer, Columbia Law School. "Energy Tax Expenditures: Worthy Goals, Competing Priorities, and Flawed Institutional Design."**

14. May 5 – Gregg Polsky, University of North Carolina School of Law, "Private Equity Tax Games and Their Implications for Tax Practitioners, Enforcers, and Reformers."

Energy Tax Expenditures:

Worthy Goals, Competing Priorities, and Flawed Institutional Design

By David M. Schizer[1]

Draft of April 17, 2015

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Although the U.S. has subsidized energy for over a century, energy subsidies surged during the energy crisis of the 1970's, and have spiked again since 2009.[2] Between 2007 and 2010, this support grew by 108% (from $17.9 billion to $37.2 billion).[3] Renewable energy subsidies increased by 186% during this period (from $5.1 billion to $14.7 billion). In total, the U.S. has spent $150 billion on green energy through 2014.[4] The lion's share has been committed through tax expenditures.[5] At the same time, the United States has not increased its gasoline tax, enacted a carbon tax, or implemented a cap and trade regime for carbon, as many other jurisdictions have done.[6] Since these other instruments are thought to be politically unattainable in the United States,[7] subsidies are offered as an alternative.[8] These policies pursue worthy goals. The environmental, national security, and economic arguments for government intervention are plausible, and some are even compelling. Yet unfortunately, our hodgepodge of subsidies – for hydrocarbons and "green" energy – is confused, inefficient, and sometimes counterproductive.

In part, these challenges arise because these we are pursuing competing goals. For example, some tax expenditures are supposed to advance environmental objectives, while others are motivated by national security. Indeed, national security is frequently invoked as a goal of energy policy, but only in general terms. To clarify what is at stake – and also what is not – this Article emphasizes two potential sources of negative externalities. First, the US could face increased defense costs in securing access to petroleum. Second, some energy producers are geopolitical rivals. Their oil and gas revenue can fund policies that are costly to us (and our allies), including terrorism, invasions of their neighbors, and nuclear weapons programs. While the magnitude of these externalities is uncertain, we can reduce both by cutting our demand for petroleum. This goal is largely consistent with our environmental goals. In contrast, another response – expanding and diversifying our supply of petroleum – usually prompts environmental opposition. Meanwhile, although other policies are routinely justified by national security, this Article takes issue with these claims. First, there is no longer a national security argument for coal, now that hydraulic fracturing has unlocked vast domestic reserves of natural gas. Second,

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[2] Martin A. Sullivan, Tech Neutrality, Tax Credits, and the Gas Tax, Tax Notes, Dec. 23, 2008 (every president since Jimmy Carter has proposed energy subsidies).
[3] EIA; Mary J. Hutzler, Testimony Before the Energy Subcommittee, March 13, 2013.
[4] Brookings study, http://www.brookings.edu/~/media/research/files/papers/2012/4/18%20clean%20investments%20muro/0418_clean_investments_final%20paper_pdf (of this $150 billion, $100 billion is for renewable energy (wind, solar, biofuels, R&D), $15 billion on conservation, $10 billion is for electric cars, $10 billion for high speed rail, $6 billion is for smart grids, $6 bilion is for nuclear).
[5] Cf. CBO (78% of energy tax expenditures are for renewables or energy efficiency; specifically, the breakdown is as follows: 68% renewable, 10% energy efficiency, 15% fossil fuels, 4% nuclear, 2% other); Hutzler.
[6] For example, Norway, Sweden, and Finland enacted Carbon Taxes in the 1990s, and Ireland and Canada have followed more recently, and Germany and the Netherlands added surcharges on electricity. The European Union has implemented a cap and trade regime for carbon. Steven Cohen, William Eimicke, Alison Miller, Sustainability Policy 72 (2015).
[7] For a gas tax proposal that is meant to be more politically attainable, see Merrill & Schizer.
[8] Cohen 82 (""In our view, the focus of climate and energy policy should be to lower the price of clean energy rather than to raise the price of dirty energy.").

for the same reason, the national security case for renewables is weak, although there obviously is an environmental case for these energy sources. In addition to the conflict between the environment and national security, there also is a tension between correcting externalities and pursuing distributional goals. By pursuing these goals with the same policy instrument, we are less likely to advance *either* effectively.

Energy tax expenditures also underperform because of flawed institutional design. By reducing the price of energy, tax expenditures have the counterproductive effect of increasing demand. They also create a number of perverse effects on supply. For example, by nurturing future substitutes for hydrocarbons, green energy subsidies induce hydrocarbon producers to cut their prices today. In addition, some tax expenditures reward production, instead of revenue or profit, and thus motivate firms to generate energy that is not needed. Likewise, many energy tax expenditures bet on specific technologies, even though the government does not have the expertise and incentives to "pick winners" effectively. Furthermore, many energy tax expenditures are too generous, subsidizing what claimants would do anyway. Indeed, some subsidize behavior that already is legally required.

In addition to cataloguing these various flaws, this Article also traces their origins. Although some would also arise with Pigouvian taxes, many are unique to subsidies. Instead of the tax expenditures we use under current law, we could pursue our goals more cost-effectively with a menu of Pigouvian taxes, each targeting different externalities (e.g., climate change, pollution, revenue to geopolitical rivals, defense costs to ensure access to petroleum, etc.). Unfortunately, the political challenges with this approach are familiar. In response, this Article considers how to make Pigouvian taxes more politically plausible. One strategy is to embed them in tax credits, so these credits become, in effect, Pigouvian taxes in disguise.

In any event, since we probably are stuck with subsidies, this Article also offers guidance about how to correct, or at least to mitigate, institutional design flaws that arise under current law. For example, we should try to subsidize the behavior we actually want (such as saving gasoline), instead of a proxy that is *related* but different (such as buying a hybrid). "Proxy" subsidies are more likely to produce imperfect or even counterproductive incentives than "results-based" subsidies. In addition, broader subsidies put less pressure on the government to "pick winners." We also should try to spend only the minimum needed to incentivize the desired behavior. That level should be zero for conduct that already is legally required. It also can be zero (or at least a very low level) when energy prices are high, since high prices produce their own incentives for energy innovation.[9]

[9] Indeed, high prices (and the decline of US manufacturing) have played an important role in recent years in making the US more energy efficient–so the energy we use to create each dollar of GDP has declined substantially. According to the US Energy Information Agency, for each dollar of GDP, the U.S. used 13,381 BTU in 1980, compared with 7328 BTU in 2011. http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=92&pid=46&aid=2&cid=US,&syid=1980&eyid=2011&unit=BTUPUSDM.

Needless to say, the government does not have to pursue energy policy goals only with Pigouvian taxes or subsidies. It also can use a broad menu of other policy instruments, ranging from command and control regulation, cap and trade, and disclosure (for environmental goals) to foreign aid, surveillance, military deployments, and treaties (for national security), and much more. This Article does not seek to cover the entire waterfront of policy instruments, or to delineate precise boundaries among them. Instead, the premise of this Article is that the government will continue to rely heavily on tax expenditures – and may at least consider Pigouvian taxes – so it is important to understand how structure these instruments more effectively.

Part I outlines the environmental, national security, and economic goals of energy tax expenditures. Part II discusses how empirical uncertainty and heterogeneity complicate efforts to pursue these objectives. Part III considers challenges that arise because of conflicts in our goals. Part IV canvasses the political economy advantages of subsidies over Pigouvian taxes, and offers suggestions about how to make Pigouvian taxes more politically palatable. Part V surveys five institutional design challenges that arise under currently law – most of which are more acute with subsidies than with Pigouvian taxes – and offers suggestions about how to mitigate them. Part VI is the conclusion.

I. Pursuing Worthy Goals: The Environment, National Security, and the Economy

The government has good reasons to intervene in energy markets. Some types of energy generate negative externalities for the environment and national security. In addition, market failures can lead to underinvestment in energy innovation.

A. Environmental Externalities

1. *Greenhouse Gas Emissions and Climate Change*

Fossil fuel combustion and industrial processes caused 78% of the increase in greenhouse gas emissions ("GHG's") between 1970 and 2010, according to the Intergovernmental Panel on Climate Change.[10] The familiar concern is that GHG's raise global temperatures. For instance, the IPCC concludes that the "period from 1983 to 2012 was likely the warmest 30-year period of the last 1400 years in the Northern Hemisphere," [11] Likewise, the World Bank cites "growing evidence . . . that . . . warming close to 1.5°C above pre-industrial levels by mid-century is already locked-in to the Earth's atmospheric system."[12]

[10] Intergovernmental Panel on Climate Change, 2014 Synthesis Report, at 4, http://ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_SPMcorr1.pdf.
[11] Id.
[12] World Bank, *Turn Down the Heat: Confronting the New Climate Normal* xvii (2014), http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/11/20/000406484_20141120090713/Rendered/PDF/927040v20WP00O0ull0Report000English.pdf.

"[T]he signature effects of human-induced climate change—rising seas, increased damage from storm surge, more frequent bouts of extreme heat—all have specific, measurable impacts on our nation's current assets and ongoing economic activity," according to the Risky Business Project.[13] The risks include damage to coastal property, declining agricultural yields in some places (possibly offset by rising yields in others), less productivity from outdoor workers, shortages of water, and outbreaks of disease. Alleviating these risks is a familiar rationale for taxing hydrocarbons or subsidizing alternative energy.

2. Pollution

Pollution is another well known source of negative externalities. For example, mining for coal can pollute streams, trigger landslides and disfigure landscapes, while burning it causes smog and acid rain.[14] Nuclear power generates radioactive waste, while accidents can emit radiation into the atmosphere. Oil can pollute land and water when pipelines leak,[15] tankers crash, and offshore rigs malfunction. Hydraulic fracturing uses toxic chemicals that can pollute water wells if spilled on the surface or not disposed of properly.[16] In addition to damaging property, pollution sometimes affects human health as well. There also are other dangers in improperly accessing, transporting, and using energy, such as fires, explosions, and seismic activity.

As a result, it is important for consumers to account for these costs in deciding how much energy to use. Obviously, a range of regulatory mechanisms can be used to mitigate these harms, including Pigouvian taxes and subsidies.

3. *Rapid Economic Development and the Consumption of Finite Resources*

While energy development has other environmental costs as well, these are less persuasive as justifications for subsidizing alternative energy. For example, energy development can trigger "boom town" conditions, such as traffic jams, housing shortages, and overtaxed public services. But the right way to deal with traffic in North Dakota is to build roads, not to subsidize solar panels. More generally, local governments should respond to these issues with zoning, taxes, and other familiar instruments.

Another concern about fossil fuels is that they eventually will run out.[17] Yet this is not a persuasive rationale for subsidizing alternative energy for two reasons. First, although concerns about exhausting the supply of hydrocarbons are longstanding – indeed, a founder of Standard

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[13] Kate Gordon, *Risky Business, The Economic Risks of Climate Change in the United States* 2 (2014), http://riskybusiness.org/uploads/files/RiskyBusiness_Report_WEB_09_08_14.pdf.
[14] Graetz, at 86, 92.
[15] The National Research Council estimates the expected cost of spills to be about ¾ of a cent per barrel. Hidden Costs of Energy, at 321.
[16] Merrill & Schizer.
[17] Cohen, at 6 (articulating principle of sustainability management that it is better to create wealth in ways that do not use up finite resources).

Oil dumped his shares in 1885, believing the world's supply of oil was nearly gone – new technologies have consistently been developed to access more.[18] Second, and more fundamentally, there is no market failure. As Harold Hotelling showed in 1931, the market price of hydrocarbons reflects their inherent scarcity. Producers have to decide how much to sell today and how much to save for the future.[19] If they expect to earn more (in present value terms) by selling later, they will do so. As a result, the current price incorporates predictions about the future, including assumptions about anticipated demand, expected extraction costs, and the likely availability of substitutes. A tighter supply causes the price of hydrocarbons to rise, creating stronger incentives to develop alternatives.[20]

B. National Security

While climate change and other environmental issues have become increasingly salient in energy policy in recent years, the original rationale for government intervention was grounded in national security.[21]

1. *Energy Shocks and Defense Costs*

The most basic connection between energy and national security is that navies cannot sail, fighter jets cannot fly, and tanks cannot run without fuel. In fact, one of the Allies' advantages in World War II was more reliable access to oil.[22] Yet the military's need for fuel is only part of the story.

The entire U.S. economy depends on energy. Although the "energy intensity" of the U.S. economy has declined – so we use less energy to generate a dollar of GDP[23] – oil shocks still have significant adverse effects on the economy.[24] The more oil we use, the more painful these

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[18] Russell Gold, *Why Peak Oil Predictions Haven't Come True*, Wall St. J., Sept. 29, 2014, http://www.wsj.com/articles/why-peak-oil-predictions-haven-t-come-true-1411937788.

[19] Harold Hotelling, The Economics of Exhaustible Resources, 39 J. Polit. Econ. 137 (1931).

[20] *See generally* Geoffrey Heal, Exhaustible Resources, The New Palgrave Dictionary of Economics. 2nd ed. (Steven N. Durlauf & Lawrence E. Blume eds) (2008) <http://www.dictionaryofeconomics.com/article?id=pde2008_E000165> doi:10.1057/9780230226203.0522

[21] Michael Graetz, The End of Energy (2010).

[22] Geoffrey Kemp & Robert Harkavy, World War II and Middle East Oil, in **Strategic Geography and the Changing Middle East: Concepts, Definitions, and Parameters (1997), http://acc.teachmideast.org/texts.php?module_id=4&reading_id=120&sequence=18**

[23] Jeremy Scott Diamond et al, America is Shaking Off Its Addiction to Oil, Bloomberg, Dec. 11, 2014, http://www.bloomberg.com/graphics/2014-america-shakes-off-oil-addiction/ (noting that U.S. has gone from using over 3.5 barrels per million dollars of GDP to less than 1.5 barrels).

[24] Stephen P.A. Brown & Hillard G. Huntington, *Assessing the U.S. Oil Security Premium*, 38 Energy Econ. 118, 121 (2013) ; Gilbert E. Metcalf, The Economics of Energy Security, Working Paper 19729 (2013), http://www.nber.org/papers/w19729.pdf ("[W]hether the impact of oil shocks on the economy is as large as it once was is a matter of considerable academic analysis. Analyses focus on factors such as the role of improved monetary policy response to oil shocks combined with a decreasing importance of oil in the economy (Nordhaus (2007)), the interplay between oil markets and other sectors (e.g. housing and automobiles) (Hamilton (2009)), and the need to

shocks are. Yet "those purchasing oil," Brown and Huntington have observed, "are unlikely to understand or consider how their own oil consumption increases the economy-wide effects of oil supply shock."[25]

Avoiding energy shocks has been a core goal of U.S. foreign policy since the Arab oil embargo of 1973. In pursuing this goal, the U.S. has repelled Saddam Hussein's invasion of Kuwait, fielded a significant naval presence in the Persian Gulf, sold weapons to friendly governments in the Middle East, and maintained military bases there.[26] To the extent that dependence on oil has caused the U.S. to commit more blood and treasure to national defense, these incremental costs are hidden costs of using oil.

Yet the magnitude of these externalities is hard to estimate. After all, having a powerful military advances a number of important goals unrelated to energy, including promoting our values, deterring conventional attacks, countering terrorism, discouraging the proliferation of weapons of mass destruction, protecting our allies, and facilitating global commerce. It may be, moreover, that only a large change in oil supply or demand would affect U.S. military policy, while a modest change would not. As a result, it is hard to know how much dependence on oil actually adds to U.S. defense burdens and commitments.[27]

Given this uncertainty, economists generally have not tried to quantify these costs, and many have concluded that they are too speculative to be considered by policymakers.[28] Others go further and conclude, as the National Research Council does, that "the marginal cost is essentially zero."[29] Yet the fact that this cost is conceptually and empirically difficult to pinpoint

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distinguish between supply and demand shocks (Kilian (2008)).”). But see National Research Council (arguing that price shocks are costly, but do not represent externalities).

[25] Stephen P.A. Brown & Hillard G. Huntington, *Assessing the U.S. Oil Security Premium*, 38 Energy Econ. 118, 121 (2013)

[26] In the past fifteen years, we have also fought two other wars in the Middle East and provided air and logistical support in other conflicts, although the role of energy in motivating these military actions is debatable.

[27] Given this uncertainty, economists generally have not tried to quantify these effects, and many have concluded that they are too speculative to be considered by policymakers. See, e.g., Bohi and Toman ("this externality is too uncertain to be used in determining energy policy"). Others go further and conclude, as the National Research Council does, that "the marginal cost is essentially zero." National Research Council, at 333; Metcalf, The Economics of Energy Security, at 19 (citing NRC report). Yet the fact that this cost is conceptually and empirically difficult to pinpoint does not necessarily mean its level is zero. While it would be simpleminded to conclude that the *entire* cost of the U.S. military presence in the Middle East is attributable to oil, it also strikes me as implausible that *none* of it is attributable to oil. This does not make it easier to estimate this cost, but this is not a reason to assume the answer is zero.

[28] See, e.g., Bohi and Toman ("In brief, a defensible estimate of the externality associated with U.S. military spending for oil import security would require an in-depth analysis of what rationales exist for military spending, how the level of spending has been affected by changes in the volume of oil imports, and how the reduction in oil imports would improve economic welfare. No study of these issues has been undertaken. Until an effort that yields a credible measure of the externality involved is completed, this externality is too uncertain to be used in determining energy policy.")

[29] National Research Council, at 333. Notably, the NRC cites, Bohi and Toman. Id. ("[T]he marginal cost is essentially zero. This view is held by a number of other researchers in this area, including Bohi and Toman (1994).

does not mean its level is zero. While it would be misguided to attribute the *entire* cost of the U.S. military presence in the Middle East to oil, it also is a stretch, in my view, to conclude that *none* is attributable to oil. In any event, the National Research Council acknowledges that substantial changes in oil markets could affect the analysis. The shale oil boom was just beginning in 2010, when NRC published their study. The dramatic price decline of 2014, which took many by surprise, was still years away. In light of these tectonic shifts in global oil markets, this issue warrants further study.

In any event, if policing access to oil does add to U.S. defense burdens, more domestically-produced oil is often invoked as a solution. Yet this is not quite right. Even if the U.S. uses only domestic oil, oil shocks are still a threat. For example, if the Persian Gulf is sealed off – so Asian and European customers can no longer buy Middle Eastern oil – they will bid up the price of U.S. oil.[30] While U.S. production is helpful in this situation, it softens the blow not because it is *domestic*, but because it is *diverse*. In this regard, new discoveries in Brazil, Canada, and the U.K. are as helpful as new finds in Texas and North Dakota. With more slack capacity, the loss of one source of supply is less likely to cause a price shock.[31] In addition, when new production comes from stable parts of the world, unstable sources represent a shrinking percentage of global oil production, which further reduces the likelihood and magnitude of shocks.[32]

The committee adopts this position.”). But Bohi and Toman are somewhat less definitive, as the passage cited in the prior footnote shows. See also Metcalf, The Economics of Energy Security, at 19 (“Noting the work of Bohi & Toman (1993), the NRC report concluded that the marginal cost of oil related military spending is essentially zero. In other words, a marginal (or even inframarginal) reduction in oil consumption might not affect our national security planning or spending significantly. “).

[30] Douglas R. Bohi & Michael A. Toman, The Economics of Energy Security 53-54 (1993); Gilbert E. Metcalf, The Economics of Energy Security, Working Paper 19729 (2013), http://www.nber.org/papers/w19729.pdf (“ Even if the United States imported no oil but rather relied on domestic production for all its oil needs, a supply shock elsewhere in the world would lead to a rise in domestic oil prices.”).

[31] Gilbert Metcalf expresses skepticism about the importance of diversity of supply. He argues that if one existing supplier drops out, another *existing* supplier can make up the shortfall, so that adding *more* suppliers does not add much. Metcalf, the Economics of Energy Security (“Diversity in supply sourcing is often cited as an energy security issue. The economic security benefits of diversification on this dimension are less clear cut. To the extent that energy sources trade in world markets, supply shortfalls from one supplier can be made up by purchases from other suppliers. . . . [I]t is not clear that increasing the number of supply sources for an individual country is especially beneficial.”). But this argument assumes there is *still excess capacity* in the system, even after some suppliers drop out. This is true as far as it goes, but where does this excess capacity come from? Assuring *there is* excess capacity is precisely the reason to expand and diversify supply.

[32]Brown & Huntington, at 119 (“Nonetheless, oil security can be greatly affected by the composition of world oil production. A given geopolitical event occurring in a region of the world is likely to remove a relatively constant proportion of the oil supplies produced in that region. Under these conditions, the increased contribution of unstable oil supplies to world oil markets will lead to bigger oil supply disruptions and bigger oil price shocks.”).
In contrast, Gilbert Metcalf asserts – without explanation – that diversifying the supply of oil would not affect oil shocks, although he acknowledges that having alternatives to oil would do so. It’s not clear why the analysis should be different.

Notably, slack capacity can be attained not just with supply enhancement, but also with demand reduction. Since petroleum is mainly used in transportation, greater fuel efficiency is helpful as well, as is the development of alternative energy sources for transportation.[33]

2. *A Source of Strength for Geopolitical Rivals*

Dependence on oil can undermine national security not only in imposing burdens on us, but also in strengthening geopolitical rivals. This can happen in three ways. First, when hostile regimes earn revenue from energy production, they can strengthen their hold on power by buying influence with key domestic constituencies. Second, this money supports their militaries and, in some cases, funds terrorist organizations.[34] Third, the ability to stop selling energy – and thus to undermine their customers' economies – is itself a source of power. For example, Russian threats to shut off natural gas sales give it significant sway over its neighbors.[35] If our reliance on particular types of energy strengthens adversaries in these ways, the energy generates additional negative externalities.

Again, we can mitigate these costs with both demand reduction and supply enhancement. Both strategies put downward pressure on prices, reducing the revenue and leverage of hostile energy producers. For example, a commonly observed advantage of exporting U.S. natural gas is countering Russia's energy-based influence in Europe. Similarly, the recent surge in U.S. oil production helped build support for sanctions on Iran, since new U.S. production could substitute for Iranian oil.[36] Increased U.S. oil production has also added to U.S. "soft" power by arguably substituting the U.S. for Saudi Arabia as the world's "swing" oil producer.[37]

So far, the analysis assumes that cutting the oil revenue of geopolitical rivals affects their *capacity* to threaten the U.S., but not their *motivation* to do so. Yet this may not always be true.

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[33] Metcalf, The Economics of Energy Security, at 21 ("Diversity in the fuels consumed provides benefits in the form of dampened impacts of supply shocks on prices and economic activity. If the share of petroleum in the mix of energy sources is reduced, any oil related supply reduction will have a smaller impact on the economy.").

[34] Graetz, at 254 (("Dollars we exchanged for oil have strengthened countries that oppose us and have helped fund radical Islamic institutions, including schools, throughout the Middle East. In some cases, oil revenue funds terrorism."). The National Research Council takes a somewhat different view, distinguishing between the bad acts funded by oil revenue (which they concede have negative externalities), and the consumption of oil that generates this revenue (which they argue does not). "U.S. oil consumption that enriches countries with which the United States has differences is not an externality," they contend. "Rather, U.S. oil consumption makes inimical actions possible." NRC, at 332. It seems like a semantic exercise to debate whether the externalities flow from bad acts, or from the revenue facilitating it. NRC offers this distinction to argue that we should target the bad acts, instead of our oil consumption. Depending on the context, this will surely be true in some cases, but may not be true in others.

[35] See National Research Council, at 332 ("[C]ountries dependent on imports subtly modify their policies to be more congenial to suppliers. For example, China is aligning its relationships in the Middle East (e.g., Iran and Saudi Arabia) and Africa (e.g., Nigeria and Sudan) because of its desire to secure oil supplies.").

[36] Daniel Yergin, *Who Will Rule the Oil Market?*, NY Times, Jan. 25, 2015 ("Over a million barrels per day were . . . taken off the market by sanctions imposed on Iran. Without that big surge of shale oil from the United States, it is highly likely that those sanctions would have failed. Prices would have spiked, countries seeking cheaper oil would have broken ranks – and Iran might not be at the nuclear negotiating table today.")

[37] Id.

Some regimes could respond by seeking a better relationship with the U.S. (*e.g.,* to secure aid or an end to sanctions), while others could ratchet up their rhetoric or even precipitate a crisis (*e.g.,* to distract and rally domestic constituencies). There could even be a change in the regime. Thus, although the U.S. is likely to benefit from weakening hostile energy producers, it is possible to imagine other scenarios as well.

Finally, low oil prices obviously create challenges for energy producers that are *not* hostile to the U.S. Some are close allies and trading partners, such as Canada. Others are at risk of being replaced by hostile insurgencies. For example, Nigeria is battling the Boko Haram insurgency.[38] Likewise, Egypt and Jordan could be destabilized if Saudi Arabia cuts its support for them in response to declining oil prices. In theory, we can increase our foreign aid budget to offset these adverse effects, but we need to have the institutional capacity and political will to do so effectively. In any event, to the extent that these increases are needed, they offset some of the national security advantages from reduced demand and enhanced supply.[39]

C. Economy

The case for government intervention is grounded not only in the environment and national security, but also in the economy – and, specifically, in three market failures.

1. *Property Rights, Innovation, and Basic Research*

First, it is well understood that property rights are not always broad enough to afford innovators all the benefits of new ideas. "If many people are able to exploit, or otherwise benefit from, research done by others, then the total or social return to research may be higher on average than the private return to those who bear the costs and risks of innovation," Ben Bernancke has written. "As a result, market forces will lead to underinvestment in R&D from society's perspective, providing a rationale for government intervention."[40] This argument is not unique to energy. It is especially persuasive for basic research, since "[t]he most applied and commercially relevant research is likely to be done in any case by the private sector."[41]

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[38] Daniel Yergin, Who Will Rule the Oil Market?, NY Times, Jan. 25, 2015 (noting that Nigeria is most populous nation in Africa, with largest economy, and that oil revenue represent 95% of exports and 75% of government revenue; "its revenues are falling as it needs more money to fight the Boko Haram insurgency").

[39] The goal here is assumed to be maximizing *national* welfare. Yet even if our goal is to maximize global welfare instead, much of the analysis does not change. For instance, oil price shocks have adverse consequences for most of the world, although they obviously can be advantageous for oil producers. Destabilizing the Nigerian government presumably is bad not only for the United States, but also for Nigeria and its neighbors. While strengthening the governments of Russia and Iran has obvious advantages for the leaders of those countries, it arguably imposes costs even within the borders of those nations (e.g., for dissidents), and has obvious negative externalities for their neighbors (e.g., Ukraine).

[40] Ben Bernanke, Promoting Research and Development: The Government's Role May 16, 2011, http://www.federalreserve.gov/newsevents/speech/bernanke20110516a.htm

[41] *Id.*

3. Network Effects, Transaction Costs, and Infrastructure

A second set of market failures, grounded in network effects and transaction costs, impede the development of energy infrastructure. For example, a key advantage of petroleum-powered cars is the prevalence of gasoline filling stations. Since there is no comparable network of natural gas filling stations or electric charging stations, natural-gas- and electric-vehicles are less appealing. Yet if consumers do not buy them, filling and charging stations are unlikely to be built. This network effects creates a "chicken and egg" problem that could justify government intervention.

Similarly, the safest way to transport oil and natural gas is via pipeline, instead of rail or truck. But it is extremely costly to secure rights of way from thousands of landowners. Indeed, a great deal of natural gas in North Dakota is burned at the well, instead of shipped to consumers, because of a lack of pipelines. A government role (*e.g.*, through eminent domain) can be justified to address these transaction costs.

3. *Investment Inefficiency*

Third, consumers might underinvest in energy efficient cars, appliances, heating systems, and other technologies – a market failure known as "investment inefficiency." Cognitive biases could keep some from focusing on this opportunity. Others might not take the time to figure out how much energy (and money) they could save, although mandatory disclosure undercuts this explanation. Credit constraints might prevent some upfront investments. Agency costs could also play a role, since those who often are best positioned to make the energy-saving investment (builders and landlords) may not benefit (directly) from reduced energy bills.

Yet this market failure is a slim reed for justifying energy subsidies. For one thing, the empirical evidence is mixed about whether consumers *actually do* underinvest in energy savings technologies. In addition, the tax treatment already is advantageous for an (unintentional) reason that has largely been overlooked in the literature: the economic return on these investments – reduced energy bills – is not taxed. This favorable tax treatment, which is a form of imputed income, derives from administrability concerns rather than a policy choice.

4. *Economic Advantages That Do Not Justify a Subsidy*

Finally, there are other economic advantages when oil and gas development and "green tech" succeed in the U.S., including economic growth, more jobs, and enhanced purchasing power. These advantages can be substantial.[42] But although these benefits are sometimes

[42] *See, e.g.,* Thiemo Fetzer, Fracking Growth, CEP Discussion Paper No 1278 (June 2014) http://cep.lse.ac.uk/pubs/download/dp1278.pdf ("Every oil- and gas sector job creates about 2.17 other jobs. Personal incomes increase by 8% in counties with at least one unconventional oil or gas well. The resource boom translates into an overall increase in employment by between 500,000 - 600,000 jobs.").

invoked to justify a subsidy,[43] there is no market failure. As a result, a subsidy actually could induce *too much* investment, draining resources from other valuable activities. Indeed, there is evidence that green tech subsidies are a costly (and even counterproductive) way to create jobs.[44]

Similarly, although reducing oil imports has economic advantages, the case for a government intervention is unclear. Presumably, the goal would be for U.S. consumers to keep more of their wealth, instead of transferring it to foreign energy producers. Some argue that the U.S. should pursue this goal by using its market power as a huge consumer of energy (so-called "monopsony" power). If cutting our consumption reduces prices, we would save money on the oil we still import. Yet using monopsony power in this way does not *repair* a market failure; it actually *creates* one.[45] In response, some try to justify this step as a response to another market failure: the market power exercised by OPEC. In any event, the premises of these "market power" arguments are somewhat dated. The price decline in 2014 raises questions about OPEC's market power. In addition, the U.S. carries less weight as a consumer, given our successful efforts at energy efficiency and the increasing energy appetites of China and others. Finally, the domestic oil boom in the U.S. means the U.S. is importing significantly less oil. As a result, cutting prices would trigger a transfer to US consumers – not only from *foreign* producers – but also from *U.S.* producers.

II. Challenges in Measuring Externalities: Uncertainty and Heterogeneity

The last Part offered a range of justifications for the government to intervene. Many are plausible, and some are even compelling. There are good reasons, then, to use taxes or subsidies (or other regulatory instruments) to internalize the relevant externalities. Yet this task becomes more difficult for two reasons, which are considered in turn. First, there is significant uncertainty about the magnitude of the relevant externalities. Second, this uncertainty is especially challenging because the externalities vary in different contexts.

A. ***Uncertainty***

To begin, then, the environmental, national security, and economic goals in Part I are all subject to significant uncertainty. Climate change is the quintessential example. There are vigorous debates about the level of emissions from particular activities. For example, when natural gas is extracted and transported, some escapes into the atmosphere. Experts differ about the magnitude of these "fugitive emissions," and thus about how beneficial it is to replace coal

[43] See, e.g., Tom Friedman.
[44] Graetz at 168, quoting study of TPI industries ($20,000 per worker subsidy for wind; $60k to $300k per worker for solar); id. at 169-70 ($4 billion subsidy, leading to the installation of smart meters, lead to the elimination of 28,000 meter reader jobs, while creating very few jobs since the meters were mostly built overseas).

[45] National Research Council, at 328.

with natural gas.[46] In addition, there are a range of views about how much temperatures are likely to rise. According to the IPCC, past trends do not supply the answer because they "are very sensitive to the beginning and end dates"; indeed, "the rate of warming over the past 15 years . . . is smaller than the rate calculated since 1951."

In any event, forecasting the change in temperature is only part of the battle. We also need to predict the welfare effects of this change, which is hard to do. It is possible that some regions will suffer severe or even catastrophic harms (*e.g.*, from droughts or flooding), while others regions will benefit (*e.g.*, from longer growing seasons in northern latitudes).[47] Since these effects are unlikely to emerge for decades, we need to choose a discount rate to value them. A market rate yields a low present value for future harms, counseling against costly responses today.[48] Some defend market rates as the most reliable benchmark for comparing different forward-looking investments.[49] Others advocate a lower rate on normative grounds.[50] Still others believe the *real* market rate is lower than we think, since climate change is likely to slow economic growth.[51] There is comparable uncertainty about the cost and efficacy of various responses. For all these reasons, there is no consensus about the social cost of carbon. While the IMF values it at $25 per metric ton of CO2, the Obama administration uses $37, and much lower and higher numbers have been asserted as well.[52]

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[46] Schizer & Merrill.
[47] Posner & Weisbach.
[48] For example, William Nordaus uses a 5.5% discount rate, while Stern uses a 1.4% rate. This difference is the main reason they offer very different policy recommendations.
[49] Kaplow & Weisbach.
[50] Daniel Farber, Climate Justice.
[51] Elizabeth J. Moyer, Mark D. Woolley, Michael J. Glotter & David A. Weisbach, Climate impacts on economic growth as drivers of uncertainty in the social cost of carbon, 43 J. Leg. Stud. 401 (2014) ("The IAWG models share one notable feature: although climate damages can become large as a fraction of output, they do not significantly alter economic trajectories.) id. at 4 ("Continued economic growth in the face of climate change is inconsistent with many (admittedly qualitative) statements by experts that climate change may have strongly detrimental effects to human society.").

[52] Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, at 2 (2010) (Original 2010 finding: $23.8 per metric ton of CO2 emission in 2015, assuming 3% discount rate; 26.3 in 2020); Interagency Working Group on Social Cost of Carbon,Technical Support Document: - Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866 (May 2013) ("IAWG issued revised estimate in May of 2013: 37 in 2015, 42 in 2020"); Frances C. Moore & Delavane B. Diaz, *Temperature impacts on economic growth warrant stringent mitigation policy*, Nature Climate Change, Jan. 12, 2015, http://www.nature.com/nclimate/journal/v5/n2/pdf/nclimate2481.pdf ("Damages from climate change that directly affect growth rates have the potential to markedly increase the SCC because each temperature shock has a persistent effect that permanently lowers GDP below what it would otherwise be.") id. ("implies a social cost of carbon several times larger than previous estimates" of perhaps $220 per ton); Robert R. Murphy, The Case for a Carbon Tax is Much Weaker Than You Think, Dec. 1, 2014, http://instituteforenergyresearch.org/analysis/case-carbon-tax-much-weaker-think/.

There are parallel disagreements about other environmental externalities. For example, there is a debate about whether hydraulic fracturing is likely to contaminate water, and how feasible it is to regulate this risk effectively.[53] Likewise, environmentalists are divided about whether to rely on nuclear power in the effort to combat climate change.

The national security implications of energy policy are also hard to quantify. Insulating our economy from oil shocks would be valuable. But studies suggest that our economy's exposure to oil shocks has declined, although the magnitude of this change, as well as the reason for it, are contested. A further question is how much the risk of oil shocks actually affects our defense budget– and, if so, by how much – since we have other reasons to fund the military. Likewise, lower oil prices have competing national security effects, potentially weakening both hostile and friendly regimes, as discussed above.

Finally, although a strong case can be made for investing in basic research and infrastructure, the devil is in the details. Should our research priority be carbon capture, battery storage, fluid-free hydraulic fracturing, hydrogen vehicles, more efficient combustion engines, or something else? Likewise, although it is clear that petroleum-fueled vehicles benefit from a powerful network effect, the right response is less clear. Is it better to invest in electric charging stations, natural gas filling stations, battery changing stations, or some other technology? Is mass transit a better strategy?

B. Heterogeneity

A further challenge is that the magnitude of relevant externalities can vary with the context. For example, different hydrocarbons generate different levels of GHG's. Our progress in reducing GHGs, then, depends on *which* hydrocarbon we replace. Burning natural gas generates fewer GHG's than burning coal,[54] so we pursue climate-related goals more effectively by replacing coal, instead of natural gas. To complicate matters further, even the *same* hydrocarbon comes in variations with different "carbon footprints." For instance, "heavy" Canadian tar sands oil emits about 17% more GHGs than the average U.S. oil.[55] To be optimal, then, a carbon tax has to vary with the carbon content of the fuel. For the same reason, a subsidy for *replacing* hydrocarbons should vary with the fuel it replaces.[56] After all, the same solar panel generates more positive externalities when replacing coal than natural gas. Yet "tracing" the benefits in this way is administratively difficult. We can try to generalize about different types

[53] Schizer & Merrill.
[54] Burning gas generates half as many GHG's as burning an energy-equivalent amount of coal but, as noted above, "fugitive" emissions of methane (the main chemical component of natural gas) are an offsetting factor.
[55] http://www.edf.org/energy/why-oil-tar-sands-different
[56] David Weisbach, Designing Subsidies for Law-Carbon Energy, 20 J. Envtl. & Sustainability L. 1, 14 (2013).

of alternative energy – for instance, observing that geothermal tends to replace coal, while wind tends to replace natural gas – but these generalizations are imprecise.[57]

National security externalities can vary in comparable ways. For instance, by reducing the global demand for oil, we cut the revenue available to oil exporting nations. Yet although we are likely to applaud this consequence for Iran, we could regret it for Canada or Nigeria, as noted above. Likewise, accessing new sources of oil weakens hostile oil exporters and helps insulate us from oil shocks. While these advantages arise when oil is found anywhere in the world, we still have reason to prefer discoveries in (friendly) Great Britain to (unfriendly) Venezuela.

III. Challenges in Pursuing Competing Goals

While empirical uncertainty and heterogeneity are important challenges in making energy policy, there is an even more fundamental challenge: some of our goals are in conflict. First, the same source of energy can have positive externalities for national security and negative externalities for the environment, and vice versa. Since the same behavior can have both positive and negative externalities, we have to determine the *net* of competing effects. Second, the policies we implement to correct externalities can undercut – or, at least, fail to advance – our distributional goals. Although it is tempting to tailor these policies so they also advance distributional goals, the result is likely to be disappointing.

A. The Environment Versus National Security

Before turning to distribution, though, we should begin with competing effects we encounter in correcting externalities.

1. Tensions in Pursuing Only Environmental Goals or Only National Security Goals

Indeed, tensions arise even if our sole priority is the environment. For example, while the environmental case for wind and solar energy is very strong, it is not unblemished. Wind turbines pose a danger to birds. Wind and solar farms require a significant amount of land, and thus can threaten habitats. Toxic chemicals are used to manufacture solar panels, and some methods of solar generation use significant amounts of water.[58] The environmental case for nuclear power, moreover, is more controversial. Nuclear reactors have both positive externalities (in generating carbon-free energy) and negative externalities (in producing

[57] Metcalfe, Metcalf, Low Carbon Technologies, at 12. In any event, even if we can ascertain the level of emissions we are avoiding, the harm caused by these emissions also is potentially heterogeneous. It is likely to be worse in poor countries, as well as in warm climates.

[58] Union of Concerned Scientists, Environmental Impacts of Solar Power, Mar. 5, 2013, http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html#.VR09G_nF-nA.

radioactive waste), as noted above. Similarly, even though many environmentalists oppose hydraulic fracturing because they worry about water pollution and other environmental harms, others support it as a way to replace high-emissions coal with lower-emissions natural gas.

Likewise, there are conflicts even if the sole goal is national security. Enhanced supply and lower prices can weaken not only hostile oil producers, but also friendly ones, as noted above. Likewise, although a low oil price weakens geopolitical rivals, it also can motivate them to rally domestic constituencies by precipitating geopolitical crises.

2. Tensions Between Environmental and National Security Goals

The conflicts multiply once we pursue *both* environmental and national security goals. These conflicts are starker with some types of energy than others. Indeed, they are especially salient with oil and natural gas.

a. Coal

It is a familiar point, for example, that coal has especially large environmental externalities. At the same time, coal arguably has positive national security externalities because, as Michael Graetz put it, the United States is "the Saudi Arabia of coal." To reduce dependence on Middle Eastern oil, the government has periodically sought to replace petroleum with coal in transportation. The "synfuels" program pursued this national security objective unsuccessfully the 1970's and 1980's. Electric cars are a more recent mechanism for replacing petroleum with coal, since coal-fired power plants can generate electricity for these cars.

Indeed, the fact that the U.S. has enough domestic coal to power industry and to generate electricity – and does not have to import energy for these purposes – offers national security advantages. A decade ago, when domestic reserves of natural gas were dwindling and the U.S. was preparing to import natural gas, there was a national security rationale for using coal instead of natural gas. Since the leading exporters of natural gas are Russia, Iran, and Qatar, dependence on imported natural gas would have negative externalities like those of imported oil.

But times have changed. Hydraulic fracturing has unlocked vast new domestic reserves of natural gas, offering one hundred years of supply. Because of this "shale revolution," the price of natural gas has fallen from over $12.00 per mbtu in June of 2008 to less than $3.00 per mbtu in February 2015.[59] As a result, the percentage of electricity generated by coal has fallen from 48% in 2008 to 39% in 2015,[60] while natural gas's share has increased from 21% to 27%.[61]

[59] http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm (monthly Henry Hub prices).
[60] Coal's share has gone from 1.99 trillion kWh of a total of 4.12 trillion kWh to 1.64 trillion kWh of 4.17 trillion kWh. http://www.eia.gov/forecasts/aeo/er/early_elecgen.cfm
[61] Natural gas's share has gone from .88 trillion kWh of a total of 4.12 trillion kWh to 1.13 trillion kWh of 4.17 trillion kWh. http://www.eia.gov/forecasts/aeo/er/early_elecgen.cfm

The boom in natural gas production has an important implication, then, which has not been adequately recognized: As long as we produce domestic natural gas, there is no national security case for coal. While the government continues to spend billions of dollars on "clean coal" technology, the case for these expenditures is significantly weaker than it used to be.

b. Natural Gas

After all, natural gas has the same national security advantages as coal, but is better for the environment. As with coal, there are no security challenges in ensuring access, and dollars spent on this energy do not strengthen foreign producers that are hostile to the U.S. Yet natural gas pollutes the air much less than coal. In addition, burning natural gas emits about half as many GHGs as burning coal. Indeed, U.S. GHG emissions have declined in recent years, and the substitution of natural gas for coal is one of the reasons. U.S. GHG's declined by about 9.7% from 2005 to 2013 (from 5753.5 million metric tons ("mmt") to 5195.5 mmt), while GHG's from power generation declined by 15% (from 2,402.1 mmt to 2,040.5 mmt).[62]

This means there is a strong national security rationale for domestic natural gas – and, in a sense, an environmental rationale for it (as a way to avoid using coal). To the extent we can replace petroleum with natural gas, the national security advantages multiply. In a limited way, this is happening in two contexts. The first is heating commercial and residential buildings, where cheaper natural gas is replacing more expensive heating oil.[63] The second is transportation, albeit on a modest scale. Instead of relying on petroleum, electric cars obviously rely on electricity, which can be generated with natural gas. In addition, about 150,000 vehicles in the U.S. have engines powered by natural gas. These vehicles are gaining a modest foothold, since natural gas is significantly cheaper than petroleum.[64] An important challenge, though, is a lack of natural gas filling stations. This issue is less serious for municipal buses, delivery trucks, and other vehicles that refuel in a depot.[65] In addition, natural gas filling stations are cropping up near interstate highways to accommodate natural-gas-powered long-haul trucks.[66]

Even so, although natural gas eases the tension between national security and environmental goals, it does not eliminate it. As noted above, natural gas is itself a potent GHG when it escapes into the atmosphere. The volume of these "fugitive" emissions – and thus the

[62] EPA, National Greenhouse Gas Data, Feb. 2015, http://www.epa.gov/climatechange/pdfs/usinventoryreport/US-GHG-Inventory-2015-Chapter-2-Trends.pdf

[63] Bill Sanderson, *Home Heating Oil is Now Cheap, But Gas is Even Cheaper*, Marketwatch, Dec. 30, 2014 ("Even though prices are way down, oil can't catch a break from homeowners who remain willing to spend thousands of dollars converting their heating systems to natural gas. Heating oil has been losing market share to natural gas, electricity and other heat sources for years. Only 6% of U.S. homes used oil heat in 2012, government data show.").

[64] U.S. Dep't of Energy, Alternative Fuels Data Center, http://www.afdc.energy.gov/vehicles/natural_gas.html ("Natural gas powers about 150,000 vehicles in the United States and roughly 15.2 million vehicles worldwide.")

[65] Id. (" Natural gas vehicles (NGVs), which can run on compressed natural gas (CNG), are good choices for high-mileage, centrally fueled fleets that operate within a limited area.").

[66] Bob Tita, *Slow Going for Natural-Gas Powered Trucks*, Wall St. J., Aug. 25, 2014, http://www.wsj.com/articles/natural-gas-trucks-struggle-to-gain-traction-1408995745 (projecting sales of about 10,500 natural-gas powered trucks in 2015, representing increase of about 20% over 2013).

extent of natural gas's advantage over coal – is debated. In addition, even though natural gas probably is less damaging than coal, it obviously emits more GHG's than wind or solar. Cheap natural gas makes it more difficult for renewable energy to become economically competitive. Thus, although cheap and plentiful natural gas has clear advantages for national security, its implications for climate change are mixed.

In addition, the natural gas boom in the U.S. has prompted a range of other familiar environmental concerns. Many environmentalists worry that hydraulic fracturing contaminates drinking water and causes earthquakes. In announcing a ban on fracturing in New York, for instance, Governor Andrew Cuomo appealed to environmentalists (and angered industry) in saying that state officials had a duty not to allow fracturing near where children play and live. Environmentalists also warn that drilling damages habitats and contributes to congestion and traffic. In addition, it is common for environmentalists to oppose the construction of pipelines, which are needed to bring natural gas to market. Even with natural gas, then, tensions arise between environmental and national security goals.

c. Petroleum

The same dynamic arises with domestic oil production. While its national security advantages are obvious, its environmental risks are familiar as well. Onshore development has relied increasingly on hydraulic fracturing, prompting the same environmental controversy as natural gas. Meanwhile, offshore oil exploration has become more controversial since the Deep Water Horizon accident in the Gulf of Mexico. For years, national security and environmental advocates have squared off about whether to allow drilling and build pipelines in particular places. The debate about the north slope of Alaska is a longstanding example, and the Keystone pipeline is a more recent one. No doubt, there will be others over the coming years, as the government mediates between these competing sets of externalities.

d. Renewables

Finally, although advocates of wind and solar energy often tout the national security advantages of this technology, the national security case for this technology is weak – or, at least, it is highly contingent. The main function of wind and solar is to produce electricity and heat, but these bases are already covered by natural gas (and coal). Wind and solar cannot replace petroleum, since they are not used in transportation (except in electric cars, which can rely on natural gas or coal, instead of renewables, to generate electricity).[67] If national security is the sole priority, then, the need for renewables is unclear.

In the near term, the only national security argument for renewables is a contingent one: if we stop using domestically-produced natural gas and coal for environmental reasons – for

[67] At the same time, cheap oil is unlikely to affect the competitive position of renewables in generating electricity, although it could affect the prospects of using renewable energy in transportation. See Geoffrey Heale & Karoline Hallmayer, Oil vs Renewables: Can Cheap Oil Threaten the Success of Renewable Energy Sources? (

instance, if there is a national ban on hydraulic fracturing and the use of coal – we would want to have another domestic source of energy. Yet this is not so much a national security defense of renewables, as it is a further affirmation of the potential tension between national security and environmental goals.

Instead of the near-term, then, we need to look to the (very) long term for a national security argument for renewables. If natural gas reserves actually do run out in one hundred years, we might need renewables then. In addition, the environmental benefits of renewables might translate into national security benefits in the long run: we can mitigate famines, droughts, and other sources of instability from climate change that otherwise might emerge in fifty or one hundred years.[68] Yet given the time horizon and uncertainty associated with these benefits, they do not constitute an especially strong case for the national security advantages (as opposed to the environmental advantages) of these technologies.

3. Potential Synergies Between Environmental and National Security Goals

Yet there is one important policy goal that clearly has *both* national security and environmental advantages: burning less petroleum. This is certainly true if we accomplish this goal by encouraging people to drive fewer miles, for instance, by promoting mass transit, car-pooling, and telecommuting. It is also true if people use less petroleum by driving more fuel efficient vehicles.

Yet if we pursue this goal by replacing petroleum with other types of energy, the environmental advantages may recede, although the national security advantages would remain. For example, if we use hydrogen cars – and the hydrogen is manufactured from methane, releasing CO_2 in the process – the climate advantages are less clear. The same is true if we use electric cars and generate the necessary electricity with coal.

4. Targeting the Net Level of All Relevant Externalities

The bottom line, then, is that national security and environmental goals are often (though not always) in conflict. How should we handle this? In structuring Pigouvian taxes and subsidies (or other policy instruments), we need to account for these competing effects. For example, each energy source could have a Pigouvian tax or subsidy that, at the margin, equals the net of these competing externalities. To accomplish this, we could have a separate Pigouvian tax for each environmental and national security externality.

First, a carbon tax, C, could be imposed on hydrocarbons, based on the GHGs they emit when burned, extracted, and transported. Thus, C would be higher for coal than for oil and natural gas. A range of familiar implementation challenges should be considered.[69] For

[68] Graetz, 158: ("Climate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments.")
[69] For a discussion of implementation issues for a carbon tax, see Metcalf & Weisbach.

example, even if the tax seeks to maximize national (as opposed to global) welfare, we would want to impose it on foreign consumers as well, since their emissions affect us.[70]

Second, another Pigouvian tax, P, could internalize pollution risks from using, extracting, and transporting different sources of energy. For instance, the P for offshore oil drilling would reflect the risks of oil spills. The P for hydraulic fracturing would internalize risks of water contamination. The P for nuclear energy would reflect the risk of accidents and the cost of disposing of nuclear waste, and so forth. A range of implementation issues obviously would have to be considered. In some cases, we will want effluent taxes (which measure and tax pollution), while in others it may be easier to have "product" taxes (which tax the use of a product that involves pollution, instead of the pollution itself). Likewise, if the tax is supposed to maximize national welfare, P is likely to be lower for imported fuels, since pollution in extracting these fuels should have less effect on the U.S.

Third, we may want a Pigouvian tax to internalize the costs of congestion and traffic, T, including delays and the heightened risk of accidents. Obviously, the magnitude of these costs will depend on location, time of day, and other context-specific factors.

Fourth, additional Pigouvian taxes could internalize national security risks. For example, a tax, NR, could apply to fuels imported from geopolitical rivals (the "R" in "NR"), reflecting the risks in providing them revenue that can fund terrorism, nuclear programs, and the like. Another tax, ND, could internalize defense costs (the "D" in "ND") associated with policing access to the fuel.

Admittedly, implementing a national security tax would be difficult, and I am not aware of any work analyzing how to do so. For example, classifying nations as hostile or friendly – or as hard or easy to defend – would give the State Department another diplomatic lever, but one that could be challenging to use. Quantifying ND would also be quite difficult. Since the oil market is global, even users of domestic oil are affected by oil shocks, as noted above, so they have a stake in securing access to Middle Eastern oil. This means ND probably is positive even for crude from North Dakota and Canada. But ND should be higher for Middle Eastern crude, if only to incentivize the development of more stable sources. In varying taxes by country, we face not only these empirical and conceptual challenges, but also the constraints imposed by trade treaties. National boundaries pose a further challenge as well. Even if the tax is supposed to advance only national welfare, we still would want to impose it on consumers outside the U.S., since their consumption choices – for instance, in supporting hostile regimes – create negative externalities for us as well. The diplomatic challenges in arranging this would be immense. Yet fortunately, most of our trading partners already have high taxes on petroleum.

Under this segmented approach, then, the total Pigouvian tax would depend on the type of hydrocarbon, as well as its source. For example, oil from North Dakota or Canada would not

[70] Nordhaus (climate clubs).

be subject to NR, but would be subject to C, P, and T, as well as a low ND. Oil from Saudi Arabia would be subject C and T, a higher ND, and a lower P. Nuclear energy would not be subject to C or NR, but it would be subject to P and perhaps also a modest ND (reflecting the cost of securing the plant and its nuclear fuel from terrorist threats). Domestic coal would be subject to C and P, but not NR or ND. The same is true of domestic natural gas, although C would be lower.

Needless to say, the administrability (and political) challenges here are significant. Even if we had perfect information about the magnitude of various externalities, there are incremental administrative costs in tailoring individualized taxes in this way. Pervasive uncertainty about the magnitude of these various externalities – and how they vary in different contexts – makes this an even taller order.

Given these challenges, the most we can hope for is a rough estimate, which accounts for relative, as well as absolute, levels. For example, even if we cannot be precise about the size of the externalities from natural gas and coal, we know the environmental harm from coal is likely to be worse, so taxes and subsidies should reflect this difference. Likewise, we would impose an extra national security tax on oil, which would not be needed for coal or natural gas. We could try also to vary the tax, at least to an extent, depending on the source of the oil.

B. Correcting Externalities versus Distribution

In addition to the clash between environmental and national security goals, another conflict that can arise in crafting energy taxes and subsidies is the tension between correcting externalities, on one hand, and pursuing distributional goals, on the other. Although Congress sometimes wants to advance distributional goals through energy taxes and subsidies, this is difficult – and, indeed, often unwise – for two reasons. First, the distributional impact of these policies can be quite opaque. Second, distribution can distract us from efforts to correct externalities, and vice versa. By pursuing these goals together, we are less likely to advance *either* effectively. Instead, it usually is better to pursue them separately.

1. Uncertain Impact of Energy Tax Expenditures on Distribution

In some cases, there is only limited information about who is claiming a subsidy or paying a tax. For instance, there is very little public information about who claims energy tax expenditures. Although the Joint Committee and Congressional Budget Office estimate the distributional impact of a number of tax expenditures, energy tax expenditures are not on their list. Moreover, even if we knew who was *claiming* these tax expenditures, the claimant might not be the *true economic beneficiary*. For example, even though a hybrid tax credit is paid to the buyer, it may allow the manufacturer to charge more. Similarly, does percentage depletion induce oil companies to cut prices, pay higher wages, or earn larger returns?

Since taxpayers pay the federal gas tax at the pump, we don't have precise information about how much each person pays and what percentage is borne by each income quintile. Even so, reliable models can draw on average consumption patterns. Based on these patterns – and, more generally, on the intuition that low income taxpayers spend a higher percentage of their incomes on gasoline – we know these taxes tend to be regressive. Presumably, the same is true of carbon taxes, although some carbon intensive luxury goods, such as SUVs or frequent personal flights, could complicate the analysis.

In any event, if we look only at who is paying a Pigouvian tax, or who is claiming a subsidy, we miss an important piece of the puzzle. To understand the distributional impact of these policies, we also should know the incidence of the *externalities* we are correcting. Yet unfortunately, the empirical and conceptual challenges in doing so are daunting. For example, who benefits when we cut the revenue to geopolitical rivals? If these governments are stopped from funding terror plots, we will never know who the victims would have been. If we spend less money defending the Persian Gulf, how will we use this savings?

It is perhaps even harder to identify which sectors of the economy, and which parts of the world, bear the costs of cutting GHG's. If the U.S. imposes a heavy tax on burning coal, will miners be laid off, or will they export coal to nations with no carbon tax? Will subsidies for solar panels benefit U.S. consumers, or the Chinese firms that build them? If anything, it is even more difficult to identify who will *benefit* from cutting GHG's. Most likely, these beneficiaries have not been born yet. There are many questions also about precisely what harms will emerge, and who will be affected. Perhaps people in warmer climates or coastal areas are at greatest risk. But even if these predictions prove to be accurate, they tell us very little about the income level of people who are especially at risk. Maybe wealthy communities will be better positioned than low-income communities to invest in the necessary infrastructure and other adaptations. Yet at the same time, some of the wealthiest communities in the world are on coastal areas, and waterfront property often is especially desirable.

The bottom line, then, is that it can be difficult to say much about the distributional implications of pursuing environmental and national security goals. In all likelihood, everyone in the United States – and many people throughout the world – could benefit, at least to an extent, if these goals are pursued successfully. But calibrating the analysis more finely than that is not easy.

2. A Flawed Mechanism for Pursuing Distributional Goals

Fortunately, though, it is not necessary to pursue distributional goals through these policies. Other instruments are available instead. For example, if a gas or carbon tax is the most effective way to correct externalities, but it is regressive, we can compensate by adjusting other aspects of our tax and transfer system. The revenue from the tax can fund cuts in social security taxes, a more generous earned income tax credit, and the like. By pursuing energy and distributional goals separately, we can use the most cost effective way to correct externalities, while still accomplishing our distributional goals.

In contrast, if we pursue these goals together, our efforts to correct externalities are likely to be less cost effective for two reasons. First, high income claimants are usually more responsive to subsidies, since they have more capacity in their budgets. It probably costs less to induce them to use alternative energy or to invest in energy efficient technologies. For instance, if a hybrid costs $15,000 more than a traditional car, the government presumably has to provide a $15,000 subsidy to a low-income person who can barely afford the traditional car. But a high-income claimant can be motivated with less. If a $5,000 subsidy is enough, focusing on high-income claimants allows us to put three times as many hybrids on the road for the same money.

Second, the social benefit is the same whether the hybrid is driven by a high-income claimant or a low-income claimant. Either way, fewer GHGs are emitted. This is an important difference from other contexts. After all, there are many settings where high-income people are more responsive, but targeting them yields less social benefit. For instance, it is probably easier to persuade high-income people to save for retirement or buy health insurance, but the government does not need to do so. They are likely to take these steps on their own. Even if they don't, they are unlikely to depend on the government for support. As a result, the government has good reason to focus on low-income people. Changing their behavior may be harder, but the social benefit from doing so is greater. Yet this is not true when the goal is curtailing emissions or reducing the amount of oil imported from hostile nations.

Unfortunately, though, Congress still includes distributional criteria in a number of energy policies. For example, the federal government has allocated billions of dollars to subsidize energy-efficient technology in homes. This spending ramped up substantially during the 2009 stimulus. While some federal funding is open to everyone,[71] most is allocated based on financial need. For example, the majority of weatherization funding uses income-based allocations. This program, administered by the Department of Energy, has weatherized the residences of 7 million low-income Americans. Its annual budget increased from $450 million per year in 2009 to $5 billion in 2011 and 2012. A recent study by Michael Greenstone, who was Chief Economist for President Obama's Council of Economic Advisers, estimates that this program has had a negative return (-4% privately, and -3% if we include the social value of reducing GHG's).[72] Presumably, this is a costly way to reduce GHGs because the program has to cover a higher percentage of weatherization costs; with high-income claimants, by contrast, a more modest fraction presumably could induce these improvements.

[71] See Section 25C ($500 credit for nonbusiness energy properties).
[72] Meredith Fowlie, Michael Greenstone & Catherine Wolfram, Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program (2014), https://economics.stanford.edu/files/Fowlie-Greenstone-Wolfram%20--%20Do%20Energy%20Efficiency%20Investments%20Deliver.pdf

Of course, prioritizing low-income claimants has obvious distributional advantages. But if our goal is redistribution, cash is more effective. To think otherwise, we have to believe low-income households would voluntarily spend marginal dollars on weatherization. With cash, on the other hand, they can buy the goods and services they value the most. To illustrate this point, assume it costs $200 to induce a high-income claimant to weatherize, and $1,000 to induce a low-income claimant to do so. Instead of a $1,000 weatherization grant to the low-income claimant, we should achieve our environmental goal with the $200 grant to the high-income claimant, and then give $800 in cash to the low-income claimant. This is Pareto improving, as long as the low-income household would prefer $800 in cash to $1,000 for weatherization.

While we generally should be wary of pursuing energy and distributional goals in the same program – since there is a risk we will not succeed at either –there could be reasons to incorporate distribution-based conditions in limited circumstances. Most importantly, focusing on low-income claimants makes sense when we target market failures, such as credit constraints, that disproportionately affect them. For instance, if high-income people weatherize on their own, since it pays for itself in reduced energy bills, a subsidy may be needed only for those who cannot afford the up-front investment. In addition, if subsidies are provided through tax deductions or nonrefundable credits, which are less valuable to low-income claimants, we may need something else for them. Finally, there may be contexts were distributional adjustments are not politically feasible. In these circumstances, we have more reason to consider distribution within the four corners of the relevant energy initiative.

IV. Political Economy and the Use of Subsidies Instead of Pigouvian Taxes

As the last Part showed, there is a strong policy case for deploying a range of Pigouvian taxes, which would internalize various externalities associated with energy. Yet the political prospects of this approach are dim for a range of familiar reasons. Politically, subsidies are easier than taxes. There is more political support for *subsidizing* what we want to *encourage* than for *taxing* what we want to *discourage*. This Part briefly surveys the familiar political dynamic here, and also canvasses the hodgepodge of energy tax expenditures under current law. Then Part V will analyze the policy implications of using subsidies instead of taxes.

A. Political Resistance to a Carbon Tax or a Higher Gas Tax

The political challenges with carbon and gas taxes are familiar. The point of these taxes is to make it more costly – and, indeed, more painful – to use the targeted type of energy. While this pain creates a socially useful incentive, it is pain, nevertheless. The tax also is likely to be salient. Taxpayers will be constantly reminded of it when they fill up their tanks and pay monthly electric bills. At the same time, few organized interest groups want to fight for the tax. For example, alternative energy producers should value a carbon tax, since it would improve their competitive position. But the attenuated nature of this advantage makes a carbon tax less appealing to them than, for instance, a subsidy for their technology.

This is not to say that enacting carbon taxes is impossible. After all, forty countries have some form of carbon taxes. But a carbon tax is a harder sell in the U.S. for two reasons, First, American political culture has a stronger anti-tax tradition than, for instance, European social democracies. Second, targeting emissions from transportation is especially hard in the U.S., where, at least in many places, mass transit options are limited and distances are vast. Indeed, it is much easier to live without a car in Berlin, Paris, or Tokyo than in Kansas City, Dallas, or Los Angeles.

It is no surprise, then, that raising the gasoline tax in the U.S. is a political "hot potato." It has been 18.4 cents per gallon for over twenty years. The tax is supposed to fund highway construction and maintenance, but the highway trust fund has been running a $10 billion annual deficit in recent years. Even so, there is strong political resistance to raising the gasoline tax, a further sign of how unreceptive the U.S. political climate is to this sort of tax. "The gas tax hasn't been increased for 20 years," President Obama said recently. "There's a reason for that."[73] Or as a Republican former member of Congress put it, "I think it's too toxic and continues to be too toxic."[74]

Nor is the United States alone. Developing countries – where carbon emissions are growing substantially – generally also resist carbon and gasoline taxes. Recognizing this dynamic, Stephen Cohen has observed, "No political leader responsible for ensuring the material well-being of his or her people in the modern global economy is going to willingly raise the price of something so central to that economy as the price of energy. This is especially true in the developing world."[75]

Another chastening precedent is Australia, which repealed a carbon tax only two years after enacting it. Prime Minister Julia Gillard said she would consider carbon "pricing" proposals, but also pledged that "[t]here will be no carbon tax under the government I lead." Yet to form a coalition with the Green party, she agreed to a carbon "price." For this seeming about-face, the opposition branded her "Ju-Liar," and she eventually was replaced as leader of her party. Meanwhile, Tony Abbott, the leader of another party, committed to lead a "people's revolt" and "fight this tax every second of every minute of every day." He eventually was elected in part on a pledge to "ax the tax." As one commentator observed, "The tax, or carbon-pricing mechanism, had defined three elections, destabilized three prime ministers and dominated public debate in this country for eight toxic years."[76]

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[73] Russell Berman, *The Tax That Dare Not Be Hiked*, N.Y. Times, Dec. 7, 2014, http://www.theatlantic.com/politics/archive/2014/12/the-tax-that-dare-not-be-hiked/383428/.
[74] Id. (quoting Steve LaTourette of Ohio, who reportedly is close to Speaker Boehner).
[75] Stephen Cohen, It's Time to Abandon the Delusion of a Carbon Tax, Sept. 29, 2014, http://www.huffingtonpost.com/steven-cohen/its-time-to-abandon-the-d_b_5899448.html.
[76] Julia Baird, A Carbon Tax's Ignoble End, NY Times, July 24, 2014, http://www.nytimes.com/2014/07/25/opinion/julia-baird-why-tony-abbott-axed-australias-carbon-tax.html?_r=0.

B. The Political Allure of Energy Subsidies

1. Avoiding the Political Traps of Carbon and Gas Taxes

In contrast, the political prospects for energy subsidies are much more favorable. Although a subsidy for "green" energy advances some of the same environmental goals as a carbon tax – and a subsidy for oil and gas production advances some of the same national security goals as a higher gas tax – these subsidies avoid the political liabilities noted above. First, instead of *raising* the price of energy we want to *discourage* – and thus inflicting "pain" – it *lowers* the price of an alternative we want to *encourage*.

Second, these subsidies are not especially salient to most voters. Someone who collects one of these subsidies – for instance, in buying a hybrid vehicle – is aware of them and, of course, is happy to have them. But most voters proceed in blissful ignorance, without the constant reminders inherent in a carbon or gas tax. Of course, we need a higher income tax (or a larger deficit) to fund these programs. But taxpayer discontent with a high tax bill is not usually focused on one program, as opposed to the host of others their taxes fund. Admittedly, this can change when a program becomes the subject of a scandal, as occurred when the bankruptcy of alternative energy manufacturers drew attention to the generous subsidies they received. Yet this sort of negative attention is the exception, rather the rule.

Third, although the public may not focus on these subsidies, organized interest groups certainly do. They become the political champions of these initiatives, hiring lobbyists, running campaign ads, and giving generously to campaigns. Indeed, several energy tax expenditures are "extenders," which are renewed (or not) every year. This structure keeps lobbyists coming back to ask for extensions, creating a perennial flow of campaign contributions.

3. A More Politically Palatable Gas Tax?: A Petroleum Price Stabilization Plan

Given these political economy differences, it is not surprising that the U.S. relies on subsidies instead of taxes. Before describing the broad range of energy tax expenditures under current law, though, it is worth considering whether Pigouvian taxes can be structured in ways that are more politically palatable.

In other work, a coauthor and I recommended a gas tax with two features to make it more politically palatable. First, this levy kicks in only when gasoline prices fall below a specified level. When prices are low, consumers should object less to a price increase, while an incentive to use less fuel becomes especially important. Second, we would pair this "price stabilization plan" with a per capita rebate. As a result, our proposal does not raise revenue; in our view, then, it is plausible not to call it a "tax." Instead, this measure creates an incentive to use less gasoline. Under this proposal, someone who uses less than the average amount receives a net payment. In effect, this is a transfer from heavy users to light users, creating an incentive that has valuable environmental and national security externalities.[77]

3. The Political Advantages of a "Saving Gas" Credit

Another possibility is to reframe a gas tax (of, say, 30 cents per gallon) so that it is presented, instead, as a refundable tax credit. Specifically, taxpayers would receive a credit that is more generous for those who use less gasoline. For example, assume that every year taxpayers receive $400 per year minus an amount based on how much gasoline they use (e.g., 30 cents per gallon). As a result, a claimant who uses no gasoline receives a $400 "saving gas" credit. One who uses the average amount (600 gallons) receives $220 – that is, $400 minus $180 (which is 30 cents for each of the 600 gallons). Likewise, a driver who uses twice the average (1200 gallons) receives only $40.[78] This sliding-scale credit is essentially a gas tax in disguise. In effect, this is the fusion of $400 lump sum payment with a 30 cent per gallon gas tax.

Like a gas tax, this "saving gas" credit creates an incentive to use less gasoline. It has the further advantage of not favoring one way of saving gasoline over another. The credit offers the same 30 cent reward for saving a gallon, whether we so do by telecommuting, buying a hybrid, driving more slowly, carpooling, and the like.

With the "saving gas" credit, have we found a magic bullet? It has most of the economic virtues of a gas tax, along with the political economy advantage of being framed as a subsidy, instead of a tax. Politicians can claim to provide a *bonus* for gas *conservation*, instead of a *tax* on gas *consumption*.

Even so, this subsidy frame comes at a cost. Once someone uses enough gasoline to exhaust the credit, there is no further disincentive to use more gasoline.[79] In addition, the 30 cent charge is deducted when claimants collect the credit, instead of at the pump. As a result, it could prove less salient, and thus have less influence.

The credit also is much harder to administer than a gas tax. To deduct the right amount, we need a reliable record of how much gasoline the claimant has used. One possibility is to require claimants to buy gas with a special credit card, which tracks their purchases. Another is to create "gas usage" accounts, perhaps linked to a claimant's driver's license or license plate, which gas stations must update with each purchase. In addition to the challenge of creating a

[77] See generally Thomas Merrill & David M. Schizer, Energy Policy for an Economic Downturn: A Proposed Petroleum Fuel Price Stabilization Plan, 27 Yale J. Reg. 1 (2010).
[78] Since the average American uses 598 gallons per year (driving 13,746 at 23 miles per gallon), their credit would $220 (since the credit would be reduced by (597 x .30), or $180). Twice the average, or approximately 1200 gallons, reduces the credit by twice this amount or by $360.
[79] In our example, a claimant receives no credit once she uses her 1334th gallon. There is no further disincentive to use the 1335th or, for that matter, the 2000th. With a 30 cent per gallon gas tax, by contrast, there is always a 30 cent disincentive to use each additional gallon.

reporting mechanism, we also have to police it. For instance, "off the books" gasoline purchases must be prevented, since they would not trigger deductions from the credit.

Still another possibility, which is administratively easier but somewhat less reliable, is to track the *miles* driven by a claimant's car, instead tracking gasoline usage directly. For instance, service stations can be required to issue certified mileage statements upon conducting annual emissions inspections. This mileage can then be divided by the average miles per gallon of the claimant's vehicle, which the government already posts online.[80] Admittedly, this assumed average is not perfectly accurate, since cars can divert from the average because of speed and driving conditions. But this approach allows us to piggyback on inspections and disclosure that already exist, instead of requiring a new reporting mechanism. Needless to say, even if this is feasible, it's not as easy as a gas tax, which simply imposes a charge on each transaction.[81]

B. *Three Types of Subsidies for Promoting Alternative Energy Under Current Law*

In any event, while it may be possible to recast Pigouvian taxes so that they look more like subsidies, this is not what Congress has done. Instead, Congress has adopted various tax expenditures that promote alternative energy (discussed in this Section) and hydrocarbons (discussed in the next Section).

Tax expenditures supporting alternative energy focus on three areas. The first is generating electricity from renewables. There is an investment tax credit for investing in tax solar, wind, and geothermal energy production (costing $600 million in 2016),[82] a production tax credit of 2.2 cents for each kWh of electricity generated from renewables (costing $1.5 billion in 2014),[83] as well as the so-called "1603 program" offering upfront grants in lieu of these credits (costing $4.3 billion in 2014).[84] There are also tax credits for advanced energy manufacturing, as well as accelerated depreciation for renewable energy investments. In addition, tax expenditures target the environmental harm from coal-powered electricity by subsidizing clean coal facilities ($200 million in 2014)[85] and coal plant scrubbers ($400 mil in 2014).[86]

The second focus of these tax expenditures is transportation. There is a $7500 credit for plug-in electric vehicles, as well as credits for qualified fuel cell vehicles, hybrids, alternative fuel vehicles, and advanced lean burn technology vehicles. Congress also provided $400 million in credits for alternative fuels, and $1.3 billion in credits for renewable diesel. Until 2012, there

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[80] http://www.fueleconomy.gov/feg/pdfs/guides/FEG2013.pdf.

[81] Relatedly, what happens when we take a taxi or buy an airline ticket? Is our credit reduced by gasoline we use indirectly through this sort of vendor? If not, we need to impose a separate tax or credit on the vendor, whose economic effects presumably are passed on (at least in part) to the customer.

[82] Section 48.

[83] Section 45.

[84] Section 1603.

[85] Sections 48A & 48B.

[86] Sections 169, 291.

also was a credit for ethanol. There is a tax credit for natural gas fueling stations, a tax expenditure encouraging trucks to install idling reduction units, and tax-favored fringe benefits for transit passes and bicycle commuters.

Finally, a number of tax expenditures promote energy-efficiency. There are tax expenditures for insulation, more efficient heating and cooling systems, and appliances – in newly-constructed homes ($300 million in 2014), existing homes ($600 million in 2014), and commercial properties ($100 million in 2014). In addition, when utilities reward consumers for making energy efficient investments, this compensation is not taxed.

C. *Subsidies for Increasing and Diversifying the Supply of Hydrocarbons*

Tax expenditures promoting alternative energy are mostly of recent vintage. The lion's share were introduced or expanded dramatically by the Obama Administration. In contrast, a second set of energy tax expenditures, which reduce the tax burden on hydrocarbon production, survive from an earlier era.

The most plausible justification for these subsidies is national security. As noted above, energy policy can advance national security goals by cutting the cost of policing access to energy, and also by reducing revenue that flows to geopolitical rivals. One way to pursue these goals is a "demand reduction strategy," for instance, by encouraging fuel efficiency or promoting new technologies, such as electric cars, to reduce our dependence on petroleum. In so doing, we reduce the revenue flowing to hostile producers, while also softening the impact of oil shocks. A second way to advance these goals, which is the focus of the tax expenditures in this Section, is through a "supply enhancement" strategy. We can diversify the supply of oil and gas, encouraging new production, especially in friendly countries. To pursue this goal, Congress lowers the tax cost of *all* domestic production (or, in some cases, *all* production) in four ways.

1. Generous Cost Recovery

First, cost recovery for oil and gas production is especially generous. Ordinarily, when businesses invest in creating income-producing assets, these expenses cannot be deducted immediately. Instead a portion is deducted each year over the course of the asset's useful life. Nevertheless, oil companies are allowed an immediate deduction for wages, supplies, fuel and other costs of drilling wells in the U.S (costing $1.1 billion in 2014).[87] There also is accelerated depreciation for geological and geophysical expenses for U.S. wells ($100 million in 2014).[88] Notably, these tax benefits are available only for production within the United States.

2. Reduced Effective Marginal Tax Rate

[87] Section 616 & 617; JCT 24.
[88] Section 167(h).

Second, a lower effective marginal tax rate is offered to oil and gas producers under three different provisions. First, domestic oil and gas producers can claim the reduced tax rate that applies to U.S. domestic manufacturing (31.85% instead of 35%).[89]

Second, a special tax benefit, known as "percentage depletion," is available to "independent" producers (who do not have refineries or retail distribution) and royalty owners (costing $1.2 billion in 2014). This tax expenditure allows producers to deduct a designated percentage of their sales revenue (15% for oil), which is assumed to reflect the decline in reserves over time.[90] These deductions, which are available only for domestic production, are especially generous because they can exceed a producer's actual costs.[91]

The third rate cut for oil and gas production, scored at $1.1 billion in 2014, is the pass-through treatment offered to master limited partnerships. These publicly-traded partnerships are exempted from corporate tax as long as they hold exploration, refining, or pipeline assets.[92] Unlike the other two rate reductions, this one is not limited to domestic oil and gas; offshore assets also can be held in an MLP.[93]

3. Targeted Credits

In addition to generous cost recovery and rate reductions, a number of targeted tax credits are also available for oil and gas production. Obviously, the research and development credit is available here, as it is in all industries.

Furthermore, three targeted credits are available only when energy prices are low, as a way to induce continued exploration and production in unfavorable economic conditions. The first is Section 45(k) – commonly called "the old Section 29 credit" because of its prior number in the Code. It provides a credit for fuel from unconventional sources, including oil from shale or tar sands, coal seams, or other "tight" formations, as well as biomass and synthetic fuels from coal. In addition, the marginal well production credit[94] and the enhanced oil recovery tax credit[95] are supposed to coax production from low-producing or high-cost domestic wells. In recent years, oil prices have been high enough that these credits have not been in effect.

4. Foreign Taxes

Finally, multinational oil companies receive especially generous treatment of some foreign taxes. When U.S. taxpayers earn income abroad, the U.S. offers a credit for taxes paid to

[89] Section 199 (allowing a 9% deduction, which translates into a reduced rate of (9 * .35) or 3.15%.
[90] Section 611, 613, 613A.
[91] There are also tax expenditures benefiting coal production. See Section 45 (coal production credit).
[92] See Section 7704.
[93] Cf. Latham & Watkins, Ten Offshore MLP Facts, www.lw.com/.../LW-offshore-**MLP**-facts (noting that foreign assets often are placed in foreign partnerships that elect to be treated as corporations for US tax purposes, and that these assets avoid U.S. entity level tax by being outside the U.S.)
[94] Section 38.
[95] Section 43.

foreign governments. The goal is to keep the same income from being taxed twice. Yet the credit is available only for income (and other comparable) taxes. It is not meant for royalties. In most nations, mineral rights are owned by the government. When U.S. firms drill for oil and gas overseas, they are often asked to pay both income taxes and royalties to the foreign government.

The multinational is thus a "dual capacity" taxpayer, since it is dealing with the foreign government not only as a taxpayer, but also as a customer or co-venturer that receives a "specific economic benefit." In this circumstance, if the multinational and foreign government can persuasively characterize the payment as an income tax, instead of a royalty, the U.S. government bears this cost (assuming other requirements are also satisfied). This means the multinational has less incentive to drive a hard bargain.[96] As a result, money that otherwise would go the U.S. Treasury ends up going to a foreign government. While the U.S. has rules that are supposed to prevent this outcome, a favorable decision for Exxon on this issue has given other multinationals a basis to claim the full credit.[97]

V. Flawed Institutional Design: Are Subsidies Less Effective Than Pigouvian Taxes? Can We Do Better?

Energy tax expenditures have political advantages, as noted above, but how effective are they as policy? This Part focuses on five challenges that arise in crafting energy tax expenditures: first, rebound; second, perverse effects for energy suppliers; third, bets on the wrong technology; fourth, inframarginal subsidies; and, fifth, the need for revenue to fund these initiatives. For each of these challenges, this Part offers examples under current law, and also asks two questions. First, are subsidies more susceptible to these challenges than Pigouvian taxes? The answer is, "generally yes, but not always." Second, how (if at all) can better institutional design eliminate, or at least mitigate, these challenges?

A. Rebound and the Use of Proxy-Policies Instead of Results-Based Policies

1. *Relative Price Versus Overall Demand*

Both Pigouvian taxes and subsidies can be used to favor one type of energy (the "favored type") over another (the "disfavored type"). For example, depending on our goal, we could favor

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[96] The multinational is not completely indifferent, though. It can defer US tax by not immediately repatriating foreign earnings. This means a (deferred) U.S. foreign tax credit does not wholly compensate for a (current) foreign tax. As a result, the multinational still has *some* incentive to minimize their foreign taxes.

[97] *Exxon v. Commissioner*, 113 T.C. 338 (1999); *see also Philips Petroleum Co. v. Commissioner*, 104 T.C. 256 (1995); Joint Committee, DESCRIPTION OF PRESENT LAW AND SELECT PROPOSALS RELATING TO THE OIL AND GAS INDUSTRY 14 (May 12, 2011) ("Subsequent to the decision in Exxon, anecdotal evidence suggests that a significant number of dual-capacity taxpayers revoked their safe harbor elections and adopted the facts and circumstances method to argue for tax treatment for the entire amount of the qualifying levy.")

renewables over hydrocarbons or domestic petroleum over imported petroleum. The key to influencing this choice is the relative price. We can change it either by *raising* the price of the disfavored type or by *lowering* the price of the favored type.

But although these strategies both change the relative price, they have different effects on the *overall demand* for energy. *Raising* the price of disfavored energy – and thus the average price of energy overall – encourages consumers to use *less* energy. In contrast, *lowering* the price of favored energy – and thus cutting the average price – induces consumers to use *more* energy. This perverse incentive is known as "rebound."[98]

For example, assume our goal is for consumers to internalize the negative externalities of petroleum, which are assumed to be 30 cents per gallon.[99] We can pursue this goal in two ways. The first is a gasoline tax of 30 cents per gallon. The second is a tax credit of $81 per year for hybrid vehicles, which use less gasoline because they run on electricity as well as gas.[100] Both policies create an incentive to buy hybrids. The credit does so directly, while the gas tax does so indirectly; by reducing gasoline consumption, a gas tax can reduce our gas tax liability.

Even so, the gas tax is more effective than the hybrid credit at reducing gas consumption. The gas tax achieves this goal by increasing the cost of each gallon we use. But the hybrid credit has a very different effect. While it reduces the gas we use per mile, it does not motivate drivers to drive less. On the contrary, better gas mileage *lowers* the marginal cost of driving, creating the (counterproductive) incentive to drive *more*. In so doing, the credit undercuts the goal it is supposed to pursue. In contrast, a gas tax does not induce "rebound," since it *raises* the marginal cost of driving.

2. Does Rebound Arise Because We Used a Subsidy Instead of a Tax?

Based on that example, it is tempting to conclude – as many do – that subsidies trigger rebound, but taxes do not. Yet the analysis is a bit more complicated. To see why, let's return to the "saving gas" credit, discussed above. As you will recall, this is a sliding-scale credit, which is more generous for those who use less gasoline. For example, claimants can receive a fixed amount ($400) per year, which is reduced by an amount based on how much gasoline they use

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[98] Gilbert E. Metcalf, Tax Policies for Low-Carbon Technologies, NBER Working Paper 15054 (June 2009).

[99] The goal here is not to provide a reliable estimate, but this estimate arguably is the right order of magnitude. US consumed 134.5 billion gallons of gasoline in 2013. At 30 cents per barrel, this tax would raise about $40 billion, which is approximately half of what the US Navy spent patrolling the Persian Gulf.

[100] Assume the credit is a lump sum, based on the negative externalities it avoids for the average driver; it is not tailored to the circumstances of the particular driver. A 2013 hybrid's gas mileage is 42 mileage per gallon ("mpg"), compared with 23 mpg for the average vehicle. If a hybrid drives the average number of miles in a year (13,746), it uses 270 gallons less per year. Since the negative externalities are assumed to be 30 cents per gallon, the tax credit is (270 x .30) or $81 per year. See U.S. Department of Energy, Fuel Economy Guide: Model Year 2013, http://www.fueleconomy.gov/feg/pdfs/guides/FEG2013.pdf.

(30 cents per gallon). This policy is structured (in form at least) as a subsidy, rather than a tax. Nevertheless, it does not trigger rebound. Since claimants lose 30 cents of their credit for each gallon they use, the saving gas credit creates an incentive to use less gasoline. The less they use, the larger their credit is. This is quite different from the hybrid credit, which offers the same financial reward – as long as claimants buy a hybrid – without accounting for how much they drive or how much gasoline they use.

So which policies are more likely to trigger rebound? Instead of distinguishing between subsidies and Pigouvian taxes, we should distinguish between "incentive" and "disincentive" policies. Incentive policies *encourage* the use of a *favored* type of energy, while disincentive policies *discourage* the use of a *disfavored* type. Incentive policies (like the hybrid credit) tend to trigger rebound, since they *lower* the marginal cost of energy. By contrast, disincentive policies (like the gas tax and the saving gas credit) do not trigger rebound, since they *raise* the marginal cost of energy. Admittedly, subsidies are *usually* incentive policies and Pigouvian taxes are *usually* disincentive policies. But as the "saving gas" credit shows, it is possible to structure a disincentive policy as a subsidy.

Unfortunately, current law relies almost exclusively on incentive policies, instead of disincentive policies. As a result, rebound is a pervasive issue. It arises with energy efficient appliances, insulation, and home heating and cooling systems. After all, a more efficient air conditioner does not save as much energy if we use it more or cool the room to a lower temperature. There is empirical evidence that consumers do, in fact, respond in this way.[101]

Rebound also arises with oil and gas subsidies. To increase and diversify production, these subsidies lower the after-tax cost of production. In doing so, they put downward pressure on oil and gas prices. But lower prices increase demand, which in turn reverses some of the benefits these subsidies otherwise offer. After all, increased demand exacerbates our exposure to oil shocks, while also ensuring that hostile producers have motivated buyers. On a net basis, this approach can still reduce negative externalities. But the decline is more modest than it otherwise would be.

4. Results-Based Versus Proxy Policies

Can we do better? Ideally, we should rely more on disincentive policies than on incentive policies. But politically, it is easier to reward than to punish, as noted above. If disincentive policies are off the table for political reasons, so that we are stuck with incentive policies, can they be improved?

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[101] Meredith Fowlie, Michael Greenstone & Catherine Wolfram, Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program (2014), https://economics.stanford.edu/files/Fowlie-Greenstone-Wolfram%20--%20Do%20Energy%20Efficiency%20Investments%20Deliver.pdf (finding that participants in the federal Weatherization Assistance Program increased their thermostats on average by .6 degrees F after weatherizing).

An important strategy is to avoid gaps between our policy goal, on one hand, and the behavior we end up rewarding, on the other. For example, if our goal is to use less gasoline, the financial incentive we create should be tied directly to this goal. A gas tax and a "saving gas" credit satisfy this condition, since the amount of the tax or credit depends on how much gas is used. In contrast, the hybrid credit is not as tightly connected to this goal. Eligibility does not turn on using less gas *per se*. Rather, claimants have to engage in behavior – buying a hybrid – that is *related*, but different. Buying a hybrid is merely a *proxy* for using less gasoline.

Unfortunately, targeting a "proxy," instead the behavior we actually want, can produce imperfect or even counterproductive incentives. This is true when we *subsidize* a proxy, as the hybrid credit illustrates. It also is true when we *tax* a proxy. For example, assume we impose a $78 annual tax on the owners of SUVs as a way to reduce oil consumption.[102] Although SUVs obviously are gas guzzlers, this is an imperfect proxy. This SUV tax applies equally to all SUVs, regardless of how much they are driven. In addition, this SUV tax fails to target other heavy users of gasoline, such as gas guzzling sedans.

The point of these examples is that "results-based" policies are more promising than "proxy" policies. The two successful examples (the gas tax and the "saving gas" credit) are both results-based. They measure the desired result itself – using less gasoline – instead of looking to other conduct that is supposed to *correlate* with this result, such as buying a hybrid or not buying an SUV. In contrast, proxy taxes and subsidies (like the SUV tax and the hybrid credit) don't always advance the desired goal.

Unfortunately, the problem with current law is not just that it relies on incentive policies, but that it relies on *poorly tailored* ones. Too often, these tax expenditures are based on proxies, instead of on the behavior we actually want to encourage.

In general, a promising way to improve "proxy" subsidies – and to mitigate perverse incentives, such as rebound – is to add more (and better) conditions. If it is feasible, the gold standard is to use a results-based condition. For example, if our goal in subsidizing hybrids is to use less gasoline, ideally we would want to add a condition tied to gasoline usage. For instance, we can disallow (or phase out) the credit if claimants use more than a maximum amount of gasoline in a year. Admittedly, though, this would be hard to administer.

Instead of adding a results-based condition, then, it might be easier to add another "proxy" condition. For example, we can offer the hybrid credit only to claimants who have mileage-based auto insurance. With this insurance, drivers pay a higher premium if they drive more miles. By adding this condition, then, we rely on the insurance company to discourage rebound. Admittedly, instead of a "results-based" condition, focusing on gasoline usage, the tax

[102]Assuming the SUV drives the average number of miles in a year (13,746), and its gas mileage is 16 per gallon, compared with 23 for the average vehicle, it would use 261 gallons less per year. See U.S. Department of Energy, Fuel Economy Guide: Model Year 2013, http://www.fueleconomy.gov/feg/pdfs/guides/FEG2013.pdf. If the negative externalities are 30 cents per gallon, the tax should be $78 per year.

expenditure now has *two* proxy conditions: one favoring a fuel efficient car, and the other constraining how much it is driven. But in this case, two is better than one. By using *both* conditions, we get closer to our actual policy goal – using less gasoline – than we could with just one of them. After all, the amount of gasoline used is a function of (a) our vehicle's gas mileage and (b) the number of miles we drive.

B. Perverse Effects on Supply

Just as energy subsidies create perverse effects on demand, as discussed above, they also create perverse effects on supply. This Section considers three supply effects.

1. Scarcity Rents

First, if subsidies succeed in launching viable substitutes for disfavored energy, producers of disfavored energy are likely to respond by cutting prices. In effect, they sell the disfavored energy while they still can. While this dynamic can arise in any market – just as grocery stores discount day-old produce – the effect is especially powerful in extractive industries. As William Hotelling observed over eighty years ago, producers of finite resources can either tap their reserve today or save it for sale tomorrow.[103] Therefore, prices today reflect expectations about prices tomorrow. Indeed, prices are not set to equal marginal production costs. They also include "scarcity rents," which reflect how scarce supply is compared with expected demand (now and in the future).[104]

If producers expect an energy innovation (such as oil from shale reserves) to replace their product (e.g., conventional oil) *in the future*, they are likely to cut prices *today*, unloading the reserve while they still can get *at least something* for it. In a sense, the unwillingness of Saudi Arabia to cut production – and the resulting decline in oil prices – reflects this sort of dynamic.

The same is true if the expected innovation is an alternative source of energy, such as wind or solar. If coal producers expect cheap wind to displace their product in ten years, they are likely to cut prices today, in effect liquidating their reserves for whatever they can get. Ironically, then, the prospect of a successful innovation in the future makes fossil fuels even harder to displace today. The more promising the innovation is, the more likely it is to reduce scarcity rents. These price cuts induce consumers to use more energy. Instead of *replacing* fossil fuels, then, the new alternative energy ends up *supplementing* them instead.[105]

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[103] Hotelling.
[104] Indeed, the prices should be the same, except that the price tomorrow is increased for time value (since producers must wait to be paid). Heale
[105] Michael Hoel, Bush Meets Hotelling: Effects of Renewable Energy Technology on Greenhouse Gas Emissions (2008) ("[F]ossil fuels are non-renewable, and the competitive supply gives a price path of the fuel which depends on present and future demand. When this "Hotelling feature" is taken into consideration, the whole price path of the carbon resource will shift downwards as a response to the reduced cost of the substitute. An implication of this, in

Notably, this perverse effect can be triggered not only with a subsidy, but also with a Pigouvian tax. By raising the price of hydrocarbons – and making them less competitive – Pigouvian taxes encourage entrepreneurs to invest in alternative energy. If a success seems imminent, fossil fuel producers are likely to respond with "Hotelling" price cuts. Yet there is a difference: the tax itself raises the price to consumers (unless the producer absorbs all of it). As a result, the tax offsets the producer's price cut, at least to an extent.

2. Perverse Effect on Supply: Production Subsidies and Negative Prices

Another perverse effect on supply arises when policies are tied to the level of *production*, instead of the level of revenue or profit: These "production" policies motivate firms to produce energy that is not needed. For example, under Section 45, firms can claim 2.2 cents per kWh for generating electricity with wind. But unfortunately, this Production Tax Credit does not require there to be *demand* for this electricity. Although it is easier to generate electricity from wind at night, there is less demand at night, and only limited capacity to store electricity. In addition, some windy locations are not close to cities, and do not have transmission lines to send electricity where it can be used. But to collect the subsidy, firms produce electricity that is not needed. They *pay customers* to take this electricity, a practice known as "negative pricing."[106]

Notably, this problem is not unique to subsidies. The same perverse incentive arises if producers avoid a Pigouvian tax or penalty by generating wind or solar energy. Indeed, thirty-three states have so-called "renewable energy portfolio standards," which require a minimum fraction of electricity to be generated from renewable sources. Utilities comply – and avoid the penalties associated with noncompliance – by acquiring the requisite number of renewable energy certificates (or "RECS"). They can do this either by generating renewable energy themselves or by purchasing RECS from other producers.[107] Unfortunately, the electricity giving rise to these RECS does not actually have *to replace* carbon-based energy. Producers can claim RECS even for electricity they *had to pay* customers to take.

Studies suggest that wind generation is usually the cause of negative pricing. For example, negative pricing is much more frequent in hours when wind generates a larger

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combination with the absence of an efficient climate agreement, is that it is no longer obvious that greenhouse gas emissions decline in the near future.")

[106] Hutzler, at 15 (production tax credit induces firms to keep producing electricity from wind that they can't sell); Graetz at 191(noting that power companies often drop price of wind-generated electricity to zero, and describing a wind facility that was built to provide 8 gigabytes, even though projections suggested 4.5 was the maximum needed).

[107] *See generally* Ed Hold & Lori Bird, NERL Technical Report: Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges, Jan. 2005, http://www.epa.gov/greenpower/gpmarket/rec.htm. Some states require all (or most) of this renewable energy to be generated within the state, while others are more flexible about crediting out-of-state renewable energy generation. Joel H. Mack, Natasha Gianvecchio & Marc T. Campopiano, All RECs Are Local: How In-State Generation Requirements Adversely Affect Development of a Robust REC Market, 2011, https://www.lw.com/thoughtLeadership/in-state-generation-requirements-hurt-rec-market.

percentage of a region's electricity. In West Texas in 2011, for instance, there was negative pricing in over 70% of the hours when wind was generating 25% or more of the region's electricity.[108]

Hopefully, technology will ameliorate this problem over time. For example, a major investment in transmission lines in West Texas in 2013 reduced in the frequency of negative pricing by shipping excess capacity to Dallas, Houston, and Austin.[109] In addition, improvements in battery and storage technologies would be helpful as well. Indeed, an advantage of electric vehicles is that their batteries can store electricity generated at night.

Nevertheless, the root of this problem is that the production tax credit and renewable portfolio standards are based on an imperfect proxy – *producing* favored energy, rather than *replacing* disfavored energy. Instead of focusing on production, it would be better to reward revenue or profit. This way, the government can piggyback on consumer judgments about the energy's value. If consumers won't pay for it, the government should not reward it. Alternatively, if these regimes continue to focus on production, we need to add another condition: electricity should not be eligible for tax credits, or counted by state RPS regimes, unless it sells for at least a minimum price.

3. Perverse Interactions with Other Regimes

Even if a subsidy otherwise creates the right incentives, it can interact with other regimes in counterproductive ways. For example, subsidies for hybrids and electric vehicles create a perverse effect under federal fuel efficiency standards. These "CAFÉ" standards set an *average* fuel efficiency standard that each manufacturer must meet for its *entire fleet*. To meet the required average, they are allowed to sell gas guzzlers, as long as they also sell cars with above-average fuel efficiency to balance them out.

When firms produce (subsidized) hybrids and electric vehicles, then, these cars raise their CAFÉ average. Yet if the CAFÉ regime keeps the same minimum average, these subsidized cars give manufacturers "cover" to produce other less efficient cars. In effect, every subsidized hybrid enables someone else to drive a gas guzzler.[110] If this happens, overall gas consumption does not decline, but is merely being redistributed among drivers.

[108] Frank Huntowski, Aaron Patterson & Michael Schnitzer, Negative Electricity Prices and the Production Tax Credit, Sept. 14, 2012, http://www.hks.harvard.edu/hepg/Papers/2012/Negative_Electricity_Prices_and_the_Production_Tax_Credit_0912.pdf (figure 8, at 12); id. at 12 ("Negative prices are most prevalent when wind output is highest relative to overall demand, such as during the overnight hours in the spring and fall months when wind output is high but demand is relatively low and less power is needed.").

[109] http://breakingenergy.com/2014/10/01/the-more-renewables-you-have-the-more-transmission-youll-need

[110] Indeed, a key source of revenue for Tesla, the electric vehicle manufacturer, are payments manufacturers of fuel inefficient cars make, in effect, to count Tesla's cars in their fleet averages.

To an extent, a Pigouvian tax can cause a similar problem. Like a subsidy for hybrids, a gas tax also encourages consumers to buy fuel efficient cars. As more people buy them – raising the fleet average – car manufacturers can sell more gas guzzlers while still meeting their CAFÉ obligations. Even so, there is an important difference between a gas tax and a hybrid credit. Although both "make room" for more gas guzzlers under CAFÉ, the gas tax also *depresses demand* for guzzlers by raising the price of driving one. The hybrid credit, by contrast, does not reduce the appeal of driving a gas guzzler.

In any event, to head off these perverse effects, there needs to be coordination between these subsidies and CAFÉ. One approach is to exclude subsidized vehicles from the CAFÉ average, treating CAFÉ as a separate mechanism for encouraging greater efficiency in unsubsidized vehicles. The other is a higher CAFÉ target, which is set to account for subsidized hybrids and electric vehicles. In fact, the CAFÉ target is scheduled to increase substantially, and the new level would be hard to meet without electric vehicles. Nevertheless, the auto industry is aggressively lobbying to scale back this scheduled increase.

C. Picking Winners

In addition to creating perverse incentives, current law has another pervasive flaw: it often relies on the government to pick which technologies to support.

1. *Familiar Limitations of Government: Information, Incentives, and Instability*

Unfortunately, the government is not well positioned to "pick winners" for a range of familiar reasons. Government officials often lack the information and expertise to evaluate competing options and place successful bets. Civil servants don't receive bonuses for completing projects on time and under-budget, and are unlikely to be fired for cost overruns. Starker incentives push the private sector to adapt more nimbly to changed circumstances.

In contrast, a government's priority is usually satisfying interest groups, instead of maximizing profits. As a result, politics infuses choices about which technologies to favor. For example, the support of farm states for ethanol is well known.[111] Likewise, in seeking to convert coal into a liquid fuel, the "synfuels" program favored Eastern coal – even though Western coal was more likely to succeed – in deference to unions and influential congressional leaders from West Virginia and Pennsylvania.[112]

2. *Counterproductive Initiatives*

Given these institutional and political limitations, it is not surprising that the government sometimes backs the wrong horse. A prominent example involves "black liquor," a waste product from paper. To claim the biofuel tax credit, a number of firms began blending it with

[111] Graetz, 130.
[112] Graetz 194

diesel. Although this credit was expected to cost only $100 million, it drained over $8 billion from the Treasury. Unfortunately, instead of replacing fossil fuels, this credit actually *increased* demand for them.[113]

Arguably, a somewhat similar problem arises with tax credits for electric cars. According to the National Research Council, manufacturing these vehicles requires significantly more energy than traditional cars.[114] To offset this additional energy footprint, they have to drive a minimum number of miles, using less energy per mile. A key question, then, is how the electricity powering them is generated. If it is generated from wind and solar, an environmental case can be made for these vehicles.[115] But if the electricity is generated from coal or even natural gas, the environmental case is hard to make (although there is still a national security argument for this petroleum-free transportation).

Counterproductive effects arise with fossil fuel subsidies as well. For example, the U.S. offers foreign tax credits to some payments that effectively are royalties, as noted above. Since multinationals can (largely) pass this cost on to the U.S. government under the "dual capacity" rules, they have less incentive to negotiate a lower royalty. From a national welfare perspective, a transfer from the U.S. government to foreign governments is undesirable. This is all the more true, of course, if the foreign government is a geopolitical rival. Indeed, if the policy goal in subsidizing fossil fuels is reducing the revenue of hostile regimes, it is counterproductive for them to be overpaid at the U.S. government's expense.

3. Technologies that Are Not Viable

Even when federal efforts at energy innovation are not counterproductive, they are often ineffective. Unfortunately, knowing when to pull the plug has never been a strength of these programs. For example, R&D on breeder reactors consumed over $10 billion without producing any commercial applications, Michael Graetz has observed, "making it the largest cost overrun in the nation's history."[116]

Likewise, in the past six years the federal government has committed over $15 billion dollars in loan guarantees to fifty failed renewable energy firms, many with political

[113] Graetz at 191-92; see also Ike Brannon, *Don't Guarino Me*, Weekly Standard.
[114] http://www.nap.edu/openbook.php?record_id=12794&page=204 ("Damages from the emissions associated with vehicle manufacture account for a large percentage of the overall life-cycle damages. Thus, even with the large decreases in emissions from generating electricity at fossil-fueled plants, the large damages from the vehicle-manufacture component mean that life-cycle damages for electric vehicles would probably be somewhat greater than those for conventional vehicles, unless there is significant reduction in energy use in manufacturing batteries and other electric vehicle components."); Hutzler, 3/13, at 11 ("When an electric car rolls of the production line, ithas already been responsible for 30,000 pounts of carbon-dioxide emissions, compared with 14,000 pounds for a conventional gasoline-powered vehicle.").

[115] Cohen, at 77-78.
[116] Graetz, at 76.

connections.[117] The challenges they faced often were foreseeable. Solyndra, for instance, used a high-cost custom design process, while About Solar produced defective panels (and claims the Department of Energy was aware of this in approving its loan). Fisker automotive manufactured what *Consumer Reports* called the worst luxury sedan on the market. The car retailed for $100,000, and *Consumer Reports* gave it a "failing grade":

> With the Karma, much attention has been paid to our unfortunately routine problems, including an early failure on our track that left the car immobile and led to the battery being replaced, frequent instrument, window and radio glitches, and recurring warning lights. So far our Karma has made multiple trips back to the dealer . . . . Such problems only try our patience. There are bigger issues here, compromises inherent in the car's basic design and execution. The Karma falls short with: poor dash controls, limited visibility, a cramped interior, awkward access into and out of the seats, an engine that is noisy when running, long battery recharge times, and a small backseat and trunk. The Karma's heavy, SUV-like weight affects agility and performance. . . .[118]

Fisker received $193 million in federal support, after spending $480,000 lobbying for it, in addition to $2.2 million in political contributions made by its venture capital investors.[119] Fortunately, the Department of Energy cancelled an additional $336 million that had been approved. Meanwhile, A123, which supplied defective batteries to Fisker, received $132 million in loan guarantees before entering bankruptcy.

4. *Cost-Effectiveness*

Fortunately, the picture is not all bad. Some technologies funded by the federal government are becoming more established. The Prius and other "full hybrid" vehicles have become increasingly popular, and no longer receive a federal tax credit (unlike "plug-in hybrids," which do). Likewise, the capacity to generate electricity from solar and wind in the U.S. has grown significantly in recent years, although it remains a relatively modest percentage of the overall market.[120]

In addition, renewables are becoming more competitive at generating electricity. When conditions are favorable, wind actually is cheaper than natural gas. According to recent estimates by Lazard, the long-run average cost of natural gas is between 6 and 8 cents per kWh.[121] When the wind blows, its cost is between 3.7 and 8 cents per kWh, depending on

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[117] Hutzler, at 8-9 (noting that 29 of the 50 firms had political connections).
[118] Jeff Bartlett, Fisker Karmer Earns a Failing Grade From Consumer Reports, Consumer Reports, Sept. 25, 2012 http://www.consumerreports.org/cro/news/2012/09/fisker-karma-earns-a-failing-grade-from-consumer-reports/index.htm.
[119] Paul Chesser, Consumer Reports: Fisker Karma the Worst Luxury Sedan, Sept. 26, 2012, http://nlpc.org/stories/2012/09/26/consumer-reports-fisker-karma-worst-luxury-sedan
[120] For example, US cumulative capacity of solar power has increased from about 1,000 Megawatts in 2010 to over 10,000 in 2013. Heale.
[121] http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf

weather conditions and the location of the facility.[122] The good news is that this number does not include federal subsidies. Yet the bad news is that it is understated for two reasons. First, wind generation is cheaper and easier at night, but peak electricity demand is during the day, as noted above. In addition, since wind must be accompanied by a backup source of power, its actual cost is higher (by approximately 1 cent per kWh). By contrast, solar has the advantage of peaking in the late afternoon, which is about the same time as demand peaks as well. Yet although the cost of solar has come down significantly,[123] it is still higher than wind and natural gas. Lazard estimates the cost of solar to be 7.2 to 8.6 cents per kWh (and, again, another cent per kWh should be added for the cost of backup generation).

Comparing Cost of Gas, Solar & Wind (Lazard)

	Concide with Peak?	Cost per kWh of Backup (cents)	Long-Run Average Cost per kWh of Generation (cents)?	Total Long-Run Average Cost
Gas	Yes	0	6 to 8	6 to 8
Solar	Yes	1	7.2 to 8.6	8.2 to 9.6
Wind	No	1	3.7 to 8	4.7 to 9 (when available)

Even when subsidies appear to be working, though, an essential question is whether they are advancing their objectives in a cost-effective way. Whether our goal is cutting GHGs, reducing the use of petroleum, or something else, we should pursue it at the lowest possible cost. Straightforward quantitative analysis can reveal what is working and what is not. How much do

[122] http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf

[123] Although fixed costs of installing solar power source are high, they have come down substantially. For example, panel costs have fallen from $8/watt to $0.80/watt in five years, due in part to learning and economies of scale, and in part from generous subsidies to manufacturers (primarily from the German and Chinese governments).

we spend to reduce GHG's or the consumption of oil by a specified amount? Needless to say, we should choose the cheapest method, so that the marginal cost of all our initiatives should be the same; otherwise, we should transfer resources from more expensive methods to less expensive ones, until the marginal cost is equalized.

Unfortunately, this is not the approach we have used. he answers are different for each technology. In 2009, the Joint Committee estimated the cost we incur in saving an MMBTU of energy from fossil fuels, and results vary from $1.01 for biomass to more than fifteen times that for solar (in unfavorable conditions).

Cost of Saving 1 MMBTU of Energy from Fossil Fuels (Jt. Comm. 2009)

Open Loop Biomass	$1.01
Nuclear	$ 1.82
Wind	$ 2.12
Geothermal	$ 2.12
2006 GMC Sierra 1500 SL	$ 5.60
Ethanol	$ 5.92
2006 Honda Accord V6 AT	$ 6.59
Biodiesel	$ 8.45
Solar (8 hours per day)	$ 9.64
2007 Toyota Camry 2.4 L Hybrid	$ 11.49
Solar (5 hours per day)	$ 15.42

(These numbers are somewhat dated, and they also probably understate the cost of wind and solar by omitting the cost of backup generation).[124]

Yet notwithstanding these variations, we still commit billions to the more expensive technologies. Between 2007 and 2010, for instance, solar subsidies grew by a factor of six.[125]

[124] Hutzler, at 16.
[125] EIA ($179 million to $1.134 billion).

Nor does Congress prioritize regions of the country where subsidies will be most effective. For instance, wind and solar conditions are more favorable in some parts of the country than in others,[126] but the subsidy is available (and uniform) throughout the country.

5. The Shale Revolution: A Successful Example of Picking a Winner?

Of course, the fact that some government initiatives have failed or underperformed does not mean the government should stop trying to promote energy innovation. After all, even successful venture capitalists place some bets that fail. Yet although some failures are inevitable, there need to be successes as well in order to justify the effort. Unfortunately, it is something of a stretch to say that there have been government home runs in this area.

Perhaps the most significant change in the US energy landscape in the past four decades is the "shale" revolution. Some commentators invoke it as a government success, arguing that the government played an important role. To make this case, they cite the so-called unconventional sources tax credit, which targeted an expansive category of potential sources, including shale and other "tight" formations. Mitchell Energy, the first company to use hydraulic fracturing to tap natural gas from shale, used the credit for its early production in the Barnett Shale.[127]

Yet the role of the credit should not be overstated. It applied only to wells drilled between 1980 and 1992, which was over a decade before the shale revolution began in earnest. Even though Mitchell Energy began drilling during that period, the number of wells it drilled annually more than doubled shortly after the credit expired.[128] In addition, the credit was less generous for the type of formations Mitchell was exploring ("tight" gas, instead of Devonian shale).[129]

To an extent, the government contributed to Mitchell's success by helping to fund research. Although meant to promote other types of energy, such as coal (microseismic imaging) and geothermal (diamond studded drill bits), this research generated applications used in shale drilling. The government also helped fund early (unsuccessful) efforts to drill for natural gas in shale in the 1970's and 1980's, although these ended over a decade before Michell's early

[126] Gilbert E. Metcalf, Tax Policies for Low-Carbon Technologies, NBER Working Paper 15054, at 20 (June 2009) (on theory that want wind everywhere).
[127] Zhongmin Wang and Alan Krupnick, A Retrospective View of Shale Gas Development In the United States, April 2013, http://www.rff.org/RFF/documents/RFF-DP-13-12.pdf.

[128] Wang & Krupnick, *supra*, at 25.

[129] Id.

successes.[130] Perhaps more significant was the technological and financial support Mitchell received from the Gas Research Institute, a private entity that receives federal funding.[131]

Even so, it is hard to argue that the government was especially focused on shale drilling. Rather, federal research and subsidies have concentrated on other initiatives – from solar power and breeder reactors in the 1970s, to synfuels in the 80's, carbon capture in the 90's, and wind and solar in the past five years. For the shale revolution, the main motivation was not government policy, but high energy prices. According to Gregory Zuckerman,

> The great leap forward should have involved alternative energy, not oil and gas. The U.S. government allocated over $150 billion to green initiatives between 2009 and 2014, according to the Brookings Institution, including money for wind farms, solar panels, and other renewable energy sources. . . . There's too little to show from the investments, however. Cars don't run on waste, and wind and solar aren't yet ready to power the world. Instead, a group of frackers, relying on market cues rather than government direction, achieved dramatic advances by focusing on fossil fuels, of all things. It's a stark reminder that breakthroughs in the business world usually are achieved through incremental advances, often in the face of deep skepticism, rather than government-inspired Eureka moments.[132]

6. Subsidies, Pigouvian Taxes, and Picking Winners

While the government's role in the shale revolution can be debated, the essential point is that picking winners is not the government's strong suit. A familiar disadvantage of subsidies, then, is that the government has to choose what to favor. In contrast, Pigouvian taxes do not require the government to make this choice, and thus are "tech neutral." For instance, as long as a carbon tax covers all disfavored fuels (and is set at the right level), the government can be agnostic about the relative merits of energy-efficient appliances, electric vehicles, solar panels, etc.[133] Instead of deciding which alternative to favor, the government can let the market choose.

Yet this distinction between subsidies and Pigouvian taxes is not quite right, since some subsidies are also "tech neutral." For example, the "saving gas" credit does not favor some ways of saving gas over others. Rather, the relevant distinction is between incentive policies (which reward "favored" types of energy) and disincentive policies (which penalize "disfavored" types of energy). Incentive policies have to identify the behavior they favor, but disincentive policies do not. Instead, they have to cover all variations of the *disfavored* activity. The tax on SUVs,

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[130] Michael Shellenberger, et al, Where the Shale Gas Revolution Came From Breakthrough Institute (May 2012), http://thebreakthrough.org/images/main_image/Where_the_Shale_Gas_Revolution_Came_From2.pdf (invoking initiatives at Morgentown Energy Research Center in 1976, Eastern Gas Shales Project in 1979, and Department of Energy Demonstration Project in Devon shale in 1986).
[131] Id.
[132] Gregory Zuckerman, The Frackers 391-92 (2013).
[133] One exception, though , is that we might also want to favor "offsets," such as reforestation.

discussed above, flunks this test by leaving out gas guzzling sedans. Likewise, if a carbon tax covers only oil and natural gas, but not coal, it has the counterproductive effect of driving consumers to coal.[134] Admittedly, this mission is not always easy. But once it is achieved, there is no need to "pick a winner."

7. Incentive Policies that are More "Tech Neutral"

Even so, current law relies overwhelmingly on incentive policies, instead of disincentive policies. If we are stuck using carrots instead of sticks for political reasons, can we ease the pressure on the government to pick winners? In general, policies that are broad and results-based tend to be more "tech neutral."

Consider Congress' efforts to make cars more fuel efficient. Unfortunately, current law favors only a handful of ways – such as the $7500 tax credit for plug-in hybrids – while neglecting other strategies that could be more cost-effective. As Martin Sullivan has emphasized, no subsidy is offered for making traditional combustion engines more efficient, even though there are a number of ways to do so, including diesel engines (30-35% more efficient), manual transmissions (10%) a turbocharged engine with fewer cylinders (7.5%), and a more aerodynamic design (15-20%).[135] Again, the problem here is the use of a proxy subsidy, which singles out a specific alternative energy technology, instead of a results-based subsidy that focuses on fuel consumption or fuel efficiency. As an alternative, Sullivan proposes a credit scaled to gas mileage, awarding $300 for each mpg above 25mpg, regardless of how this efficiency is achieved. This would be better.

In the same spirit, Senator Max Baucus proposed in December 2013 to consolidate various tax credits for "green" electricity into a single tech neutral credit:

> "Any facility producing electricity that is about 25 percent cleaner than the average for all electricity production facilities will receive a tax credit. The cleaner the facility, the larger the credit. Cleanliness is defined by a simple ratio of the greenhouse gas emissions of a facility, as determined by the Environmental Protection Agency (EPA), divided by its electricity production."

He proposed a similar measure for "green" transportation fuel. Like Sullivan's proposal for fuel efficient cars, these proposals define a goal – reducing carbon emissions from electricity or from transportation fuel – and offer a reward for achieving it, without picking the technology that industry should use to pursue it. This would be a significant improvement over current law.

Although subsidies for green energy under current law are narrow, tax expenditures for hydrocarbons are broader and thus more tech neutral. For example, the favorable treatment of

[134] The same problem would arise with a "burn less carbon" credit – a variation of the "saving gas" credit, discussed above – that omits coal.
[135] Martin Sullivan, The Losers in the Energy Subsidy Game, Tax Notes, Oct. 30, 2008 (listing of 50 ways to save gasoline that are not subsidized).

MLP's is available for a broad class of energy-related assets anywhere in the world. Likewise, tax expenditures for hydrocarbons generally do not focus on particular types of drilling (except for three modest credits – for marginal wells, enhanced oil recovery, and unconventional sources – which are in effect only when oil prices are low). Likewise, tax expenditures for hydrocarbons usually are available to all producers (except for percentage depletion, which is available only to "independents").

Even so, these tax expenditures are too narrow in one respect: many are available only for drilling in the United States. Yet if the goal is to diversify supply – so we cut the cost of policing oil supplies, as well as the revenue flowing to geopolitical rivals – production in Canada and Mexico should be just as good. This is not to say that all production is created equal. We should not subsidize wells in hostile nations (e.g., Iran or Russia), since this would afford them more revenue. Likewise, increasing production in places that are hard to police is not as good as increasing it in places that are more secure. For example, it is probably better to subsidize wells in Brazil than in Iraq or Libya. But given our national security goals, the subsidy should be available for production not only in the U.S., but also in nations that are friendly and easy to access.

8. Administrative Costs

In seeking to improve energy subsidies, should one of our goals be to take them out of the tax system? To the extent that government officials need to make judgments about which technologies to favor, tax experts are not the right ones to do it. They are unlikely to know which alternative energy technologies are most promising, how much of a subsidy is needed to promote them, and how to describe them with appropriately precise statutory language.

Yet most of this expertise is needed to *draft* these provisions, rather than to *administer* them. If the division of labor is that other government experts formulate these provisions, and the tax system's role is just to dispense the money, this division of labor could be reasonable. Although it adds to the administrative burdens borne by the tax system, it should not add to the overall burden of the government *as a whole*. In this spirit, Senator Baucus's proposals, discussed above, rely on EPA instead of on the IRS to determine the carbon footprint of various technologies, and thus the generosity of the relevant tax expenditure in a particular context.

The tax system has a comparative advantage if it already is doing some of the necessary work. For example, the tax system already collects a gasoline tax to fund the highway trust fund. If we also want a gas tax for national security or environmental reasons, we should fold it into the existing tax. Otherwise, total administrative costs would rise if we add a second gas tax, adopt a separate "cap and trade" regime for petroleum, or add the "saving gas" credit described above.

D. Inframarginal Subsidies

Under current law, another familiar challenge is that the government sometimes pays people to do what they would do anyway.

1. Mandated Technologies

Most importantly, if the government already *mandates* a particular technology, *subsidizing* it is unnecessary. Perhaps the quintessential example is the tax credit for ethanol. Congress spent $10 billion on this subsidy over three decades, even though it already mandated the use of ethanol.[136] Fortunately, this subsidy was allowed to expire in December of 2011.[137]

Similarly, twenty-nine states have renewable portfolio standards requiring a minimum percentage of electricity to be generated with renewables. So why subsidize this electricity in these states? In addition to committing federal money unnecessarily, this subsidy creates the wrong incentive for consumers. It would be better to fund renewables through higher electricity prices, which temper demand for electricity. Indeed, if rates for coal- and gas-fired electricity are raised to fund renewables, this premium functions like a carbon tax on ratepayers.

2. Motivated Claimants

Even without a legal requirement, a subsidy is inframarginal if claimants have their own reasons to take the relevant step. This was a common critique of the "cash for clunkers" program. It subsidized the purchase of new (and hopefully more fuel efficient) cars, even though consumers eventually were going to replace these "clunkers" anyway.[138]

For similar reasons, the Department of Energy should not fund "demonstration projects" to test the commercial viability of a new energy technology – or at least should do so sparingly. If the technology is promising, the private sector has its own reasons to conduct these tests.

In contrast, subsidies are less likely to be inframarginal for basic research and development ("R&D"). Those who conduct R&D do not internalize all the benefits from their work – since it can spawn commercial applications not covered by U.S. intellectual property protections, as noted above – so they do less than is socially optimal. As a result, funding R&D should be a high priority.

3. Overly-Generous Subsidies

A similar issue arises when subsidies are too generous. For example, Larry Summers, Carol Browner, and Ron Klain raised this concern about subsidies for renewables in a 2010

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[136] Gilbert E. Metcalf, Tax Policies for Low-Carbon Technologies, NBER Working Paper 15054, at 16 (June 2009).
[137] Robert Pear, *After Three Decades, Ethanol Credit Expires*, N.Y. TIMES, Jan. 1, 2012, http://www.nytimes.com/2012/01/02/business/energy-environment/after-three-decades-federal-tax-credit-for-ethanol-expires.html?_r=0.
[138] Arguably, then, the rationale was not to promote energy efficiency, to accelerate consumer spending for macroeconomic reasons.

memo to President Obama.[139] They warned that green energy firms were "double-dipping" by claiming production tax credits, accelerated depreciation, and loan guarantees from the federal government, as well as generous support from states. As an example, they analyzed the "Shepherd Farms" wind energy development. This project was expected to cost $1.9 billion, of which $1.2 billion (more than 60%) would be funded by government. These terms not only gave developers relatively little "skin in the game," but also offered a 30% return on equity, which presumably was more than needed to induce private sector participation. As a result, emissions would be reduced at a cost of $130 per ton, which was six times the government's estimate of the social cost of carbon at the time. Yet notwithstanding the warning of Summers, Browner and Klain, these terms were approved.

Similarly, fossil fuel subsidies can also be too generous. When prices are high, exploration and development is profitable without subsidies. But although a few hydrocarbon subsidies phase out when prices are above a minimum level, most do not.

In addition, tax expenditures for hydrocarbons do not require claimants to show they are *increasing* production. Instead, these subsidies simply use lower tax costs as an imperfect proxy for increased production. In some cases, the key to a lower tax bill is spending on costs that correlate with production, such as drilling and geological expenses. But even this low bar is not always required. For example, claimants do not need to invest in these ways in order to benefit from percentage depletion; rather, this deduction is unrelated to how the claimant actually spends money and, indeed, can *exceed* a claimant's actual expenses. Likewise, the deduction for domestic manufacturing and the availability of pass-through treatment are essentially rate reductions, whose appeal depends on profitability rather than on increased production.

4. Leakage from Using the Tax System

Another familiar problem with tax expenditures is that claimants cannot use them unless they otherwise owe tax.[140] This means tax expenditures are not useful if a producer of hydrocarbons or renewable energy is not profitable. Instead, these producers have to recruit passive partners who are able to use the tax credit.

By providing these subsidies through the tax system – instead of through a grant to the producer – the government gives suppliers of "tax equity" negotiating power. This problem with tax expenditure, which Stanley Surrey criticized decades ago, intensified during the financial crisis. Many of the usual investors in renewable deals – including Lehman brothers and other financial institutions – were insolvent or, at least, unsure about how profitable they would be. To eliminate this middleman, and the premium they would command in those market conditions, the

[139] Carol Browner, Ron Klain & Larry Summers, Memorandum to the President, Renewable Energy Loan Guarantees and Grants, Oct. 25, 2010, http://www.windaction.org/posts/28820-white-house-memo-on-renewable-energy-loan-guarantees-and-grants#.VPXX2fnF-nA.

[140] Obviously, this is not true of "refundable" tax credits, but no energy tax credits are refundable.

government started offering producers the option of claiming a direct grant (the so-called Section 1603 credit) instead of tax credits.

5. Duration

To avoid wasting money on inframarginal subsidies, the government should police not only how the subsidy is claimed or how much it is, but also how long it lasts. Even as we support "infant" technologies, we want to preserve incentives to cut costs and become competitive over time. In this spirit, tax credits for alternative energy vehicles are available only for the first 200,000 produced. Admittedly, the marginal benefits (e.g., in cutting emissions or oil consumption) are the same for the 199,999th Prius as for the 200,001st.[141] But there is value in weaning firms off of subsidies. For similar reasons, wind farms receive subsidies for only ten years, which is less than is expected useful life.[142]

At the same time, unpredictability in the duration of these subsidies creates a different problem. Alternative energy subsidies are prone to "boom and bust" cycles,[143] which rise and fall with the price of oil. For example, the production tax credit for wind has expired three times since it was first enacted in 1992, and installations declined between 76% and 93% each time.[144] In theory, these cycles could be driven by policy considerations, instead of politics, if relevant negative externalities vary with oil prices. It could be, for instance, that hostile oil exporters are emboldened when flush with oil revenue. Yet some negative externalities clearly do not correlate with oil prices. For example, greenhouse gases have the same climate effects whether oil prices are high or low, and a naval presence in the Persian Gulf is expensive either way.

Even so, many alternative energy credits are temporary, and are either reenacted (temporarily) or are allowed to expire. While this fixed lifespan makes them an evergreen source of interest group lobbying and contributions, the associated uncertainty can impede long-term planning. For example, the credit for residential energy efficiency improvements expired on December 31, 2013. While it was extended for 2014, the extension was not signed into law until December, 19, 2014,[145] leaving taxpayers less than two weeks in the year. Some claimants presumably made improvements before the extender passed. But in taking this gamble, claimants presumably discounted the subsidy for the risk of nonrenewal. When discounted in this way, a subsidy offers the government less "bang for the buck."[146] If claimants estimate the chance of reenactment at 80%, they treat a $500 credit like a $400 credit, even though it still costs the government $500.

[141] Sullivan.
[142] Hutzler, at 16.

[143] Graetz, 194 (noting a pattern of "boom and bust financing, characterized by excessive optimism about technological developments, impatience for results, and a process of haste and waste").
[144] Cohen, at 57.
[145] Ashley Ebelling, *Obama Signs 2014 Tax Extenders: Money In Your Pocket*, Forbes, Dec. 19, 2014, http://www.forbes.com/sites/ashleaebeling/2014/12/19/obama-signs-2014-tax-extenders-money-in-your-pocket/
[146] Metcalf, Low Carbon, at 14.

6. *Subsidies Versus Taxes*

Like many problems described in this Part, the risk of paying people for what they would do anyway is unique to subsidies. This problem does not arise with Pigouvian taxes. After all, the government can overpay only if it actually is making a payment.

Admittedly, a (somewhat) parallel problem can arise with a Pigouvian tax imposed on conduct that taxpayers would not engage in anyway. In that case, the tax is unnecessary; little or no revenue is collected, and any administrative costs associated with the tax are wasteful.

4. Strategies for Minimizing Inframarginal Subsidies

Three points emerge from the discussion so far. First, an advantage of Pigouvian taxes over subsidies is that they avoid this cost. Second, if we use subsidies anyway, we should not subsidize steps that are legally required anyway. Third, we also should keep the levels low, especially in cases where claimants have their own reasons to take the relevant step anway.

Aside from these broad principles, it is not a simple matter to craft a subsidy that applies only at the margin. After all, the government does not know what claimants would do without a subsidy, so it is hard to know when funding actually is needed to induce more of the desired behavior.

In theory, if a particular production technique is used only when firms need more output – perhaps because costs are higher – a subsidy can focus on this technique. Presumably, this is why we subsidize nearly-dry wells with the marginal well and enhanced oil recovery credits. But the premise of these subsidies is probably wrong: when more production is needed, it is not clear that nearly-dry wells actually are next in line. This flawed premise suggests a broader point. It is fortunate that oil and gas subsidies usually do not identify the type of production that is marginal. The government is not well positioned to figure this out.[147]

Since identifying the next source of marginal production is so difficult, another strategy is to focus on price, which is easier to observe and also influences production decisions. Obviously, high prices are a strong inducement to increase production,[148] while low prices can persuade firms to scale back. There is some justification, then, for offering subsidies when energy prices are low, and phasing them out when prices are high.

Even so, a subsidy is not needed if the market can simply self-correct. If low prices cause projects to be cancelled, supply should tighten up, leading to higher prices and then more production. The key to this self-correcting dynamic, though, is that new production has to begin reasonably promptly. If this is not true – so higher prices don't actually induce more production

[147] Admittedly, though, the nonconventional sources credit actually did target where new production would be: shale and other "tight" rock formations. Shale production was not economical when this credit was enacted in 1980. Even so, this credit played only a limited role in facilitating the "shale revolution," as noted above.
[148] Cohen, 65-66.

for extended periods of time – a subsidy when prices are low is more plausible. It is a way to keep some production "in the game."

This argument for subsidies when prices are low, then, depends on who the marginal producers are, and how long they take to restart production. In the production of hydrocarbons, offshore wells require significant lead time and up-front investment before they produce.[149] If offshore projects are the marginal producers, then, a subsidy now could prevent disruptions later. Yet under current market conditions, the marginal producers are probably not offshore projects, but shale wells.[150] Fortunately, these "tight" oil rigs can be started and stopped more quickly. As a result, the same case cannot be made for keeping shale producers "in the game" when prices are low. In other words, because shale production can restart quickly, there is less need for a subsidy when prices are low.

E. Revenue

A final difference between tax expenditures and Pigouvian taxes is also worth noting: Pigouvian taxes raise revenue, while tax expenditures forgo revenue. At first blush, this seems like a significant disadvantage for tax expenditures, since we have to incur efficiency costs in raising the revenue needed to fund them. Put another way, Pigouvian taxes seem to offer a "double dividend." In addition to correcting an externality (the first "dividend"), they provide revenue that can fund the repeal of other distortive taxes (the second "dividend").

Yet the argument for a "double dividend" is too optimistic. It assumes that the Pigouvian tax is a more efficient source of revenue than the tax it replaces. This could be true in some cases, but it does not have to be. For example, a carbon tax is probably more efficient than the notoriously inefficient corporate tax, but it is not more efficient than, say, a lump sum "head" tax. Pigouvian taxes are not immune from distorting labor and savings choices. For example, when we decide how much to work, we know a carbon tax reduces what we can buy with extra earnings. In response, we might cut our hours, just as we might do in response to an income or consumption tax. Indeed, any tax that redistributes income creates distortions. Of course, poorly- designed taxes create more distortions than necessary, and we should replace those taxes. But there is no magic in replacing them with Pigouvian taxes, instead of other well-designed consumption or income taxes.[151]

Likewise, the assumption that a subsidy adds to excess burden is also not inherently true. If we fund it with a lump sum tax, for instance, there is no additional excess burden. The same is

[149] Travis Huim, Offshore versus Onshore Drilling: Which is the Better Investment?, The Motley Fool, Jan. 29, 2013, http://www.fool.com/investing/general/2013/01/29/offshore-vs-onshore-drilling-which-is-a-better-inv.aspx ("Ultra-deepwater wells take months to drill, and oil companies are locking up rigs with extremely long-term contracts. ").

[150] Yergin.

[151] See James Fullerton & Gilbert Metcalf, Environmental Taxes and the Double-Dividend Hypothesis: Did You Really Expect Something for Nothing, 73 Chi. Kent L. Rev. 221 (1998).

true if we fund it by repealing some other spending program, so that we don't need additional revenue.[152] If we do end up needing more, the key question is how we raise it. Of course, we could increase excess burden substantially by using an especially inefficient tax. But this has nothing to do with how we spend this revenue. The same waste arises whether we spend this money on an energy subsidy, an entitlement, a military operation, deficit reduction, or the repeal of another tax. In other words, the source of this excess burden is not the subsidy itself, but the decision to fund it with a poorly-designed tax.

VII. Conclusion

[To come]

[152] To be precise, there is no additional excess burden from substitution effects, although there could be from income effects (assuming these are not offset by the subsidy).