2015

Energy Subsidies: Worthy Goals, Competing Priorities, and Flawed Institutional Design

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I. Introduction

The United States uses targeted subsidies for both "green" energy and hydrocarbons.[1] These subsidies pursue worthwhile goals. But unfortunately, many have design flaws that make them less effective or even counterproductive.[2] The goal of this Article is to show how to do better.

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1 Martin A. Sullivan, Tech Neutrality, Tax Credits, and the Gas Tax, 64 Tax Notes 619 (Feb. 2, 2009) (noting that every president since Jimmy Carter has proposed energy subsidies). These subsidies grew by 108%—from $17.9 billion to $37.2 billion per year—between 2007 and 2010. U.S. Energy Info. Admin., Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010, at xi (2011), http://docs.wind-watch.org/US-subsidy-2010.pdf. During this period, renewable energy subsidies increased by 186% (from $5.1 billion to $14.7 billion). Id. at xiii-xiv. In total, the United States spent $150 billion on green energy between 2009 and 2014. Jesse Jenkins, Mark Muro, Ted Nordhaus, Michael Shellenberger, Letha Tawney & Alex Trembath, Brookings Inst., Beyond Boom & Bust: Putting Clean Tech on a Path to Subsidy Independence 6 (2012), https://www.brookings.edu/wp-content/uploads/2016/06/0418_clean_investments_final-paper_PDF.pdf. As stimulus funding was exhausted, these levels tapered somewhat. See U.S. Energy Info. Admin., Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013, at xiii (2015), https://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf ("The total value of direct federal financial interventions and subsidies in energy markets decreased 23% between FYs 2010 and 2013, declining from $38.0 billion to $29.3 billion.").

2 Comm. on the Effects of Provisions in the Internal Revenue Code on Greenhouse Gas Emissions, Nat'l Research Council, Effects of U.S. Tax Policy on Greenhouse Gas Emissions 10 (William D. Nordhaus, Stephen A. Merrill & Paul T. Beaton eds., 2013) ("[C]urrent tax expenditures and subsidies are a poor tool for reducing greenhouse gases and achieving climate-change objectives. The committee has found that several existing provisions have perverse effects, while others yield little reduction in GHG emissions per dollar of revenue loss.").

Specifically, this Article focuses on three sets of issues. First, there often is tension between our environmental and national security goals. Unfortunately, the economics literature on energy largely ignores these trade-offs by omitting national security from the analysis.[3] This Article takes issue with this approach and suggests ways to manage these trade-offs. Second, this Article argues that subsidies are a flawed way to deal with these costs, and shows that Pigouvian taxes (or tradeable permits) are better alternatives. Third, if Congress is stuck with subsidies for political reasons, this Article offers a number of ways to improve them.

One reason why the United States needs better energy policies is national security. Our energy choices—especially our dependence on oil—affect national security in at least two ways. First, the United States faces increased defense costs in securing access to oil. Second, some oil producers are geopolitical rivals, who spend oil revenue on terrorism, invasions, or nuclear weapons programs.

Yet the economics literature neglects these costs, because they are hard to quantify. For instance, when the United States deploys forces in the Middle East, determining how much of this cost is attributable to oil, as opposed to other interests (such as countering terrorism), is not straightforward.[4] However, difficulties in computing a cost are not a reason to ignore it. After all, climate effects are also uncertain, but commentators still try to account for them. National security warrants a comparable effort.

This is especially important because trade-offs arise between national security and environmental goals. For instance, increasing U.S.

[3] See Douglas R. Bohi & Michael A. Toman, The Economics of Energy Security 54 (1996) ("Until an effort that yields a credible measure of the externality [associated with U.S. military spending for oil import security] is completed, this externality is too uncertain to be used in determining energy policy."); see also, e.g., Gilbert E. Metcalf, The Economics of Energy Security, 6 Ann. Rev. Resource Econ. 155, 168 (2014) (citing reports indicating that "U.S. oil consumption may constrain foreign policy," but noting that "[t]hese are important political issues that have been studied more by political scientists than economists"); id. ("An important area of future research is to assess whether and how economic costs associated with energy market–induced constraints on foreign policy can be measured and analyzed . . . .");Comm. on the Effects of Provisions in the Internal Revenue Code on Greenhouse Gas Emissions, Nat'l Research Council, Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use 333 (2010) [hereinafter Hidden Costs] (rejecting the view that "the true cost of oil does not reflect the cost of maintaining a military presence in the Middle East"); Ian W.H. Parry & Joel Darmstadter, The Costs of U.S. Oil Dependency 19 (Res. for the Future, Discussion Paper 03-59, 2003), https://pdfs.semanticscholar.org/4deb/8d7bccd001cbd76896cbdc63fa3d4d2675b6.pdf ("U.S. military expenditures in the Middle East are in part the result of U.S. interests in securing its flow of imported oil from that region, and therefore count as a total cost of oil-import dependency. However, many analysts do not include them when assessing the external costs of marginal changes in U.S. oil imports.").

[4] See, e.g., Parry & Darmstadter, note 3, at 19-20.

oil production enhances national security, but also triggers familiar environmental costs. This sort of trade-off has to be managed, not ignored.

The best way to internalize dueling externalities is a Pigouvian tax (or tradeable permit) for each one. For instance, the United States could have a national security tax, a carbon tax, and a pollution tax. But instead, the United States has relied on targeted subsidies for particular technologies.

While other commentators have criticized this choice,[5] this Article offers a different critique, rooted in administrative costs, that is new to the literature. Since producers and consumers can increase (or decrease) negative externalities in many ways, the cost of increases (and the reward for decreases) should be the same, regardless of how they do it. But this Article shows why consistency is easier for taxes (and permits) than for subsidies: While taxes would have to reach all *sources* of harm, subsidies would have to reach all *ways to mitigate* harm, which is a much longer list.

For example, identifying all goods and services that *use* oil, and thus should be taxed, would not be easy; the tax would have to cover gasoline, diesel, jet fuel, plastics, and the like. But reaching every step that *reduces* the use of oil, and thus should be subsidized, would be much harder. A subsidy would be needed for driving more efficient vehicles, driving less, driving slowly, accelerating evenly, pumping up the tires, carpooling, taking mass transit, and much more.

Put another way, a tax could simply be added to the price of energy, but a subsidy would have to reward a host of choices—not just about *which* energy to use, but also about *how much*.[6] To make a subsidy comprehensive, then, the government would have to identify and monitor all these choices. As a practical matter, this is simply not feasible. Perhaps the literature has overlooked this disparity between taxes and subsidies because it is not an inherent difference, but a product of administrability constraints.

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[5] See, e.g., Lawrence H. Goulder & Ian W.H. Parry, 2 Rev. Envtl. Econ & Pol'y 152, 155 (2008) ("At the margin, [a subsidy] provides the same incentives as emission taxes or cap-and-trade, since every additional unit of emissions implies a cost to the firm in forgone subsidy receipts. Thus, these subsidies can bring about the same choices for input intensities and end-of-pipe treatment as other emissions pricing policies. However, in practice such subsidies are less cost-effective than emissions taxes or tradable allowances.").

[6] The point is not just that regulators have to *quantify the benefit* of these alternative solutions—a challenge that is well understood in the literature—but that they have to *identify* and *cover* them. Cf., e.g., Jonathan S. Masur & Eric A. Posner, Toward a Pigouvian State, 164 U. Penn. L. Rev. 93, 95 (2015) ("[I]n order to determine the correct command-and-control rule, the regulator must know both the cost and benefit of the activities. In contrast, the regulator only needs to know the cost of the activity to determine the correct Pigouvian tax. It is not necessary to know the benefit.") (footnote omitted).

Unfortunately, *taxing* what should be discouraged is harder politically than *subsidizing* what should be encouraged, at least in the United States.[7] As a result, this Article considers various ways to make taxes more plausible politically.

If these alternatives are not politically viable—so Congress is stuck with subsidies—institutional design problems under current law need to be mitigated. For instance, this Article emphasizes the importance of rewarding the desired behavior, instead of a proxy for it. Otherwise, the subsidy can have perverse effects. For example, under current law, Congress pays 2.3 cents for each kWh of electricity generated with wind.[8] To claim this subsidy, producers sometimes generate electricity that no one needs, and then *pay* customers to take it.[9] This perverse effect arises because this subsidy rewards a proxy (*producing* wind energy), instead of the desired result (*replacing* carbon-based energy).

Needless to say, in pursuing energy policy goals, the government can use other policy instruments in addition to subsidies, taxes, and permits. For instance, environmental goals also can be pursued with command-and-control regulation, "nudges," and disclosure, while national security objectives also can be advanced with foreign aid, alliances, treaties, intelligence gathering, covert operations, military deployments, and the like. This Article does not delineate the full universe of policy instruments or offer a comprehensive analysis of when each should be used. Instead, the goals here are to highlight the relevance of national security, to identify an advantage of taxes over subsidies that the literature has previously overlooked, and to show how subsidies can be improved, since Congress shows no sign of giving up on them.

Part II canvasses environmental, economic, and national security market failures associated with energy, and shows how empirical uncertainty and competing goals complicate efforts to correct them. Part III discusses political advantages of subsidies over taxes and permits, and surveys targeted subsidies under current law. Part IV identifies a range of policy challenges in using targeted subsidies. Some are new to the literature, while others are familiar. Part V considers effects of energy taxes and subsidies on labor and savings decisions and distribution. Part VI highlights this Article's policy implications, and Part VII is the conclusion.

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7 See Steven Cohen, William Eimicke & Alison Miller, Sustainability Policy: Hastening the Transition to a Cleaner Economy 33, 56 (2015).

8 Notice 2015-32, 2015-20 I.R.B. 967 (May 18).

9 E.g., Daniel Gross, The Night They Drove the Price of Electricity Down, Slate (Sept. 18, 2015, 3:30 PM), http://www.slate.com/articles/business/the_juice/2015/09/texas_electricity_goes_negative_wind_power_was_so_plentiful_one_night_that.html.

II. Worthy Goals and Competing Priorities: The Environment, Economy, and National Security

The first step in evaluating energy subsidies is to consider their policy goals, which are rooted in the environment, economy, and national security. These goals are quite important, but accomplishing them is especially challenging for two reasons. First, the relevant harms are uncertain. Second, environmental and national security goals sometimes conflict.

A. Environmental Externalities

1. Climate Change

Climate change is perhaps the most common justification for subsidizing renewable energy. Fossil fuels and industrial processes caused 78% of the increase in greenhouse gas emissions (GHGs) between 1970 and 2010.[10] According to the Intergovernmental Panel on Climate Change (IPCC), GHGs have warmed the atmosphere, so the "period from 1983 to 2012 was *likely* the warmest 30-year period of the last 1400 years in the Northern Hemisphere."[11] As the Risky Business Project has observed, "the 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."[12] 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.[13] One way to mitigate these harms is to favor energy that emits fewer GHGs. A subsidy for this alternative energy should equal the marginal benefit of emitting fewer GHGs—that is, the marginal climate harm this alternative energy avoids.

Nevertheless, estimating climate harms is difficult for five familiar reasons. First, the level of emissions from some activities is uncertain.

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[10] Intergovernmental Panel on Climate Change, Climate Change 2014 Synthesis Report Summary for Policymakers 5 (2014), https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

[11] Id. at 2; see also World Bank, Turn Down the Heat: Confronting the New Climate Normal, at xvii (2014), http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/11/20/000406484_20141120090713/Rendered/PDF/927040v20WP00O0ull0Report000English.pdf (citing "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] Kate Gordon, Risky Business Project, Risky Business: The Economic Risks of Climate Change in the United States 2 (2014), http://riskybusiness.org/site/assets/uploads/2015/09/RiskyBusiness_Report_WEB_09_08_14.pdf.

[13] Id. at 3-5.

For example, when natural gas is extracted and transported, some escapes into the atmosphere and contributes to climate change. Experts differ about the magnitude of these "fugitive emissions," and thus about the climate impact of natural gas, and the benefit of using it instead of coal.[14] Second, even if emissions can be estimated accurately, their effect on temperature is debated. 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."[15] Third, even if temperature changes can be forecasted accurately, their welfare effects are hard to predict. Some regions could suffer severe or even catastrophic harms,[16] while others could actually benefit (for example, from longer growing seasons). Fourth, and relatedly, there is a vibrant debate about whether global or national welfare is the appropriate benchmark.[17] National welfare costs are considerably lower, since the United States has fewer areas prone to flooding and is cooler than much of the world. Finally, since climate effects are unlikely to emerge for decades, a discount rate is needed to value them.[18] A market rate yields a low present value, undercutting costly responses today.[19] Some defend market rates as the right benchmark for comparing forward-looking investments.[20] Others favor a lower rate on normative grounds[21] or argue that the *real* market rate is lower than we think if climate change slows economic growth.[22]

[14] Thomas W. Merrill & David M. Schizer, The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy, 98 Minn. L. Rev. 147, 166-70 (2013).

[15] IPCC, note 10, at 2-4.

[16] See Eric A. Posner & David Weisbach, Climate Change Justice 19-20 (2010).

[17] See, e.g., Alan D. Viard, Comment Letter on Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (Feb. 26, 2014), http://www.aei.org/wp-content/uploads/2014/03/-viard-america-the-world-and-the-social-cost-of-carbon_091659741639.pdf (arguing that a national measure is more appropriate for unilateral actions by the U.S. government, since its primary mission is to advance national welfare, while a global measure is appropriate for multilateral actions, such as global cooperation pursuant to a treaty).

[18] Posner & Weisbach, note 16, at 144-68.

[19] For example, William Nordaus uses a 5.5% discount rate, while Nicholas Stern uses a 1.4% rate. This disparity is the main reason they offer very different policy recommendations. Id. at 148.

[20] See id. at 150-51.

[21] See, e.g., Daniel A. Farber, Climate Justice, 110 Mich. L. Rev. 985, 997-98 (2010).

[22] E.g., Elizabeth J. Moyer, Mark D. Woolley, Nathan J. Matteson, 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, 405-06 (2014) (arguing that the IWG 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 403 ("[W]hen we relax the assumption of continued growth in the face of climate change, [the social cost of carbon] estimates increase, in some cases by orders of magnitude.").

Given this uncertainty, there is no consensus about the climate cost of carbon. While the IMF values it at $25 per metric ton of CO_2,[23] the Obama administration uses $38[24], and others have offered much lower or higher numbers.[25] Yet even though these costs are hard to measure, uncertainty should not be a reason for inaction.

2. *Pollution*

Pollution is another familiar negative externality from energy, and thus is also a reason to subsidize cleaner sources. For example, mining for coal pollutes streams and disfigures landscapes, while burning it causes smog and acid rain. Nuclear power generates radioactive waste, and accidents can emit radiation. Oil pollutes land and water when pipelines leak, tankers crash, and offshore rigs malfunction. Different types of energy also can cause fires, explosions, and seismic activity. These various effects can harm human health, as well as property.[26]

As with climate change, the magnitude of these effects is uncertain. For example, there is a heated debate about whether hydraulic fracturing contaminates water, and how feasible it is to regulate this risk effectively.[27] The risks of nuclear power also are vigorously contested.[28]

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23 Int'l Monetary Fund, Energy Subsidy Reform: Lessons and Implications 9 (2013), http://www.imf.org/external/np/pp/eng/2013/012813.pdf.

24 E.g., Interagency Working Grp. on Soc. Cost of Carbon, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, at 3 (2013), https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf (estimating $38 per metric ton of CO_2 emission in 2015 and $43 in 2020, assuming a 3% discount rate).

25 See, e.g., Frances C. Moore & Delavane B. Diaz, Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy, 5 Nature Climate Change 127, 127 (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 [social cost of carbon] because each temperature shock has a persistent effect that permanently lowers GDP below what it would otherwise be."); id. at 127-28 (explaining that "[o]ptimal climate policy in this model . . . implies a social cost of carbon several times larger than previous estimates" of perhaps $220 per ton); Robert P. Murphy, Inst. for Energy Research, 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/ (concluding that the optimal carbon tax should be zero per ton).

26 See generally Michael Graetz, The End of Energy: The Unmaking of America's Environment, Security, and Independence (2011) (exploring the true cost of energy, and arguing that these costs are not reflected in the price of energy consumed in the United States).

27 See generally Merrill & Schizer, note 14 (considering how to regulate the risk of water contamination associated with hydraulic fracturing).

28 See Michael Totty, The Case for and Against Nuclear Power, Wall St. J. (June 30, 2008), http://www.wsj.com/articles/SB121432182593500119 (examining arguments on both sides of the debate for and against the use of nuclear power).

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

Unlike climate change and pollution, other environmental costs of energy are not persuasive reasons to subsidize alternative energy. For example, although energy development can trigger "boom town" conditions, such as traffic jams, housing shortages, and overtaxed public services,[29] subsidies for alternative energy are an oblique response at best. Instead, local governments should build roads, add new tolls and taxes, provide more services, and the like.

Similarly, the concern that fossil fuels may eventually run out[30] is not a reason to subsidize alternative energy, since there is no market failure. As Harold Hotelling showed in 1931, the market price of hydrocarbons reflects their inherent scarcity.[31] Producers have to decide how much to sell today and how much to save for the future. If they expect to earn more by selling later, they will do so. As a result, the current price incorporates predictions about the future, including assumptions about future demand, extraction costs, and substitutes. Tighter supply increases hydrocarbon prices, creating stronger incentives to develop alternatives.[32]

B. *Economy*

1. *Four Market Failures: Incomplete Property Rights, Network Effects, Investment Inefficiency, and Energy Shocks*

The case for government intervention in the energy market is grounded not only in the environment, but also in the economy. Specifically, four market failures can justify a government role.

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[29] E.g. Jordan Malter, How the Oil Boom Changed the Face of Small-Town North Dakota, CNN Money (Feb. 4, 2015), http://money.cnn.com/2015/02/04/news/economy/oil-boom-infrastructure/.

[30] Cohen et al., note 7, at 6 (articulating a principle of sustainability management that it is better to create wealth in ways that do not use up finite resources). Even though concerns about exhausting the supply of hydrocarbons are longstanding—for instance, a founder of Standard 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. See 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.

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

[32] See generally Geoffrey Heal, Exhaustible Resources, The New Palgrave Dictionary of Economics (Steven N. Durlauf & Lawrence E. Blume eds., 2d ed. 2008), http://www.dictionaryofeconomics.com/article?id=pde2008_E000165 (exploring the dynamics of resource allocation and efficiency in the context of exhaustible resources).

First, intellectual property rights are not broad enough to afford innovators all the benefits of new ideas.[33] "As a result, market forces will lead to under-investment in R&D from society's perspective," Ben Bernanke has written, "providing a rationale for government intervention."[34] 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."[35]

Second, transaction costs and network effects in energy infrastructure can justify a government role. For example, new pipelines or power lines require rights of way from thousands of landowners, and eminent domain is a familiar way to manage these costs. Similarly, a vehicle is more useful if filling stations are easy to find. This is a key advantage of petroleum-powered vehicles over natural gas and electric vehicles. As a result, consumers hesitate to buy alternative vehicles, and the resulting shortage of customers keeps more stations from being built. This chicken-and-egg problem—and the associated network effect—can warrant government intervention.

Third, to justify subsidies, some commentators invoke a market failure known as "investment inefficiency," which causes consumers to under-invest in energy-efficient cars, appliances, or other technologies.[36] This under-investment could derive from credit constraints, as well as from cognitive biases or search costs that cause consumers to overlook potential savings. Since builders and landlords do not benefit (directly) in cutting a buyer or tenant's energy bills, agency costs may also play a role.[37] Nevertheless, the empirical evidence is mixed about whether consumers *actually do* under-invest in energy efficiency.[38] Instead, hidden costs, instead of market failures, may explain why these investments are not made.[39]

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33 See Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Reserve Sys., Promoting Research and Development: The Government's Role, Address at the Georgetown University New Building Blocks for Jobs and Economic Growth Conference 3-4 (May 16, 2011), https://www.federalreserve.gov/newsevents/speech/bernanke20110516a.pdf.

34 Id. at 4.

35 Id. at 8.

36 See, e.g., Hunt Allcott & Michael Greenstone, Is There an Energy Efficiency Gap?, J. Econ. Persp., Winter, 2012, at 3, 19-21 (explaining how imperfect information leads consumers to under-invest in energy efficient technologies).

37 Id.

38 Id. at 5.

39 See, e.g., Meredith Fowlie, Michael Greenstone & Catherine Wolfram, Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program (Nat'l Bureau Econ. Research, Working Paper No. 21331, 2015), www.nber.org/papers/W21331 (finding that savings from home weatherization were overstated by predictive modeling and did not exceed initial investment, due to unanticipated costs).

The literature also overlooks a subsidy the tax system already offers (unintentionally) to buy these technologies: The return on these purchases—reduced energy bills—is untaxed "imputed" income. For instance, assume one can spend an extra $1000 that saves $50 per year in electric bills. The $50 annual return on this $1000 (lower electric bills) is not taxed. Alternatively, one can spend $1000 less and invest this savings in a bond, yielding $50 of annual interest, which pays for extra electricity. The return on this $1000 (interest on a bond) obviously *is* taxable. This differential derives from administrability concerns, rather than from a choice to subsidize energy efficiency.

A fourth justification for subsidizing energy—and, in particular, sources that are unlikely to be cut off abruptly—is the harm from sudden supply disruptions.[40] Indeed, of the eleven U.S. recessions since World War II, nine followed a spike in oil prices.[41] Energy prices have this disproportionate impact because energy is an input in all goods and services, and also is part of every household's budget.[42] Thus, spikes in energy prices reduce consumer demand, discouraging businesses from hiring and investing.[43]

These effects may not be fully reflected in the market price of energy. Although consumers may realize that using more energy magnifies *their exposure* to energy shocks, they are unlikely to focus on how *their* consumption exacerbates the exposure of *others*.[44] "When summed across the 300+ million people in the United States," Stephen

[40] See, e.g., Exec. Office of the President, Council of Econ. Advisors, The All-of-the-Above Energy Strategy as a Path to Sustainable Economic Growth 20 (July 2014), https://www.whitehouse.gov/sites/default/files/docs/aota_report_updated_july_2014.pdf [hereinafter Energy Strategy] ("Historically, temporarily high oil price shocks arising from foreign supply disruptions have cut GDP growth and reduced employment."); Stephen P.A. Brown & Hillard G. Huntington, Assessing the U.S. Oil Security Premium, 38 Energy Econ. 118, 121-22 (2013); Metcalf, note 3, at 161 ("Whether 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 . . ., the interplay between oil markets and other sectors (e.g. housing and automobiles) . . ., and the need to distinguish between supply and demand shocks . . ."). But see Nat'l Research Council, Hidden Costs, note 3, at 328-30 (arguing that price shocks are costly, but do not represent externalities).

[41] Brown & Huntington, note 40, at 118.

[42] This effect is compounded if interest rates are increased to keep high energy prices from aggravating inflation. See generally Lutz Killian, The Economic Effects of Energy Price Shocks, 46 J. Econ. Lit. 871 (2008) (assessing a range of theories, as well as empirical evidence, about the effects of oil shocks on the broader economy).

[43] See Ben S. Bernanke, Mark Gertler & Mark Watson, Systematic Monetary Policy and the Effects of Oil Price Shocks, Brookings Papers on Economic Activity 91, 122-24 (1997).

[44] Brown & Huntington, note 40, at 121 ("[T]hose purchasing oil are unlikely to understand or consider how their own oil consumption increases the economy-wide effects of oil supply shocks.").

Brown and Hillard Huntington observe, "this small external effect is significant in the aggregate."[45]

2. *Economic Advantages That Do Not Justify Government Intervention*

Successful oil and gas development and "green tech" also offer other economic advantages, such as more economic growth and jobs.[46] Yet although some invoke them to justify a subsidy, there is no market failure. As a result, a subsidy could induce *too much* investment, draining resources from other valuable activities.[47]

Similarly, even though reducing oil imports has economic advantages—by keeping wealth in the United States[48]—the case for the government to pursue this goal is unclear. Some want the United States to use its market power as a huge consumer of oil (so-called "monopsony power") to cut prices by reducing U.S. consumption, thereby saving money on imports.[49] Yet, this use of market power would actually *create* a market failure, instead of *repairing* one.[50] In addition, this strategy's premises are outdated in three ways. First, even if this sort of intervention once could be justified by another market failure—the power of OPEC—the cartel's influence has

45 Id. at 121, 125 (estimating this "oil premium" at approximately $5 per barrel).

46 See, e.g., Thiemo Fetzer, Fracking Growth 1 (Ctr. for Econ. Performance, Discussion Paper No. 1278, 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."); Energy Strategy, note 40, at 15 (finding domestic oil and gas production contributed 0.2% to GDP growth, or 1/10 of total economic growth, in both 2012 and 2013, and the figure is higher if one accounts for spillover effects, such as greater employment in sectors that service the energy industry); Jason Bordoff & Akos Losz, Oil Shock: Decoding the Causes and Consequences of the 2014 Oil Price Drop, Horizons Dev., Spring 2015, at 199 (noting that decline in oil prices in 2014 is likely to increase GDP by 0.4%, and perhaps twice that when spillover effects are considered).

47 Indeed, evidence suggests that green tech subsidies are a costly (and even counterproductive) way to create jobs. See Graetz, note 26, at 170. A study on TPI Industries, a manufacturer of wind energy equipment, concluded that TPI Industries had received subsidies averaging $20,000 per worker. Id. at 168. Solar photovoltaic–manufacturing enterprises received up to $300,000 per worker. Id. at 169. Another $4 billion subsidy was spent on producing and installing nearly 20 million "smart meters" by 2015, but the technology would lead to the elimination of 28,000 meter reader jobs, while creating very few jobs since the meters were mostly built overseas. Id. at 169-70.

48 Cf. Energy Strategy, note 40, at 22-24 (noting that drain on purchasing power from oil shocks is especially severe when energy is imported, since resources leak out of economy); id. at 3 (noting that trade deficit as percentage of GDP is lowest since the 1990's, and that more than a fifth of narrowing of the trade deficit since 2006 peak is attributable to declines in oil imports).

49 Nat'l Research Council, Hidden Costs, note 3, at 327-28.

50 Id. at 329.

waned.[51] Second, the influence of U.S. consumption on global prices has declined, given our greater energy efficiency and the growing appetite of China and others.[52] Third, U.S. shale production has reduced U.S. imports from 60% to 20%.[53] As a result, lower prices cause a transfer to U.S. consumers not only from *foreign* producers, but also from *U.S.* producers.

C. National Security?

In addition to environmental and economic reasons for the government to intervene in energy markets, another justification is national security. This Article focuses on two national security costs: first, the cost of policing access to oil, and second, the use of oil revenue by geopolitical rivals to fund policies that harm the United States and its allies.

1. Defense and Foreign Policy Costs

First, since energy shocks cause economic disruptions, as noted above,[54] avoiding them has been a goal of U.S. foreign policy for decades.[55] President George H.W. Bush emphasized this tradition in deploying U.S. troops to repel Saddam Hussein's invasion of Kuwait in 1990:

> [M]y administration, as has been the case with every President from President Roosevelt to President Reagan, is committed to the security and stability of the Persian Gulf. . . .
>
> . . . The stakes are high. . . . Our country now imports nearly half the oil it consumes and could face a major threat

[51] Bordoff & Losz, note 46, at 195 ("The American oil revolution . . . has vanquished, at least temporarily, OPEC's ability to set a floor on world oil price."); see also Tim Worstall, Opinion, Opec's Problem Is That All Cartels End This Way: Challenges, Chaos and Cheating, Forbes (Dec. 15, 2015), http://www.forbes.com/sites/timworstall/2015/12/15/opecs-problem-is-that-all-cartels-end-this-way-challenges-chaos-and-cheating/#1eb248f53703.

[52] Cf. Bordoff & Losz, note 46, at 194 (noting that China added 500,000 barrels per day to global oil demand each year each year between 2002 and 2007, and that non-OECD nations added a total of 1.3 million barrels per day during that period).

[53] Id. at 195.

[54] See Subsection II.B.1.

[55] According to the National Defense Council, this policy began with the U.S. defense commitment to Saudi Arabia during World War II. Milton R. Copulos, Nat'l Def. Council Found., The Hidden Cost of Oil: An Update 2 (Jan. 8, 2007), http://www.ndcf.org/energy/NDCF_Hidden_Cost_2006_summary_paper.pdf.

> to its economic independence. Much of the world is even more dependent upon imported oil . . . .[56]

In addition to Operation Desert Storm, the United States also has fielded a significant naval presence in the Persian Gulf, operated military bases there, maintained a strategic petroleum reserve, and offered military and other support to various governments in the Middle East.[57] Some of these regimes have proved unstable, in part because oil-rich economies tend to grow slowly and to fail at developing other industries.[58] To the extent that using oil has caused the United States to commit more blood and treasure to national defense—and, for that matter, to support regimes, make commitments, or adopt policies we otherwise would not have favored—these incremental costs are a hidden price of oil.

For example, 383 U.S. soldiers were killed in Operation Desert Storm (along with more than 100,000 Iraqi soldiers), and the war cost approximately $61 billion.[59] The second Iraq war was longer and more costly, with 4507[60] U.S. soldiers killed (along with 3481 contractors),[61] and an overall total, including civilians, of approximately 165,000),[62] and an estimated budgetary cost of $1.7 trillion (along with another $500 billion for health care for veterans).[63] If a portion of these costs are attributable to oil, as some U.S. political leaders suggest, these hidden costs of oil consumption are significant.[64]

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56 George H.W. Bush, U.S. President, Address on Iraq's Invasion of Kuwait (Aug. 8, 1990), http://millercenter.org/president/bush/speeches/speech-5529.

57 See generally Middle East, in 2015 Index of U.S. Military Strength, Heritage Found. 117-30 (2015), http://ims-2015.s3.amazonaws.com/Sections/12_02_AssessingtheGlobalOperatingEnvironmentMiddleEast.pdf.

58 Jeffrey D. Sachs & Andrew M. Warner, Natural Resources and Economic Development: The Curse of Natural Resources, 45 Eur. Econ. Rev. 827, 828, 837 (2001).

59 Saudi Arabia, Kuwait, and other Gulf States covered approximately $36 billion of these costs, and Japan and Germany covered approximately $16 billion, leaving a residual of $9 billion. CNN Library, Gulf War Fast Facts, CNN.com, http://www.cnn.com/2013/09/15/world/meast/gulf-war-fast-facts/ (last updated Aug. 2, 2016, 1:24 PM).

60 Operation Iraqi Freedom, http://icasualties.org/ (last visited Oct. 26, 2016).

61 Anila Daulatzai, Catherine Lutz & Ken MacLeish, Costs of War: US & Allied Killed and Wounded, Watson Inst. for Int'l & Pub. Affairs, Brown U., http://watson.brown.edu/costsofwar/costs/human/military (last updated Apr. 2015).

62 Neta C. Crawford, Costs of War: Iraqi Civilians, Watson Inst. for Int'l & Pub. Affairs, Brown U., http://watson.brown.edu/costsofwar/costs/human/civilians/iraqi (last updated Apr. 2015).

63 Neta C. Crawford, US Budgetary Costs of Wars Through 2016: $4.79 Trillion and Counting—Summary of Costs of the US Wars in Iraq, Syria, Afghanistan and Pakistan and Homeland Security, Watson Inst. for Int'l & Pub. Affairs, Brown. U. 2 (Sept. 2016), http://watson.brown.edu/costsofwar/files/cow/imce/papers/2016/Costs%20of%20War%20through%202016%20FINAL%20final%20v2.pdf.

64 Some U.S. government officials have invoked oil as a motivation for the 2003 invasion of Iraq, although other motives have been emphasized as well. "Of course it's about oil; we can't really deny that," said Gen. John Abizaid, former head of U.S. Central Command

Yet for two reasons, the economics literature generally does not account for these costs. First, military expenditures and foreign policy commitments also advance other goals unrelated to energy, including countering terrorism, discouraging the proliferation of chemical and nuclear weapons, and protecting allies. Isolating the causal role of oil, as opposed to these other goals, is not easy.

Second, some commentators consider defense a fixed cost, which is unlikely to change in response to limited shifts in oil supply and demand. As Gilbert Metcalf puts it: "[A] marginal (or even inframarginal) reduction in oil consumption may not affect our national security planning or spending significantly."[65]

Based on these twin concerns, the prevailing view in the economics literature is that defense costs are too speculative to be considered in energy policy. As Douglas Bohi and Michael Toman put it in a widely cited passage:

> 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.[66]

Others go further and conclude, as the National Research Council does, that "the marginal cost is essentially zero."[67]

It is true that military and foreign policy commitments spring from a combination of motives, so teasing out the role of oil is challenging. Yet, although we should not attribute the *entire* cost of U.S. commitments in the Middle East to oil, it is equally misguided to attribute *none* to oil. More generally, we are not free to ignore a cost just because it is conceptually and empirically difficult to pinpoint. The con-

and Military Operations in Iraq, in 2007. Antonia Juhasz, Why the War in Iraq Was Fought for Big Oil, CNN.com (Apr. 15, 2013, 7:42 AM), http://www.cnn.com/2013/03/19/opinion/iraq-war-oil-juhasz/. Former Federal Reserve Chairman Alan Greenspan made the same point: "I am saddened that it is politically inconvenient to acknowledge what everyone knows: the Iraq war is largely about oil." Id. Then-Senator (and later Defense Secretary) Chuck Hagel said the same in 2007: "People say we're not fighting for oil. Of course we are." Id.

[65] Metcalf, note 3, at 168.

[66] Bohi & Toman, note 3, at 54.

[67] Nat'l Research Council, Hidden Costs, note 3, at 333.

trast with climate change is striking. Even though climate effects are uncertain, commentators still try to account for them. The same should be true of national security.

In addition, even if *modest* changes in oil markets have minimal effects on U.S. foreign and defense policy, *major* changes can make a difference,[68] and there has, in fact, been a major change in recent years: U.S. oil production has increased by 60%.[69] This additional production helped induce a 70% decline in crude prices from June of 2014 to February 2016,[70] and has also eased U.S. geostrategic burdens in various ways. For example, imposing effective multilateral sanctions on Iran was easier because the United States could replace Iranian crude that came off the market.[71] In addition, extra U.S. capacity has provided a cushion against oil shocks. For example, although instability in Libya triggered a price spike in 2011, renewed instability there in 2014 to 2015 did not cause another spike.[72]

More generally, even though the Middle East is wracked by war and instability, oil is still cheap. This affords the United States more flexibility in deciding how to address this instability.[73] While this benefit is hard to quantify, ignoring it is not the right answer.

Whatever estimate we use for the national security costs of oil, the government should apply it consistently in different policy areas. It is problematic to treat these costs as high in formulating defense and

[68] The National Research Council acknowledged the significance of major shifts, even in arguing that marginal ones make no difference. Id.

[69] U.S. Energy Info. Admin., U.S. Field Production of Crude Oil, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpus2&f=a (last updated Sept. 30, 2016) (from 5.48 million barrels per day in 2010 to 8.76 million barrels per day in 2014).

[70] See, e.g., U.S. Energy Info. Admin., Cushing, OK WTI Spot Price FOB, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D (last updated Oct. 26, 2016) (reporting spot prices of $106.07 per barrel on June 30, 2014, and $32.74 per barrel on February 29, 2016, resulting in a 70% decline in crude prices).

[71] Daniel Yergin, Who Will Rule the Oil Market?, N.Y. Times, Jan. 25, 2015, at SR6, http://www.nytimes.com/2015/01/25/opinion/sunday/what-happened-to-the-price-of-oil.html ("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.").

[72] In 2015, Libya produced only one-fourth of the 1.6 million barrels per day it used to export. Libya Needs Weapons to Defend Its Oil, Maritime Exec. (Aug. 17, 2015, 10:45 AM), http://www.maritime-executive.com/article/libya-needs-weapons-to-defend-its-oil ("Today, the output is only 400,000 barrels and Libya is now OPEC's smallest producer due to the ongoing civil unrest.").

[73] For example, the United States announced in August 2015 that it no longer would have an aircraft carrier in the Persian Gulf at all times. Kristina Wong, Navy Reducing Presence in Persian Gulf, The Hill (Aug. 16, 2015, 8:00 AM), http://thehill.com/policy/defense/251197-navy-reducing-presence-in-persian-gulf ("Although the Navy has maintained at least one aircraft carrier in or near the Gulf for the last seven years, it is planning longer periods where there will be no carriers there at all.").

foreign policy, but low in forging energy policy (or vice versa). For example, assume defense analysts value national security costs at 50 cents per gallon, and are considering a response (for example, a troop deployment) that costs 45 cents per gallon. At the same time, energy policymakers, who value these costs at only 5 cents per gallon, are considering a response that costs only 10 cents per gallon (for example, greater fuel efficiency). This use of inconsistent valuations can lead the government to adopt the costlier (military) response, even if a more cost-effective (fuel efficiency) response is available.

2. *A Source of Strength for Geopolitical Rivals*

There is a second way that oil can undermine U.S. national security. In addition to imposing burdens on the United States, our dependence on oil also strengthens geopolitical rivals that produce oil. This can happen in three ways. First, rivals solidify power by using oil revenue to reward key domestic constituencies. Second, rivals fund their military and, in some cases, terrorist organizations as well.[74] For example, when Russian troops moved into Crimea in March 2014, oil prices were above $100, and had been for three years.[75] Since Russia earns 68% of its export revenue and 50% of its tax revenue from hydrocarbons, high oil prices afforded Russia the resources to undertake this operation.[76] Third, the ability to stop selling energy—and thus to undermine their customers' economies—is a source of power. For example, Russia's ability to shut off natural gas sales provides leverage over its neighbors,[77] and presumably is one of the reasons why Germany has made major investments in green energy. If relying on oil and gas

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[74] Graetz, note 26, at 254 ("Dollars we exchanged for oil have strengthened countries that oppose us and have helped to fund radical Islamic institutions, including schools, throughout the Middle East."); Clifford Winston, Government Failure Versus Market Failure: Microeconomics Policy Research and Government Performance 47 (2006) ("Given recent tensions in the Middle East, it has also been argued that it is not in America's interest to import oil from hostile countries that may use the profits from their exports to fund terrorist activities.").

[75] U.S. Energy Info. Admin., Europe Brent Spot Price FOB, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s =RBRTE&f=D (last updated Oct. 26, 2016).

[76] U.S. Energy Info. Admin., Oil and Natural Gas Sales Accounted for 68% of Russia's Total Export Revenues in 2013, (July 23, 2014), http://www.eia.gov/todayinenergy/detail.php?id=17231.

[77] See Nat'l Research Council, Hidden Costs, note 3, 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." (quoting John Deutch & James R. Schlesinger, Council on Foreign Rel., National Security Consequences of U.S. Oil Dependency 26-27 (2006), http://i.cfr.org/content/publications/attachments/EnergyTFR.pdf)).

strengthens geopolitical rivals in these ways, it generates additional negative externalities.[78]

Not only does oil revenue *facilitate* the costly behavior of rivals, but it also can play a role in *causing* it. For instance, oil wealth can take pressure off nations to modernize their economies and political institutions. This revenue can enable governments to fund a police state,[79] to depend less on the tax revenue (and goodwill) of citizens, and to buy off dissenters instead of affording them political rights.[80] Oil wealth also can substitute for entrepreneurship, more diversified growth, and the social rights they facilitate.[81] Civil wars may also become more likely, as competing groups jockey to control oil resources.[82] As a result, oil can make regimes more corrupt, unstable, and repressive,[83] although this causal connection is contested and is likely to vary in different contexts.[84]

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78 The National Research Council rejects this 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). They contend: "U.S. oil consumption that enriches countries with which the United States has differences is not an externality. Rather, U.S. consumption makes inimical actions possible." Nat'l Research Council, Hidden Costs, note 3, at 331-32. It seems like a semantic exercise to debate whether the externalities flow from bad acts, or from the revenue facilitating it. The National Research Council offers this distinction to argue that we should target the bad acts, instead of our oil consumption. Yet, at least in some contexts, we will want to target both. After all, stopping some bad acts is easier if we reduce the resources available to fund them.

79 See generally Michael L. Ross, The Oil Curse: How Petroleum Wealth Shapes the Development of Nations 1-26 (2012) (exploring causes and consequences of the "oil curse," finding that oil-extracting nations are generally less democratic and more secretive compared with similar countries that lack oil).

80 See id. at 63 ("[O]il has kept autocrats in power by enabling them to increase spending, reduce taxes, buy the loyalty of the armed forces, and conceal their own corruption and incompetence.").

81 Michael L. Ross, Oil, Islam, and Women, 102 Am. Pol. Sci. Rev. 107 (2008) (arguing that oil wealth impedes gender equality).

82 Paul Collier, Natural Resources and Conflict in Africa, The Beacon (Nov. 2009), http://the-beacon.info/blog/wp-content/uploads/2011/05/Natural-Resources-and-Conflict-in-Africa.pdf (containing an article that "originally appeared on the Crimes of War Project's website on October 2004"); Ross, note 79, at 145 ("Since the early 1990s, oil-producing countries have been about 50 percent more likely than other countries to have civil wars.").

83 Michael L. Ross, Does Oil Hinder Democracy?, 53 World Pol. 325, 325, 344, 356-57 (2001) (analyzing "pooled time-series cross-national data from 113 states between 1971 and 1997" to show that oil exports are strongly associated with authoritarian rule; that this effect is not limited to the Middle East; and that other types of mineral exports have a similar anti-democratic effect, while other types of commodity exports do not).

84 See generally Ross, note 79, at 1-4 (arguing that oil undermines democratic development, describing and responding to critiques of this idea); see also, e.g., Ahmet T. Kuru, Book Review—The Oil Curse: How Petroleum Wealth Shapes the Development of Nations, Brookings Inst. (Oct. 6, 2012), http://www.brookings.edu/research/opinions/2012/10/06-ross-oil-curse-kuru (critiquing Ross' emphasis on secrecy as the reason why oil-rich governments are more likely to be authoritarian, and his failure to focus on the lack of a

While starving these oil-producing rivals of revenue diminishes their *capacity* to harm the United States, it can have mixed effects on their *motivation* to do so. Some could respond by seeking a better relationship with the United States, for instance, to secure aid, the restoration of trade, or an end to sanctions. In contrast, others could feel freer to defy the United States—since they have less to lose—or could even precipitate a crisis to rally (or distract) domestic constituencies.[85] Thus, although the United States is likely to benefit from weakening hostile energy producers, it is possible to imagine other scenarios as well.

A low oil price can also be a mixed blessing for another reason. Although it weakens rivals like Iran, it also hurts allies who produce oil, such as Canada, as well as governments menaced by hostile insurgencies, such as Nigeria.[86] Likewise, Egypt and Jordan could be destabilized if Saudi Arabia cuts its support for them in response to declining oil prices. Yet, although these effects are undesirable, the United States could offset them, for instance, by increasing foreign aid.[87]

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middle class or of developed political institutions); Thad Dunning, Crude Democracy: Natural Resource Wealth and Political Regimes 1-36 (2008) (arguing that oil can promote both authoritarianism and democracy, but they do so through different mechanisms, and emphasizing democratic trends in Latin America as a counterexample to the "oil curse" thesis); Thad Dunning, Endogenous Oil Rents, 43 Comp. Pol. Stud. 379 (2010); Anar Kamil Ahmadov, A Conditional Theory of the "Political Resource Curse:" Oil, Autocrats, and Strategic Contexts 3 (Sept. 2011) (unpublished Ph.D. thesis, London School of Economics and Political Science), http://etheses.lse.ac.uk/618/1/Aahmadov_Conditional_Theory_Political_Resource_Curse.pdf (arguing that effects of oil on government are not uniform, and in particular that states vary in percentage of oil revenue claimed by central government; and using former Soviet republics to argue that effects of oil wealth on political institutions can vary, depending on "[t]he spread of alternative political elites, relative size of the ethnic minority with ties to a powerful kin state, and oil production geography").

[85] If commercial ties with the United States have a moderating influence, scaling back these ties can be counterproductive. But some reasons why commercial ties can be moderating—such as the development of a middle class to champion internal reforms and better relations with the United States—do not necessarily apply here. As noted above, oil revenue can stunt this sort of reform in many cases, instead of promoting it.

[86] Yergin, note 71, at SR6 (noting that Nigeria is the most populous nation in Africa with the largest economy and oil revenue representing 95% of exports and 75% of government revenue and stating that "its revenues are falling as it needs more money to fight the Boko Haram . . . insurgency").

[87] The goal here is assumed to be maximizing *national* welfare, but the analysis may not change much if the goal instead is to maximize *global* welfare. 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 government of Iran appeals to its leaders, there are costs even within the borders of Iran (for example, for dissidents), as well as for its neighbors.

3. The Solution: Slack Capacity Rather Than Domestic Production

To sum up, dependence on oil can increase U.S. defense burdens and strengthen geopolitical rivals. Therefore, in addition to environmental and economic rationales for government intervention in energy markets, there is a national security rationale as well.

Although the solution typically sought by politicians is domestically-produced oil, this is not entirely responsive. Even if the United States imports no oil, U.S. prices would still spike if the Persian Gulf were sealed off. The reason is that European and Asian consumers would bid up the price of U.S. oil if they could not buy Middle Eastern oil.[88]

Therefore, the way to mitigate these national security costs is not domestic production per se, but slack capacity in the global market. If supply is ample relative to demand, the sudden loss of one supplier is less likely to trigger an energy shock.[89] Prices also are lower, so geopolitical rivals earn less revenue.

While more production in the United States can create excess capacity, so can increased production in *other* stable and friendly nations, such as Canada and Brazil. These nations are unlikely to use revenue in ways that harm the United States. In addition, when new sources of oil are tapped in stable parts of the world, unstable sources represent a shrinking percentage of global oil production, which reduces the likelihood and magnitude of shocks.[90]

Excess capacity arises not only from increased supply, but also from reduced demand. One way to ease demand is greater energy effi-

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[88] Bohi & Toman, note 3, at 74-75; Metcalf, note 3, at 157. Admittedly, price spikes are especially harmful when oil is imported, since they drain more resources out of our economy, but shocks are still disruptive even when oil is domestically produced. Energy Strategy, note 40, at 27-28 (estimating the magnitude of disruptions from oil shocks to conclude that costs associated with importing oil represent only a fraction of economic harm—specifically, by one-half to two-thirds of the 0.5% estimated decline in GDP when oil imports are high and oil prices increase by 10%).

[89] 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 "it is not clear that increasing the number of supply sources for an individual country is especially beneficial." Metcalf, note 3, at 169. But Metcalf's argument assumes there is *still excess capacity* in the system after some suppliers drop out. Where does this excess capacity come from? Assuring *there is* excess capacity is precisely the reason to expand and diversify supply.

[90] Brown & Huntington, note 40, 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, 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. See note 89. It is not clear why the analysis should be different.

ciency. Using less energy offers the same national security benefits as new production. Fortunately, the "energy intensity" of the U.S. economy—that is, the amount of energy used per dollar of GDP—has declined significantly, as has U.S. petroleum consumption.[91]

Another way to reduce demand for oil is to replace it with other types of energy. For instance, if natural gas can substitute for oil, new supplies of natural gas create the same slack in the oil market—and thus the same national security advantages—as new sources of oil. In the United States, replacing oil with other energy sources is easier for some functions than others. As a transportation fuel, oil is hard to displace. The "synfuels" program was an unsuccessful attempt in the 1970's to use coal instead.[92] More recently, ethanol and other biofuels have made some inroads. Efforts also are under way to power vehicles with natural gas,[93] hydrogen, and electricity. But gasoline-powered cars still have the formidable advantage of a vast infrastructure of fueling and maintenance facilities.

While the United States needs oil for transportation, it hardly uses oil to generate electricity, power industry, or heat homes.[94] Coal, natural gas, nuclear, and renewables perform these functions, offering national security advantages in sparing us from using oil. Yet, more than one source of energy can replace oil in these settings. As a result, there is not necessarily a national security advantage in using one, as opposed to another. For instance, if natural gas can substitute for oil, there is less need for coal to do so, and vice versa.

[91] For each dollar of GDP, the United States used 13,381 BTU in 1980, compared with 7328 BTU in 2011. U.S. Energy Info. Admin., International Energy Statistics: Energy Intensity—Total Primary Energy Consumption Per Dollar of GDP, http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=92&pid=46&aid=2&cid=US,&syid=1980&eyid=2011&unit=BTUPUSDM (last visited Oct. 7, 2016) (reporting BTU per year in 2005 U.S. dollars); see also Jeremy Scott Diamond, Lynn Doan, David Marino & Dan Murtaugh, 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 the United States has gone from using over 3.5 barrels per million dollars of GDP to less than 1.5 barrels per million dollars of GDP); Energy Strategy, note 40, at 10-11 (stating that petroleum consumption has declined since 2006 because of greater fuel efficiency and slower economic growth).

[92] Linda R. Cohen & Roger G. Noll, The Technology Pork Barrel 259-60 (1991).

[93] Alternative Fuels Data Ctr., U.S. Dep't of Energy, http://www.afdc.energy.gov/vehicles/natural_gas.html (last visited Oct. 7, 2016) ("Natural gas powers about 150,000 vehicles in the United States and roughly 15.2 million vehicles worldwide.").

[94] Bill Sanderson, Home Heating Oil Is Now Cheap, But Natural Gas Is Even Cheaper, Marketwatch (Dec. 30, 2014, 8:35 AM), http://www.marketwatch.com/story/cheap-oil-who-cares-homeowners-prefer-natural-gas-2014-12-18 ("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.").

D. Competing Goals: The Environment Versus National Security

To sum up, a number of different market failures can justify government efforts to favor or discourage particular types of energy. Yet although each of these market failures is important, solving one market failure can exacerbate another. A key challenge is that some policies that enhance national security undercut environmental goals, and vice versa.

1. Oil

This tension is clearest with oil. One way to reduce the national security costs of oil, as noted above, is to develop new sources of supply in the United States or in other stable and friendly nations.[95] This additional supply shrinks the market power and revenue of geopolitical rivals, and also eases pressure to assure access to less secure sources. Yet, these national security advantages come at an environmental cost. More supply leads to more consumption, which generates more GHGs. In addition, more production increases the risk of offshore spills, water contamination from hydraulic fracturing, and pipeline and tanker accidents.

Notably, another strategy for reducing the national security costs of oil—reducing demand, instead of increasing supply—does not create the same tension with environmental goals.[96] Conservation and energy efficiency not only reduce national security costs, as discussed above,[97] but also have environmental advantages. For instance, greater fuel economy and better mass transit reduce emissions and pollution.

A third strategy to ease the national security costs of oil—replacing it with other energy sources—can also create tensions with environmental goals, depending on which substitute we choose. Some pose greater environmental risks than others. In addition, even if these substitutes reduce the national security costs of oil, they could pose national security risks of their own. Natural gas, coal, and renewables are considered in turn.

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[95] See Subsection II.C.3.

[96] While the focus here is on the national advantages of energy efficiency, Sarah Light considers the converse: the energy efficiency advantages of national security. Sarah E. Light, The Military-Environmental Complex, 55 B.C. L. Rev. 879 (2014). In particular, she observes that the military has strong incentives to promote energy efficiency since it uses so much energy, and that innovations developed by the military can be used by others. Id. at 884-86.

[97] See Subsection II.C.3.

2. *Natural Gas*

A decade ago, it seemed likely that natural gas would begin posing similar national security issues as oil. Domestic natural gas reserves were dwindling and the United States was preparing to become a major importer. At the time, the world's leading exporters were Russia, Iran, and Qatar.[98] As a result, importing natural gas would have provided another reason to police access to unstable regions, and also would have provided revenue to geopolitical rivals.

These national security risks never materialized, however, because of an unexpected surge in U.S. natural gas production. Hydraulic fracturing unlocked over 100 years of supply, and also slashed U.S. natural gas prices from over $12 per mbtu in June 2008 to $2.28 per mbtu in January 2016.[99] This domestic natural gas—unlike domestic oil—is largely insulated from global supply shocks for two reasons. First, natural gas is much less integrated than oil in the global market. While foreign buyers can buy U.S. oil,[100] and thus can bid up prices during a supply shock, they cannot buy U.S. natural gas because the necessary infrastructure is not yet in place. This will change by the end of the decade, as projects are completed to liquefy natural gas and ship it overseas. But even then, the capacity to reroute domestic supply for export will be limited, especially for rapid shifts in response to supply disruptions abroad.[101] Second, even if international buyers buy significant amounts of U.S. natural gas, U.S. prices should not increase very much because U.S. producers can produce a lot more at nearly the same marginal cost, either for export or for domestic consumption.[102]

While this new supply of natural gas offers national security advantages, its environmental impact is mixed. On the positive side of the

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[98] Nasser Karimi, Russia, Iran, Qatar Consider Natural Gas Cartel, S.F. Gate (Oct. 22, 2008, 4:00 AM), http://www.sfgate.com/news/article/Russia-Iran-Qatar-consider-natural-gas-cartel-3189154.php (stating that Russia, Iran, and Qatar provided one-third of the world's natural gas exports at the time).

[99] U.S. Energy Info. Admin., Henry Hub Natural Gas Spot Price, http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm (last updated Oct. 26, 2016) (reporting monthly natural gas prices at the Henry Hub distribution hub in Erath, Louisiana).

[100] For many years, there was a ban on the export of crude oil, but refined oil could be exported. In December 2015, Congress lifted the ban on crude exports. Skip York, U.S. Lifts the Ban on Crude Oil Exports: When Might It Matter for Producers?, Forbes (Jan. 19, 2016, 1:10 PM), http://www.forbes.com/sites/woodmackenzie/2016/01/19/us-lifts-the-ban-on-crude-oil-exports-when-might-it-matter-for-producers/#2d34aa2c328d.

[101] Bordoff & Losz, note 46, at 199.

[102] U.S. Energy Info. Admin., Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets 15-19 (Oct. 2014), http://www.eia.gov/analysis/requests/fe/pdf/lng.pdf (noting that U.S. supply curve is fairly flat); id. at 12 ("Across the different export scenarios and baselines, higher natural gas production satisfies about 61% to 84% of the increase in natural gas demand from LNG exports . . . .").

ledger, natural gas pollutes the air much less than coal. In addition, burning natural gas emits approximately one-half as many GHGs as burning coal.[103] Indeed, since 2005, GHG emissions have declined more in the United States than anywhere else, and the substitution of natural gas for coal is a key reason.[104] Between 2005 and 2013, U.S. GHGs from power generation declined by 15%, and U.S. GHGs declined overall by 6.9%.[105]

But on the other side of the ledger, natural gas has environmental costs as well. It is itself a potent GHG, as noted above, and some escapes into the atmosphere. The volume of these "fugitive" emissions—and thus the extent of natural gas' advantage over coal—is debated. In addition, the U.S. natural gas boom relies on hydraulic fracturing, which has prompted concerns about water contamination and seismic activity.

To sum up, the domestic natural gas boom has clear national security advantages, and its implications for the environment probably are also positive, though not unequivocally so.

3. *Coal*

For coal, the environmental harms are worse, while the national security benefits are less clear or, at least, more contingent. Coal pollutes the air more than natural gas and probably emits more GHGs.[106]

In response, defenders of coal sometimes invoke its national security advantages, since the United States has ample domestic reserves. Yet, the boom in natural gas production has an important implication that has not been adequately recognized: As more natural gas becomes available, the national security case for coal becomes weaker. After all, natural gas offers the same national security advantages—since we also have sizable domestic reserves—at lower environmental cost.

The best national security argument for coal is diversification. If the United States can no longer meet its energy needs with natural gas, coal can fill the gap. Indeed, so far natural gas has displaced coal

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103 See, U.S. Energy Info. Admin., Frequently Asked Questions http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11 (last visited Oct. 8, 2016) (listing the pounds of carbon dioxide emitted per million BTU of energy for coal and natural gas).

104 Energy Strategy, note 40, at 32 (estimating that one-half of this decline is attributable to substitution of natural gas for coal, and one-half is attributable to economic downturn).

105 Envtl. Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014, at 2-4 to 2-5 tbl.2-1 (Apr. 15, 2016), https://www.epa.gov/sites/production/files/2016-04/documents/us-ghg-inventory-2016-main-text.pdf (reporting that GHGs from power generation declined from 2400.9 million metric tons ("mmt") in 2005 to 2039.3 mmt in 2014, and GHGs overall declined from 7378.8 mmt in 2005 to 6870.5 mmt in 2014).

106 See notes 103–05 and accompanying text.

partially, but not completely.[107] U.S. natural gas production, however, can increase further without a significant rise in natural gas prices, as noted above. As a result, the national security case for subsidizing "clean coal" technology is questionable; instead, mitigating the environmental risks of natural gas probably is a more promising strategy.

4. *Renewables*

While natural gas has environmental advantages over coal, wind and solar energy are even better for the environment, since they emit no GHGs or pollution. As a result, there is a strong (and familiar) environmental case for renewables.

Sometimes, proponents of solar and wind power also assert its national security advantages, but these are less clear. After all, if national security were the only priority—requiring a domestic source of energy other than oil—the United States could rely on natural gas or coal. For the foreseeable future, the contribution of solar and wind power would be more limited. They are less reliable than hydrocarbons (since the sun has to shine or the wind has to blow),[108] and also still depend on government support (although costs have declined substantially, rendering them competitive in some conditions).[109]

Given these limitations, the national security case for renewables is that if we have to stop using domestically-produced natural gas and

[107] Coal used to generate two or three times as much electricity as natural gas in the United States, but in recent years natural gas has been catching up. In April 2015, natural gas generated more electricity for the first time, in part because cheap natural gas has been causing utilities to add natural gas generators. Housley Carr, Torn Between Two Fossil Fuels—Coal vs. Gas in the U.S. Power Sector, RBN Energy, LLC (Sept. 9, 2015), https://rbnenergy.com/torn-between-two-fossil-fuels-coal-vs-gas-in-the-us-power-sectoris. In addition, the Obama Administration's Clean Power Plan created incentives to reduce the use of coal. Envtl. Protection Agency, Overview of the Clean Power Plan 2, https://www.epa.gov/sites/production/files/2015or08/documents/fs-cpp-overview.pdf (last updated June 27, 2016). But in March 2017, President Trump initiated an effort to withdraw the Clean Power Plan. Juliet Eilperin & Brady Dennis, Trump Moves Decisively to Wipe Out Obama's Climate-Change Record, Wash. Post, Mar. 28, 2017, https://www.washingtonpost.com/national/health-science/trump-moves-decisively-to-wipe-out-obamas-climate-change-record/2017/03/27/411043d4-132c-11e7-9e4f-09aa75d3ec57_story.html?utm_term=.8d9836653a64. A different legal reason for utilities to decommission coal plants, the EPA's Mercury and Air Toxic Standards (MATS) rule, was invalidated by the Supreme Court in June 2015. Mich. v. Envtl. Prot. Agency, 135 S. Ct. 2699, 2711-12 (2015).

[108] With current technology, it is not feasible to store energy generated in favorable conditions for later use, so renewables need a back-up power source, which usually is natural gas.

[109] See generally Geoffrey Heal & Karoline Hallmeyer, How Lower Oil Prices Impact the Competitiveness of Oil with Renewable Fuels, Columbia SIPA Ctr. on Global Energy Pol'y (Oct. 2015), http://energypolicy.columbia.edu/sites/default/files/energy/How%20Lower%20Oil%20Prices%20Impact%20the%20Competitiveness%20of%20Oil%20with%20Renewable%20Fuels_October%202015.pdf.

coal for environmental reasons, renewables can help fill this gap (e.g., instead of oil). But the real point here is that renewables have environmental advantages—not national security advantages—over coal and gas. Second, when U.S. natural gas and coal reserves run out decades (or even centuries) from now, we will need alternatives. Third, in the long run, environmental benefits of renewables could translate into national security benefits by avoiding famines, droughts, and other sources of instability from climate change.[110] Yet, these national security payoffs are uncertain and remote in time.

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To sum up, the government has a number of environmental, economic, and national security reasons to intervene in energy markets. Yet many of the relevant externalities are hard to measure. In addition, some types of energy generate both positive and negative externalities, requiring policymakers to mediate among competing priorities.

III. Current Law: Targeted Subsidies Instead of Pigouvian Taxes

The last Part surveyed the case for government intervention in energy markets, as well as the tensions between environmental and national security goals. To balance these goals, Congress could use Pigouvian taxes or tradeable permits. But these instruments are rarely used in the United States, even though they are common in other jurisdictions; *taxing* disfavored types of energy has been harder politically in the United States than *subsidizing* favored types.[111] This Part offers an example of how to use a menu of taxes to internalize energy externalities, considers why subsidies are used instead, and canvasses the hodgepodge of targeted subsidies under current law.

A. *Targeting the Net Level of All Relevant Externalities: A Menu of Pigouvian Taxes*

Enhancing and diversifying the supply of oil (and, to an extent, other energy sources) has national security advantages, but environmental costs. Each goal is important, so how can they be reconciled?

[110] Graetz, note 26, at 158 ("[C]limate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments." (quoting U.S. Dep't of Def., Quadrennial Defense Review Report 85 (2010)).

[111] See, e.g., id. at 62-65 (discussing current subsidies for fossil fuels and advocating subsidies for renewable energy).

Ideally, both environmental and national security harms should be priced, using Pigouvian taxes or tradeable permits.[112] Each incorporates both private and social costs in the price.[113] Four types of taxes or tradeable permits should be considered. For ease of exposition, this discussion uses taxes.

First, a carbon tax (*C*) should apply to hydrocarbons and other emitting sources. Since *C* would be based on the GHGs they emit, it would be higher for coal than oil and natural gas.[114]

Second, another Pigouvian tax (*P*) should internalize pollution. For instance, the *P* for offshore oil drilling would reflect oil-spill risks. The *P* for coal would address air and water pollution, and so forth.[115]

Third, a tax (*T*) could be added for negative externalities from traffic and congestion, including delays and accidents. Estimates suggest these costs are quite large.[116]

Fourth, another Pigouvian tax (*NS*) could internalize national security risks. The most straightforward approach is an extra tax on oil. By reducing consumption, and thus creating more slack in the system, *NS* would ease pressure on the United States to police access to insecure supply, while also reducing the revenue of geopolitical rivals.

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[112] Goulder & Parry, note 5, at 169 ("Apart from administrative considerations, the most cost-effective approach is to introduce multiple taxes. Each tax would be set based on the marginal external cost of a different externality, which would yield appropriate incentives to deal with each of the various problems (emissions, congestion, etc.) involved."). A tax fixes the price, relying on the market to set the volume of activity. In contrast, tradeable permits determine volume, letting the market set the price.

[113] There is a robust literature comparing Pigouvian taxes and tradeable permits. As long as permits are auctioned off for fair value, the results are largely comparable. Indeed, differences that are commonly invoked in the literature (such as the greater flexibility of permits) often fade on closer inspection. See, e.g., Louis Kaplow & Steven Shavell, On the Superiority of Corrective Taxes to Quantity Regulation, 4 Am. L. & Econ. Rev. 1 (2002) (defending the superiority of corrective taxes, and noting that Martin Weitzman's widely cited critique of corrective taxes relies on the implausible assumption that they have to be linear and fixed).

[114] A range of implementation challenges have to be considered. For example, a different point of collection might be needed for each source, so natural gas would be taxed when it is extracted, while oil would be taxed when it is refined, and so forth. See Gilbert Metcalf & David Weisbach, The Design of a Carbon Tax, 33 Harv. Envtl. L. Rev. 499 (2009).

[115] In this spirit, the United States has a successful tradeable permit regime for sulfur dioxide, which was enacted in the 1990 Clean Air Act amendments to address acid rain. Pub. L. No. 101-549, title IV, § 403, 104 Stat. 2399, 2589 (1990); see Dallas Burtraw, Innovation Under the Tradable Sulfur Dioxide Emission Permits Program in the U.S. Electricity Sector (Resources for the Future, Discussion Paper 00-38, 2000), http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-00-38.pdf; see also Cohen, note 7, at 59-60.

[116] See, e.g., Aaron S. Edlin & Pinar Karaca-Mandic, The Accident Externality from Driving, 114 J. Pol. Econ. 931, 931 (2006) (estimating that adding a driver to a heavy traffic state, such as California, can increase the insurance costs of other drivers by $1725 to $3239 per year, and that a Pigouvian tax could raise $220 billion nationwide).

In theory, a national security tax could be calibrated more finely, so it is imposed only on oil from geopolitical rivals. The goal would be to force them to sell at a lower price. For example, if the global price for crude was $50, and a $10 tax was imposed on crude from a rival, it would have to offer a pretax price of $40 in order to compete.

Nevertheless, this tax might prove easy to avoid, since identifying the original source of oil is not easy. In addition, like any sanctions regime, this tax could not succeed if some oil-importing nations did not impose it; then the targeted nation could still sell to them at $50, or perhaps a modest discount.

Likewise, it is also tempting, but difficult, to impose an extra tax on *unstable* suppliers, giving *stable* suppliers a competitive advantage and encouraging them to increase production. But again, if other nations did not follow, unstable sources could simply export to these nations.

Another problem is that disadvantaging unstable suppliers (and officially classifying them as "unstable") may destabilize them further. Indeed, it would be challenging, and potentially awkward, for the State Department to classify nations as stable or unstable—or, for that matter, as friendly or hostile.

These difficulties would be avoided if the favored category was narrowed to domestically-produced oil, as in some subsidies under current law. But this approach omits friendly and stable producers such as Canada and Brazil, who offer comparable national security benefits, as noted above.[117]

In any event, imposing a tax only on imports, or on imports from some nations but not others, could founder not only on these conceptual challenges, but also on trade treaties. If these issues could not be resolved satisfactorily, the best we could do is an extra national security tax on *all* oil.

So far, this analysis has assumed that energy markets are competitive, but Pigouvian taxes could have different effects on monopolists.[118] For instance, they might respond to these taxes by raising prices and reducing output.[119] This response could mitigate environmental externalities (by reducing consumption), while exacerbating national security externalities (by protecting the profits of hostile energy producers). Even so, unpacking the effects on monopolists is unnecessary, since energy markets currently are competitive. For

117 See Subsection II.C.3.

118 I thank David Weisbach for this observation.

119 Rajeev K. Goel & Edward Wei-Te Hsieh, Market Structure, Pigouvian Taxation, and Welfare, 25 Atlantic Econ. J. 128, 132 (1997) ("[T]he monopolist decreases output when faced with a higher tax. While the expected level of social damage from production will be smaller than before, the magnitude of the already existing monopolistic distortion from underproduction will increase.")

instance, although OPEC sometimes has functioned as an effective cartel, the surge in U.S. oil production has undercut OPEC's ability to control prices.[120]

To sum up, separate Pigouvian taxes could account for the costs of climate change, pollution, congestion, and national security. Under this segmented approach, the total Pigouvian tax would vary for each energy source. For example, oil would be subject to all of these taxes. Coal and natural gas would not be subject to the national security and congestion taxes, but would be subject to the carbon and pollution taxes (though at different levels). Nuclear would be subject to the pollution tax (and perhaps also a charge for securing nuclear power plants), but not the carbon and congestion taxes. Solar and wind would not be subject to any of these taxes.

A potential advantage of this menu of Pigouvian taxes is that other policies, and the administrative burdens and efficiency costs they entail, would no longer be necessary. For example, most energy subsidies under current law could be repealed (although there still would be reason to support research and development in energy, as in other fields). Likewise, fuel economy standards and various environmental regulations of power plants could be scaled back as well.

At the same time, there would be obvious challenges in administering these taxes. Quantifying the externalities is daunting, as noted above.[121] There also would be incremental administrative costs in tailoring individualized taxes in this way. Given these challenges, the best we can do is a rough estimate, which accounts for relative, as well as absolute, levels. For example, even if the externalities from natural gas and coal cannot be estimated with precision, the environmental harm from coal is likely to be worse, so the taxes should reflect this difference.

B. Political Advantages of Energy Subsidies Over Pigouvian Taxes

While the government has compelling reasons to intervene in energy markets, and ideally would do so with a menu of Pigouvian taxes or permits, this approach faces familiar political obstacles.[122] To sidestep these political barriers, the United States has used targeted subsidies instead. This choice has policy costs, as Part IV shows. Before turning to these problems, this Section briefly considers the political advantages of subsidies over taxes and permits.

120 See note 51 and accompanying text.
121 See Part II.
122 Cohen, note 7, at 55-56.

1. Resistance to a Carbon Tax or a Higher Gas Tax

Forty countries have some form of carbon tax or tradeable permit,[123] and many nations have higher gasoline taxes than the United States.[124] But unfortunately, the political opposition in the United States to carbon taxes, "cap and trade," and higher gasoline taxes is familiar.

A key challenge is that these regimes add to the cost of the targeted type of energy. Although socially useful, these added costs are both salient and unappealing to consumers.[125] Voters would constantly encounter them in filling their tanks and paying electric and heating bills.[126]

This unpopularity with consumers is particularly significant since U.S. political institutions are especially responsive to interest group pressure.[127] While these policies have many opponents, they have few interest group champions. For example, even though a carbon tax would improve the competitive position of solar and wind energy producers, they prefer the more immediate advantage of a subsidy for their specific technology.

Higher gasoline taxes in the United States also are a harder sell because mass transit options are limited and distances are vast in many places. It is easier to live without a car in Berlin, Paris, or Tokyo than in Kansas City, Dallas, or Los Angeles. As a result, the federal gas tax has remained at 18.4 cents per gallon for over twenty years.[128] The tax is supposed to fund highway construction and maintenance, but the highway trust fund has been running an annual deficit of ap-

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123 World Bank, Pricing Carbon, http://www.worldbank.org//en/programs/pricing-carbon (last visited Oct. 29, 2016).

124 OECD, Taxing Energy Use 2015: OECD and Selected Partner Economies 47 (2015), http://www.oecd.org/tax/taxing-energy-use-2015-9789264232334-en.htm.

125 Graetz, note 26, at 252-53, 255; Steven Cohen, It's Time to Abandon the Delusion of a Carbon Tax, Huffington Post (Sept. 29, 2014, 8:26 AM), http://www.huffingtonpost.com/steven-cohen/its-time-to-abandon-the-d_b_5899448.html ("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.").

126 See Neil Hume & Pilita Clark, Chevron Chief Lashes Out at European Oil Groups on Climate Change, Fin. Times (June 3, 2015), http://www.ft.com/intl/cms/s/0/0625af4c-0a10-11e5-82e4-00144feabdc0.html#axzz3jfrOVvN0 ("I don't think that putting a price on carbon is necessarily the answer. I've never had a customer come to me and ask to pay a higher price for oil, gas or other products."(quoting John Watson, CEO of Chevron)).

127 See Christine Mahoney, Lobbying Success in the United States and the European Union, 27 J. Pub. Pol'y 35, 35-36, 55 (2007) (emphasizing greater electoral accountability and availability of private campaign finance in the United States).

128 U.S. Dep't of Transp., Office of Highway Pol'y Info., Federal Tax Rates on Motor Fuels and Lubricating Oil (1), at 1 tbl.FE-101A (2015), http://www.fhwa.dot.gov/policy-information/statistics/2014/pdf/fe101a.pdf.

proximately $10 billion in recent years.[129] Even so, increasing this tax is a political "hot potato."[130] As President Obama put it, "The gas tax hasn't been increased for 20 years. There's a reason for that."[131]

2. *The Political Allure of Energy Subsidies*

In contrast, energy subsides have more favorable political prospects. Although a subsidy for "green" energy advances some of the same environmental goals as a carbon tax—and a subsidy for oil production advances some of the same national security goals as a higher gasoline tax—these subsidies do not inflict pain by *raising* the price of energy that Congress wants to *discourage*. Instead, they *lower* the price of an alternative that Congress wants to *encourage*.

In addition, although subsidies are salient to those who claim them, they are largely invisible to the average voter. Of course, higher taxes or larger deficits are needed to fund these programs. But voter concerns about taxes and deficits do not usually focus on a particular subsidy, since so many other programs are funded as well.

At the same time, organized interest groups enthusiastically support these subsidies, hiring lobbyists, running campaign ads, and contributing to campaigns. Indeed, several energy tax expenditures have been extenders, which had to be renewed every year.[132] This structure induced perpetual lobbying, and thus an evergreen flow of campaign contributions.

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[129] Sean Lowry, Cong. Research Serv., RL30304, The Federal Excise Tax on Motor Fuels and the Highway Trust Fund: Current Law and Legislative History 5 tbl.3 (2015), available at http://nationalaglawcenter.org/wp-content/uploads/assets/crs/RL30304.pdf ("Congress has prevented potential shortfalls to the HTF by transferring over $69.9 billion (after sequestration) from Treasury's general fund to the HTF. . . . [G]eneral fund transfers to the HTF have been scheduled seven times by six authorizing laws since 2008.").

[130] A carbon tax has become comparably toxic in Australia, which repealed it only two years after enacting it. After pledging that "[t]here will be no carbon tax under the government I lead," Prime Minister Julia Gillard agreed to a carbon "price" in order to form a coalition with the Green party. Julia Baird, Editorial, A Carbon Tax's Ignoble End, N.Y. Times, July 24, 2014, at A 27, http://www.nytimes.com/2014/07/25/opinion/julia-baird-why-tony-abbott-axed-australias-carbon-tax.html?_r=0. For this seeming about-face, the opposition branded her "Ju-Liar," and she lost the leadership of her party. Id. Meanwhile, Tony Abbott, the leader of another party, was elected in part on a pledge to "ax the tax." Id.

[131] Russell Berman, The Tax That Dare Not Be Hiked, The Atlantic (Dec. 7, 2014), http://www.theatlantic.com/politics/archive/2014/12/the-tax-that-dare-not-be-hiked/383428/.

[132] For instance, a number of these provisions were extended for two years in December of 2015, including the production tax credit, as well as various incentives for biofuels, biodiesel, and alternative fuels. Consolidated Appropriations Act of 2016, Pub. L. No. 114-113, § 301, 129 Stat. 2242, 3038 (2015) (extending the production tax credit); id. §§ 184, 185, 129 Stat. at 3073 (extending credits for biofuel and biodiesel); id. § 192, 129 Stat. at 3075 (extending excise tax credits relating to alternative fuels).

C. Targeted Energy Subsidies Under Current Law

Mindful of these political advantages, Congress has used a wide range of tax expenditures to promote both alternative energy and hydrocarbons.

1. Tax Expenditures Promoting Alternative Energy

Most tax expenditures for alternative energy are narrowly targeted, supporting particular technologies. The lion's share were introduced or expanded dramatically by the Obama Administration. They focus on three areas.

The first is "greener" electricity. There are tax credits for energy manufacturing;[133] special accelerated depreciation rules for renewable energy;[134] and subsidies for "clean coal" facilities[135] and coal plant scrubbers.[136] In addition, taxpayers can claim an investment tax credit for investing in solar, wind, and geothermal energy production;[137] a production tax credit of 2.3 cents for each kWh of electricity generated from wind or geothermal energy, and half that amount for hydroelectric and some other technologies,[138] and the so-called "1603 program," offering upfront grants in lieu of these credits.[139]

The second focus of these tax expenditures is transportation. In recent years, Congress has offered a $7500 credit for plug-in electric vehicles,[140] as well as credits for qualified fuel cell vehicles, hybrids, alternative fuel vehicles, and advanced lean burn technology vehicles.[141] Congress also has provided credits for alternative fuels.[142]

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[133] E.g., IRC § 48C (offering a credit for businesses which establish, expand or re-equip a manufacturing facility for the production of renewable energy); see Staff of the Joint Comm. on Tax'n, 115th Cong., JCX-3-17, Estimates of Federal Tax Expenditures for Fiscal Years 2016-2020, at 29 tbl.1 (2016), https://www.jct.gov/publications.html?func=startdown&id=4971.

[134] IRC § 168(e)(3)(B)(vi) (classifying a number of renewable energy technologies as five-year property); see Joint Comm., note 133, at 30.

[135] IRC §§ 48A, 48B (providing tax credits for qualifying advanced coal and gasification projects); See Joint Comm., note 133, at 29 $200 million in 2016).

[136] IRC §§ 169, 291.

[137] IRC § 48; Joint Committee, note 133, at 29 tbl.1 ($2.6 billion in 2016).

[138] IRC § 45; Joint Committee, note 133, at 29 tbl.1 ($3.3 billion in 2016); see also U.S. Dep't of Energy, Renewable Electricity Production Tax Credit (PTC), http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc (last visited Nov. 21, 2016) (listing the production tax credit as adjusted for inflation).

[139] As of July 31, 2016, $24.9 billion of Section 1603 grants had been dispensed. Treasury Dep't, Overview and Status Update of the § 1603 Program 1 (2016), https://www.treasury.gov/initiatives/recovery/Documents/STATUS%20OVERVIEW.pdf.

[140] IRC § 30B.

[141] See, e.g., IRC § 30D.

[142] IRC § 5626.

Until 2012, there was a credit for ethanol as well.[143] Tax expenditures also have supported natural gas fueling stations, idling reduction units in trucks, transit passes, and bicycle commuting.[144]

A third set of tax expenditures promotes energy efficiency, including heating and cooling systems, appliances, and insulation in newly-constructed homes, existing homes, and commercial properties.[145] In addition, utilities can offer tax-free rewards to consumers for making energy efficient investments.[146]

3. *Tax Expenditures to Increase and Diversify the Supply of Hydrocarbons*

While alternative energy subsidies are mostly of recent vintage, hydrocarbon subsidies survive from an earlier era. A few focus on consumption (for example, commuter parking), but most are for producers.

These tax expenditures are broader than their alternative energy counterparts, targeting expansive categories of hydrocarbon production instead of particular technologies. The most plausible policy justification for them is national security, although they also reflect the industry's political clout. To induce more production—adding stable sources of supply and reducing the revenue of geopolitical rivals—the tax bill on production is cut in four ways.

The first are special cost recovery rules, which apply only to U.S. production. Ordinarily, when income-producing assets are created, costs cannot be deducted immediately. Instead a portion is deducted each year of the asset's useful life.[147] In contrast, an immediate deduction is offered for costs of drilling wells in the United States, including wages, supplies, and fuel.[148] In addition, accelerated depreciation is available for geological and geophysical expenses of U.S. wells.[149] Percentage depletion is another special deduction, which is available only to "independent" producers (who do not have refin-

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143 IRC § 6426(b) (expired January 1, 2012); see Robert Pear, After Three Decades, Tax Credit for Ethanol Expires, N.Y. Times, Jan. 1, 2012, at A11, http://www.nytimes.com/2012/01/02/business/energy-environment/after-three-decades-federal-tax-credit-for-ethanol-expires.html.

144 IRC § 30C (credit for alternative fuel vehicle refueling property), § 4053(9) (excise tax exemption for idling reduction units), § 132(f)(1) (exemption for transit passes and bicycle commuting reimbursements).

145 IRC §§ 25C, 25D. The Joint Committee estimated the cost of subsidies for energy efficiency in homes at $1.6 billion in 2016. Joint Committee, note 133, at 29-30 tbl.1.

146 U.S. Dep't of Energy, Tax Credits, Rebates & Savings, https://energy.gov/savings (last visited Feb. 2, 2017) (listing utility programs and other incentives by state).

147 See, e.g., IRC § 168.

148 IRC §§ 616, 617; Joint Committee, note 133, at 30 tbl.1 ($1.8 billion in 2016).

149 IRC § 167(h); Joint Committee, note 133, at 30 tbl.1 ($100 million in 2016).

eries or retail distribution) and royalty owners.[150] It allows producers to deduct a designated percentage of revenue, which is assumed to reflect the decline in reserves over time (for example, 15% for oil).[151] It is especially generous because it can exceed a producer's actual costs. The oil and gas industry defends these cost-recovery rules as comparable to tax benefits claimed by other industries, such as R&D deductions for the pharmaceutical industry.[152]

Second, oil and gas producers are sometimes taxed at a reduced rate. The rate reduction for domestic manufacturing (31.85% instead of 35%) applies to domestic oil and gas producers.[153] In addition, publicly traded partnerships that hold exploration, refining, and pipeline assets do not pay corporate tax.[154] This tax benefit is not limited to domestic production.[155]

Third, targeted tax credits are offered for exploration and production when energy prices are low. Section 45K funds unconventional production.[156] The marginal well production credit[157] and enhanced oil recovery tax credit[158] subsidize low-producing or high-cost U.S. wells. In recent years, high energy prices have rendered these credits unavailable.

Fourth, multinational oil companies receive especially generous treatment for deals they strike with foreign governments. Multinationals usually have to pay both taxes and royalties to these governments. The U.S. offers a tax credit for taxes (so income is not taxed twice), but not for royalties.[159] Given this difference, producers obviously prefer to classify payments as taxes. If this planning strategy succeeds—so the U.S. government bears the cost—producers have

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150 IRC § 613A(d)(2), (4); Joint Committee, note 133 at 30 tbl.1 ($700 million in 2016).

151 IRC §§ 611, 613, 613A.

152 Oil and Gas Tax Incentives and Rising Energy Prices: Hearing Before the S. Comm. on Fin., 112th Cong. 8-9 (2011) (statement of John Watson, Chairman of the Board and Chief Executive Officer, Chevron Corporation), https://permanent.access.gpo.gov/gpo29708/75747.pdf.

153 IRC § 199 (allowing a 9% deduction, which translates into a reduced rate of (9 x .35) or 3.15%).

154 IRC § 7704.

155 Joint Committee, note 133, at 30 tbl.1 ($900 million in 2016). Cf. Sean T. Wheeler & C. Timothy Fenn, Ten Offshore MLP Facts, Latham & Watkins (2013), https://www.lw.com/thoughtLeadership/LW-offshore-MLP-facts (noting that foreign assets often are placed in foreign partnerships that elect to be treated as corporations for U.S. tax purposes, and that these assets avoid U.S. entity-level tax by being outside the United States).

156 This includes oil from shale or tar sands, coal seams, or other "tight" formations, as well as biomass and synthetic fuels from coal. IRC § 45K(c). This credit is often called the "old Section 29 credit" because of its former position in the Code.

157 IRC § 45I.

158 IRC § 43.

159 IRC § 901.

less incentive to resist high royalties,[160] and U.S. tax dollars are rerouted to foreign governments. This is particularly unfortunate when the foreign government is a geopolitical rival, which uses revenue in ways that undercut U.S. interests. Yet, a favorable judicial decision for Exxon has enabled producers to claim foreign tax credits for what arguably are royalties.[161]

III. Institutional Design Challenges with Targeted Subsidies

While the government has good reasons to intervene in energy markets, the last Part showed that political dynamics in the U.S. favor subsidies over taxes and permits. In some ways, these instruments are similar. They all use prices to create incentives, instead of mandating or prohibiting particular practices. This flexibility can promote competition and innovation.[162]

However, although energy subsidies have political advantages, they have important policy disadvantages. While other commentators also favor taxes over subsidies, this Part identifies a number of problems with subsidies that are new to the literature, including administrative challenges in covering all the relevant behavior. This Part also suggests ways to mitigate some of these problems, if Congress is stuck with targeted subsidies for political reasons.

[160] One reason the multinational might care is that it can defer U.S. tax by not immediately repatriating foreign earnings. This means it relies on a (deferred) U.S. foreign tax credit to compensate for a (current) foreign tax. Under "new view" assumptions, the deferred credit could still fully compensate for the current tax (for example, if after-tax returns are the same everywhere and the repatriation tax at a fixed rate is inevitable). Daniel N. Shaviro, Fixing U.S. International Taxation 82-85 (2014). Yet, this is no longer the case—so firms will, in fact, seek to reduce their foreign taxes (as, indeed, many do)—if these assumptions no longer hold. Id. at 85-87.

[161] Exxon Corp. v. Commissioner, 113 T.C. 338 (1999) (applying "dual capacity" rules to treat as a creditable tax a payment that the Treasury considered a royalty); see also Philips Petroleum Co. v. Commissioner, 104 T.C. 256 (1995); Staff of the Joint Comm. on Tax'n, 112th Cong., JCX-27-11, Description of Present Law and Select Proposals Relating to the Oil and Gas Industry 16 (2011), https://www.jct.gov/publications.html?func=startdown&id=3787 ("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."). The Obama Administration proposed to modify the tax rules for dual capacity taxpayers by limiting the creditable tax to the portion of a foreign "levy" that does not exceed the foreign levy the taxpayer would pay if it were not a dual capacity taxpayer. Treasury Dep't., General Explanations of the Administration's Fiscal Year 2016 Revenue Proposals 26-27 (2015), https://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2016.pdf.

[162] See Goulder & Parry, note 5, at 163, 166-68; see also Kate Gordon, Why Renewable Energy Still Needs Subsidies, Wall St. J.: Experts, Sept. 14, 2015, http://blogs.wsj.com/experts/2015/09/14/why-renewable-energy-still-needs-subsidies/.

A. Covering All Relevant Behavior: A Particular Challenge for Subsidies

By incorporating externalities in prices, energy taxes and subsidies force producers and consumers to account for the full social cost of each energy source in deciding how much to use. To accomplish this goal, taxes (and permit prices) should equal the marginal harm *caused* by the taxed behavior. Likewise, the subsidy should equal the marginal harm *avoided* by the subsidized activity.

Producers and consumers, however, will not make optimal choices if externalities are internalized only *some* of the time. For example, a carbon tax that covers natural gas and oil, but not coal, would encourage greater use of coal. To avoid counterproductive outcomes, taxes, permits, and subsidies have to treat harms *the same way*, wherever they arise. The literature calls this goal "tech neutrality."[163] A core contribution of this Article is to show why a tech-neutral *tax* is easier to draft and administer than a tech-neutral *subsidy*. Indeed, as a practical matter, a tech-neutral subsidy is impossible.

1. The Advantages of Tech Neutrality

Before showing why tech neutrality is harder for subsidies, consider why it matters. Tech neutrality has two familiar advantages.

First, harms are abated more cost effectively. When subsidies, taxes, and permits are applied consistently, the government does not favor some technologies or abatement methods over others. As a result, heterogeneous individuals can choose the abatement method that is most appealing to them. In response to a national security tax on oil, for instance, some can carpool or ride mass transit, while others can opt for shorter commutes or fuel-efficient cars. Firms can compete to develop different options, such as hybrids, fuel-efficient gasoline engines, and vehicles that run on electricity or natural gas. In contrast, if the government omits some harms, choices become more constrained, leading to inefficient or even counterproductive outcomes. For instance, a gas tax that applies to cars, but not SUVs, would cause more consumers to drive (gas guzzling) SUVs.[164] Gaps in subsidies create parallel distortions. For example, if the government

[163] See, e.g., Sullivan, note 1, at 619; see also Gilbert Metcalf, Tax Policies for Low-Carbon Technologies, 62 Nat'l Tax J. 519, 522-23 (2009).

[164] By analogy, U.S. fuel economy standards do not reach sport utility vehicles and minivans; this fact no doubt contributed to the increase in their market share from 3% in 1978 to 50% in 2003. Soren T. Anderson, Ian W.H. Parry, James M. Sallee & Carolyn Fischer, Automobile Fuel Economy Standards: Impacts, Efficiency, and Alternatives, 5 Rev. Envtl. Econ. & Pol'y 89, 94 (2011).

subsidizes shorter commutes, but not mass transit, some who prefer the bus will change their residence instead.

Tech-neutral subsidies and taxes also have a second advantage: The government sets the abatement process in motion, but does not have to direct it. Instead of targeting specific practices, the government can rely on market judgments and competition. This is a notable advantage, since government officials often lack the information, expertise, and incentives to evaluate competing abatement options, and are subject to interest group pressure in making these judgments.

2. *Administrability Constraints on the Scope of Subsidies*

A key goal for both taxes and subsidies, then, is to cover all the relevant alternatives. Taxes have to reach all *sources* of a problem. Likewise, subsidies need to cover all *solutions*. Although comparable *in principle*, these efforts are quite different *in practice*: Subsidies require more information and better calibrated rules.

To see the point, compare two ways of internalizing environmental and national security externalities from gasoline, which are assumed to be $*X* per gallon. One is to impose a tax of $*X* on every gallon we use. The other is to offer a subsidy of $*X* for each gallon we conserve.

A neutral tax has to reach every gallon that is used. Admittedly, this is not a straightforward task. For example, robust enforcement is needed, so vendors actually collect the tax; otherwise, they may seek a competitive advantage in charging customers a tax-free price. Likewise, a tax has perverse effects if it covers only gasoline, but not alternatives that impose comparable environmental and national security costs. For example, if a tax reaches gasoline, but not jet fuel, some people will fly instead of driving.[165] To avoid these perverse effects, the tax needs to be broadened to include diesel, propane, jet fuel, plastics, and the like. Covering *all* uses of oil is not easy, but we should be able to come fairly close.

In contrast, a comparably comprehensive subsidy is simply not feasible. There are too many ways to reduce gasoline usage. Reaching them all—or even most of them—would require a monumental administrative effort. Specifically, the subsidy has to reach three types of choices.

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165 In general, air travel has the greatest climate impact per mile travelled, but the comparison to cars, buses, and trains depends on how full each of them is. See generally Jens Borken-Kleefeld, Jan Fuglestvedt & Terje Berntsen, Mode, Load, and Specific Climate Impact from Passenger Trips, 47 Envtl. Sci. & Tech. 7608 (2013) (comparing the specific climate impact of long-distance car travel with bus, train, or airplane travel, accounting for factors such as efficiency and occupancy).

First, a tech-neutral subsidy has to cover every type of fuel-efficient car. It also has to reward other ways of enhancing fuel efficiency, such as slow driving, properly inflated tires, and trips during less congested hours.

Second, the subsidy also has to discourage driving. To do so even-handedly, it has to cover mass transit, bicycling, carpooling, moving closer to work, telecommuting, forgoing discretionary trips, favoring closer destinations over remote ones, and more. For example, beach vacations should be subsidized for those living near the beach, while mountain vacations should be subsidized for those living near the mountains.[166]

Third, the subsidy also has to reward us for reducing how much *others* drive. For instance, the government would cut checks for buying locally grown produce, hiring local service providers, socializing with neighbors, and so on.

To be truly neutral, then, a subsidy has to be astonishingly comprehensive. Detailed and complex rules are needed, along with an extraordinary amount of taxpayer-specific information, as well as costly and sophisticated monitoring mechanisms. Put another way, although a tax can simply be added to the price of energy, a subsidy has to reward an almost infinite number of choices, which the government has to identify and monitor.

Perhaps because the difference between taxes and subsidies derives from administrative considerations—rather than from principle—the literature has overlooked it. Yet, this difference is quite significant. As a practical matter, energy subsidies cannot be tech-neutral, but energy taxes and permits can—or, at least, they can come much closer.

Since the scope of energy subsidies has to be fine-tuned, they are especially vulnerable to interest group pressure. Not only do they dispense money—a draw in and of itself—but they do so selectively, benefitting some industries and firms more than others. They also use intricate criteria, which the general public is unlikely to understand or monitor. As prime targets for lobbying, these subsidies become all the more prone to perverse effects.

3. Broadening Technology-Specific Subsidies

Not surprisingly, many green energy subsidies under current law do not *even try* to reach all abatement options. Instead, they place bets on particular technologies. For instance, to make cars more fuel-efficient, Congress offers tax credits for specific types of cars, such as

166 I thank Louis Kaplow for this vivid example.

plug-in electric vehicles and fuel cell vehicles.[167] In contrast, as Martin Sullivan has emphasized, there is no subsidy for making traditional combustion engines more efficient, for instance, with diesel engines, manual transmissions, turbocharging, or more aerodynamic designs.[168]

The narrowness of subsidies is a good reason to prefer taxes and permits, as noted above. But if Congress is stuck with subsidies for political reasons, the subsidies should be broader. For instance, Sullivan proposes a credit that rewards fuel efficiency however it is achieved by offering a fixed dollar amount, such as $300, for each mpg above twenty-five mpg.[169]

In a similar effort to avoid "picking winners," Senator Max Baucus has proposed to consolidate various tax credits for "clean" fuels (for example, from alcohol, algae, feedstocks, and the like)[170] into a single tech-neutral credit: "Any fuel that is about 25 percent cleaner than conventional gasoline will generally receive a credit. The cleaner . . . the fuel, the larger the credit. Cleanliness is defined as how clean a given fuel production process is on a lifecycle emissions basis, as determined by the EPA."[171] Like Sullivan's suggestion for fuel-efficient cars, this proposal defines a goal (reducing emissions and pollution from transportation fuel) and offers a reward for achieving it, without choosing which technology to use in pursuing it. Baucus has offered a similar proposal for clean electricity production as well.[172]

Compared with the green energy subsidies under current law, hydrocarbon subsidies usually are somewhat broader, and thus more neutral. For example, most do not focus on particular types of drill-

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[167] IRC §§ 30D, 30B(b).

[168] Martin A. Sullivan, The Losers in the Energy Subsidy Game, 121 Tax Notes 510, 512-15 (Nov. 3, 2008) (listing fifty ways to save gasoline that are not subsidized).

[169] Id. at 510. Although this proposal avoids the problem of "picking winners," it does not avoid another general problem with subsidizing fuel efficiency: Since the fuel cost of driving another mile is reduced, drivers drive these cars more. For a discussion of this "rebound" effect, see Subsection IV.C.1.

[170] IRC § 40 (providing a credit for fuels from alcohol and qualified feedstock such as algae), § 40A (credit for biodiesel and renewable diesel).

[171] S. Fin. Comm., 113th Congress, Chairman's Summary of Staff Discussion Draft; Energy Tax Reform 5 (Comm. Print 2013), http://www.finance.senate.gov/imo/media/doc/121813%20Energy%20Tax%20Reform%20Discussion%20Draft%20Summary1.pdf [hereinafter Chairman's Discussion Draft]. The proposal also adjusts the credit for the energy density of the fuel. Id.

[172] Id. at 3. The proposal offers a credit based on the ratio of a producer's emissions over their energy production. Id. A flaw in this proposal is that producers can improve their ratio, and thus earn a more generous credit, by producing renewable energy that no one needs, and paying customers to take it. This problem already arises with the production tax credit, discussed below. See Subsection IV.C.2.

ing,[173] and are available to all hydrocarbon producers.[174] Nevertheless, nearly all are too narrow in applying only to U.S. production, even though production in other secure and friendly nations also can enhance national security, as noted above.[175]

4. *Geographical Scope*

A somewhat related challenge in setting the scope of subsidies—and of taxes and permits as well—is that they apply in some countries, but not others. For example, assume *Country A* either taxes coal, or subsidizes substitutes for it, while *Country B* does not. Although demand for coal in *Country A* will decline, there are two offsetting effects. First, coal prices should fall, inducing *Country B* to use more coal. Second, when selling goods made with coal, such as steel—both in *Country A* and in other markets—firms in *Country B* have a comparative advantage.[176] In response, firms in *Country A* may move production to *Country B*. Without multilateral coordination, then, *Country A*'s policy could end up merely *shifting* the consumption of coal to other countries, instead of *reducing* it.

To mitigate this problem, countries can make contingent commitments, which take effect only if other countries match them. Or they can proceed unilaterally, using the credibility they gain in doing so to urge others to follow.[177]

B. *Overall Demand for Energy*

In addition to their inability to reach all the relevant substitutes, subsidies have another disadvantage, which features prominently in the literature: Unlike taxes and permits, subsidies do not raise energy prices, and thus do not depress overall demand for energy.

To see the difference, assume gasoline costs $2.50, and an energy-equivalent amount of ethanol costs $3. Ethanol becomes competitive

[173] Three subsidies focus on particular types of production—the credits for marginal wells, enhanced oil recovery, and unconventional sources, IRC §§ 45I, 43, 45K—but they are not currently in effect, since they can be claimed only when prices are sufficiently low.

[174] Percentage depletion generally is available only for "independent" producers. IRC § 613A(c).

[175] See Subsection II.C.3.

[176] Goulder & Parry, note 5, at 170. To blunt this effect, *Country A* can try to extend its coal tax to these imported goods. Determining the influence of coal on their price is difficult, however, and trade rules further complicate this effort.

[177] Energy Strategy, note 40, at 39-40 ("While some might suggest that the growing international share of GHG emissions means that U.S. reductions are too small to matter, in fact the opposite is true. . . . [B]y taking strong steps to reduce emissions at home, . . . the Administration is in a much stronger position to secure similar commitments from other nations.").

if either the price of gasoline is increased (with a 50 cent tax or permit price) or the price of ethanol is reduced (with a 50 cent subsidy). Although these alternatives have the same effect on *relative* price (that is, whether gasoline is cheaper than ethanol), they have different effects on the *absolute* price (that is, whether fuel costs $2.50 or $3.00). Since fuel prices are higher with the tax (or permit) than the subsidy, consumers are motivated to use less fuel. As Metcalf has observed, "consumers shift away from consuming energy to consuming other goods."[178]

There also is another reason why subsidies, but not taxes, might increase the demand for energy: subsidies for *conservation* may be harder to administer, and thus less common, than subsidies for *new sources of energy*. For example, the purchase of an electric car is easier for the government to observe – and thus to subsidize – than the choice to skip errands or to vacation near home. If this theory is correct—so subsidies for conservation actually are less common—this bias could increase the overall demand for energy.

In contrast, gas and carbon taxes should be immune from this bias. They ask only how many gallons we buy, and requires no information about what we do (or do not do) to use less.[179] As a result, a gas tax is equally able to reward new sources of energy, on one hand, and conservation, on the other.

C. Targeting Results Instead of Proxies

While some subsidies under current law are too narrow, as the last two Sections have shown, other subsidies suffer from a different limitation: They reward the wrong behavior. Specifically, gaps can emerge between the policy goal, on one hand, and the behavior that is rewarded, on the other.

1. Energy Efficiency and Rebound

A familiar example is "rebound," which is a perverse effect of subsidizing energy-efficient cars and appliances: Consumers end up using

[178] Metcalf, note 163, at 524. In addition to these substitution effects, taxes and subsidies also can have income effects. For instance, by *raising* the price of fuel, a gas tax *reduces* a consumer's purchasing power. Likewise, by *lowering* the price of fuel, an ethanol subsidy *increases* purchasing power. Yet to assess the income effects of taxes and subsidies, we also need to know how the tax revenue is spent, and how the subsidy is funded. For instance, if a gas tax funds a cut in *another* tax (such as the income tax), the gas tax and the income tax cut have competing effects on purchasing power. The net of these effects determines the overall income effect.

[179] I am grateful to Louis Kaplow for this observation.

them more, so less energy is saved.[180] For instance, consider two options for internalizing the negative externalities of oil, which are assumed to be $1 per gallon: a gasoline tax of $1 per gallon[181] or a tax credit of $265 per year for fuel-efficient "plug-in" hybrid vehicles.[182] Both encourage drivers to buy plug-in hybrids. The credit does so directly, while the gas tax does so indirectly by discouraging the use of gasoline. Nevertheless, the gas tax is likely to be more effective at reducing gasoline usage. The difference is that the tax increases the cost of using another gallon, while the hybrid credit does not. On the contrary, the credit actually *lowers* the marginal cost of driving by reducing the gasoline used per mile, thus creating an incentive to drive *more miles*.

The problem with this hybrid credit—and, more generally, with subsidies for energy efficiency—is that they do not reward the *actual* behavior we want (using less energy), but behavior that is *related but different* (using fuel-efficient technology). Buying a hybrid is merely a *proxy* for using less gasoline. A proxy could be tempting if it is more administrable, more politically palatable, or more salient. Yet targeting a proxy, instead of the behavior we actually want, can produce flawed incentives.[183]

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180 Metcalf, note 178, at 524 (discussing rebound); see also Energy Efficiency and Sustainable Consumption 2-10 (Horace Herring & Steve Sorrell eds., 2008). Empirical evidence suggests that consumers do, in fact, react in this way. See, e.g., Anderson et al., note 164, at 93 (rebound estimated at about 10% of fuel savings from the Corporate Average Fuel Economy (CAFE) program).

181 A tradeable permit costing $1 would have the same effect.

182 While a "regular" hybrid uses electricity at low speeds and shifts to gasoline at higher speeds, "plug-in" hybrids use electricity at all speeds, but use some gasoline to generate electricity. Alternative Fuels Data Ctr., U.S. Dep't of Energy, Hybrid and Plug-In Electric Vehicles, http://www.afdc.energy.gov/vehicles/electric.html (last visited Oct. 9, 2016); Plug-in Hybrids, Fueleconomy.gov, https://www.fueleconomy.gov/feg/phevtech.shtml (last visited Nov. 21, 2016). While there is a tax credit for plug-in hybrids under current law, it generally is $2500 to $7500 per vehicle, depending on the size of the battery. IRC § 30D. The $265 per year in the example here is hypothetical, but it is used to establish (seeming) parity with a $1 per gallon gas tax. Specifically, if a 2013 hybrid's gas mileage is 42 miles per gallon (mpg), compared with 23 mpg for the average vehicle, then if a hybrid drives the average number of miles in a year (13,476), it uses 265 gallons less per year. U.S. Dep't of Energy, Model Year 2013 Fuel Economy Guide 29-30 (2016) http://www.fueleconomy.gov/feg/pdfs/guides/FEG2013.pdf [hereinafter 2013 Fuel Economy Guide]; Average Annual Miles Per Driver by Age Group, Fed. Highway Admin., https://www.fhwa.dot.gov/ohim/onh00/bar8.htm (last modified July 13, 2016). Since the negative externalities are assumed to be $1 per gallon, the tax credit is $265 per year.

183 See Don Fullerton, Inkee Hong & Gilbert E. Metcalf, A Tax on Output of the Polluting Industry Is Not a Tax on Pollution: The Importance of Hitting the Target, in Behavioral and Distributional Effects of Environmental Policy 13-15 (Carol Carraro & Gilbert E. Metcalf eds., 2001) (considering welfare costs of imperfectly-targeted environmental instruments); Goulder & Parry, note 5, at 157 ("Still another pricing instrument is a tax on an input, produced goods, or service associated with emissions. . . . However, because these

The point of this example is that "results-based" policies are more promising than proxy policies.[184] The successful example (the gas tax) is more results-based, since it encourages the desired behavior (using less gasoline) instead of conduct that may *correlate* with this behavior (buying a hybrid).[185]

Even so, if we are stuck with an imperfect proxy, one way to improve it is to add more conditions. For example, a hybrid credit reduces gasoline consumption more effectively if another requirement is added: To be eligible, claimants must have mileage-based auto insurance, so they pay higher premiums for driving more. In effect, the task of discouraging rebound is delegated to an insurance company. Admittedly, instead of a results-based condition, which focuses on gasoline usage, the subsidy now uses *two* proxy conditions: one favoring fuel-efficient cars, and the other constraining how much these cars are driven. Yet the *combination* of these conditions targets the goal better than either can *alone*.

2. *Production Incentives and Negative Pricing*

A less familiar example of a proxy subsidy, which also creates perverse incentives, is the production tax credit.[186] It rewards firms for producing electricity from renewable sources. While other subsidies are available for *investing* in wind farms, this subsidy, which is tied to *producing* electricity, leads firms to produce more electricity, as a recent study shows.[187] Although the study implies that this greater productivity is beneficial,[188] the reality is more complicated.

taxes do not focus sharply on the externality, they do not engage all of the pollution reduction channels described above, implying a loss of cost-effectiveness.").

[184] This is true not only when we *subsidize* a proxy, but also when we *tax* it (or require a permit for it). For example, assume we impose an annual tax on owners of SUVs to reduce oil consumption. Although SUVs obviously are gas guzzlers, this "product tax" uses an imperfect proxy (the SUV itself), instead of the behavior we want to discourage (use of gasoline). This SUV tax is both too broad (in applying to all SUVs, regardless of how many miles they travel) and too narrow (in excluding gas-guzzling sedans).

[185] Admittedly, a gasoline tax is also a proxy, since the problem it targets is not the use of gasoline *per se*, but the environmental harm from extracting and burning it, and the national security cost of policing access and enriching rivals. But although a gas tax is also a proxy, it is a *better* proxy than the hybrid credit.

[186] IRC § 45.

[187] Joseph E. Aldy, Todd D. Gerarden & Richard L. Sweeney, Capital Versus Output Subsidies: Implications of Alternative Incentives for Wind Energy 1 (Sept. 2016) (unpublished manuscript), http://www.bc.edu/content/dam/files/schools/cas_sites/economics/pdf/Seminars/SemF2016/AGS_Capital_v_Output_Subsidies_Paper_HKS.pdf (finding that wind farm developers choosing an upfront investment subsidy produce 5-12% less electricity than wind farms selecting an output subsidy).

[188] Id. at 23. (noting that the "rationale behind wind subsidies is to displace conventional, polluting generation with zero-emissions electricity").

Unfortunately, the credit is available even if the wind electricity is *not needed*, and thus does not *actually replace* hydrocarbons.[189]

Specifically, § 45 offers a credit of 2.3 cents for each kWh of electricity generated with wind and sold to unrelated third parties. Generating electricity from wind is easier at night, but there also is less demand,[190] and electricity generally cannot be stored. Moreover, some windy locations are remote, and do not have transmission lines to send electricity where there is more demand.[191] This means firms have ample opportunities to generate electricity that is not needed.[192] To collect the credit, they *pay customers* to take this excess power—a practice known as "negative pricing"[193]—and also pay the grid to absorb it.

Hopefully, negative pricing can induce at least some changes in consumption patterns; for instance, some dishwashers may be run at night.[194] In addition, technology should ameliorate this problem over time. For example, new transmission lines in West Texas have reduced the frequency of negative pricing by shipping excess capacity to Dallas, Houston, and Austin.[195] In addition, improvements in battery

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189 Richard Schmalensee, The Performance of U.S. Wind and Solar Generators, 37 Energy J. 123, 144-45 (2016) ("Encouraging renewable generation when its marginal value to the electric grid is negative obviously raises costs to society, but that is what both the federal PTC and state RPS programs do . . . .").

190 Id. at 15, 18.

191 Id. at 16 (noting that negative pricing often derives from transmission congestion).

192 Id. at 32 (empirical finding that "when spot prices are negative and they can generate, wind and solar plants generally do so"); id. at 17 (noting that "on average wind facilities outside [New England] had positive outputs during 92% of hours during which the spot price they faced was negative," and that "wind plants produced 49% more on average during those hours than at other times"). This problem is more severe for wind than solar. As a result, Richard Schmalensee has concluded that output from solar is 32% more valuable than output from wind, since solar does not produce at night when demand is low. Id. at 12, 15.

193 Frank Huntowski, Aaron Patterson & Michael Schnitzer, The NorthBridge Grp., Negative Electricity Prices and the Production Tax Credit: Why Wind Producers Can Pay Us to Take Their Power—And Why That Is a Bad Thing 2 (2012), http://www.northbridgegroup.com/publications/Negative_Electricity_Prices_and_the_Production_Tax_Credit.pdf. Empirical evidence suggests 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 percentage of a region's electricity. Id. at 5-6. In West Texas in 2011, for instance, there was negative pricing in over 70% of the hours when wind was generating at least 25% of the region's electricity. Id. at 12 fig.8 ("[N]egative 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.").

194 Clifford Krauss & Diane Cardwell, A Texas Utility Offers a Nighttime Special: Free Electricity, N.Y. Times (Nov. 8, 2015), http://www.nytimes.com/2015/11/09/business/energy-environment/a-texas-utility-offers-a-nighttime-special-free-electricity.html.

195 U.S. Energy Info. Admin., Fewer Wind Curtailments and Negative Power Prices Seen in Texas After Major Grid Expansion, (June 27, 2014), http://www.eia.gov/todayinenergy/detail.php?id=16831.

and storage technologies would help as well;[196] indeed, one 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 uses a flawed proxy—*producing* renewable energy, instead of *replacing* carbon-based energy.[197] One way to solve this problem is for the credit to reward revenue or profit, instead of production. This way, the government can piggyback on consumer judgments about the energy's value.[198] If consumers will not pay for it, the government should not subsidize it. Alternatively, if these regimes continue to focus on production, we should add another condition: To be eligible for the credit, electricity has to sell for at least a minimum (positive) price.

D. Heterogeneous Harms

One reason why targeting the right behavior is essential is that the size of subsidies and taxes is supposed is depend on how harmful this behavior is. But this fine-tuning is hard for three reasons, which are more daunting for subsidies than for taxes.

First, seemingly identical activities can generate different harms. For example, the GHG's emitted from an electric car – and thus, the social benefit from using one – depend on whether the electricity is generated from coal or wind.[199] So in setting the subsidy for electric cars, should we assume the electricity is generated with coal or wind? This problem does not arise with a carbon tax, since no such assumption is needed. Instead, the tax increases the price of electricity from

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[196] Bill Tucker, Promises, Promises . . . and Energy Storage, Forbes: Commodities & Currencies (Mar. 18, 2015, 4:56 PM) http://www.forbes.com/sites/billtucker/2015/03/18/promises-promises-and-energy-storage/#31f4ebbb62c2 (noting that the energy storage industry expects to grow by 250% and that improvements would allow electricity from peak generation periods to be used after the sun has set or the wind has stopped blowing).

[197] This is not to say that negative pricing arises only from the production tax credit or other poorly targeted subsidies. In some cases, negative pricing can arise (temporarily) when power is generated in ways that cannot be quickly ramped down, triggering excess supply. I thank Felix Mormann for this observation.

[198] Schmalensee, note 189, at 145 ("In regions with organized wholesale markets, it would provide superior incentives to pay output subsidies only when the spot price is positive or even to pay them on top of (or even make them proportional to) the spot price . . . .")

[199] Cohen et al., note 7, at 77-78; Joshua S. Graff-Zivin, Matthew J. Kotchen & Erin T. Mansur, Spatial and Temporal Heterogeneity of Marginal Emissions: Implications for Electric Cars and Other Electricity-Shifting Policies, 107 J. Econ. Behav. & Org. 248, 263-64 (2014). The authors compare marginal CO_2 emission rates from electric cars with those of hybrid vehicles and traditional gasoline-powered cars. They find that the environmental benefit of driving an electric vehicle is dependent on the "substantial geographic and temporal variation in the emission rates of power plants" nationwide. Id. at 263.

coal, but not from wind. Therefore, consumers can account for climate costs in deciding whether to buy an electric car, and how much to drive it.

Second, assessments of harms have to account for the full "life cycle" of an activity. For instance, the carbon footprint of an electric vehicle includes not only the electricity to drive it, but also the GHGs to *manufacture* it. In fact, more GHGs are emitted in manufacturing electric vehicles—and, in particular, their batteries—than gasoline-powered cars.[200] A subsidy that omits these costs is mispriced. But once again, a carbon tax avoids this problem. A tax forces producers of electric cars to internalize these "upstream" climate costs, so they are incorporated in the price of these goods.

Third, and relatedly, although taxes (and permits) are based on the harm a targeted activity *causes*, subsidies are based on the harm it *avoids*. Yet *avoided* harms are especially hard to measure because, by definition, they never happen. For example, a wind turbine avoids more emissions in replacing coal than natural gas.[201] Identifying which plant is decommissioned is not easy, while identifying which is never built is impossible.[202] Therefore, to determine how much a subsidy improves a situation—an inquiry known as "additionality"—we need to know what would happen without it,[203] but this baseline is not always clear.

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[200] Nat'l Research Council, Hidden Costs, note 3, at 203-04 ("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."); Joshua Linn & Virginia McConnell, How Electric Cars Can Increase Greenhouse Gas Emissions, 184 Resources 33, 35-37 (2013), http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-Resources-184_Feature-LinnMcConnell.pdf.

[201] David Weisbach, Designing Subsidies for Low-Carbon Energy, 20 J. Envtl. & Sustainability L. 1, 14 (2013); see Joseph Cullen, Measuring the Environmental Benefit of Wind-Generated Electricity, Am. Econ. J., Nov. 2013, at 107, 108 ("[T]he quantity of emissions offset by wind power will depend crucially on which generators reduce their output.").

[202] The best the government can do is to make assumptions based on general trends (for example, geothermal tends to replace coal while wind tends to replace natural gas), but these assumptions are not always accurate. Metcalf, note 3, at 169.

[203] Michael Gillenwater, What Is Additionality? Part One: A Longstanding Problem 3 (Greenhouse Gas Mgmt. Inst., Discussion Paper No. 001, 2012), http://ghginstitute.org/wp-content/uploads/2015/04/AdditionalityPaper_Part-1ver3FINAL.pdf ("Conceptually, additionality is a determination of whether a proposed activity will produce some 'extra good' in the future relative to a reference scenario, which we refer to as a baseline.").

E. Coordination of Different Policy Instruments

A further challenge with targeted subsidies—and, indeed, also other narrowly tailored instruments—is that they tend to be used in combination, and thus need to be coordinated.

One reason to use more than one instrument is that if one fails, the other can still advance the relevant policy goal. But built-in redundancy works only if gaps in the two instruments are *different*. Otherwise, they are likely to fail at the same time.[204]

This problem arises with two instruments currently used to promote fuel efficiency: subsidies for specific types of cars, as discussed above, and fuel efficiency standards (i.e., the so-called "Corporate Average Fuel Economy" or "CAFE" standards).

Unfortunately, subsidies and CAFE share two limitations. First, as noted above, subsidies reward some ways of enhancing fuel efficiency, but not others (such as electric motors, but not light frames). In principle, CAFE should avoid this problem: Instead of a minimum standard for *each* car, CAFE sets a minimum *average* for *all* cars sold by a particular manufacturer.[205] As a result, while CAFE requires manufacturers to sell enough cars with *above-average* fuel efficiency (to balance those it sells with *below-average* efficiency), CAFE should be able to do so, at least in principle, without telling the manufacturer *how* to make cars more fuel-efficient. But unfortunately, the new CAFE standards for 2017–2021 stray from this tech neutral path. They favor electric vehicles by giving them double weighting in the CAFE average.[206] As a result, CAFE reinforces the bias for electric cars that already is present in subsidies under current law.[207]

Second, subsidies for fuel-efficient cars and CAFE share another limitation as well. In seeking to reduce the use of petroleum, these policies influence only one relevant choice (which car to purchase), but not another (how much to drive it).[208]

In contrast, a gas tax does not share these limitations, since it rewards consumers for using less gasoline, without favoring one conservation method over another. As a result, a gas tax would be a better

[204] David M. Schizer, Between Scylla and Charybdis: Taxing Corporations or Shareholders (or Both), 116 Colum. L. Rev. 1849 (2016).

[205] There are actually two sets of CAFE requirements. The National Highway Transportation Safety Administration promulgates one on fuel economy, while the Environmental Protection Agency promulgates another based on GHGs. Anderson et al., note 162, at 90-91.

[206] Federal Vehicle Standards: Calculating Light-Duty Vehicle CAFE Then and Now, Center for Climate and Energy Solutions (Jan. 30, 2017), https://www.c2es.org/federal/executive/vehicle-standards#calculating.

[207] See Subsection IV.A.3.

[208] See Subsection IV.C.1.

backstop for either of these policies, if more than one instrument is desired.

F. Scarcity Rents

Even if these other problems are solved, subsidies still would pose a further challenge: If they succeed in launching viable substitutes for disfavored energy—or are expected to succeed in the future—producers of this disfavored energy are likely to respond by cutting prices. In effect, they would sell this energy while they still can.[209] As William Hotelling observed, producers of finite resources always face the choice of either tapping their reserve today or saving it for sale tomorrow.[210] Therefore, prices today reflect expectations about prices tomorrow.[211] If producers expect an energy innovation (such as shale gas or renewables) to replace a product (like coal) *in the future*, they cut prices *today*, unloading the reserve while they still can get *something* for it.

Therefore, energy subsidies can have a perverse effect: By promoting green alternatives for the *future*, they can make fossil fuels harder to displace *today*. The more promising this alternative is, the more motivated producers are to cut prices. These price cuts are likely to induce consumers to use more energy.[212] As a result, the new source of energy can end up *supplementing* fossil fuels, instead of *replacing* them.

To an extent, taxes and permits also can trigger this unintended effect. By making hydrocarbons less competitive, taxes and permits encourage investments in alternative energy, which can inspire fossil fuel producers to cut prices. Yet this problem should be less severe, since taxes and permits increase the price of hydrocarbons, offsetting these "Hotelling" cuts, at least in part.[213]

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209 While this dynamic can arise in any market—just as grocery stores discount day-old produce—the effect is especially powerful in extractive industries.

210 Hotelling, note 31, at 137-40.

211 In addition to marginal production costs, prices include "scarcity rents," which reflect how scarce supply is compared with expected demand. Indeed, the prices should be the same, except that the price tomorrow is increased for time value (since producers must wait to be paid). See generally Heal, note 32 (exploring the economics of resource allocation in the context of exhaustible resources).

212 Michael Hoel, Bush Meets Hotelling: Effects of Renewable Energy Technology on Greenhouse Gas Emissions 4 (CESifo Grp., Working Paper No. 2492, 2008), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1314688 ("[F]ossil fuels are non-renewable, and the competitive supply gives a price path of the fuel which depends both 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.").

213 Even so, taxes (and permits) can be especially counterproductive if phased in over time. If fossil fuel producers expect tax and permit costs to rise in the future, they sell

V. Institutional Design Challenges: Traditional Tax Policy Concerns

Part IV analyzed institutional design challenges with targeted subsidies. This Part adds three additional considerations, which are grounded in traditional tax policy concerns. Congress should keep them in mind, but in general they do not create a strong basis to favor taxes over subsidies, or vice versa. First, both energy taxes and subsidies can distort labor and savings decisions; second, energy subsidies are a flawed vehicle for pursuing distributional goals;[214] and third, the tax system has familiar limitations in pursuing environmental and national security goals.

A. *Labor and Savings Distortions*

At first blush, a potential disadvantage of subsidies is that they *consume* revenue, while Pigouvian taxes and some tradeable permits *raise* revenue.[215] By this logic, taxes and permits seem to offer a "double dividend." In addition to correcting an externality (the first dividend), they can replace other distortive taxes, easing labor and savings distortions (the second dividend).

But this apparent advantage is illusory.[216] After all, carbon and gasoline taxes are not distortion-free. Like other taxes, they also affect labor and savings choices. By increasing the after-tax cost of goods and services, these taxes erode the purchasing power of additional earnings, and thus can distort labor and savings choices.

Even so, carbon and gasoline taxes are likely to cause milder labor and savings distortions than a progressive income tax. The reason is that they are less redistributive, since high-income households devote a lower percentage of their *income* to gasoline (and gasoline taxes). Because gas and carbon taxes become less burdensome as taxpayers earn more, they are less likely to discourage work and saving. Obviously, the opposite is true of a progressive income tax, which (by defi-

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more *now*. See Hans Werner Sinn, Public Policies Against Global Warming: A Supply Side Approach, 15 Int'l Tax Pub. Fin. 360, 380 (2008) (defining the "green paradox" as the possibility that resource owners will accelerate extraction to make "the price path sufficiently steep to compensate for the rising tax rate").

214 In other work, I have distinguished between the effect of tax expenditures on "programmatic benefits"—that is, the positive and negative externalities they create—and their effect on excess burden and distribution. See generally David M. Schizer, Limiting Tax Expenditures, 68 Tax L. Rev. 275 (2015) (offering strategies for limiting tax expenditures, focusing in part on programmatic benefit, excess burden, and distribution).

215 Permit regimes can raise revenue if permits are auctioned, instead of given away for free.

216 Don Fullerton & Gilbert E. Metcalf, Environmental Taxes and the Double-Dividend Hypothesis: Did You Really Expect Something for Nothing?, 73 Chi.-Kent L. Rev. 221, 222 (1998) (discussing the validity of the double-dividend hypothesis).

nition) becomes more burdensome as taxpayers earn more. As a result, replacing a *progressive* income tax with a *regressive* gas or carbon tax makes the system less redistributive, and thus can ease labor and savings distortions.

But to be precise, this easing of distortions derives from reducing redistribution, not from changing the tax base (i.e., from income to gas). Congress can get a similar result by keeping the income tax, but making rates less progressive. After all, if an income tax and a gas tax collect the same tax on an additional dollar of income, they should cause the same labor and savings distortions.[217]

As a result, using a carbon or gas tax does not commit us to a specific level of redistribution (or labor and savings effects). Congress can attain the level of redistribution it wants by pairing these taxes with other adjustments to the tax system. For example, a regressive carbon tax could be bundled with more progressive income tax rates.[218]

The same is true of energy subsidies. They can encourage work and saving by reducing the cost of energy, and thus increasing the purchasing power of marginal earnings. But the taxes funding this subsidy can have the opposite effect. If the overall package has the same impact on distribution as one introducing an energy tax, the two reforms should affect labor and savings choices the same way.

To illustrate this point, the following examples pair an income tax with an energy tax in one case, and with an energy subsidy in the other. This example shows that either package can generate the same effective marginal rate, and thus the same effect on labor and savings choices and distribution.

Assume an average taxpayer would ordinarily spend 9% of her marginal earnings on energy, but a subsidy would increase this level to 10%, while a Pigouvian tax would reduce it to 8%.[219] As Table 1 shows, this average taxpayer has the same 18% effective marginal rate under each of the following three regimes: first, an 18% income tax; second, a 16% income tax paired with a 25% tax on (disfavored) energy purchases; and third, a 20% income tax with a deduction (and thus a subsidy) for (favored) energy purchases:

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[217] Of course, other sources of deadweight loss could be different, such as the costs of drafting and enforcing tax rules and of complying (and planning around) them.

[218] Louis Kaplow, Optimal Control of Externalities in the Presence of Income Taxation, 53 Int'l Econ. Rev. 487, 488 (2012) ("when reforms are implemented in this distribution-neutral manner, labor supply is unaffected . . . .").

[219] In this stylized example, the taxpayer buys hydrocarbons if there is no tax or subsidy. If a Pigouvian tax is imposed on hydrocarbons, she continues to buy them but reduces her consumption. If a subsidy for green energy is enacted instead, she switches to green energy and increases her energy spending.

TABLE 1
TAX ON AN ADDITIONAL $100 OF EARNINGS

Regime	Energy Purchased	25% Energy Tax	Energy Deduction	Taxable Income	Income Tax Rate	Income Tax	Total Tax
18% Income Tax	$9	$0	$0	$100	18%	$18	$18
16% Income Tax with 25% Energy Tax	8	2	0	100	16%	16	18
20% Income Tax with Deduction for Energy	10	0	10	90	20%	18	18

The energy tax keeps the effective rate at 18%—and thus does not change labor and savings distortions—because it has two offsetting effects. On one hand, it funds a cut in the marginal income tax rate from 18% to 16% (easing distortions). On the other hand, it increases the cost of (disfavored) energy, and thus erodes the purchasing power of marginal earnings (exacerbating distortions).[220] For the average taxpayer, the energy tax functions like a 2% tax on marginal earnings, which reverses the 2% cut in the income tax.[221]

Similarly, the energy subsidy also has two offsetting effects, which keep the effective rate at 18% (and thus cause the same labor and savings distortions). On one hand, the stated income tax rate is increased (from 18% to 20%) to fund this subsidy (exacerbating distortions). On the other hand, the deductibility of (favored) energy enhances the purchasing power of marginal earnings (easing distortions). For the average taxpayer, this energy subsidy functions as a 2% marginal rate cut, reversing the 2% income tax increase.

Notably, these effects offset perfectly—instead of partially—only for those who buy the *average* amount of energy. Those who buy *less* come out ahead when an energy tax funds an income tax cut. Because they buy so little energy, their energy tax bill is less than their income tax savings. The opposite is true of a heavy user of energy, since their energy tax bill exceeds their income tax savings. In other words, although distribution-neutral reforms should not affect labor distortions *on average*, they could do so for particular individuals. Again, energy taxes and subsidies are the same in this way.

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[220] Lawrence H. Goulder, Climate Change Policy's Interactions with the Tax System, 40 Energy Econ. S3, S4 (2013).

[221] In the literature, the first is called a tax interaction effect, and the second is called a revenue recycling effect. Id.

B. Distribution

Another potential concern about energy subsidies is that high-income claimants are more likely to claim them. According to Severin Borenstein and Lucas Davis, households in the top 20% of the income distribution have claimed 60% of the clean energy credits under current law, while households in the bottom 60% have claimed only 10%.[222] As a result, commentators express concern about the distributional impact of these programs, and some credits have been amended to exclude high-income households.[223]

However, the fact that these subsidies are claimed disproportionately by high-income claimants is not surprising. Targeting them actually makes sense when two conditions are satisfied.

First, the favored technology involves added (private) costs, which are daunting to low- and middle-income households. For example, hybrid and electric vehicles have significantly higher purchase prices than conventional cars.[224] As a result, low- and middle-income households are likely to choose cheaper alternatives (conventional cars), which offer comparable private benefits (transportation) without the relevant externalities (reduced GHGs and gasoline consumption).[225] If a hybrid costs $15,000 more than a traditional car, low- and middle-income households are unlikely to buy one unless the subsidy is almost $15,000. In contrast, a high-income household can be motivated with less. If a $5000 subsidy is enough, Congress puts three times as many hybrids on the road for the same money by making high-income claimants eligible for the subsidy.[226]

In addition, whether the driver of a hybrid has a high or low income, the positive externalities are the same. Either way, GHGs and gasoline usage are reduced. This raises a second reason to subsidize high-income claimants, which is somewhat unique to energy subsidies: The social benefit is comparable, whether the subsidy is claimed by someone with a high or low income. In subsidizing the hybrid, the

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[222] Severin Borenstein & Lucas Davis, The Distributional Effects of U.S. Clean Energy Tax Credits, 30 Tax Pol'y & Econ. 191, 191 (2016).

[223] For example, regulators in California recently excluded high-income households from state subsidies for electric vehicles. Patrick McGreevy, California Limits Hybrid Rebates to Households Earning Less Than $500,000, L.A. Times (Aug. 23, 2015), http://www.latimes.com/local/politics/la-me-pol-electric-cars-20150824-story.html.

[224] The Real Cost of Owning a Hybrid: Do Fuel Savings Offset a Higher Price?, Edmunds.com (Sept. 9, 2013), http://www.edmunds.com/fuel-economy/the-real-costs-of-owning-a-hybrid.html.

[225] Hunt Allcott, Christopher Knittel & Dmitry Taubinsky, Tagging and Targeting of Energy Efficient Subsidies, 105 Am. Econ. Rev. 187, 190 (2015) (empirical analysis showing that subsidies for energy-efficient durable goods, such as air conditioners and cars "preferentially accrue to wealthier consumers").

[226] The assumption here is that hybrids reduce GHGs and petroleum consumption, not withstanding rebound.

objective is not to offer *private* benefits to the driver (for example, by helping her to afford a car), but to generate *environmental* and *national security benefits* for everyone. This is an important difference from subsidies for retirement savings and healthcare, for instance, where private benefits for the claimant are a more significant motivation. For the same reason, it is unsatisfying to measure the distributional impact of these energy subsidies by asking who *claims* them, instead of who *benefits* when the targeted harms are abated.[227]

Unfortunately, Congress still includes distributional criteria in some energy subsidies. For example, the Department of Energy spent billions on "weatherizing" the residences of seven million low-income Americans.[228] Focusing on low-income claimants, however, is not cost-effective, as noted above, because the government presumably has to cover a higher percentage of weatherization costs. Not surprisingly, a recent study determined that this program had a negative return.[229]

Another problem with using an energy subsidy to pursue distributional goals is that it is unlikely to be a cost-effective way to help low-income households. If the goal is to channel resources to them, an energy subsidy is less efficient than cash, since it can be used only for a designated purpose.[230]

Therefore, energy goals generally should be pursued as cost effectively as possible, without regard to distribution. Some of the savings can then be allocated to programs that pursue distributional goals efficiently, such as payroll tax cuts or increases in the earned income tax credit.[231]

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[227] Cf. Schizer, note 214, at 278 (arguing that the people who claim a tax expenditure are not necessarily those who benefit from the positive externalities it creates).

[228] Office of Energy Efficiency and Renewable Energy, U.S. Dept. of Energy, About the Weatherization Assistance Program, http://energy.gov/eere/wipo/about-weatherization-assistance-program-0 (last visited Nov. 16, 2016). This program's annual budget increased from $450 million per year in 2009 to $5 billion in 2011 and 2012. See Energy Conservation and Production Act, 42 U.S.C. § 6861 (2012) (authorizing federal support and technical assistance for the weatherization program); American Recovery and Reinvestment Act, Pub. L. No. 111-5, § 105, 123 Stat. 115, 138 (2009) (providing for increase in budget of weatherization program); see also Fred Sissine, Cong. Research Serv., R42147, DOE Weatherization Program: A Review of Funding, Performance, and Cost-Effectiveness Studies 9 n.32 (2012) (stating that the Obama Administration provided the weatherization program budget a one-time increase to $5 billion, "a major increase over the $450 million appropriated for the program in FY2009").

[229] The private return over a twenty-year time span was 1.5%, while the social return, which includes reducing GHGs, was -6.1%. Fowlie et. al., note 39, at 31-33, 49 tbl.7.

[230] For instance, instead of $1000 to weatherize their home, a low-income household would prefer a payroll tax refund of $1000 (or even $800), which can be used for any purpose.

[231] As a stylized example, assume a $200 weatherization grant to a high-income claimant has the same environmental benefit as a $1000 weatherization grant to a (less responsive)

Even so, favoring low-income claimants still makes sense in three circumstances. First, some market failures, such as credit constraints, disproportionately affect them.[232] For instance, if weatherization pays for itself over time in reduced energy bills, a subsidy is needed only for those who cannot fund the up-front investment. In this case, focusing on low-income households actually is the most cost-effective response. Second, if subsidies are provided through tax deductions or nonrefundable credits, which are less valuable to low-income claimants, a separate program may be needed for them. Third, if separate distributional adjustments (such as the $800 in the example above) are not politically feasible, there is more reason to account for distribution within the energy program itself.

C. Tax as a Leaky Mechanism for Delivering Subsidies

Finally, two other familiar challenges arise when the tax system is used to deliver energy subsidies. First, tax benefits are not equally valuable to everyone. Second, tax administrators do not have expertise about energy policy.

1. Limited Market for Tax Benefits

When structured as tax expenditures, energy subsidies have less influence on some claimants. For example, if these tax benefits are not refundable, they have no value to those who pay no U.S. tax, including nonprofits, loss corporations, and foreigners.[233]

These limits narrow the universe of investors for renewable projects, raising their cost of capital.[234] Although profitable utilities

low-income claimant. It is Pareto improving to give this grant to the high-income claimant, and to pay $800 in unrestricted cash to the low-income claimant, as long as the low-income claimant prefers the flexibility of $800 in cash to $1000 for weatherization.

232 See Allcott et al., note 225, at 187, 190-91 (arguing that subsidies for energy-efficient durable goods should be limited to low-income households, since they are more likely to be credit constrained).

233 Likewise, if tax expenditures are structured as deductions instead of credits, the subsidy varies with the claimant's bracket. In addition, energy tax expenditures generally are subject to the passive loss rules (except for working interests in oil and gas and some credits claimed by the real estate industry). This means broad classes of taxpayers (individuals, personal services firms, and closely held firms) can use them to shelter only passive income. Furthermore, some energy tax credits cannot reduce the alternative minimum tax. IRC § 38(c).

234 See Michelle D. Layser, Improving Tax Incentives for Wind Energy Production: The Case for a Refundable Production Tax Credit, 81 Mo. L. Rev. 453, 460 (2016) (describing the costs of raising "tax equity" and proposing a refundable credit as a way to avoid these costs); see also, Michael Mendelsohn & John Harper, Nat'l Renewable Energy Laboratory, § 1603 Treasury Grant Expiration: Industry Insight on Financing and Market Implications, at iii (2012), http://www.nrel.gov/docs/fy12osti/53720.pdf ("This need for such specialized investors constrains the availability of private capital for renewable energy projects, partic-

and energy producers can fund these projects "in-house," investors from outside the energy industry are harder to recruit. Nonprofits and many individual investors cannot claim the tax benefits, as noted above, and profitable public companies often are reluctant to commit capital outside their core areas. Because the pool of potential investors is limited, they can extract more favorable terms.[235] In addition, extra transaction costs sometimes have to be incurred to claim these tax benefits.[236] In response to these concerns, the government temporarily replaced some tax credits with direct grants (the so-called § 1603 credit) for projects begun before December 31, 2011.[237]

2. *Drafting and Administering Tax Expenditures: Mismatch in Expertise*

Another familiar challenge is that tax experts are not the right government officials to make judgments about energy policy. This is a good reason not to use the tax system for energy programs.

If the tax system is already doing some of the necessary work, though, building on its existing responsibilities is plausible. For example, the tax system already collects a gasoline tax to fund the highway trust fund. If this tax is increased for environmental or national security reasons, the existing administrative infrastructure can be used.

When new taxes or subsidies are added, however, other agencies should draft and interpret the relevant provisions and resolve any policy issues that arise. Or if a finite benefit has to be allocated among competing claimants—a process Congress has used for some energy tax expenditures, as well as for the low-income housing credit—agencies with more expertise (such as the Department of Energy) should make these judgments.[238] The tax system's role should be limited to the ministerial function of dispensing or collecting the money. In this spirit, Senator Baucus's proposals, discussed above,[239] rely on the

ularly for projects that are developed by entities that are smaller, have less development experience, or that seek to deploy new or less-proven technologies.").

235 This was especially true during the financial crisis when many of the usual investors, including Lehman brothers, were insolvent or unsure how profitable they would be. Mendelsohn & Harper, note 234, at iii (noting that the number of available tax equity investors dropped from approximately twenty to approximately five in 2008-2009).

236 Felix Mormann, Beyond Tax Credits: Smarter Tax Policy for a Cleaner, More Democratic Energy Future, 31 Yale J. on Reg. 303, 330-33 (2014).

237 American Recovery and Reinvestment Act, Pub. L. No. 111-5, § 1603, 123 Stat. 115, 364 (2009).

238 For instance, this sort of process has been used for credits for gasification, coal, advanced nuclear projects, and other advanced energy projects. For a discussion, see Daniel Halperin, Incentives for Conservation Easements: Charitable Deduction or Another Way, 74 L. & Contemp. Prob. 29, 47-49 (2011).

239 See notes 171-72 and accompanying text.

EPA instead of on the IRS to determine the carbon footprint of various technologies, and thus the generosity of the relevant tax expenditure.

V. Policy Implications

The bottom line is that energy subsidies pursue worthy goals, but a number of institutional design flaws undermine their effectiveness. Four implications follow from this assessment: First, the effects of energy on national security warrant more attention in the academic literature; second, carbon and gasoline taxes and tradeable permits have distinct advantages over energy subsidies; third, given these advantages, if we are unable to enact these instruments for political reasons, we should look for variations that are more politically palatable; fourth, if energy subsidies continue to be used, their design flaws need to mitigated. This Part highlights these implications in turn.

A. National Security

This Article has emphasized two risks to U.S. security when oil markets do not have slack capacity: First, pressure increases on the United States to police access to unstable or insecure exporters; second, more revenue flows to geopolitical rivals.

While some government officials presumably focus on these issues, the academic literature has neglected these costs on the theory that their magnitude is too hard to estimate, or that only fundamental shifts in energy markets can affect them. Yet, difficulties in estimating a cost are not a license to ignore it. In addition, the "shale revolution" is likely to affect the analysis in ways that are not yet fully understood.

In unpacking these effects, we should be precise about which energy sources prompt national security concerns. Given the newly abundant supply of domestic natural gas, the national security argument for coal and renewables has become correspondingly weaker. Indeed, national security issues mainly arise with oil.

Efforts to enhance oil production in friendly and stable regions offer national security advantages, although they have offsetting environmental costs. Efforts to reduce demand through conservation and greater efficiency also yield national security benefits, while advancing environmental objectives as well. As a result, there is a strong national security argument for higher taxes (or a permit regime) on gasoline, aviation fuel, diesel, and other oil-based products. There also are reasons to favor producers that are friendly and stable (for example, with a lower tax), but the challenges in administering this differentiated approach are significant. More work is needed on these important issues.

B. Pigouvian Taxes or Tradeable Permits Instead of Subsidies

This Article also shows why Pigouvian taxes or tradeable permits are preferable to subsidies. Several commentators have also come to this conclusion, although the opposite view has supporters as well.[240] In particular, subsidies have five weaknesses.

First, although taxes, permits, and subsidies all share the common challenge of reaching all potential substitutes, this task is harder for subsidies. Covering all sources of harm (with taxes or permits) is easier than reaching all options for abating this harm (with subsidies).

Second, and relatedly, instead of trying to cover the waterfront in this way, many green energy subsidies under current law seemingly embrace the opportunity to "pick winners." But it is not clear that government officials have the information, expertise, and incentives to choose which technologies to favor, and they are subject to interest group pressure in attempting to do so.

Third, unlike taxes and permits, subsidies often do not increase the price of energy. As a result, they fail to curtail overall demand.

Fourth, subsidies price harm *avoided* by the targeted activity, while taxes and permits price harm *caused* by the targeted activity. Knowing what harm is avoided is more difficult, since (by definition) it does not happen.

Finally, if hydrocarbon producers expect viable substitutes for their product to be developed in the future, they are likely to cut prices today. Taxes and permits, which raise the price of hydrocarbons, counter this Hotelling effect more effectively than subsidies.

Given the advantages of taxes and permits over subsidies, the best policy response is a menu of Pigouvian taxes or permits, along the lines discussed above. The environmental, economic, and national security stakes are high, and this approach is most effective in advancing these goals. Although it requires political courage for leaders to adopt these policies, the policy payoff would be significant.

C. Compromises to Attract Political Support

If necessary, this approach can be modified somewhat in order to attract more support. This Section canvasses four ideas, some of which are more familiar than others.

[240] See generally Cohen et al., note 7.

1. *Free or Discounted Tradeable Permits*

With a permit system, a familiar political compromise is to give away some permits for free or at a discount. This windfall can "buy off" potential opponents, allowing previously unpriced externalities to be internalized. Unfortunately, though, the government loses revenue in discounting permits.

2. *Repeal of Subsidies for Hydrocarbons*

If Congress cannot add a Pigouvian tax or a permit system, Congress can get some of the same benefit by cutting existing subsidies for energy it wants to discourage. For instance, if hydrocarbon subsidies are encouraging greater use of coal, oil, or natural gas, repealing or cutting these subsidies would discourage consumption at the margin.

Admittedly, the extent to which these subsidies actually have increased the use of hydrocarbons is unclear. For example, the National Research Council has concluded that these subsidies do not increase GHGs, in part because they believe they mostly increase natural gas production, which reduces GHGs when replacing coal.[241]

Assuming the National Research Council is correct, the implication could be to eliminate only a subset of these subsidies. For instance, there should be environmental advantages (without offsetting national security disadvantages) in eliminating the subsidy for coal. Likewise, there also may be national security advantages in narrowing the foreign tax credit regime—and, in particular, denying the credit for royalties—so fewer U.S. tax dollars are redirected to geopolitical rivals.

3. *A Petroleum Price Stabilization Plan*

Another option, which I have proposed with Thomas Merrill in other work, is a gas tax with two features to make it more politically palatable.[242] First, the tax would kick in only when gasoline prices fall below a specified level. The political advantage of this feature is that, when prices are low, consumers should object less to a price increase.

Admittedly, this political advantage comes at a policy cost: Externalities would not be internalized when the market price is above the threshold.

Yet putting a floor on gasoline prices still helps address environmental and national security costs in an important way: Designing more fuel-efficient cars is a multi-year process, and manufacturers are

[241] Nat'l Research Council, note 2, at 25, 63.

[242] Thomas Merrill & David M. Schizer, Energy Policy for an Economic Downturn: A Proposed Petroleum Fuel Price Stabilization Plan, 27 Yale J. on Reg. 1 (2010).

more wary of investing in these innovations if they worry that gasoline prices will be low—so consumers will not be interested—by the time the new cars come to market.[243]

A second feature to enhance the political prospects of this idea is a rebate. The government would not keep the revenue raised through this program. Instead, each American would receive a check, equal to the tax paid by the average user of gasoline.[244] For example, if $162.5 billion is raised, each of 325 million Americans would receive a $500 check, regardless of how much gasoline they used.[245]

This feature has two political advantages. First, the regime can be called a "price stabilization plan," instead of a tax, since it does not raise revenue. Second, these checks should create a political constituency for the program. Light users of gasoline would come out ahead – since their rebate would exceed the tax they pay at the pump – so they would want the program to continue.

While this proposal is designed as a gasoline tax, it could be broadened to become a "standby" carbon tax, if other hydrocarbons are included. The levels for gasoline can be adjusted to account for national security harms, and other pollution risks can be priced in as well. Although this structure does not deliver all the policy benefits of noncontingent Pigouvian taxes and permits, it is appealing if these other options are politically unattainable. Unlike the targeted subsidies under current law, this approach does not increase the demand for energy or rely on the government to bet on particular technologies.

4. *"Saving Gas" or "Saving the Climate" Credits*

Another possibility is to embed a Pigouvian tax inside a lump sum credit, so it can be framed as a "reward," instead of a tax. Claimants would receive nothing if they used more than a certain amount of disfavored energy. Using less would entitle them to a payment, which becomes more generous as their usage declines.

243 A further concern is that a price floor would erode the incentive of gasoline producers or refiners to compete and cut costs. But these incentives remain if the tax is computed based on global crude prices, instead of local gasoline prices. Because the U.S. consumer represents only a fraction of the global market for crude, the U.S. tax should not constrain this price, in the way it could if implemented at the local level. For these and other implementation issues, see id.

244 The lump sum nature of this rebate has a policy price: Congress forgoes the opportunity to use this revenue to replace distortive taxes.

245 Another option is to vary these rebates by region, given variations in density and the availability of mass transit. For instance, the rebate in New York City could be $400, and the rebate in rural Texas could be $600.

For instance, assume a "saving gas credit" offered $1000 per year minus an amount based on how much gasoline they used (for example, $1 per gallon). Those who used no gasoline would receive a $1000 credit. Those who used the average amount (800 gallons)[246] would receive $200,[247] and those who used 20% more than the average (960 gallons) would receive only $40.[248] This sliding-scale credit essentially fuses a $1000 lump sum payment with a $1 per gallon gasoline tax.

Although structured as a subsidy (at least in form), this sliding-scale credit discourages the use of gasoline.[249] In effect, it is a gasoline tax "in disguise."

The credit can be expanded to mimic a carbon tax. Specifically, a "saving the climate" credit would reward using not just less gasoline, but also less natural gas, coal, and other sources of GHGs as well.

Embedding a Pigouvian tax in a lump sum payment has a notable political advantage: The program can be called a "reward" or "bonus," instead of a "tax."[250]

At the same time, this sliding scale credit shares two policy advantages of a tax or permit. First, it creates an incentive to use less gasoline or emit fewer GHGs. Second, the government does not favor one abatement method over another. For instance, the "saving gas" credit offers the same $1 reward for saving a gallon by telecommuting, buying a hybrid, driving more slowly, carpooling, or some other way.

Even so, compared with Pigouvian taxes or tradeable permits, these credits have four policy disadvantages. First, for households that exhaust the credit by using too much gasoline or emitting too much CO_2, the credit offers no incentive to curtail usage.[251] Second, the need for revenue, discussed above, can have policy as well as political costs, at

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246 The U.S. Energy Information Agency estimated that households spent $2912 on gasoline in 2012, at an average price of $3.70 per gallon. U.S. Energy Info. Admin., U.S. Household Expenditures for Gasoline Account for Nearly 4% of Pretax Income (Feb. 4, 2013), http://www.eia.gov/todayinenergy/detail.php?id=9831. This is approximately 800 gallons per household.

247 $1000 minus $800, which is $1 for each of the 800 gallons.

248 The $1000 credit would be reduced by (960 x $1) or $960.

249 Admittedly, this structure is in ways more like a tax than a subsidy, and that of course is the point of it. Notably, though, Mitchell Polinsky has used a subsidy with a structure like this to generalize about problems with subsidies. See generally A. Mitchell Polinsky, Notes on the Symmetry of Taxes and Subsidies in Pollution Control, 12 Can. J. Econ. 75, 77-78 (1979) (considering whether subsidies for pollution abatement increase entry into polluting industries).

250 Even so, this political edge can be dulled, to an extent, by a credit's budgetary impact. For instance, if the average household uses 800 gallons of gasoline each year, the average "saving gas" credit would be $200. If it is claimed by each of the 116 million households in the United States, the annual cost would be approximately $23 billion.

251 In the example, a claimant receives no credit once she uses her 1000th gallon. There is no further disincentive to use the 1001st or, for that matter, the 2000th. With a $1 per gallon gas tax, by contrast, there is always a $1 disincentive to use each additional gallon.

least if revenue is raised with especially inefficient taxes. Notably, there is a trade-off between these two factors. Increasing the credit amount (for example, from $1000 to $1100) enables the credit to apply to more heavy users, but also increases its budgetary cost.

Third, compared with these credits, Pigouvian taxes offer more frequent reminders to curtail usage: They are imposed each time the relevant type of energy is purchased. In contrast, if these "saving" credits are included on the annual tax return, they are computed only once a year. This difference could cause the credits to be less salient, and thus less effective at encouraging abatement.

Fourth, unlike Pigouvian taxes, "saving" credits require households to track their energy consumption. For instance, to compute the "saving gas" credit, claimants have to know how much gasoline they use, so they can reduce the lump sum credit by the appropriate amount. This information is difficult for claimants to compile and for the government to verify.

One approach is to require claimants to buy gas with a special credit card that tracks purchases, and to prohibit (and penalize) cash and other off-the-books purchases.

Another approach is for gas stations to report each purchase of gasoline on a national database, including gallons purchased, name on the driver's license, car's license plate, and the like. An obvious risk, though, is that taxpayers would use fake driver's licenses or would bribe vendors to understate their purchases.

Still another possibility is to track the *miles* a claimant drives, instead of gasoline usage. For instance, service stations can be required to issue certified mileage statements in 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.[252] Unfortunately, these averages are an approximation at best, since mileage varies with speed and driving conditions. Yet this approach has the advantage of piggybacking on inspections and disclosure that already exists, instead of requiring a new reporting mechanism. Obviously, none of these strategies is ideal. Solving this problem is a key challenge for these credits—and, notably, one that Pigouvian taxes do not face.[253]

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[252] 2013 Fuel Economy Guide, note 182, at 5-36.

[253] In theory, a gasoline tax would present the same challenge if it were collected on the taxpayer's return, instead of at the pump.

D. Better Institutional Design for Energy Subsidies

Given the advantages of Pigouvian taxes or tradeable permits over energy subsidies, the best solution is the menu of taxes or permits described above. If it is politically unattainable, variations of taxes or permits that are more politically plausible should be considered, even if the policy case for them is less compelling.

If this strategy fails—in other words, if Congress is stuck with energy subsidies—better institutional design is needed. Specifically, Congress should fix, or at least mitigate, six problems discussed in Parts IV and V.

First, in deciding which technologies to favor and how generous to be, Congress needs to account for hidden costs. For instance, although *driving* electric vehicles does not emit GHGs, *manufacturing* them does—indeed, more than gasoline-powered vehicles.

Second, subsidies should not single out specific technologies. A broader formulation encourages competition and offers options to heterogeneous consumers. For instance, instead of a credit for hybrids, Congress can enhance fuel efficiency more cost effectively with a credit for *any* car with sufficiently high gas mileage.

Third, subsidies should target results, instead of proxies. To avoid perverse effects, such as subsidizing energy that is not used, Congress needs to reward the right behavior. For instance, the goal should not be to *produce* electricity from wind *per se*, but to *replace* electricity from coal or gas. If using a proxy is unavoidable (for example, for administrability reasons), conditions should be included to foreclose perverse outcomes. For instance, a subsidy that rewards production (instead of profit or revenue) should be available only when energy sells for a minimum (or positive) price.

Fourth, climate and national security externalities are global. Therefore, policies targeting these issues are more effective if coordinated with other countries.

Fifth, Congress should either not use the tax system to deliver these subsidies or should address familiar limitations in doing so. For instance, since tax administrators are not experts in environmental or national security policy, experts in these areas should formulate and interpret the criteria for the subsidy, leaving tax experts the ministerial responsibility of dispensing funds.

Sixth, energy policy objectives and distribution generally should be pursued separately. On one hand, if the goal is to improve national security or the environment, subsidizing low-income claimants ordinarily is less cost-effective; they have less capacity in their budgets, and thus are less responsive. On the other hand, if the goal is to channel resources to low-income households, green energy subsidies are a less efficient currency than cash, which allows claimants to pursue their own priorities.

VII. Conclusion

Energy can have profound effects on our environment, economy, and national security. Unfortunately, the hodgepodge of energy subsidies under current law underperforms in a number of ways. The goals are worthy—indeed, many are compelling—but these subsidies suffer from a range of design flaws.

This Article has four main implications for energy policy. First, the economics literature on energy needs to incorporate national security in the analysis, something it so far has failed to do. Second, Pigouvian taxes and tradeable permits are likely to be better than subsidies. Third, since taxes and permits face political challenges in the United States, Congress should consider variations that have better political prospects, even if their policy merits are not as strong. Fourth, if Congress is stuck with subsidies, it can still improve on current law in a number of ways. For instance, Congress should broaden the subsidies and target results instead of proxies. There is ample room for improvement. This is fortunate, since the stakes are high.