RED, WHITE, AND BLUE—AND ALSO GREEN: HOW ENERGY POLICY CAN PROTECT BOTH NATIONAL SECURITY AND THE ENVIRONMENT

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ABSTRACT

Too often, energy policy protects the environment while neglecting national security, or vice versa. Since each goal is critical, this Article shows how to advance both at the same time.

For national security, the key is to avoid depending on the wrong suppliers. If they are vulnerable to attack (like some Middle Eastern producers), they need to be defended. Or, if they are themselves geopolitical threats (like Russia and Iran), their energy exports fund harmful conduct. This Article breaks new ground in showing why suppliers tend to be insecure or menacing: authoritarian regimes—which are more likely to pose these risks—have a comparative advantage in producing oil and gas, since they are less responsive to opposition from environmentalists, local residents, and other groups.

To avoid depending on the wrong suppliers, the U.S. and its allies should pursue two strategies. First, they should cut demand for fossil fuel. Along with making it easier to stop buying from the wrong suppliers, slashing demand also reduces greenhouse gas emissions and pollution. Yet although these are significant national security and environmental

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advantages, there is an offsetting national security risk: like fossil fuel, the main alternative—clean energy—also can foster dependence on insecure or potentially hostile suppliers (like Congo and China). In response, the U.S. and its allies should ramp up domestic production of clean energy technology, while also encouraging households and businesses to use it.

Second, since the transition to clean energy will take time, the U.S. and its allies also need to tap new sources of fossil fuel in countries that are secure and friendly. Yet since new fossil fuel development raises familiar environmental concerns, this Article proposes three ways to do it while still reducing emissions and pollution. First, these new sources should be as "clean" as possible (for example, natural gas instead of coal). Second, in adding new capacity, the goal should be to replace other fossil fuel sources, not to add to them (for example, so more production in the U.S. means less production in Russia). Third, new sources should be flexible, so they can ramp up and scale back as needed. Fortunately, these shifts are relatively easy for U.S. shale producers—indeed, more so than for others—and can be encouraged with the right regulatory approach.

While government intervention is needed to pursue these goals, policymakers should strive to harness the private sector's capacity to innovate, cut costs, and enhance quality. A moratorium on new fossil fuel development is counterproductive, entrenching a status quo that depends too much on coal, as well as on insecure and hostile energy suppliers. Instead, the best approach is to "price" the relevant national security and environmental costs with Pigouvian taxes, motivating businesses and consumers to mitigate these costs and letting them choose how to do it. Yet if Pigouvian taxes are not politically feasible, this Article recommends a heuristic called "the marginal efficiency cost of energy": policymakers should account for all the social costs of each source—private costs, national security costs, and environmental costs—and strive to replace high-cost sources with low-cost sources. This framework should guide all aspects of energy policy—from permits and regulations to rate-setting, mandates, moratoriums, subsidies, and government leases—so policymakers stay focused on both environmental and national security goals.

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In December 2021, the Biden Administration blocked the construction of a natural gas pipeline from the Eastern Mediterranean to Europe. "Why would we build a fossil fuel pipeline," the Administration's senior energy advisor asked, "when our entire policy is to support new technology . . . and new investments in going green and in going clean?"[1]

1. Lahav Harkov, *US Informs Israel It No Longer Supports EastMed Pipeline to Europe*, JERUSALEM POST (Jan. 18, 2022, 16:12 PM), https://www.jpost.com/international/article-693866

The answer to this rhetorical question should have been clear. In a word, it was "Russia." Just three months later, Russia would invade Ukraine, and troops were already amassing on the border. To fund this military build-up, the Russian government depended heavily on energy exports, which accounted for a whopping 45% of its revenue.[2] Since Russia's main market was Europe, one way to weaken Russia was to wean Europe off its energy. A new pipeline from the Eastern Mediterranean would help (although it would take years to complete). Even so, the Biden Administration nixed this pipeline,[3] prioritizing the environment over national security.

As this example illustrates, energy policy has a profound impact on both national security and the environment, but too often the focus is on one or the other. Indeed, several prominent scholars have chosen to omit national security from their analysis altogether.[4] For example, an influential 1996 book on energy security pointedly ignores the cost of defending Middle Eastern oil, arguing that energy is not the only reason for the U.S. to intervene in the region.[5] But oil surely is *one of the reasons*. Ignoring it

[https://perma.cc/P64H-P9UC] (quoting Amos Hochstein, the State Department Senior Advisor for Energy Security). Hochstein offered these thoughts before returning to the government, when he was interviewed for a documentary aired on Turkish state media. Turkey opposes the EastMed pipeline and has been lobbying for Israeli gas to be routed through Turkey instead of Greece. *Id.*

2. *Energy Fact Sheet: Why Does Russian Oil and Gas Matter?*, INT'L ENERGY ASS'N (Mar. 21, 2022) [hereinafter *Energy Fact Sheet*], https://www.iea.org/articles/energy-fact-sheet-why-does-russian-oil-and-gas-matter [https://perma.cc/H9EX-PGV4] ("Russia relies heavily on revenues from oil and natural gas, which in 2021 made up 45% of Russia's federal budget.").

3. *See* Harkov, *supra* note 1. Months later, Egypt and Israel signed a memorandum of understanding with the European Union to supply natural gas to Europe. Since no pipeline is in place, the assumption is that they will rely on Liquefied Natural Gas ("LNG") terminals in Egypt. *See* Stuart Elliott, *EC Inks Trilateral MOU for Supply of Israeli Gas to Europe via Egypt*, S&P GLOBAL (June 15, 2022, 9:22 PM), https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/061522-ec-inks-trilateral-mou-for-supply-of-israeli-gas-to-europe-via-egypt [https://perma.cc/F48N-EMJH]. In October of 2022, Israel and Lebanon resolved a long-standing dispute about the ownership of offshore natural gas fields; brokered by the U.S., this deal was intended in part to facilitate the export of more gas to Europe. Dov Lieber, *Israel, Lebanon Reach Rare Deal for Gas Extraction and Export to Europe*, WALL ST. J. (Oct. 11, 2022, 2:12 PM), https://www.wsj.com/articles/israel-lebanon-agree-to-u-s-brokered-maritime-border-deal-for-gas-extraction-11665489608 [https://perma.cc/4C2Z-WEYN].

4. *See, e.g.*, Gilbert E. Metcalf, *The Economics of Energy Security* 18 (Nat'l Bureau of Econ. Rsch., Working Paper No. 19729, 2013), https://www.nber.org/system/files/working_papers/w19729/w19729.pdf [https://perma.cc/72SN-NVHM] ("Reducing oil consumption (as opposed to oil imports) might lessen the influence of oil rich countries. But it might not materially affect military and strategic thinking."); IAN W. H. PARRY & JOEL DARMSTADTER, THE COSTS OF US OIL DEPENDENCY 15 (2004) ("US military expenditures in the Middle East are in part the result of US 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 US oil imports."); NAT'L RSCH. COUNCIL OF THE NAT'L ACADS., HIDDEN COSTS OF ENERGY: UNPRICED CONSEQUENCES OF ENERGY PRODUCTION AND USE 333 (2010) ("[T]he marginal cost is essentially zero. This view is held by a number of other researchers in the area, including Bohi and Toman (1995). The committee adopts this position."). For a discussion of the views of these scholars, see *infra* Sections I.D & II.C.

5. DOUGLAS R. BOHI & MICHAEL A. TOMAN, THE ECONOMICS OF ENERGY SECURITY 53–54

renders their analysis incomplete. Instead, energy policy needs to account for—and, indeed, to protect—both national security and the environment. This Article shows how to do it.

To enhance national security, the key is to avoid depending on the wrong suppliers. If they are vulnerable to attack (like some Middle Eastern suppliers), they need to be defended. Or, if they are themselves geopolitical threats (like Russia and Iran), their exports fund harmful conduct.

Unfortunately, it is no accident that fossil fuel suppliers often are insecure or hostile. This Article breaks new ground in explaining why. In democracies, fossil fuel production regularly faces staunch opposition from local residents, economic competitors, and environmental groups. But interest groups have less influence in authoritarian regimes, so production gravitates to these countries. This "authoritarian comparative advantage," as the dynamic is called here, renders the U.S. and other democracies more dependent on authoritarian suppliers, which are more likely to be insecure or hostile.

To mitigate these national security risks, the U.S. and its allies should rely less on these suppliers. In general, there are two ways to do this. The first is to reduce demand for their product, while the second is to find other suppliers. This Article analyzes both alternatives, evaluating their implications for national security and the environment.

The first strategy—cutting demand for fossil fuel—lessens the stakes. There is less economic disruption when the U.S. and its allies stop buying from insecure or hostile suppliers. Finding other suppliers also is easier, since there is more slack in the system. Along with these national security advantages, reducing demand also yields familiar environmental benefits, reducing greenhouse gas emissions and pollution.

Yet although it is important to reduce demand for fossil fuel—for instance, by depending more on clean energy—this strategy poses national security risks of its own. Unfortunately, as with oil and gas, many clean energy suppliers are insecure or potentially hostile. For example, China is a leading supplier of EV batteries, solar panels, and minerals needed for clean energy. Arguably, replacing Russian hydrocarbons with Chinese clean energy is like jumping out of the frying pan into the fire.

In response, the U.S. and its allies should ramp up domestic production of clean energy technology, while also encouraging households and businesses to use it. To incentivize this effort, Congress offered a range of subsidies in the Inflation Reduction Act of 2022, although it remains to be

(Kluwer Acad. 1996).

seen how effective these subsidies will be; as I have emphasized elsewhere, targeted subsidies require Congress to pick which technologies to fund, but Congress often lacks the expertise and incentives to make the right choices.[6] Even with these subsidies, moreover, clean energy still faces daunting regulatory barriers. For example, the permitting process for wind projects, mines, and solar farms is expensive, slow, and risky, but Congress failed to pass a 2022 bill on permitting reform.[7] For this reason (and others as well), the "friend-shoring" of supply chains—and, more generally, the transition to clean energy—is likely to take many years.

Meanwhile, the U.S. and its allies should also pursue a second strategy. To ease their dependence on insecure and hostile fossil fuel suppliers, they should find other suppliers. Yet this effort, which involves adding new wells, pipelines, and infrastructure, raises familiar environmental concerns.

To square this circle, this Article proposes three ways to develop new sources of fossil fuel while still reducing emissions and pollution. First, these new sources should be as "clean" as possible; for example, natural gas generally is preferable to coal. Second, in adding new capacity, the goal should be to *replace* other fossil fuel sources, not to *add* to them. For instance, the point of increasing *U.S.* exports should be to reduce *Russian* exports. Third, new sources should be flexible, so they can ramp up and scale back, as needed. Fortunately, these shifts are relatively easy for U.S. shale producers—indeed, more so than for others—and can be encouraged with the right regulatory approach. For example, in awarding permits for a new pipeline or Liquefied Natural Gas ("LNG") facility, the government should reserve (and pay for) the right to shut it down after a specified period. This would be much better than the Biden Administration's decision in January 2024 to "pause" decisions on new export permits.[8]

To protect both the environment and national security, then, the U.S. and its allies need to reduce demand for fossil fuel, while also tapping new supply. But who is supposed to pursue these twin goals? After all, producing

6. David M. Schizer, *Energy Subsidies: Worthy Goals, Competing Priorities, and Flawed Institutional Design*, 70 TAX L. REV. 243, 277–87 (2017) [hereinafter Schizer, *Energy Subsidies*].

7. David Blackmon, *The Death of Manchin's Permitting Reform Effort Is a Loss for Everyone*, FORBES (Sept. 28, 2022, 7:38 AM), https://www.forbes.com/sites/davidblackmon/2022/09/28/the-death-of-manchins-permitting-reform-effort-is-a-loss-for-everyone [https://perma.cc/4XEQ-UJ44].

8. FACT SHEET: BIDEN-HARRIS ADMINISTRATION ANNOUNCES TEMPORARY PAUSE ON PENDING APPROVALS OF LIQUEFIED NATURAL GAS EXPORTS (Jan. 26, 2024) (imposing "a temporary pause on pending decisions on exports of Liquefied Natural Gas (LNG) to non-FTA countries until the Department of Energy can update the underlying analyses for authorizations"), https://www.whitehouse.gov/briefing-room/statements-releases/2024/01/26/fact-sheet-biden-harris-administration-announces-temporary-pause-on-pending-approvals-of-liquefied-natural-gas-exports/ [https://perma.cc/8LDE-HCV9].

energy is not a government responsibility—at least not in the U.S. Rather, this is the job of private firms, and rightly so. They have the expertise and incentives to innovate, cut costs, and enhance quality. So even though authoritarian systems are better at overcoming interest group opposition, free societies have their own edge—economic dynamism—which they should harness.

Yet the private sector can do only what it is allowed to do. New wells and pipelines require permits, as do wind farms and mines for clean energy minerals, while extensive regulations also apply. The wrong government policies would thwart the approach recommended here. For example, a moratorium on new fossil fuel development—a step with influential supporters, including the International Energy Agency ("IEA")[9] —would be counterproductive, entrenching a status quo that depends too much on coal, as well as on insecure and hostile suppliers of oil and gas.

Yet the point is not for the government to leave these issues to the market, but to intervene the right way. The most efficient response is a Pigouvian tax. By adding environmental and national security harms to market prices, it creates financial incentives to mitigate them. At the same time, a Pigouvian tax lets consumers and businesses pick the solutions that are best for them, from electric vehicles and energy efficient appliances to shorter commutes, mass transit, better home insulation, and much more. The government does not have to pick specific responses to support—a key advantage because the government is not good at "picking winners."[10]

Unfortunately, Pigouvian taxes have encountered stiff political resistance in the U.S.[11] If they are not available, policymakers should use other policy instruments to reduce the demand for fossil fuels and change the ones we use. To guide this effort, this Article proposes a heuristic called "the marginal efficiency cost of energy": policymakers should account for all the social costs of each source—private costs, national security costs, and environmental costs—and then seek to replace high-cost sources with low-cost sources. This framework should guide all aspects of energy policy—from permits and regulations to rate-setting, mandates, moratoriums,

9. INT'L ENERGY AGENCY, NET ZERO BY 2050: A ROADMAP FOR THE GLOBAL ENERGY SECTOR 21 (2021) [hereinafter NET ZERO BY 2050], https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf [https://perma.cc/2AJ5-BNJZ] ("There is no need for investment in new fossil fuel supply in our net zero pathway.").

10. *See* Schizer*, Energy Subsidies*, *supra* note 6, at 298 ("[M]any 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.").

11. *Id.* at 270–72.

subsidies, and government leases.

Admittedly, this agenda faces political challenges. Generating the requisite political support will require compromise, as well as an alliance between advocates for the environment and for national security.

Part I analyzes the national security costs of defending insecure fossil fuel suppliers, showing that these costs can be reduced by cutting demand for fossil fuel and adding secure new sources. Part II shows that this two-part strategy also addresses another national security cost of fossil fuel: strengthening hostile exporters. Since energy policy should also protect the environment, Part III briefly surveys two familiar environmental goals: limiting climate change and pollution. To identify synergies and tensions among the various national security and environmental goals, Part IV focuses on strategies to reduce demand for fossil fuel, while Part V considers strategies to tap secure new sources. Part VI generalizes these insights into a regulatory strategy, and Part VII is the conclusion.

I. DEFENSE EXTERNALITIES: A COST OF DEPENDING ON THE WRONG SUPPLIERS

When energy exporters are vulnerable to attack, they may need to be defended; indeed, the U.S. and its allies have protected Middle Eastern oil producers for decades. But this Part argues that instead of *defending* insecure suppliers, the U.S. and its allies should find ways to *depend less* on them. By tapping new sources of supply and reducing demand, the U.S. and its allies could cut their defense budgets.

Even so, some commentators and government agencies dismiss this potential benefit, deeming it too speculative to consider in energy policy. The last Section in this Part responds to their claims.

A. THE NATIONAL SECURITY IMPLICATIONS OF ENERGY

1. Defining National Security

Before considering this link between energy policy and national security, it is important first to clarify what the phrase "national security" means here. This Article uses the classical "realist" definition, which focuses on physical security and material well-being, rather than on the advancement of ideals.[12]

12. *See generally* HANS J. MORGENTHAU, POLITICS AMONG NATIONS: THE STRUGGLE FOR POWER AND PEACE (Alfred A. Knopf, Inc. 1948) (advocating for a classical realist approach to international politics).

The goal here is to enhance the security of the U.S. and its allies, not to maximize global welfare. For example, conduct that is dangerous to U.S. citizens is considered harmful, even if it is beneficial to adversaries of the U.S.

To identify threats, this Article relies on the U.S. Intelligence Community's annual threat assessments.[13] The 2022 analysis highlighted four threats—China, Russia, Iran, and North Korea[14]—while earlier assessments also focused on terrorism.[15]

In mentioning "allies" of the U.S., this Article refers to countries that feature prominently as "allies and partners" in the Biden-Harris 2022 National Security strategy, including the U.K., Germany, France, and other NATO allies in Europe; Canada and Mexico in North America; and Japan, Australia, and South Korea in the Indo-Pacific.[16]

2. Links Between Energy and National Security

As the U.S. and its allies strive to counter security threats, energy is relevant in a number of ways. This Part focuses on the cost of *defending* suppliers, while the next considers the cost of *empowering* them.

But admittedly, these are not the only links between national security and energy. The military needs fuel to fight wars, just as it also needs weapons, rations, and other materials.[17] The familiar response is to stockpile these supplies.

Energy policy also can cause environmental harms, which some classify as security threats.[18] Yet as a matter of terminology, this Article

13. OFF. OF THE DIR. OF NAT'L INTEL., ANNUAL THREAT ASSESSMENT OF THE U.S. INTELLIGENCE COMMUNITY (2022) [hereinafter 2022 U.S. ANNUAL THREAT ASSESSMENT], https://www.dni.gov/files/ODNI/documents/assessments/ATA-2022-Unclassified-Report.pdf [https://perma.cc/64FE-FYVR].

14. *Id.* at 6–17. Admittedly, the U.S. relationship with China is not solely rivalrous, since robust trade can benefit both parties in various ways. In any event, a comprehensive effort to classify and assess nuances in these various relationships is beyond this Article's scope.

15. *See, e.g.*, DANIEL R. COATS, WORLDWIDE THREAT ASSESSMENT OF THE US INTELLIGENCE COMMUNITY 10–13 (2019), https://www.dni.gov/files/ODNI/documents/2019-ATA-SFR---SSCI.pdf [https://perma.cc/D4M8-4FJ4].

16. *See generally* THE WHITE HOUSE, NATIONAL SECURITY STRATEGY (2022) [hereinafter BIDEN-HARRIS NATIONAL SECURITY STRATEGY], https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf [https://perma.cc/T42C-HKCQ].

17. For example, access to oil played a key role in World War II, both in starting the war and in influencing how it was fought. *See* DANIEL YERGIN, THE PRIZE: THE EPIC QUEST FOR OIL, MONEY, AND POWER 300–09 (Simon & Schuster 1991) (discussing how the U.S. decision to stop selling oil to Japan helped to motivate the attack on Pearl Harbor); *id.* at 312–26 (describing Germany's reliance on synthetic fuel, its efforts to conquer Russia's oil fields, and the impact of fuel shortages on German campaigns).

18. For example, the Biden Administration's 2022 National Security Strategy treated climate

classifies them instead as environmental harms, discussing them in Part III's analysis of climate change and pollution.[19]

Energy also affects national security through the economy. Without cheap and reliable energy, it is harder to produce and deliver food, medicine, and other essentials; heat homes; enforce the law; maintain effective communications and transportation networks; and engage in a range of other indispensable activities. In short, energy is a fundamental ingredient of modern life.

To avoid severe economic and social disruptions, countries need to protect their electrical grids, pipelines, and power plants.[20] This is no different from the need to defend other vital infrastructure.

For similar reasons, countries also need reliable sources of fuel. Recognizing the importance of this precious resource, the literature used to focus on another security challenge: the economic drain from energy imports.

In the U.S., this was mainly an issue for oil, not for natural gas or coal. The U.S. became a net importer of petroleum in the 1950s, and these imports generally increased every year after 1954 until they peaked in 2005.[21] Since the U.S. was the world's largest oil importer for decades, the cost of these imports loomed large in the literature on energy and national security.[22] In contrast, the U.S. did not depend on imports for natural gas during this period, although experts worried that this would change as U.S. reserves dwindled.[23] There was no such concern about coal, though. With the largest

change as a national security threat. *See* BIDEN-HARRIS NATIONAL SECURITY STRATEGY, *supra* note 16, at 27 ("The climate crisis is the existential challenge of our time. A warming planet endangers Americans and people around the world—risking food and water supplies, public health, and infrastructure and our national security.").

19. *See infra* Section III.A.2.

20. *See, e.g.*, Alistair MacDonald, *Ukraine Hunts the World for Parts to Fix Crippled Energy Grid*, WALL ST. J. (Dec. 2, 2022, 10:57 AM), https://www.wsj.com/articles/ukraine-hunts-the-world-for-parts-to-fix-crippled-energy-grid-11669975331 [https://perma.cc/XZU4-FSDS] (describing Russian strategy of targeting Ukraine's electrical grid and power plants).

21. *Oil and Petroleum Products Explained: Oil Imports and Exports*, U.S. ENERGY INFO. ADMIN. [hereinafter *Oil and Petroleum*], https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php [https://perma.cc/TXV9-N2ER].

22. An extensive literature focused on "the oil premium," arguing that the U.S. imported so much oil that it should have been able to influence global prices, but there was a negative externality: consumers did not consider the impact of their purchases on global prices. *See, e.g.*, PAUL N. LEIBY, ESTIMATING THE ENERGY SECURITY BENEFITS OF REDUCED U.S. OIL IMPORTS 5 (2007) ("The approach estimates the incremental benefits to society, in dollars per barrel, of reducing U.S. imports."); PARRY & DARMSTADTER, *supra* note 4, at 9–10 ("This transfer [to other nations] is an additional cost borne by the United States as a whole that is not taken into account by individual US consumers . . . .").

23. DANIEL YERGIN, THE NEW MAP: ENERGY, CLIMATE, AND THE CLASH OF NATIONS 31 (Penguin Publ'g Grp. 2020) (noting the consensus of the early 2000s that dwindling domestic supply would cause the U.S. to begin importing significant volumes of natural gas).

reserves in the world,[24] the U.S. has been a net exporter for decades.[25]

Yet the economic drain from energy imports is no longer a concern in the U.S. In the past fifteen years, U.S. firms have unlocked vast oil and gas reserves in shale formations, using hydraulic fracturing.[26] This innovation has turned the U.S. into the world's largest producer of oil and gas.[27] U.S. oil production surged 145% from 2008 to 2019, from 5,000 to 12,289 barrels per day.[28] Likewise, U.S. natural gas production increased 88% between 2005 and 2019.[29] After a dip during the coronavirus pandemic, U.S. gas production set a record in the summer of 2022,[30] reaching a level that once was unimaginable.[31] This "shale boom" has turned the U.S. into a net exporter of oil and gas,[32] so energy no longer contributes to the U.S. trade deficit. The economic drain of energy imports still burdens many U.S. allies, but not the U.S.

B. NATIONAL SECURITY RISKS FROM INSECURE SUPPLIERS

Even so, the U.S. still faces another important energy security challenge, which is the focus of this Section: the risk of sudden contractions in the global supply of energy. This can happen if a supplier suddenly stops producing because of a revolution, war, or other geopolitical crisis. Notably, these supply shocks can still harm the U.S.—even though it is a net exporter—by triggering economically damaging spikes in energy prices.

24. *Countries with the Biggest Coal Reserves*, MINING TECH. (Jan. 6, 2020), https://www.mining-technology.com/features/feature-the-worlds-biggest-coal-reserves-by-country [https://perma.cc/C5KB-2TV2] ("The US tops the list holding more than one-fifth of the total proven coal reserves . . . .").

25. *Coal Explained: Coal Imports and Exports*, U.S. ENERGY INFO. ADMIN. https://www.eia.gov/energyexplained/coal/imports-and-exports.php [https://perma.cc/TM6Q-CPFU].

26. *See* YERGIN, *supra* note 23, at 11–12, 24 (describing the impact of the shale revolution on U.S. oil and gas production).

27. *Id.* at xiv–xv.

28. *Petroleum & Other Liquids*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpus2&f=a [https://perma.cc/UU75-KNPM].

29. *Natural Gas*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/dnav/ng/hist/n9070us1A.htm [https://perma.cc/ZEB8-622J] (increasing from 18,051 billion cubic feet ("bcf") to 33,899 bcf).

30. Sheetal Nasta, *Long Story Short—Natural Gas Production Hits 100 Bcf/D, but Is No Match for Record Demand*, RBN ENERGY (Sept. 18, 2022), https://rbnenergy.com/long-story-short-natural-gas-production-hits-100-bcf-but-is-no-match-for-record-demand [https://perma.cc/4UQ6-RH3W] (producing more than 100 bcf per day).

31. *Id.* ("Lower 48 natural gas production this month hit a once-unthinkable milestone, topping the all-important psychological threshold of 100 Bcf/d for the first time.").

32. *Oil and Petroleum*, *supra* note 21 ("In 2021, the United States exported about 8.54 million barrels per day (b/d) and imported about 8.47 million b/d of petroleum, making the United States an annual total petroleum net exporter for the second year in a row since at least 1949." (footnote omitted)); *see also* PARRY & DARMSTADTER, *supra* note 4, at 10 ("If the United States were self-sufficient in oil there would be no monopsony power externality.").

1. Supply Shocks

These supply shocks can trigger both inflation and recessions in the U.S. and across the globe. For example, when Arab nations slashed oil production in 1973 and embargoed the U.S. to protest U.S. support of Israel, the spike in energy prices triggered nearly a decade of "stagflation."

Soaring energy prices are especially painful for low-income households. Energy represents a larger percentage of their budgets, so price spikes are even more noticeable, causing difficult tradeoffs between oil, gas, and electricity, on the one hand, and necessities like food, medicine, rent, and education, on the other. Unlike wealthier households, families with low incomes do not have the liquidity to invest in more energy efficient cars, homes, and appliances or, in many cases, the flexibility to move closer to work or telecommute.

To head off these dire economic consequences, policymakers need "to ensure that the United States . . . is more resilient to inevitable global energy shocks," Jason Bordoff and Meghan O'Sullivan have observed.[33]

2. Cost of Defending Access to Energy

The traditional way to avoid energy shocks is to police access to fossil fuel, especially oil. For decades, the U.S. armed forces have "maintain[ed] the security of international oil flows for the global market," a RAND Corporation analysis explained in 2009.[34]

Like climate effects and pollution, this cost is not included in the price at the pump, so consumers do not consider these "defense externalities" in deciding how much fuel to use. Instead, "[t]he cost of those forces . . . generates a burden on the U.S. taxpayer."[35]

For many years, the U.S. has defended oil suppliers in the Middle East. For example, when the Soviet Union invaded Afghanistan in 1979, President Jimmy Carter warned that "[a]n attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America."[36] Two years later, President Ronald

33. Jason Bordoff & Meghan L. O'Sullivan, *By Not Acting on Climate, Congress Endangers U.S. National Security*, FOREIGN POL'Y (July 21, 2022, 1:58 PM), https://foreignpolicy.com/2022/07/21/climate-change-action-us-congress-biden-bill-national-security [https://perma.cc/F972-ZR9E].

34. KEITH CRANE, ANDREAS GOLDTHAU, MICHAEL TOMAN, THOMAS LIGHT, STUART E. JOHNSON, ALIREZA NADER, ANGEL RABASA & HARUN DOGO, IMPORTED OIL AND U.S. NATIONAL SECURITY 59 (RAND Corp. 2009).

35. *Id.*

36. Toby Craig Jones, *America, Oil, and War in the Middle East*, 99 J. AM HIST. 208, 208 (2012) (quoting President Carter's State of the Union Address).

Reagan pledged to defend oil producers from their neighbors as well.[37]

Honoring this commitment, President George H.W. Bush protected Kuwait from an invasion by Iraq in 1990, invoking U.S. reliance on fossil fuels, among other things, to justify a military response. "[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," he told the American people.[38] "Our country now imports nearly half the oil it consumes and could face a major threat to its economic independence."[39]

To secure the Middle East (and its oil) after the First Gulf War, the U.S. permanently stationed troops there for the first time. This U.S. military presence, especially in Saudi Arabia, was one of the reasons invoked by Osama Bin Laden to rally support for terrorist strikes against the U.S.[40]

Bin Laden's attacks on September 11, 2001 prompted the U.S. to invade Afghanistan. So, although this invasion was a response to terrorism, the terrorism itself was motivated (at least in part) by U.S. efforts to defend fossil fuels. "You can draw a thread through the whole thing with oil," argued Admiral Dennis C. Blair, former director of National Intelligence.[41]

Similarly, although the U.S. invaded Iraq in 2003 for a number of reasons, energy was a key motivation for Vice President Dick Cheney. "Armed with an arsenal of these weapons of terror, and seated atop ten percent of the world's oil reserves," he observed six months before the invasion, Iraq's leader Saddam Hussein could then be expected to "seek domination of the entire Middle East" and "take control of a great portion of the world's energy supplies."[42]

37. Steven R. Weisman, *Reagan Says U.S. Would Bar a Takeover in Saudi Arabia That Imperiled Flow of Oil,* N.Y. TIMES (Oct. 2, 1981), https://www.nytimes.com/1981/10/02/world/reagan-says-us-would-bar-a-takeover-in-saudi-arabia-that-imperiled-flow-of-oil.html [https://perma.cc/TNC6-HTEC] ("There's no way that we could stand by," Ronald Reagan said, "and see [Saudi Arabia] taken over by anyone that would shut off that oil.").

38. Former U.S. President George H.W. Bush, Address on Iraq's Invasion of Kuwait (Aug. 8, 1990), https://millercenter.org/the-presidency/presidential-speeches/august-8-1990-address-iraqs-invasion-kuwait [https://perma.cc/49QV-LAYJ].

39. *Id*.

40. *The Military Cost of Defending the Global Oil Supply*, SECURING AMERICA'S FUTURE ENERGY 1, 10 (2018) [hereinafter SAFE], http://secureenergy.org/wp-content/uploads/2020/03/Military-Cost-of-Defending-the-Global-Oil-Supply.-Sep.-18.-2018.pdf [https://perma.cc/C5BM-6YZR].

41. *Id.*

42. David E. Sanger, *The World: First Among Evils?*; *The Debate Over Attacking Iraq Heats Up*, N.Y. TIMES (Sept. 1, 2002), https://www.nytimes.com/2002/09/01/weekinreview/the-world-first-among-evils-the-debate-over-attacking-iraq-heats-up.html [https://perma.cc/999S-A4BD] (quoting Dick Cheney); *see also Full Text of Dick Cheney's Speech at the Institute of Petroleum Autumn Lunch, 1999*, LONDON INST. OF PETROL. (June 8, 2004), https://www.resilience.org/stories/2004-06-08/full-text-dick-cheneys-speech-institute-petroleum-autumn-lunch-1999 [https://perma.cc/P4H9-VWH4] ("Oil is unique

Admittedly, the U.S. has intervened in the Middle East not only to protect its oil, but also to counter terrorism, support allies, contain rivals, and defend the principle of sovereignty. But although energy is not the *only* factor shaping U.S. defense policy, it is an *important* one, as a group of retired senior military planners affirmed in interviews for a 2018 study.[43] "We are not in the Persian Gulf because we are benevolent. We want oil to flow out of there," one observed.[44] "Since the end of [the] Cold War, the only real threats we have are threats to the oil supply," another said.[45] "[M]ore than half the Defense budget is for the security of Persian Gulf oil."[46]

These military efforts have long been reinforced by diplomacy. The U.S. has maintained close ties with oil-producing regimes, including ones that do not share U.S. values.[47] Propping up these authoritarian "petrostates" is all the more costly because they often are unstable.[48]

3. As a Net Exporter, Can the U.S. Stop Worrying About Supply Shocks?

Can the U.S. stop supporting these regimes now that it has become a net exporter of petroleum?[49] Are Americans protected from oil shocks, as long as U.S. wells keep pumping? Unfortunately, the answer is "no."

For one thing, key allies and trading partners still import oil, and their economic health affects the U.S. Energy shocks drain away money they otherwise would spend on U.S. goods and services, as well as on shared strategic interests.

Supply shocks also still affect the U.S. more directly: when consumers in Europe or Asia cannot buy from their usual supplier, they try to buy from

in that it is so strategic in nature. We are not talking about soapflakes or leisurewear here. Energy is truly fundamental to the world's economy. The Gulf War was a reflection of that reality.").

43. SAFE, *supra* note 40, at 7–11.

44. *Id.* at 11 (quoting General Charles Wald, former Deputy Commander, Headquarters United States European Command).

45. *Id*. at 9 (quoting John Lehman, former secretary of the Navy).

46. *Id.* at 3 (quoting John Lehman, former Secretary of the Navy).

47. JOHN DEUTCH, JAMES R. SCHLESINGER & DAVID G. VICTOR, COUNCIL ON FOREIGN RELATIONS INDEPENDENT TASK FORCE REPORT # 58: NATIONAL SECURITY CONSEQUENCES OF U.S. OIL DEPENDENCY 26 (2006), https://www.cfr.org/report/national-security-consequences-us-oil-dependency [https://perma.cc/8RD3-VY9A] (noting that oil dependence can cause "political realignments that constrain the ability of the United States to form partnerships to achieve common objectives").

48. Jeffrey D. Sachs & Andrew M. Warner, *Natural Resources and Economic Development: The Curse of Natural Resources*, 45 EUR. ECON. REV. 827, 828, 837 (2001).

49. The U.S. is both an importer and an exporter. A key reason why is that many U.S. refineries are better suited to process "heavy" oil (from the Middle East) instead of "light" oil (from the shale boom). *See* Martin Tillier, *America Produces Enough Oil to Meet Its Needs, so Why Do We Import Crude?*, NASDAQ (Mar. 8, 2022, 10:18 AM), https://www.nasdaq.com/articles/116merica-produces-enough-oil-to-meet-its-needs-so-why-do-we-import-crude [https://perma.cc/C6CQ-LTHN].

U.S. producers, bidding up the price.[50] This is why U.S. gasoline prices spiked after Russia invaded Ukraine, even though the U.S. was importing very little oil from Russia.[51] In a global market, a war or revolution thousands of miles away—involving suppliers who do not sell to U.S. consumers—can still cause U.S. prices to spike.

Does the U.S. have the same sort of exposure with natural gas? The answer is "yes, but not nearly as much." The difference is that oil is easier to ship. Since a tanker can take Texas oil to either Athens or Alabama, buyers in both places can bid for it, yielding a (relatively) uniform global price.

In contrast, the price of natural gas is set locally because it is harder to transport. The cheapest way is a pipeline, but then the destination is fixed. If the pipeline goes to Alabama, Athenians cannot easily buy this gas. They would have to turn it into liquid, ship it on a tanker, and then turn it back into gas. This costly process requires a sophisticated infrastructure. At the moment, the U.S does not have enough liquefaction facilities to satisfy European demand. This constraint on exports leaves more gas for domestic consumption. As a result, prices in the U.S. are much lower than in Europe and Asia.

Even so, U.S. natural gas prices are still affected by global supply shocks, at least to an extent. When prices spike in other markets, U.S. suppliers can export *at least some* gas, a choice that reduces domestic supply. This helps explain why U.S. natural gas prices spiked for several months after Russia invaded Ukraine (while European prices went much higher).[52] Looking ahead, global demand will have even more impact on U.S. prices as the U.S. builds more LNG facilities.[53]

50. *See* YERGIN, *supra* note 23, at 61 ("Even if the U.S. is not importing much Middle Eastern oil, a supply disruption would drive up global prices, including in the United States.").

51. Gabriel T. Rubin, *U.S. Inflation Hits New Four-Decade High of 9.1%*, WALL ST. J. (July 13, 2022, 7:07 PM), https://www.wsj.com/articles/us-inflation-june-2022-consumer-price-index-11657664129 [https://perma.cc/U4QB-7VQB] ("The consumer-price index's advance for the 12 months ended in June was the fastest pace since November 1981 . . . . A big jump in gasoline prices—up 11.2% from the previous month and nearly 60% from a year earlier—drove much of the increase . . . .").

52. David Uberti & Ryan Dezember, *Why Gas Bills Are Going Crazy—With No End in Sight,* WALL ST. J. (Mar. 15, 2023, 7:56 AM), https://www.wsj.com/articles/natural-gas-prices-energy-bills-ea3ea9da [https://perma.cc/3VJR-M89U] ("Homeowners and businesses across the country have seen their gas bills go wild . . . . Policy decisions from the White House . . . have exacerbated the situation . . . . [F]ederal officials have said they would boost gas exports to support U.S. allies, particularly in Europe."); Robert Rapier, *Why Natural Gas Prices Quadrupled in Two Years*, FORBES (Sept. 27, 2022, 6:00 AM) https://www.forbes.com/sites/rrapier/2022/09/27/why-natural-gas-prices-quadrupled-in-two-years [https://perma.cc/ADQ8-B3BH] (noting that European demand for LNG drove natural gas prices higher in the U.S.).

53. Even with the Biden Administration's "pause" on new export permits, projects already in development can still be completed. Yet exports obviously will increase even more if the pause is lifted, so new projects can be added as well. David Braziel, *Take Five - Gauging The Impact Of The DOE's Pause In LNG Export Licenses*, RBN ENERGY (Jan. 31, 2024), https://rbnenergy.com/take-five-gauging-

To sum up, energy supply shocks are still a challenge, even though the U.S. has become a net exporter of petroleum and gas. The traditional U.S. response has been to protect oil and gas suppliers, especially in the Middle East. The costs of defending these suppliers are a hidden price of fossil fuels.

C. DEPENDING LESS ON INSECURE SUPPLIERS

Is the U.S. stuck bearing these defense externalities? Or can these costs be reduced over time? In principle, there is another way to deal with supply shocks: instead of *defending* insecure suppliers, we can *depend less* on them. Admittedly, reducing reliance on these suppliers can be difficult, especially on short notice. Yet easing this dependence has become much more plausible than it used to be, and the right policies can accelerate this progress.

1. An Illustrative Example

To illustrate different responses to defense externalities, assume that two neighboring countries, Emirate and Warmonger, are both oil exporters. Unfortunately, Warmonger has been threatening to invade Emirate. If war breaks out, the two countries' combined exports of 4.3 million barrels per day will suddenly become unavailable.

The traditional way to avert this oil shock is for the U.S. and its allies to protect Emirate by issuing security guarantees and, if necessary, dispatching troops. If we replace "Emirate" with Kuwait and "Warmonger" with Iraq, this is precisely what happened in 1990.

Yet there are two other ways to avoid this oil shock. First, if another supplier can increase production by 4.3 million barrels per day, it can replace the exports from Emirate and Warmonger. To avoid extra defense costs, this supplier should be easy to defend. The U.S. obviously fits the bill, as do Canada, Brazil, Norway, Mexico, the U.K.,[54] and other secure jurisdictions.

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the-impact-of-the-does-pause-in-lng-export-licenses. Like natural gas prices, coal prices are also influenced by global trends, but still vary by location. As with natural gas, the cost of transporting coal is high compared with the cost of extracting it. As a result, redirecting it from one market to another is not always practical. *See, e.g.*, *Coal Explained: Coal Prices and Outlook*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/coal/prices-and-outlook.php [https://perma.cc/WYD7-ZTX8] ("In some cases . . . , transportation costs are more than the price of coal at the mine."); Peter Nagle & Kaltrina Temaj, *Energy Market Developments: Coal and Natural Gas Prices Reach Record Highs*, WORLD BANK BLOGS (July 19, 2022), https://blogs.worldbank.org/opendata/energy-market-developments-coal-and-natural-gas-prices-reach-record-highs [https://perma.cc/BU3Y-68PG] (noting that when Europe decided to boycott Russian coal in 2022, selling it "to other countries . . . will be costly as coal is bulky and expensive to transport").

54. Currently, they are the fourth, ninth, eleventh, thirteenth, and twentieth largest producers of crude oil in the world, respectively. *See Top 20 Oil Producing Countries in 2022*, OR NOIR AFRICA, https://ornoirafrica.com/en/top-20-des-pays-producteurs-de-petrole-en-2022 [https://perma.cc/3T6W-Z69Q].

If enough additional supply can be coaxed from secure countries, there is less need to defend insecure ones. In this way, energy development can be a substitute for military spending. National security is protected with wells and pipelines, instead of troops and fighter planes.

Second, the same is true of reductions in demand. There would be no oil shock if the global economy could cut consumption by 4.3 million barrels per day through fuel efficiency, renewable energy, mass transit, and the like. "Meeting more of the energy needs of the United States through alternative sources of energy," Bordoff and O'Sullivan have observed, "can lessen exposure to global markets by reducing U.S. consumption of oil and gas overall . . . ."[55] So, like new supply, efforts to reduce demand can be an alternative to military spending.

2. Reducing Dependence on Insecure Suppliers: Promising Trends

Admittedly, severing ties with a problematic supplier is sometimes quite challenging, especially in the short run. Indeed, after Russia invaded Ukraine in 2022, Europe's efforts to stop buying oil, gas, and coal from Russia were painful. Even so, replacing—instead of defending—a supplier has become more realistic in recent years, and the right policies can make this alternative even more plausible.

For example, if some oil from the Middle East becomes unavailable, do other suppliers have the potential to replace it? A promising candidate is the U.S., where production has surged in recent years, as noted above. This increase (about seven million barrels per day) is much more than the 4.3 million barrels per day that Iraq and Kuwait were exporting in 1990 when Iraq invaded. In other words, the recent U.S. increase is *almost twice* the size of the disruption the U.S. intervened to prevent in the First Gulf War.

The U.S. also has ample reserves of natural gas and coal. As long as the U.S. has the necessary LNG terminals and other infrastructure to transport these fossil fuels, it may be able to replace other gas and coal producers in a crisis, even if they serve markets far from the U.S.

Obviously, any effort to replace other suppliers is more effective, and thus more likely to reduce defense externalities, when the products are fungible. For example, LNG can replace natural gas from a pipeline (though LNG is more expensive). Likewise, coal and natural gas are plausible substitutes for each other since both generate electricity. Yet neither can

55. Bordoff & O'Sullivan, *By Not Acting on Climate, Congress Endangers U.S. National Security*, *supra* note 33.

substitute for oil, as long as oil (not electricity) is the main fuel for transportation.

Looking ahead, could the U.S. develop the potential to increase fossil fuel production even more in a crisis? Do U.S. firms have the capacity and incentives to ramp up? Could policymakers encourage them to do so? If the answer is "yes," this backup capacity would reduce the pressure to defend other suppliers.

This pressure would ease not only if the U.S. and its allies could *produce more* fossil fuel, but also if they *used less*. In a supply shock, prices do not spike as much if demand also contracts. Even if prices do rise, there is less harm if the economy is less reliant on fossil fuel.

This brings us to a second promising trend: even as demand for fossil fuel has increased worldwide (and especially in the developing world), the U.S. and its allies have become less dependent on fossil fuel in recent years. For example, the "energy intensity" of the U.S. economy—a measure of how much energy is needed to produce a given level of economic output—is less than half of what it was forty years ago.[56] Even as the population and economy have grown significantly, U.S. oil consumption has held steady at about 18.5 million barrels per day.[57] Vehicles and appliances have become more energy efficient,[58] and the U.S. economy depends less on energy intensive industries, such as manufacturing. In addition, renewable energy has become less expensive, and thus more common. It generated 12.61% of all energy used in the U.S. in 2021—a new high[59]—as well as 67% of new electric power generation in the first half of 2022.[60]

56. Specifically, energy intensity is energy consumption divided by GDP. *U.S. Energy Intensity Has Dropped by Half Since 1983, Varying Greatly by State*, U.S. ENERGY INFO. ADMIN. (Aug. 3, 2021), https://www.eia.gov/todayinenergy/detail.php?id=48976 [https://perma.cc/2CH4-PDE7].

57. The U.S. consumed 18.51 million bpd in 1970, and 18.684 million bpd in 2021. *See* U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY REVIEW (2012), https://www.eia.gov/totalenergy/data/annual/showtext.php?t=ptb0501a [https://perma.cc/5XNK-3ZGK]; *Oil Consumption in the United States From 1998–2021*, STATISTA (Mar. 2, 2023), https://www.statista.com/statistics/282716/oil-consumption-in-the-us-per-day [https://perma.cc/HMR5-PP2F].

58. For instance, over the next five years, greater fuel efficiency and increased use of electric cars are projected to save 1.85 million barrels of oil per day worldwide. INT'L ENERGY AGENCY, OIL 2021: ANALYSIS AND FORECAST TO 2026 28 (2021).

59. Ken Bossong, *US Renewable Energy Production in 2021 Hit an All-time High*, RENEWABLES NOW (Mar. 31, 2022, 11:40 AM) https://renewablesnow.com/news/us-renewable-energy-production-in-2021-hit-an-all-time-high-779202 [https://perma.cc/62P8-XG5V].

60. Michelle Lewis, *Wind, Solar Provide 67% of New US Electrical Generating Capacity in First Half of 2022*, ELECTREK (Aug. 15, 2022, 12:05 PM), https://electrek.co/2022/08/15/wind-solar-provide-67-of-new-us-electrical-generating-capacity-in-first-half-of-2022 [https://perma.cc/T7NM-MK4N]. Likewise, the global share of electricity from renewables reached 29% in 2020 (up from 27% in 2019). *Global Energy Review 2021: Renewables*, INT'L ENERGY AGENCY, https://www.iea.org/reports/global-energy-review-2021/renewables [https://perma.cc/J7R5-BGC6].

Can U.S. firms and households build on this progress? Can policymakers encourage this trend? Again, if the answer is "yes," there would be less pressure to defend insecure fossil fuel suppliers.

3. Encouraging Extra Supply

How can the U.S. and its allies keep reducing defense externalities? What else can they do to tap more supply from secure sources, while also cutting demand? How can policymakers reinforce these trends?

i. Stockpiles

A key challenge is timing. Supply shocks come on suddenly, but it takes time to tap new supply and reduce demand. Until these efforts bear fruit, the U.S. and its allies are exposed to higher prices. If these responses take years to implement, instead of weeks or months, there could be significant economic disruptions in the interim.

As a (partial) response, the U.S. and its allies can rely on stockpiles of fossil fuel, such as the Strategic Petroleum Reserve ("SPR") for oil.[61] "[E]mergency stocks could smooth economically harmful price spikes until markets are able to adjust," observed Jason Bordoff, Antoine Halff, and Akos Losz.[62]

Even so, a stockpile is more effective when the supply shock is temporary. Since a stockpile's supply is finite, the market knows it eventually will run out. The key question, then, is whether the stockpile can outlast the supply shock. If the answer is "yes"—for instance, while a pipeline is being repaired—prices should remain stable. But a stockpile is less effective when the shock is expected to persist, which is likely for a revolution, an invasion, or another geopolitical crisis.[63] Since market prices

61. *See generally* JASON BORDOFF, ANTOINE HALFF & AKOS LOSZ, COLUMBIA CTR. ON GLOB. ENERGY POL'Y, NEW REALITIES, NEW RISKS: RETHINKING THE STRATEGIC PETROLEUM RESERVE (2018), https://www.energypolicy.columbia.edu/sites/default/files/pictures/CGEP_Rethinking_the_Strategic_Petroleum_Reserve_June2018.pdf [https://perma.cc/SMB3-XEZW] (analyzing the continuing need for strategic petroleum reserve in the U.S.). These stockpiles are either physically stored (as in the U.S.) or required of refiners. Similarly, Germany and other European countries have storage facilities for natural gas. *Europe's Underground Gas Storage Sites*, PROSPERO EVENTS GRP. (Dec. 3, 2021), https://www.prosperoevents.com/europes-underground-gas-storage-sites-2 [https://perma.cc/F5RJ-ZCUL]; Arne Delfs, *Germany Takes Control of Gazprom Unit to Ensure Energy Supply*, BLOOMBERG (Apr. 4, 2022), https://www.aljazeera.com/economy/2022/4/4/germany-takes-control-of-gazprom-unit-to-ensure-gas-supply [https://perma.cc/Y6JP-7L39].

62. BORDOFF ET AL., *supra* note 61, at 6.

63. Richard G. Newell & Brian C. Prest, *Informing SPR Policy Through Oil Futures and Inventory Dynamics* 2 (Nat'l Bureau of Econ. Rsch., Working Paper No. 23974, 2017), https://ideas.repec.org/p/nbr/nberwo/23974.html [https://perma.cc/YJ3D-J96R] ("SPR releases are more effective and appropriate in response to temporary supply shocks, and less so in the face of persistent shocks.").

are forward-looking, they will still rise, even when supply from the stockpile is released, because everyone knows the extra supply is only temporary.[64]

As a result, a stockpile alone cannot address supply shocks. Other measures are also needed, which either increase supply or reduce demand. A shock is averted only if the market expects these measures to kick in before the stockpile runs out.

ii. Spare Capacity

When the solution is new supply, it needs to get to market quickly. Yet, although firms have economic incentives to ramp up production when prices rise, a rapid pace often is not feasible.

"Generally speaking, the oil industry is highly capital intensive and relatively slow moving," observed Bordoff, Halff, and Losz.[65] "Most oil development projects cost billions of dollars and take years to bring into production."[66] Natural gas projects have an added challenge, emphasized above: transporting gas requires either pipelines or liquefaction facilities, which take years to build.

Fortunately, some suppliers can respond more quickly. In the oil market, the fastest response is what the International Energy Agency calls "spare capacity": additional production that comes online within thirty days and lasts for more than ninety days. This pace usually is feasible only for Saudi Arabia. It "maintains the largest spare capacity and has historically played the role of 'swing' supplier," explained Bordoff, Halff, and Losz, "adjusting production in line with market conditions."[67]

Even so, Saudi Arabia is not always able (or willing) to ramp up oil production. For example, after Russia invaded Ukraine, the Saudis agreed to only a minor increase.[68] A few months later, they cut production,

64. Hopefully, SPR releases can keep prices from surging even higher. For example, oil prices still spiked after Russia invaded Ukraine, even though President Biden responded with the largest SPR release in history. *See* Adam Aton, *Biden's Use of Oil Reserves Overshadows Past Presidents*, E&E NEWS (Oct. 20, 2022, 6:53 AM), https://www.eenews.net/articles/bidens-use-of-oil-reserves-overshadows-past-presidents [https://perma.cc/VXK7-KUYA] (reporting that Biden released 50 million barrels in response to price increases in the months before the invasion, another 180 million shortly after the invasion, and another 15 million in October of 2022); Press Release, U.S. Dep't of Treasury, The Price Impact of the Strategic Petroleum Reserve Release (July 26, 2022), https://home.treasury.gov/news/press-releases/jy0887 [https://perma.cc/9NW2-24KV] (concluding that SPR release lowered gas prices by 17 to 42 cents per gallon).

65. BORDOFF ET AL., *supra* note 61, at 19.

66. *Id*.

67. *Id.* at 20.

68. Ryan Hogg, *Saudi Arabia Can't Increase Oil Production Further in the Medium Term, Crown Prince Mohammad bin Salman Reportedly Said*, BUS. INSIDER (July 16, 2022, 5:54 AM), https://www.businessinsider.com/saudi-arabia-agrees-to-boost-oil-production-after-biden-visits-2022-7 [https://perma.cc/K4HC-JUUH].

disregarding a U.S. request to pump at capacity.[69]

As this disagreement highlighted, Saudi and U.S. interests sometimes diverge. For one thing, the Saudis benefit from high oil prices. The U.S. and the Saudis also have clashed over Saudi ties to Russia, U.S. diplomatic approaches to Iran (the Saudis' main regional rival), and the murder of a dissident Saudi journalist. The relationship was further strained by Joe Biden's comments on the kingdom while running for President: asserting that there was "very little social redeeming value in the present government in Saudi Arabia," he pledged to make them "the pariah that they are."[70] Indeed, ties between the Biden Administration and the Saudi leadership were so frayed that when the Saudis restored diplomatic relations with Iran in 2023, they worked through China instead of the U.S., a step that was "a real slap in the face to Biden."[71]

iii. Increasing Supply in Other Ways and Reducing Demand

Instead of relying on Saudi Arabia to stabilize global oil markets, the U.S. would be better off developing its own backup capacity, which could be tapped in a crisis. But is this feasible? Can U.S. oil producers ramp up quickly enough to play this role? What about the U.S. natural gas industry? How can policymakers encourage faster responses?

In general, the answer depends on the type of well and the availability of key infrastructure. Offshore wells take years for permitting, construction, and drilling, costing billions of dollars. But fortunately, drilling in shale is different.[72] The "ability of US shale producers to ramp output up or down relatively quickly in response to price signals or changing market conditions," Bordoff, Halff and Losz have explained, "could be seen as a form of insurance against disruption risks . . . ."[73] The same is true of new

69. Dmitry Zhdannikov, Steve Holland & Jarrett Renshaw, *OPEC+ Oil Output Cut Shows Widening Rift Between Biden and Saudi Royals*, REUTERS (Oct. 8, 2022, 12:46 AM), https://www.reuters.com/world/opec-oil-output-cut-shows-widening-rift-between-biden-saudi-royals-2022-10-07 [https://perma.cc/7CY7-F25E].

70. Alex Emmons, Aída Chávez & Akela Lacy, *Joe Biden, In Departure from Obama Policy, Says He Would Make Saudi Arabia a "Pariah,"* INTERCEPT (Nov. 20, 2019, 9:52 PM), https://theintercept.com/2019/11/21/democratic-debate-joe-biden-saudi-arabia [https://perma.cc/W6GQ-5AK7].

71. Stephen Kalin, Benoit Faucon, Vivian Salama & David S. Cloud, *Saudi Arabia, Iran Restore Relations in Deal Brokered by China*, WALL ST. J. (Mar. 10, 2023, 2:07 PM), https://www.wsj.com/articles/saudi-arabia-iran-restore-relations-in-deal-brokered-by-china-406393a1 [https://perma.cc/K5CQ-K33C] (quoting Aaron David Miller, a veteran U.S. negotiator in the Middle East).

72. Nick Lioudis, *Oil and Gas Production Timelines*, INVESTOPEDIA (Sept. 30, 2022), https://www.investopedia.com/ask/answers/061115/how-long-does-it-take-oil-and-gas-producer-go-drilling-production.asp [https://perma.cc/PRX8-3MFT] ("Shale wells can be drilled in two to four weeks and brought on line within months, while offshore wells are costlier and can take much longer.").

73. BORDOFF, ET AL., *supra* note 61, at 19.

natural gas wells in shale.

Yet even if wells can be drilled quickly, pipelines and other infrastructure are needed to bring oil and gas to market. Even so, with the right infrastructure in place—and, more generally, with the right policies—the U.S. could take advantage of the elasticity of shale production to respond to supply shocks. Part V of this Article explores this possibility, and the synergies and tradeoffs it presents for national security and the environment.

To become less dependent on insecure suppliers, the U.S. and its allies also should reduce demand. Like new supply, this response takes time but, again, the right policies can accelerate it. Part IV explores the national security and environmental implications of promoting energy efficiency and renewable energy.

Admittedly, neither of these strategies—increased supply or reduced demand—is easy to execute on short notice.[74] But the same is true of an effective military response. All of these efforts require long-term investment and preparation.

The fundamental question, then, is which response maximizes welfare. To head off supply shocks—and, more generally, to access energy at the lowest social cost—is it better to build aircraft carriers, drill new wells, or install electric vehicle charging stations? The answer is a combination of measures—not just military responses, but also new sources of fossil fuel, as well as efforts to use less of it.

D. DIVISION OF LABOR BETWEEN THE PRIVATE AND PUBLIC SECTORS

Which institutions are supposed to pursue these various goals? Unlike in some countries, the U.S. does not have government-owned energy companies, which could be tasked with implementing government policy along with earning profits.

By relying instead on the private sector, the U.S. reaps familiar benefits. In a competitive market, private firms have strong incentives to cut costs and experiment with new approaches. In this way, the private sector sometimes delivers transformative innovations, such as the U.S. shale boom.[75]

Yet a familiar downside of private firms is that they do not minimize negative externalities, such as the national security and environmental costs in this Article. Rather, addressing these externalities requires a government response. Policymakers can choose from a range of policy instruments,

74. DEUTCH ET AL., *supra* note 47, at 23 ("In general, policies intended to affect consumption or supply are slow to take effect.").

75. Thomas W. Merrill & David M. Schizer, *The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy*, 98 MINN. L. REV. 145, 148 (2013).

including Pigouvian taxes, permitting policies, subsidies, moratoriums, and mandates. Part VI surveys various options, highlighting their advantages and disadvantages.

E. OBJECTIONS TO CONSIDERING DEFENSE EXTERNALITIES IN ENERGY POLICY

So far, this Part has argued that depending on fossil fuel adds to the defense budget, and that policymakers need to account for this cost in evaluating the merits of different energy sources. However, other commentators have taken the opposite view, urging policymakers to omit defense externalities from this analysis. Douglas Bohi and Michael Toman made this case in an influential 1996 book.[76] Several other commentators have followed their lead,[77] as have a number of U.S. government agencies. For example, a 2018 analysis of tougher fuel economy standards omitted the national security advantages of using less petroleum,[78] as did a 2009 National Research Council study[79] and a 1992 Congressional Research Service report.[80] The literature has offered two reasons to ignore defense externalities, and this Section shows why neither is persuasive.[81]

76. BOHI & TOMAN, *supra* note 5, at 53–54.

77. Metcalf, *supra* note 4; PARRY & DARMSTADTER, *supra* note 4, at 15 ("US military expenditures in the Middle East are in part the result of US 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 US oil imports."). Although a 2006 Council of Foreign Relations study does not cite Bohi and Toman, it echoes their argument. DEUTCH ET AL., *supra* note 47, at 29 (noting that the U.S. "will depend on the Persian Gulf" for oil for the next twenty years and that, even if it did not, "there would be reasons to maintain a substantial military capability in the region").

78. *See* The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, 83 Fed. Reg. 42986, 43211 n.426 (Aug. 24, 2018) ("While the U.S. maintains a military presence in certain parts of the world to help secure global access to petroleum supplies, that is neither the primary nor the sole mission of U.S. forces overseas. Additionally, the scale of oil consumption reductions associated with CAFE standards would be insufficient to alter any existing military missions focused on ensuring the safe and expedient production and transportation of oil around the globe."); *see also* EPA, PROPOSED DETERMINATION ON THE APPROPRIATENESS OF THE MODEL YEAR 2022–2025 LIGHT-DUTY VEHICLE GREENHOUSE GAS EMISSIONS STANDARDS UNDER THE MIDTERM EVALUATION: TECHNICAL SUPPORT DOCUMENT Section 3.5.2.4, at 3-35 to 3-36 (2016) ("Military Security Cost Components of Energy Security") ("[I]t is unclear that incremental reductions in either U.S. imports, or consumption of domestic petroleum, would produce incremental changes to the military expenditures related to the oil protection mission." (citation omitted)).

79. NAT'L RSCH. COUNCIL OF THE NAT'L ACADS., *supra* note 4, at 333 ("[T]he marginal cost is essentially zero. This view is held by a number of other researchers in the area, including Bohi and Toman (1995). The committee adopts this position.").

80. CARL E. BEHRENS, JOHN E. BLODGETT, MARTIN R. LEE, JOHN L. MOORE & LARRY PARKER, CONG. RSCH. SERV., 92–574–ENR, THE EXTERNAL COSTS OF OIL USED IN TRANSPORTATION 31 (1992) ("The security cost of oil . . . is either insignificant or ponderous, depending on the assumptions made.").

81. I have made these arguments in earlier work as well. *See* Schizer, *Energy Subsidies, supra* note 6, at 256–58.

1. Many Factors Influence Defense Policy

The first argument is that energy is just one of many factors affecting the defense budget, so its impact is too hard to isolate.[82] "Until an effort that yields a credible measure of the externality involved is completed," Bohi and Toman wrote, "this externality is too uncertain to be used in determining energy policy."[83]

But even when a cost is difficult to quantify, we should not simply ignore it. After all, we do not do this with climate externalities, even though they are hard to measure.[84] Instead, the right approach is to use the best available estimate, however imperfect it is.

For example, a 2018 study concluded that the Pentagon spends 16% of its general operating budget to protect Middle Eastern oil.[85] To cover this cost, U.S. gasoline taxes would have to increase by 28 cents per gallon[86] (and by an additional 70 cents to fund the wars in Afghanistan and Iraq).[87] Admittedly, this estimate may be off the mark. Other studies propose estimates of their own—some higher, some lower—by using different methodologies and assumptions.[88] The goal here is not to defend a particular estimate, but to show that these costs are too substantial to ignore.

2. Can Shifts in Energy Markets Change the Defense Budget?

Second, these commentators argue that energy policy should ignore the cost of defending fossil fuel, not only because this cost is hard to measure, but also because it is fixed. In their view, the U.S. is stuck protecting insecure suppliers, and energy policy cannot do anything about it. For example, even if U.S. energy policy delivers modest increases in energy efficiency and in domestic oil and gas production, the U.S. would still have to defend the Middle East.[89]

82. *See* CRANE ET AL., *supra* note 34, at 59 ("[M]ilitary forces are . . . multipurpose and fungible . . . . It is . . . difficult to distill the genesis of a military operation to a unitary aim.").

83. BOHI & TOMAN, *supra* note 5, at 54.

84. Schizer, *Energy Subsidies*, *supra* note 6, at 256–57.

85. SAFE, *supra* note 40 (offering an estimate based on the average of seven other studies).

86. *Id*. These calculations are in 2017 dollars.

87. *Id*.; *see also* Joseph E. Stiglitz & Linda J. Bilmes, *Estimating the Costs of War: Methodological Issues, with Applications to Iraq and Afghanistan*, *in* OXFORD HANDBOOK OF THE ECON. OF PEACE AND CONFLICT 3 (Michelle R. Garfinkel & Stergios Skaperdas eds., 2012) ("Some argued that the invasion of Iraq was motivated largely by a desire to control the supply of oil."). Again, SAFE's calculations are in 2017 dollars.

88. *See* SAFE, *supra* note 40 (surveying other studies).

89. BOHI & TOMAN, *supra* note 5, at 53 ("[M]ilitary security expenditures are a fixed cost, and their internalization in the price of oil will not solve the problem that they are intended to address."); Metcalf, *supra* note 4, at 168 ("[A] marginal (or even inframarginal) reduction in oil consumption may not affect our national security planning or spending significantly.").

While this argument is persuasive for *limited changes*, there have been *major shifts* since Bohi and Toman made this claim in 1996. As emphasized above, domestic production of oil and gas has surged, while energy efficiency and renewable energy have enabled the U.S. and its allies to depend less on fossil fuel. If government policy can accelerate these trends, there will be less pressure to defend insecure suppliers.

To sum up, American dependence on fossil fuels has added to U.S. military and foreign policy burdens. These "defense externalities" are a hidden price of oil and gas. To reduce the cost of defending insecure suppliers, the U.S. and its allies need to depend less on them. The answer is a two-pronged strategy, which reduces demand for fossil fuel, while also tapping new supply in the U.S. and other secure locations.

II. FUNDING EXTERNALITIES: ANOTHER COST OF DEPENDING ON THE WRONG SUPPLIERS

While the last Part analyzed the cost of *protecting* fossil fuel suppliers, this Part considers the cost of *strengthening* them. Unfortunately, some energy exporters use fossil fuel revenue to pay for harmful conduct. For example, Russia's energy exports have financed its war in Ukraine. Buying from bad actors can facilitate their threatening behavior. Like defense externalities, these "funding externalities"—the national security costs of providing revenue to dangerous suppliers—do not appear in the price of energy.

So how should policymakers respond? As with defense externalities, the key is to depend less on the wrong suppliers. Again, the U.S. and its allies should use less fossil fuel, while also finding other (friendly) suppliers. Even so, some commentators urge policymakers to ignore funding externalities, so the last Section of this Part responds to their claims.

A. NATIONAL SECURITY RISKS FROM DANGEROUS SUPPLIERS

There are national security risks from depending not only on *insecure* suppliers, but also on *threatening* ones. "Governments of some countries openly hostile to the United States . . . ," the RAND Corporation observed, "rely on oil exports for most of their budget revenues."[90] They use this revenue to pursue harmful agendas both abroad and at home.[91] Unfortunately, buying from these suppliers undermines national security by

90. CRANE ET AL., *supra* note 34, at 43; *see also* DEUTCH, ET AL., *supra* note 47, at 26 ("[T]he control over enormous oil revenues gives exporting countries the flexibility to adopt policies that oppose U.S. interests and values.").

91. *See* Schizer, *Energy Subsidies*, *supra* note 6, at 258–60.

facilitating this threatening behavior.

1. Funding War, Terrorism, and Other Threats

Let us begin with the harm these suppliers cause outside their borders. Russia is the quintessential example. In 2022, its energy exports paid for its invasion of Ukraine. Before the war, Russia was the world's largest exporter of oil and natural gas[92] and Europe's main supplier.[93] Russia was also the world's third largest exporter of coal in 2021 (behind Australia and Indonesia and ahead of the U.S.).[94] Since Russia's largest energy companies were state owned and private producers were heavily taxed,[95] nearly half of the Russian government's revenue in 2021 came from energy exports.[96] "Increased production and long periods of high prices gave President Vladimir Putin the resources to beef up Russia's army and throw his weight around," Ricardo Hausmann has observed.[97]

Since the costs of "throwing his weight around" did not appear in the market price, consumers did not account for them in deciding how much fossil fuel oil to buy. Europe kept paying Russia for energy, even as troops amassed on the Ukrainian border. Once the war began, the human toll from these purchases became clear: hundreds of thousands of casualties, millions of displaced civilians, and massive economic dislocation.[98] As the foreign

92. YERGIN, *supra* note 23, at 71. Russia was the third largest producer of oil (after the U.S. and Saudi Arabia), the second largest producer of natural gas (after the U.S.), and the largest exporter of both commodities.

93. *Energy Fact Sheet*, *supra* note 2. Russia supplied 40% of Europe's natural gas, *id.*, as well as more than 25% of its imported crude oil. Charlotte Edmond, *How Much Energy Does the EU Import from Russia?*, WORLD ECON. F. (Mar. 17, 2022), https://www.weforum.org/agenda/2022/03/eu-energy-russia-oil-gas-import [https://perma.cc/H5EJ-KW2Z].

94. Daniel Workman, *Coal Exports by Country*, WORLD'S TOP EXPORTS, https://www.worldstopexports.com/coal-exports-country [https://perma.cc/K56V-8JCC].

95. *See* Jennifer Josefson & Alexandra Rotar, *Oil and Gas Regulation in the Russian Federation: Overview*, THOMPSON REUTERS PRACTICAL LAW (Apr. 1, 2021), https://uk.practicallaw.thomsonreuters.com/0-527-3028 [https://perma.cc/XF3F-L494] (describing complex system of subsoil license fees, taxes on revenue and extraction, export duties, and other taxes).

96. *Energy Fact Sheet*, *supra* note 2 ("Russia relies heavily on revenues from oil and natural gas, which in 2021 made up 45% of Russia's federal budget.").

97. Ricardo Hausmann, *How to Eat Russia's Oil Lunch*, PROJECT SYNDICATE (Mar. 31, 2022), https://www.project-syndicate.org/commentary/how-to-reduce-russias-share-of-global-oil-market-by-ricardo-hausmann-2022-03 [https://perma.cc/3ZDW-TVKT].

98. Helene Cooper, *Russia and Ukraine Each Have Suffered Over 100,000 Casualties, the Top U.S. General Says*, N.Y. TIMES (Nov. 10, 2022), https://www.nytimes.com/2022/11/10/world/europe/ukraine-russia-war-casualties-deaths.html [https://perma.cc/2UKJ-TT2C] (explaining that the U.S. estimates 200,000 military and 40,000 civilian casualties and 15 to 30 million displaced civilians); Valerie Hopkins, Neil MacFarquhar, Steven Erlanger & Michael Levenson, *100 Days of War: Death, Destruction, and Loss*, N.Y. TIMES (June 3, 2022), https://www.nytimes.com/2022/06/03/world/europe/russia-ukraine-war-100-days.html [https://perma.cc/YA9X-J77V] (explaining the U.N. estimates that Ukraine's GDP fell by 50% in 2022. Half of Ukraine's businesses closed, 4.8 million jobs were lost, and 90% of the population were at risk of

minister of Lithuania put it, "buying Russian oil and gas is financing war crimes."[99] Yet even as the war raged, Russia still earned nearly $1 billion per day exporting energy. Although the U.S. and its allies tried to stop buying from Russia, soaring oil prices—stoked in part by the war itself—kept Russia's coffers full in the months following the invasion.[100]

Russia is not the only fossil fuel exporter that threatens the U.S. and its allies. Iran uses export revenue to finance its nuclear program,[101] as well as terrorist organizations such as Hamas and Hezbollah.[102] Venezuela poses a threat to its neighbors,[103] and Saudi Arabia funds institutions that promote Islamic extremism.[104]

2. Extortion

Hostile fossil fuel exporters can threaten others by harnessing not just the revenue they earn, but also the leverage they exert.[105] To influence their buyers' policies, exporters can use fossil fuel as a carrot (by dangling favorable terms) or a stick (by threatening to stop selling).

Again, Russia's invasion of Ukraine is a paradigmatic example. When Europe supported Ukraine, Russia retaliated by reducing the flow of natural gas, causing prices in Europe to skyrocket.[106] The goal was to pressure

poverty).

99. Jake Epstein, *Lithuania's Top Diplomat Says Buying Russian Oil and Gas is 'Financing War Crimes' and Urges EU Not to Be 'an Accomplice,'* BUS. INSIDER (Apr. 4, 2022, 8:39 AM), https://www.businessinsider.com/lithuania-diplomat-says-buying-russian-oil-financing-war-crimes-ukraine-2022-4 [https://perma.cc/5WRP-UVTD] (quoting Gabrielius Landsbergis).

100. Hiroko Tabuchi, *Russia's Oil Revenue Soars Despite Sanctions, Study Finds*, N.Y. TIMES (June 13, 2022), https://www.nytimes.com/2022/06/13/climate/russia-oil-gas-record-revenue.html [https://perma.cc/GG9N-C7QL] (citing new study by the Center for Research on Energy and Clean Air, a research organization based in Helsinki, Finland).

101. CRANE ET AL., *supra* note 34, at 45–48.

102. *Id.* at 56–57.

103. *Maduro Government a Threat to U.S. National Security: Pompeo*, REUTERS (Apr. 10, 2019, 9:05 AM), https://www.reuters.com/article/us-venezuela-politics-pompeo/maduro-government-a-threat-to-u-s-national-security-pompeo-idUSKCN1RM25K [https://perma.cc/Y5CU-8YCA] (statement of Secretary of State Mike Pompeo) ("I don't think there is any doubt that . . . the Maduro regime presents a threat to the United States of America."). In November 2022, the U.S. shifted gears, allowing Venezuela to resume energy exports. Although the stated reason was to recognize the Maduro government's willingness to engage in talks with the opposition, commentators believe the U.S. also was trying to bring down global oil prices, which spiked after Russia invaded Ukraine. *See* Matt Daily, *Biden Gives Chevron Permit to Restart Venezuelan Oil Sales*, POLITICO (Nov. 26, 2022, 3:08 PM), https://www.politico.com/news/2022/11/26/biden-chevron-permit-venezuelan-oil-sales-00070836 [https://perma.cc/W8PH-M5V4].

104. CRANE ET AL., *supra* note 34 (noting Saudi financing of Wahhabi religious institutions).

105. DEUTCH ET AL., *supra* note 47 ("[C]ountries dependent on imports subtly modify their policies to be more congenial to suppliers.").

106. The Nord Stream 1 pipeline, connecting Russia and Germany, first slowed gas deliveries, then stopped them entirely, and then was damaged in explosions that many attribute to sabotage. Melissa Eddy, *Pipeline Breaks Look Deliberate, Europeans Say, Exposing Vulnerability,* N.Y. TIMES (Sept. 27, 2022),

Europeans to "vote their pained pocketbooks," Daniel Yergin and Michael Stoppart explained.[107] "The ultimate aim is to bring governments to power in Europe that aren't committed to supporting Ukraine . . . ."[108]

Unfortunately, Europe could not easily replace Russian gas on short notice. The price of LNG skyrocketed—even as U.S. firms redirected their LNG exports from Asia to Europe—because there were not enough liquefaction facilities to meet Europe's needs.[109] These shortages exacted a severe economic toll as inflation spiked and the economy slowed.[110] This energy crisis exposed the geopolitical cost of depending on Russia, empowering it not only with export revenue, but also with the ability to turn off the spigot.

3. Entrenching Repressive Regimes

Buying from hostile petrostates empowers them to harm not just the U.S. and its allies, but also their own people. Authoritarian leaders often use this revenue to line their own pockets and stay in power.[111] Again, this cost does not appear in the price at the pump.

Venezuela is a tragic example. Despite its vast oil reserves,[112] Venezuela has faced hyperinflation and a steep decline in GDP in recent years.[113] The poverty rate is 90%, and food shortages caused the average

https://www.nytimes.com/2022/09/27/world/europe/pipeline-leak-russia-nord-stream.html [https://perma.cc/GVU4-X4LB]; Adam Entous, Julian E. Barnes & Adam Goldman, *Intelligence Suggests Pro-Ukrainian Group Sabotaged Pipelines, U.S. Officials Say*, N.Y. TIMES (Mar. 7, 2023), https://www.nytimes.com/2023/03/07/us/politics/nord-stream-pipeline-sabotage-ukraine.html [https://perma.cc/EK74-58ZP] ("New intelligence reviewed by U.S. officials suggests that a pro-Ukrainian group carried out the attack on the Nord Stream pipelines.").

107. Daniel Yergin & Michael Stoppard, *Winter in Europe May Be Springtime for Putin*, WALL ST. J. (Aug. 3, 2022, 6:28 PM), https://www.wsj.com/articles/winter-in-europe-may-be-springtime-for-putin-ukraine-energy-gas-supplier-war-european-union-shipments-pipeline-11659556722 [https://perma.cc/6DNM-FJLC].

108. *Id*.

109. Marianna Parraga, *More U.S. LNG Heads to Europe Despite Output Constraints*, REUTERS (Oct 3, 2022, 12:16 PM), https://www.reuters.com/business/energy/more-us-lng-heads-europe-despite-output-constraints-2022-10-03 [https://perma.cc/FYC7-T58G].

110. Andreas Walstad, *Energy Prices Trigger EU Inflation, Poor Worst Hit*, POLITICO (Nov. 28, 2022, 6:00 AM), https://www.politico.eu/sponsored-content/energy-prices-trigger-eu-inflation-poor-worst-hit [https://perma.cc/4X4N-LNMP] (noting added burden on European households because of higher energy prices).

111. *See* DEUTCH, ET AL, *supra* note 47*,* at 9 ("Too often, these revenues accrue to a small minority that is unaccountable to any representative political authority.").

112. Amelia Cheatham*,* Diana Roy & Rocio Cara Labrador, *Venezuela: The Rise and Fall of a Petrostate*, COUNCIL ON FOREIGN RELS. (Dec. 29, 2021, 10:30 AM), https://www.cfr.org/backgrounder/venezuela-crisis [https://perma.cc/R486-M4AC].

113. GDP fell by roughly two-thirds from 2014 to 2020. *Id.* Inflation reached an all-time high of 344,509.50% in February of 2019. *Venezuela Inflation Rate*, TRADING ECON., https://tradingeconomics.com/venezuela/inflation-cpi [https://perma.cc/22T9-7P22]. The rate fell to a

citizen to lose 24 pounds in 2017.[114] Meanwhile, President Nicolás Maduro's "policies are marked by authoritarianism, intolerance for dissent, and violent and systematic repression of human rights and fundamental freedoms."[115]

Even so, Maduro clings to power by exporting oil. These sales represent 99% of the nation's export earnings and about 25% of its GDP.[116] Maduro controls this revenue, using it to maintain the military's support and reward political allies.[117]

To sum up, there are national security risks from buying oil and gas from Russia, Iran, and other threatening suppliers. These "funding externalities" arise when suppliers use export revenue to finance wars and terrorism abroad and repressive policies at home.

B. DEPENDING LESS ON HOSTILE SUPPLIERS

So what should the U.S. and its allies do? How can they reduce these funding externalities? As with defense externalities, the key is to depend less on the wrong suppliers. Indeed, since the responses are so similar, the discussion here can be brief.

To avoid empowering hostile suppliers, the U.S. and its allies should stop buying from them, while encouraging others to do the same. But if these commercial ties need to be severed quickly, there is a risk of a supply shock. Indeed, this is what happened after Russia invaded Ukraine, prompting Europe to wean itself off of Russian oil, gas, and coal.[118]

How can the U.S. and its allies mitigate these supply shocks? As with defense externalities, the answer is a two-part effort. Along with reducing demand, they should tap more supply in friendly countries, such as the U.S., Canada, Mexico, Brazil, Norway, Israel, Cyprus, and the U.K.

(still extreme) 686.4% in 2021. Nicolle Yapur, *Venezuela Breaks One of World's Longest Hyperinflation Bouts*, BLOOMBERG (Jan. 14, 2022, 1:10 PM), https://www.bloomberg.com/news/articles/2022-01-14/venezuela-breaks-one-of-world-s-longest-hyperinflation-bouts [https://perma.cc/D3ZF-NM2R].

114. Robert Valencia, *Venezuelans Are Losing a Lot of Weight Amid Money Crisis*, NEWSWEEK (Feb. 22, 2018, 4:30 PM), https://www.newsweek.com/venezuelans-are-losing-lot-weight-amid-money-crisis-816886 [https://perma.cc/LS56-4UUM].

115. *U.S. Relations with Venezuela: Bilateral Relations Fact Sheet*, U.S. DEP'T OF STATE), https://www.state.gov/u-s-relations-with-venezuela [https://perma.cc/APR8-FSAN].

116. Cheatham et al., *supra* note 112.

117. Scott Morgenstern & John Polga-Hecimovich, *Why Venezuela's Oil Money Could Keep Undermining its Economy and Democracy*, CONVERSATION (Feb. 8, 2019, 6:35 AM), https://theconversation.com/why-venezuelas-oil-money-could-keep-undermining-its-economy-and-democracy-111013 [https://perma.cc/S49F-CZGU] ("He installed military cronies as managers . . . . [C]orruption has run rampant.").

118. *See supra* Sections II.A.1 & 2.

In responding to funding externalities, the U.S. and its allies face an additional challenge, which does not arise with defense externalities: persuading *other countries* to stop buying from the relevant supplier.

Why the difference? Either way, the U.S. and its allies do not buy from the supplier, but the reason is different. With defense externalities, the supplier *cannot* sell (for example, because it has been invaded). In contrast, with funding externalities, the supplier might still *want to sell*, but the U.S. and its allies *do not want to buy* from it (for example, because it has launched an invasion).

In refusing to buy, their goal is to deprive the supplier of revenue, and thus to reduce its military and economic power. Yet this goal will not be achieved if the supplier can simply sell to other buyers. To discourage these other buyers, the U.S. and its allies can try a range of policies, including embargoes, tariffs, price caps, restrictions on financing and insuring cargoes, sanctions on buyers, and the like.

Admittedly, these policies can be hard to enforce. Some countries will not adopt them. Hostile suppliers also might evade them with deception (for example, by selling through intermediaries, falsifying records, and so forth).

Fortunately, however, even porous sanctions can still reduce funding externalities, as long as they force the hostile supplier to sell at a discount, eroding the funding for its harmful agenda. For example, even though China and India did not join the U.S.-led embargo of Russian oil in 2022, they bought this oil at a steep discount.[119]

C. OBJECTIONS TO CONSIDERING FUNDING EXTERNALITIES IN ENERGY POLICY

While this Article warns about risks from buying fossil fuel from hostile suppliers and offers a strategy to deal with these funding externalities, some commentators are not troubled by these risks. In their view, the real problem is with the hostile regime itself, not with the commodities it exports, and that sometimes the best way to moderate the regime is to buy its energy. This Section responds to these claims.

119. *Russian Oil Selling at 30% Discount to Global Benchmark, Data Show*, BLOOMBERG (May 31, 2022, 3:56 AM), https://www.bloomberg.com/news/articles/2022-05-31/the-deepening-discounts-on-russian-oil-in-the-country-s-own-data [https://perma.cc/7GE5-MYX3]. The discount has narrowed as Russia has figured out more ways to evade Western sanctions. Lisa Shidler, *Not Giving In - Is The G-7'S Price Cap On Russian Crude Oil Exports Having Its Intended Effect?*, RBN ENERGY (Jan. 30, 2024), https://rbnenergy.com/not-giving-in-is-the-g7s-price-cap-on-russian-crude-oil-exports-having-its-intended-effect (noting that discount on Russian crude has gone from $40 in early 2023 to $17 in the second half of 2023).

1. The Problem is the Regime, Not its Fossil Fuel Exports

Even though a number of fossil fuel exporters pose a threat to the U.S. and its allies, some commentators urge us to distinguish between these regimes, on the one hand, and their exports, on the other.[120] This argument is a bit like the mantra of some gun rights advocates: "Guns don't kill people, people kill people."[121] In this spirit, "fossil fuel exports don't harm people, exporting regimes do."

They are right that not all fossil fuel exporters are threatening. After all, Canada and Norway are major exporters.[122] At the same time, some potentially threatening regimes are not fossil fuel exporters, including China and North Korea.[123]

But unfortunately, some fossil fuel exporters clearly do pose a threat to the U.S. and its allies, including Russia and Iran. Their fossil fuel exports give them more power to pursue their threatening ambitions. Indeed, if the invasion of Ukraine in 2022 has taught us anything, it has revealed the folly of ignoring defense costs in energy policy. The willingness of Europe—and of Germany in particular—to become so dependent on Russian energy has turned out to be a grave mistake.

In Russia, Iran, and other energy producers, energy exports do not just *facilitate* harmful behavior; in some cases, they actually *cause* it. As Michael Ross has argued, a government funded by energy exports is less accountable,[124] and thus is more likely to pursue reckless policies. To extract oil and gas, the government can rely on a small fraction of the population (or on foreign partners).[125] So, instead of depending on the labor, tax dollars, and the good will of its people, the regime can use export revenue to fund a police state, buy off dissent, and control the press.[126] This revenue also can cause a "resource curse," undermining entrepreneurship, diversified growth,

120. *See, e.g.*, CRANE ET AL., *supra* note 34, at 57 ("[O]il revenues provide a means, not a motivation.").

121. Michael Shammas, *It's Time to Retire the 'Guns Don't Kill People—People Kill People' Argument. Guns DO kill People*, MEDIUM (Apr. 5, 2018), https://medium.com/@mshammas/its-time-to-retire-the-guns-don-t-kill-people-people-kill-people-argument-60d91889f806 [https://perma.cc/X5HS-BAZF] (critiquing view of gun control opponents that "guns don't kill people, people kill people").

122. Daniel Workman, *Crude Oil Exports by Country*, WORLD'S TOP EXPORTS, https://www.worldstopexports.com/worlds-top-oil-exports-country [https://perma.cc/CKL3-GM3X].

123. As the 2009 RAND study put it, "Oil exports are not a necessary condition for financing rogue states." CRANE ET AL., *supra* note 34, at 43.

124. MICHAEL L. ROSS, THE OIL CURSE: HOW PETROLEUM WEALTH SHAPES THE DEVELOPMENT OF NATIONS 74 (2012) (explaining that oil rich countries are 50% more likely to be ruled by autocrats and none have successfully become democracies between 1960 and 2010).

125. *See, e.g.*, *id.* (noting that oil and gas accounts for 90% of Saudi Arabia's GDP but employs only 1.6% of population).

126. *Id.* at 63.

and the social rights they facilitate.[127] For a regime presiding over this sort of stagnant economy, an aggressive foreign policy can rally domestic support, tapping into nationalist sentiment, justifying military expenditures that keep the military on its side, and distracting citizens from the regime's failings. As a result, it is no accident that petrostates tend to be unstable or aggressive (or both).

In short, it is not always persuasive to distinguish between a threatening regime and its fossil fuel exports. These exports facilitate (and sometimes may even motivate) its aggressive and repressive policies.

2. Target the Harmful Conduct, Not the Revenue That Funds It

Even if fossil fuel exports contribute to harmful conduct, some commentators argue that the right response is to target *the conduct*, not the revenue that pays for it.

It would be better "to address the foreign policy problem directly," the National Research Council argued in its 2006 report, instead of "reduc[ing] oil consumption to lower world prices," since "such an effort would be an imperfect proxy for better targeted instruments and would hurt oil producing friends and foe alike."[128]

Admittedly, targeting the behavior is *sometimes* more efficient, but this is not *always* true. In some situations, going after the revenue stream could be cheaper, less risky, more technologically feasible, or otherwise more effective. Nor are these approaches necessarily alternatives.[129] For example, when Russia invaded Ukraine, the U.S. and its European allies reduced their purchases of oil and gas from Russia, while also supplying military and

127. Jeffrey D. Sachs & Andrew M. Warner, *Natural Resources and Economic Development: The Curse of Natural Resources*, 45 EUR. ECON. REV. 827, 828, 837 (2001).

128. NAT'L RSCH. COUNCIL OF THE NAT'L ACADS., *supra* note 4, at 333. In making this argument, the National Research Council incorrectly asserts that there is no negative externality when someone buys fossil fuel from hostile or repressive regimes:

> A simple analogy illustrates the problem with viewing that situation as an externality. Let us assume that my neighbor burns trash in his backyard that causes pollution that adversely affects my household. This is a clear externality. Further assume that I purchase commodities in a store owned by my neighbor. My consumption thus provides income for my neighbor that leads him to purchase more commodities and produce more trash to be burned. My purchase of goods from my neighbor's store is not an externality. Rather, the neighbor's burning of trash is the externality.

Id. at 331.Yet even though externalities affect third parties, there is no third party in this example; rather, the *same person* spends money in the store and lives next door. To illustrate the externality, let us change the example so someone else—not the wronged neighbor—spends this money: R likes to burn trash, which harms U, who lives next door. Meanwhile, G, who lives far away, spends money in R's store, giving R the funds needed to set large and toxic bonfires. If we substitute "Russia" for R, "Ukraine" for U, and "Germany" for G, we see that G's transaction with R hurts U, who is not part of their transaction. This clearly is an externality.

129. Schizer, *Energy Subsidies*, *supra* note 6, at 259 n.78.

humanitarian aid to Ukraine. Ultimately, the right answer is to pick the response—or, indeed, the combination of responses—that is most efficient under the circumstances.

3. Exports Might Moderate the Regime

In this spirit, there may be times when the most efficient course is not to *stop* buying from a hostile regime, but to *buy more* from them. If trade would moderate a hostile regime, persuading it not to pursue aggressive or repressive policies, the externalities for these purchases actually would be positive, instead of negative.[130]

How can trade have this beneficial impact? For one thing, it gives a regime's leaders something to lose. They may shy away from an aggressive policy if they think it will jeopardize export revenue (but not if they expect this revenue to continue anyway). In addition, trade can moderate a regime by empowering constituencies that press for change, such as a pro-Western middle class. Unfortunately, fossil fuel exports often have the opposite effect of strengthening regime loyalists.[131]

For decades, Germany hoped to moderate Russia through trade (and, a cynic would add, to reap the commercial advantages of cheap Russian energy). Angela Merkel doggedly pursued this policy as chancellor.[132] Her predecessor, Gerhard Schröder, struck the deal to build the Nord Stream 1 pipeline and then earned sizable sums after leaving office as chair of the pipeline's shareholder committee and a board member of Russia's state-controlled oil company.[133] Schröder has not been willing to concede error even after Russia invaded Ukraine. "I don't do mea culpa," he said.[134] "It's not my thing."[135] Nevertheless, his approach to Russia has been thoroughly discredited. "Obviously, this policy has totally failed," said Marcel Dirsus, a German security expert, articulating a widely shared view.[136]

Yet, although commercial ties have not moderated Russia (but, on the contrary, have made the country a more dangerous foe), this will not be true of every regime. To predict the effect of export revenue, policymakers need

130. *Id.* at 260.

131. *See supra* Section II.A.3.

132. Katrin Bennhold, *The Former Chancellor Who Became Putin's Man in Germany*, N.Y. TIMES (Apr. 23, 2022), https://www.nytimes.com/2022/04/23/world/europe/schroder-germany-russia-gas-ukraine-war-energy.html [https://perma.cc/U3F2-ESPG].

133. *Id.*

134. *Id.*

135. *Id.*

136. Hans von der Burchard, *Ukraine Crisis Prompts Germany to Rethink Russian Gas Addiction*, POLITICO (Feb. 22, 2022, 11:42 PM), https://www.politico.eu/article/germany-russia-gas-ukraine-crisis-nord-stream [https://perma.cc/VEX7-JRCQ] (quoting Marcel Dirsus).

to make context-specific judgments about a country's leadership, the potential influence of other constituencies, and the like. But the general assumption in this Article is that policymakers will want to weaken and deter hostile regimes, not to rely on trade to moderate them.

To sum up, the key to weakening hostile suppliers is to depend on them less. In this spirit, the U.S. and its allies should reduce demand for oil and gas, while also looking for new (friendly) suppliers. Through this two-part strategy, energy policy can enhance national security by reducing both defense and funding externalities.

III. ENVIRONMENTAL GOALS AND CONSTRAINTS: CLIMATE, POLLUTION, AND THE AUTHORITARIAN COMPARATIVE ADVANTAGE IN ENERGY PRODUCTION

So far, this Article has focused exclusively on national security. Yet environmental goals are also important in energy policy, so we need to understand how these goals affect the analysis. What are the environmental implications of the proposal in Parts I and II to reduce demand for fossil fuels and tap new supply? What changes, if any, are needed to ensure that this strategy protects the environment, as well as national security? The rest of this Article focuses on these issues.

To lay the groundwork for this analysis, this Part briefly surveys two familiar environmental goals in energy policy: limiting climate change and pollution. How can we advance these goals, while also reducing demand for fossil fuel and tapping new supply? Parts IV, V, and VI identify synergies and tensions among these various goals, showing how to make progress on all fronts.

But before the rest of this Article digs into these policy details, this Part identifies a blunter tension between the environment and national security, which is rooted more in political economy than in policy. To enhance national security, the U.S. and its allies should produce more energy domestically, so they depend less on insecure and hostile suppliers. But unfortunately, democracies are not easy places to produce energy. Opposition to energy production—whether from local residents, environmental organizations, or other groups—gains more traction in democracies than in authoritarian regimes. As a result, the production of fossil fuel gravitates to authoritarian countries, as do some aspects of the production of clean energy. This unfortunate reality, which this Article calls the "authoritarian comparative advantage," can harm both national security and the environment.

A. CLIMATE HARM FROM FOSSIL FUELS

The connection between energy policy and climate change is familiar: fossil fuel is the key driver of rising temperatures.

1. Fossil Fuel, Emissions, and the Social Cost of Rising Temperatures

The concentration of CO_2 in the atmosphere has increased by 50% in the 250 years since the industrial revolution began.[137] A scientific consensus has emerged that these emissions are raising global temperatures.[138]

"The largest source of CO_2, and of overall greenhouse gas emissions," the EPA recently reported, "was fossil fuel combustion primarily from transportation and power generation."[139] For example, petroleum represents 90% of transportation fuel in the U.S., accounting for 27% of total U.S. emissions.

According to the U.N. Intergovernmental Panel on Climate Change ("UN IPCC"), rising emissions are already causing a range of harms, including extreme weather, wildfires, water shortages, rising sea levels, more heat-related deaths, and species extinctions.[140] Looking ahead, the UN IPCC warns of significant economic losses from submerged coastal property, damaged infrastructure, effects of heat on health and productivity, storm damage, and reduced crop yields.[141]

These costs do not appear in the market price of energy. So, like the funding and defense externalities discussed above, consumers do not account for them in deciding how much energy to use.

137. News Release, Nat'l Oceanic and Atmospheric Admin., *Carbon Dioxide Now More Than 50% Higher Than Pre-Industrial Levels* (June 3, 2022), https://www.noaa.gov/news-release/carbon-dioxide-now-more-than-50-higher-than-pre-industrial-levels [https://perma.cc/C384-KLAJ] (noting that current concentration of CO_2 in atmosphere of 421 parts per million (ppm) is up from 280 ppm before the industrial revolution).

138. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS 5 (2021) [hereinafter IPCC, CLIMATE CHANGE 2021], https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf [permalink] ("The likely range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8°C to 1.3°C, with a best estimate of 1.07°C." (footnote omitted)).

139. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS 1990–2020 ES-7 (2022) [hereinafter SINKS 1990–2020], https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf [https://perma.cc/MJM9-Q6R9].

140. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2022: IMPACTS, ADAPTATION AND VULNERABILITY 9-13 (2022) [hereinafter IPCC, CLIMATE CHANGE 2022], https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf [permalink]; *see also* RISKY BUS. PROJECT, THE ECONOMIC RISKS OF CLIMATE CHANGE IN THE UNITED STATES (2014), https://riskybusiness.org/report/national [https://perma.cc/5KXN-GSU3].

141. IPCC, CLIMATE CHANGE 2022, *supra* note 140, at 14–20.

2. Climate Change as a National Security Threat

In addition to the costs described above, the Biden Administration has emphasized that some climate harms affect national security. When the administration requested an analysis of this question, the intelligence community highlighted three issues. First, there will be geopolitical tension about how to respond to climate change, including the speed of the response, who will pay for it, and whether China and India will join the effort.[142]

Second, nations may clash over resources and refugees. For instance, there will be competition for fresh water, as well as for resources in the Arctic, a region that will become more accessible as temperatures rise.[143] In addition, when areas become uninhabitable, the flight of refugees will stoke tensions along borders.[144]

Third, climate change will be especially costly in warmer regions. This could "increase the potential for instability and possibly internal conflict" in central Africa, Latin America, South and East Asia, and island nations in the Pacific.[145]

In principle, this Article could label these climate-related national security risks either "climate" costs or "national security" costs. For clarity of exposition, this Article calls them "climate" costs, as noted above,[146] but this choice should not affect the analysis. After all, a cost is a cost, regardless of what we call it. Either way, energy policy is more efficient if it accounts for these externalities, as well as the others flagged in this Article.

3. Reducing Climate Externalities from Fossil Fuel

To mitigate climate harms, the UN IPCC has called for "[n]ear term actions that limit global warming to close to 1.5°C."[147] This step, the UN IPCC has said, "would substantially reduce projected losses and damages related to climate change."[148]

Given the role of fossil fuel in climate change, energy policy needs to feature prominently in this effort. The right policies can reduce climate

142. NAT'L INTEL. ESTIMATE, CLIMATE CHANGE AND INTERNATIONAL RESPONSES INCREASING CHALLENGES TO US NATIONAL SECURITY THROUGH 2040, at 1 (2021) [hereinafter CLIMATE CHANGE INTERNATIONAL], https://www.dni.gov/files/ODNI/documents/assessments/NIE_Climate_Change_and_National_Security.pdf [https://perma.cc/PWX4-RJYP]. The Administration tasked the intelligence community with analyzing this issue. *See id.* at i–ii.

143. *Id.* at 8, 10.

144. *Id.* at 10.

145. *Id.* at 11.

146. *See supra* Section I.A.2.

147. IPCC, CLIMATE CHANGE 2022, *supra* note 140, at 13.

148. *Id.*

change in three ways. The first is to dial back the use of fossil fuel. Greater energy efficiency reduces the need for it, as does the wider use of clean energy, such as solar, wind, and nuclear power.

Second, since fossil fuels vary in their climate impacts, it is better to use ones with lower carbon footprints. Coal is the worst offender, since burning it produces nearly twice as much CO_2 as burning natural gas.[149] Admittedly, natural gas has a limitation of its own: its main component, methane, is a potent greenhouse gas that can leak into the atmosphere.[150] But as long as these leaks are prevented—and they are, indeed, preventable—emissions can be slashed by replacing coal with natural gas.[151]

This is precisely what has happened in the U.S., causing U.S. emissions to fall even as they have increased in China, India, and the developing world (and thus overall).[152] In the U.S., the percentage of electricity generated by coal fell from about 50% to 24% between 2007 and 2019, with natural gas picking up most of the slack. "That was the main reason," Dan Yergin observed, "why U.S. carbon dioxide (CO_2) emissions dropped down to the levels of the early 1990s, despite a doubling in the U.S. economy."[153]

Third, along with using less fossil fuel and changing the ones we use, another strategy is to offset or capture emissions. Planting trees and reclaiming land reduces the concentration of CO_2, as does trapping emissions

149. *Carbon Dioxide Emissions Coefficients*, U.S. ENERGY INFO. ADMIN. (Oct. 5, 2022), https://www.eia.gov/environment/emissions/co2_vol_mass.php [https://perma.cc/D96D-LLTA] (noting that coal emits 211.87 pounds of CO_2 per million Btu, while natural gas emits only 116.65 points per million Btu).

150. Benjamin Storrow, *Methane Leaks Erase Some of the Climate Benefits of Natural Gas*, SCI. AM. (May 5, 2020), https://www.scientificamerican.com/article/methane-leaks-erase-some-of-the-climate-benefits-of-natural-gas [https://perma.cc/3UW6-LZBF].

151. *Id.* (noting that technology to curb leaks is widely available and quoting the Environmental Defense Fund's Chief Scientist Steve Hamburg in saying that "[t]here is no need for this pollution. It is just completely unnecessary.").

152. IPCC, CLIMATE CHANGE 2021, *supra* note 138, at 8 ("In 2019, atmospheric CO_2 concentrations were higher than at any time in at least 2 million years . . . .").

153. YERGIN, *supra* note 23, at 12–13; *see also Electric Power Sector CO_2 Emissions Drop as Generation Mix Shifts from Coal to Natural Gas*, U.S. ENERGY INFO. ADMIN. (June 9, 2021), https://www.eia.gov/todayinenergy/detail.php?id=48296 [https://perma.cc/RHA8-HH7W] ("Although both the increased use of renewables and the shift from coal-fired to natural gas-fired generation contributed to reductions in electric power sector CO_2 emissions, the shift from coal to natural gas had a larger effect."). According to EPA, U.S. emissions decreased by 13% from 2005 to 2019 (including a 1.7% decline from 2018 to 2019). EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS 1990–2019 ES-4 (2021), https://www.epa.gov/sites/default/files/2021-04/documents/us-ghg-inventory-2021-main-text.pdf [https://perma.cc/C6CM-UQGQ] (attributing decline in emissions to greater energy efficiency, as well as "a continued shift from coal to less carbon intensive natural gas and renewables in the electric power sector."). Notably, there was a steep decline in 2020, driven largely by the pandemic, but this was temporary. *See* SINKS 1990–2020, *supra* note 139, at ES-4 ("The sharp decline in emissions from 2019 to 2020 is largely due to the impacts of the coronavirus (COVID-19) pandemic on travel and economic activity.").

underground or converting them into chemicals or plastics.[154]

B. POLLUTION FROM FOSSIL FUEL

Along with climate change, energy policy also needs to account for pollution. It is well understood that fossil fuel is dirty to extract, transport, and burn, and that these costs are not always reflected in the market price.

1. Polluting Air, Water, and Soil

Extracting fossil fuel can damage the air, water, and land, harming human health, disrupting local economies, and disturbing animal habitats. Perhaps the most extreme example was the accident at *Deepwater Horizon*, an offshore oil rig, that released 130 million gallons of oil into the Gulf of Mexico in 2010. Tragically, it took eighty-seven days to stop the oil from flowing. During those long weeks, the spill caused $17.2 billion of environmental damage to animals, beaches, coral, fish, and marshes.[155] The spill killed millions of marine mammals, sea turtles, birds, and fish,[156] while also causing lasting health problems among workers who cleaned up the spill.[157]

Extracting fossil fuel can cause pollution in more mundane ways as well. Coal mining causes miners to contract black lung disease and other health problems,[158] while also polluting streams and disfiguring landscapes. For example, "[m]ountaintop removal, a particularly destructive form of surface mining, involves stripping all trees and other vegetation from peaks and hilltops," the Union of Concerned Scientists has explained, "and then blasting away hundreds of feet of the earth below with explosives."[159]

154. Vincent Gonzalez, Alan Krupnick & Lauren Dunlap, *Carbon Capture and Storage 101*, RES. FOR THE FUTURE (May 6, 2020), https://www.rff.org/publications/explainers/carbon-capture-and-storage-101 [https://perma.cc/7AR3-9WUU].

155. Mike Gaworecki, *BP's Deepwater Horizon Oil Spill Caused $17.2 Billion in Environmental Damage to the Gulf of Mexico*, MONGABAY (Apr. 20, 2017), https://news.mongabay.com/2017/04/bps-deepwater-horizon-oil-spill-caused-17-2-billion-in-environmental-damage-to-the-gulf-of-mexico [https://perma.cc/7ZCW-CMPD].

156. Joan Meiners, *Ten Years Later, BP Oil Spill Continues to Harm Wildlife—Especially Dolphins,* NAT'L GEOGRAPHIC (Apr. 17, 2020), https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon [https://perma.cc/7U3Z-5VLY].

157. Mark A. D'Andrea & G. Kesava Reddy, *The Development of Long-Term Adverse Health Effects in Oil Spill Cleanup Workers of the Deepwater Horizon Offshore Drilling Rig Disaster*, 6 FRONTIERS IN PUBLIC HEALTH 1, 1 (2018) ("[Workers involved in cleanup developed] persistent alterations or worsening of their hematological, hepatic, pulmonary, and cardiac functions," as well as "prolonged or worsening illness symptoms even 7 years after their exposure to the oil spill.").

158. *Mining Topic: Respiratory Diseases*, CDC, https://www.cdc.gov/niosh/mining/topics/respiratorydiseases.html [https://perma.cc/HMU5-N9XQ].

159. *The Hidden Costs of Fossil Fuels*, UNION OF CONCERNED SCIENTISTS (July 15, 2008), https://www.ucsusa.org/resources/hidden-costs-fossil-fuels [https://perma.cc/L2KQ-F8VG].

Likewise, extracting oil and gas also can cause pollution. For example, wastewater from hydraulic fracturing can contaminate water or induce seismic activity if not disposed of properly.[160]

Transporting fossil fuels can also cause pollution, for instance, when pipelines leak or there are accidents involving tankers, barges, trains, and trucks. In March of 1989, for example, the *Exxon Valdez*, an oil supertanker, ran aground in Prince William Sound, releasing 11 million gallons of oil.[161] While the ship's hungover captain slept, his third mate missed a turn. This careless mistake dealt a devastating blow to local wildlife, with some effects lasting for years.[162]

Likewise, a train carrying oil exploded in the small Canadian town of Lac-Mégantic in July of 2013, killing forty-seven people, destroying over forty buildings, and releasing millions of gallons of oil into the soil and the nearby Chaudière River. Sadly, another seven trains carrying oil derailed in Canada between 2013 and 2020.[163]

Even if there are no mishaps in extracting or transporting fossil fuel, burning it is a familiar source of pollution. For example, coal-fired power plants and factories cause smog and acid rain, which can affect air quality thousands of miles away.[164] Auto exhaust also degrades air quality.[165] Indeed, air pollution from fossil fuel harms human health in a range of ways.[166]

160. *See* Merrill & Schizer, *supra* note 75, at 179–96 (discussing seismic risks and water contamination).

161. Shamseer Mambra, *The Complete Story of the Exxon Valdez Oil Spill*, MARINE INSIGHT (Mar. 23, 2022), https://www.marineinsight.com/maritime-history/the-complete-story-of-the-exxon-valdez-oil-spill [https://perma.cc/L7CY-77RX].

162. Doug Struck, *Twenty Years Later, Impacts of the Exxon Valdez Linger*, YALE ENV'T 360 (Mar. 24, 2009), https://e360.yale.edu/features/twenty_years_later_impacts__of_the_exxon_valdez_linger [https://perma.cc/9TBY-6PZL].

163. Guy Quenneville, Dave Seglins & Joseph Loiero, *Why Crude Oil Trains Keep Derailing and Exploding in Canada—Even After the Lac-Mégantic Disaster*, CBC (June 15, 2020, 1:00 AM), https://www.cbc.ca/news/canada/saskatoon/lac-megantic-crude-oil-train-canada-guernsey-saskatchewan-rail-1.5608769 [https://perma.cc/53LD-23VP].

164. Stephanie A. Ewing, John N. Christensen, Shaun T. Brown, Richard A. Vancuren, Steven S. Cliff & Donald J. Depaolo*, Pb Isotopes as an Indicator of the Asian Contribution to Particulate Air Pollution in Urban California*, 44 ENV'T SCI. TECH. 8911, 8911 (2010) (finding that 29% of airborne Pbs in the San Francisco area originated in Asia).

165. *Vehicles, Air Pollution, and Human Health*, UNION OF CONCERNED SCIENTISTS (July 18, 2014), https://www.ucsusa.org/resources/vehicles-air-pollution-human-health [https://perma.cc/9ZL6-3UNE] (noting that passenger vehicles and trucks are major sources of pollution).

166. Karn Vohra, Alina Vodonos, Joel Schwartz, Eloise A. Marais, Melissa P. Sulprizio & Loretta J. Mickley, *Global Mortality from Outdoor Fine Particle Pollution Generated by Fossil Fuel Combustion: Results from GEOS-Chem*, 195 ENV'T RSCH. 110754, 110759 (2021) (estimating deaths from fossil fuel pollution).

2. Reducing Pollution from Fossil Fuel

How can energy policy reduce pollution from fossil fuel? Although the literature on this topic is vast, and the details are beyond this Article's scope, it is worth emphasizing that the three responses to climate change, noted above, also reduce pollution.

First, using less fossil fuel generally reduces the pollution it causes. Again, energy efficiency and clean energy can help, although some types of clean energy have pollution risks of their own (such as the radioactive waste from nuclear power).[167]

Second, some types of fossil fuel are dirtier than others. Again, coal is the worst of them. It produces the most pollution, and its pollutants are most harmful to human health[168] At the same time, some types of coal—and, indeed, some types of mining—are worse than others.[169] As a result, replacing coal with natural gas reduces pollution, as well as emissions.

Third, when fossil fuels are used, there are ways to keep pollutants from being released. For instance, thick well casings prevent fracking fluid from seeping into drinking water when oil is extracted, while tankers with two hulls prevent oil spills when oil is transported.[170] Likewise, catalytic converters in cars and scrubbers in power plants contain some pollutants when fossil fuel is burned.[171]

167. *See* Michael Hendryx, Keith J. Zullig & Juhua Luo, *Impacts of Coal Use on Health*, 41 ANN. REV. PUB. HEALTH 397, 406 (2020) ("In sum, it is clear that no fuel source for power generation is entirely benign, although renewables pose a substantially smaller risk potential for human health than do fossil fuels." (citations omitted)).

168. *Id.* at 403 ("Per kilowatt hour, coal combustion generates more particulate matter, heavy metals, sulfur dioxide, and nitrogen oxides than does natural gas or other fuels. In turn, coal combustion pollutants contribute to widespread organ system pathology and to substantially greater mortality and morbidity compared with other fuel sources." (citations omitted)).

169. For example, different types of coal produce different levels of sulphur dioxide, while surface or "strip" mining harms landscapes more than subsurface mining. *See, e.g.*, HEAL Briefing, *Lignite Coal—Health Effects and Recommendations from the Health Sector* 4 (Genon K. Jenson et al. eds., 2018), https://www.env-health.org/wp-content/uploads/2018/12/HEAL-Lignite-Briefing-en_web.pdf [https://perma.cc/8MXX-6PHJ] ("Lignite, also called brown coal, is the most health harming type of coal."); *Coal Explained: Coal and the Environment*, U.S. ENERGY INFO. ADMIN. [hereinafter *Coal Explained*], https://www.eia.gov/energyexplained/coal/coal-and-the-environment.php [https://perma.cc/F7ZV-JJ47] ("Underground mines generally affect the landscape less than surface mines.").

170. Merrill & Schizer, *supra* note 75, at 166–70 (discussing ways to avert release of wastewater); Doug Helton, *The Spills That Never Happened Thanks to Double Hulls*, NOAA OFF. RESPONSE RESTORATION BLOG (Mar. 26, 2021, 1:44 PM), https://blog.response.restoration.noaa.gov/spills-never-happened-thanks-double-hulls [https://perma.cc/K95Y-F2HA].

171. Theo Schmit, *The Catalytic Converter: Its Pros and Cons in the Modern World*, SEQUOYAH STEM INST. BLOG (Feb. 6, 2019), https://sequoyahsteminstitute.org/blog/2019/2/1/the-catalytic-converter-its-pros-and-cons-in-the-modern-world [https://perma.cc/5E2K-4AV3] (noting that the catalytic converter "has been highly effective in reducing air pollution, especially in major cities"); *Coal Explained*, *supra* note 169 ("Power plants use flue gas desulfurization equipment, also known as *scrubbers*, to clean sulfur from the smoke before it leaves their smokestacks.").

C. NATIONAL SECURITY AND THE ENVIRONMENT: SYNERGIES AND TENSIONS

So far, this Article has showed that the U.S. and its allies need to pursue a range of goals in energy policy. Along with encouraging firms to generate and transport energy efficiently and reliably—goals that a competitive market usually is well suited to advance—policymakers also need to address four externalities, which require government intervention: first, the cost of protecting insecure suppliers; second, the cost of funding hostile suppliers; third, the cost of climate change; and fourth, the cost of pollution.

As Parts I and II showed, the key to addressing the first two externalities—and, thus, to protecting national security—is to reduce demand for fossil fuel, while also tapping new supply in secure and friendly countries. Yet what effect does this two-part strategy have on the environment?

In principle, the first strategy—reducing demand—has the potential to advance environmental goals. After all, using less fossil fuel can reduce emissions and pollution. But in fact, reducing demand is not always a "win-win" for national security and the environment. For example, even as clean energy eases dependence on problematic *fossil fuel* suppliers (such as Russia), it increases dependence on problematic *clean energy* suppliers (such as China). Part IV analyzes various options to reduce demand for fossil fuel, highlighting synergies and tensions between national security and environmental goals.

What about the second part of the two-part strategy? Is it feasible to tap new sources of fossil fuel while also protecting the environment? At first blush, these goals seem to conflict. Instead of drilling new wells (to protect national security), aren't we supposed to phase out fossil fuel (to protect the environment)? But in fact, this tension can be resolved with the right policies, which tap new sources of fossil fuel while still reducing emissions and pollution. The key is for the new sources to be lower-carbon fossil fuels (for example, natural gas instead of coal) and for them to replace, instead of adding to, existing sources. Part V considers a range of strategies to tap new supplies of fossil fuel, identifying synergies and tensions between national security and environmental goals.

D. AUTHORITARIAN COMPARATIVE ADVANTAGE

The rest of this Article shows how nuanced policy judgments, with careful attention to the relevant tradeoffs, can deliver gains for both national security and the environment. But before turning to this challenge of policy, it is important to highlight a challenge of political economy that complicates

efforts to adopt better policies: compared with authoritarian regimes, democracies are at a disadvantage in producing and transporting energy.

In a nutshell, the problem is interest group opposition. When democratic governments are asked to approve new wells, pipelines, or other fossil fuel infrastructure, there is almost always opposition from environmental groups, local residents and businesses (motivated by "not in my backyard" or "NIMBY" concerns), regulators who protect culturally significant sites, and economic competitors (such as coal companies, which regularly oppose natural gas pipelines).[172] In the U.S. and Europe, these coalitions have banned fracking in several jurisdictions, halted drilling in some places, and blocked pipelines and LNG terminals.

Ironically, similar dynamics also have thwarted clean energy projects, including nuclear power plants and wind and solar facilities.[173] For example, after a failed effort to secure approval, which took sixteen years and cost $100 million, a clean energy company gave up on installing wind turbines off the coast of Cape Cod.[174] "The project unfortunately demonstrated," observed a Massachusetts regulator who supported the project, "that well-funded opposition groups can effectively use the American court system to stop even a project with no material adverse environmental impacts . . . ."[175]

In contrast, this sort of interest group pressure gains much less traction in authoritarian regimes. For instance, environmental campaigns in Russia often "butt up against political realities," observed a 2021 report by a U.S. think tank, "leading to the prosecution of activists and even physical threats and abuse toward . . . them by state institutions, often on behalf of a private company."[176] Likewise, "it can be said that there is no green movement in

172. *See, e.g.*, Sam Levin, *Dakota Access: Company Under Scrutiny over Sacred Artifacts in Oil Pipeline's Path*, GUARDIAN (Nov. 5, 2016, 8:00 PM), https://www.theguardian.com/us-news/2016/nov/05/dakota-access-oil-pipeline-native-american-artifacts-discovered [https://perma.cc/6RNE-HM8J]; Matt Reynolds, *Coal Companies Lose Battle over Gas Pipeline*, COURTHOUSE NEWS SERV. (Oct. 6, 2010), https://www.courthousenews.com/coal-companies-losebattle-over-gas-pipeline [https://perma.cc/LYF8-BXFF].

173. Matthew Dalton, *Tourism and Manufacturing Fight for the Future of Power in Europe*, WALL ST. J. (Jan. 2, 2023, 1:19 PM), https://www.wsj.com/articles/tourism-manufacturing-fight-wind-power-natural-gas-europe-11672682789 [https://perma.cc/DVS7-GU63] ("Europe's plans to install wind and solar power . . . [are] running into opposition from residents and officials who say a wave of new projects will harm the region's landscapes, cultural sites, and valuable tourism industry."); Katharine Q. Seelye, *After 16 Years, Hopes for Cape Cod Wind Farm Float Away*, N.Y. TIMES (Dec. 19, 2017), https://www.nytimes.com/2017/12/19/us/offshore-cape-wind-farm.html [https://perma.cc/9UJT-EBKV].

174. Seelye, *supra* note 173.

175. *Id.* (quoting Ian Bowles, former state secretary of energy and environmental affairs).

176. Angelina Davydova, *Environmental Activism in Russia: Strategies and Prospects* (Mar. 3, 2021), CTR. STRATEGIC & INT'L STUDS., https://www.csis.org/analysis/environmental-activism-russia-strategies-and-prospects [https://perma.cc/2X7H-M98Z].

Iran," concluded a 2019 study by Iranian academics.[177] "Policy makers in Iran still don't cooperate with ENGOs [environmental NGOs] and even newspapers consider them as marginal issues."[178]

As a result, fossil fuel production (and, indeed, some clean energy initiatives) gravitate to authoritarian countries. In a sense, their insulation from political pressure gives them an edge, which this Article calls "authoritarian comparative advantage."

This is the mirror image of a more familiar idea, noted above, that extractive industries encourage authoritarianism (for example, by freeing governments from depending on citizens for tax revenue and labor).[179] The point here is that the causal link can run in the other direction as well: not only do extractive industries facilitate authoritarianism, but authoritarianism also can facilitate extractive industries.

To weaken the competition, some authoritarian leaders cynically encourage environmental opposition in democracies. For example, Vladimir Putin regularly warns western audiences of the risks of fracking. "Today's technology of shale oil production and shale gas," he said at a 2019 business conference, "are without any doubt . . . barbaric."[180] He made the same point quite heatedly at an earlier conference. "I was going to ask him a normal question about diversifying your economy," recalled energy expert Daniel Yergin, whose question prompted this outburst.[181] "And I said 'shale,' and to be shouted at by him in front of 3,000 people [was] a really unpleasant experience."[182] Putin's vehemence presumably stems not from concern for the planet, but from economics and geopolitics. "[S]hale was a challenge for Russia," Yergin explained.[183]

To protect Russia's market share, Putin has allegedly funded groups opposing shale development in Europe, as Hillary Clinton and the Secretary General of NATO each have claimed.[184] "We were . . . up against phony

177. Faezeh Hashemi, Hasan Sadighi, Mohammad Chizari & Enayat Abbasi, *The Relationship Between ENGOs and Government in Iran*, HELIYON 1, 3 (Nov. 8, 2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6926184 [https://perma.cc/97SB-ZFSC].

178. *Id*.

179. *See supra* Section II.C.1.

180. Sam Meredith, *Russia's Putin Says Shale Oil Technologies Are 'Barbaric'*, CNBC (Nov. 20, 2019, 10:52 AM), https://www.cnbc.com/2019/11/20/russias-putin-says-shale-oil-technologies-are-barbaric.html [https://perma.cc/XEA3-YTEG] (quoting Vladimir Putin).

181. Michael P. Regan & Vildana Hajric, *How an Energy Expert Triggered Vladimir Putin with One Word*, BLOOMBERG (May 21, 2022, 9:09 AM), https://www.bloomberg.com/news/articles/2022-05-21/how-an-energy-expert-triggered-vladimir-putin-with-one-word [https://perma.cc/5CBR-U5BD].

182. *Id*.

183. YERGIN, *supra* note 23, at 59.

184. Fiona Harvey, *Russia 'Secretly Working with Environmentalists to Oppose Fracking'*, GUARDIAN (June 19, 2014, 11:34 AM), https://www.theguardian.com/environment/2014/jun/19/russia-

environmental groups, and I'm a big environmentalist," Clinton asserted, "but these were funded by the Russians to stand against any effort, 'Oh that pipeline, that fracking, that whatever will be a problem for you,' and a lot of the money supporting that message was coming from Russia."[185]

As Putin understands, when democracies abstain from energy production, authoritarian regimes fill the gap. Unfortunately, this makes the U.S. and its allies more dependent on authoritarian suppliers, which often are insecure or hostile.[186] It would be far better to rely on production in democracies, which usually are more secure and friendly.[187] But as this Section has showed, this is an uphill climb politically.

Even so, this climb must be attempted. After all, relying on authoritarian suppliers is problematic not just for national security, but also for the environment. Who is more vigilant in regulating emissions and pollution? Do we trust Russia and Iran more than the U.S. and the EU? Admittedly, when environmental harms are localized, democracies can deflect these costs to the citizens of authoritarian countries—in effect, a form of global nimbyism. But two of the most important risks—climate change and air pollution—are global, not local. So instead of simply farming out fossil fuel

secretly-working-with-environmentalists-to-oppose-fracking [https://perma.cc/9KR3-TMDQ] ("I have met allies who can report that Russia, as part of their sophisticated information and disinformation operations, engaged actively with so-called non-governmental organisations—environmental organisations working against shale gas—to maintain European dependence on imported Russian gas." (quoting Anders Fogh Rasmussen, secretary-general of NATO and previously the premier of Denmark)).

185. Valerie Richardson, *Leaked Emails Show Hillary Clinton Blaming Russians for Funding 'Phony' Anti-fracking Groups,* WASH. TIMES (Oct. 10, 2016), https://www.washingtontimes.com/news/2016/oct/10/clinton-blames-russians-anti-fracking-groups [https://perma.cc/JP32-F2MM] (noting remarks to tinePublic, a Canadian promotional group in June of 2014). Similar allegations have been made about funding for U.S. environmental groups, but they are hotly contested. *See, e.g.*, Glenn Kessler, *The Bogus 'Allegation' That Putin Is Funding a California Environmental Charity,* WASH. POST (Mar. 17, 2022, 3:00 AM), https://www.washingtonpost.com/politics/2022/03/17/bogus-allegation-that-putin-is-funding-california-environmental-charity [https://perma.cc/89PE-FPH5].

186. Jason Bordoff & Meghan L. O'Sullivan, *Jason Bordoff and Meghan O'Sullivan on Maintaining Energy Supply While Still Hitting Climate-Change Goals*, ECONOMIST (Mar. 26, 2022), https://www.economist.com/by-invitation/jason-bordoff-and-meghan-o-sullivan-on-maintaining-energy-supply/21808312 [https://perma.cc/543C-VLEX] ("[T]he world cannot ignore more immediate energy security needs in the process of making this transition [to decarbonized energy]. To do so emboldens petro-states like Russia . . . .").

187. There is a robust debate about whether (and why) democracies are less likely to go to war, whether with each other (an idea known as "dyadic" democratic peace) or with any other state (which is known as "monadic" democratic peace). *See generally, e.g.,* MICHAEL W. DOYLE, LIBERAL PEACE: SELECTED ESSAYS (Florence: Routledge 2012) (arguing that liberal states generally have maintained peace among themselves, but have tended to fight wars with non-liberal states, exploring the strategic value of cooperation among liberal states); Dan Reiter, *Democratic Peace Theory*, OXFORD BIBLIOGRAPHIES, https://www.oxfordbibliographies.com/display/document/obo-9780199756223/obo-9780199756223-0014.xml [https://perma.cc/VL7S-M4FW] (surveying extensive literature on democratic peace theory). The details of this debate are beyond this Article's scope.

development (and other energy initiatives) to authoritarian regimes, democracies should rely more on domestic production.

More specifically, the U.S. and its allies should pursue a two-part strategy that protects both national security and the environment: first, they should reduce the demand for fossil fuel; second, they should tap new supplies of fossil fuel in environmentally responsible ways. The next two Parts consider these strategies in turn.

IV. REDUCING DEMAND FOR FOSSIL FUELS: SYNERGIES AND TENSIONS

Let us begin with reducing demand. This Part shows how efforts to use less fossil fuel have the potential to be a "win-win," protecting both national security and the environment. Yet the devil is in the details. Does an initiative *actually* reduce demand, once *all* the relevant fuel consumption is considered? If it does, are there offsetting costs, such as new risks to national security or the environment? Some strategies to reduce fossil fuel demand are better than others. Finding and implementing the right ones is critical.

At the same time, reducing demand should not be our exclusive focus. Since the transition away from fossil fuel will take years, the U.S. and its allies also need to find new sources that are secure, friendly, and can be tapped in environmentally responsible ways.

A. POTENTIAL TO BE A "WIN-WIN"

In general, the demand for fossil fuel can be cut in two ways: energy efficiency, and wider use of clean energy. Both are promising and should be pursued vigorously.

1. Energy Efficiency

A key step is to change the habits of consumers. For example, instead of driving to work, they should walk, carpool, take mass transit, or work from home. The right policies can encourage these shifts, including congestion pricing, bike lanes, cheaper mass transit fares, lower speed limits, and the like.

Technological innovations—and policies that encourage them—also can enhance energy efficiency. For example, switching from incandescent to more efficient LED bulbs—as the Biden Administration mandated in 2022—should reduce U.S. emissions by 222 million metric tons over thirty years and save nearly $3 billion annually in electricity costs.[188] Likewise, changing

188. Press Release, Am. Council Energy-Efficient Econ., U.S. Light Bulb Standards Will Cut

the idle power settings on computers also can "save $3 billion a year . . . and reduce CO_2 emissions by 20 million metric tons," Kit Kennedy has explained, "without any impact on computer performance. . . ."[189] The same is true of better heating and cooling systems. For example, "heat pumps" use 50% less energy because they do not actually *generate* heat; instead, they *extract* it from the air.[190]

Energy efficiency has obvious national security advantages, as German Vice-Chancellor Robert Habeck emphasized a few weeks after Russia invaded Ukraine. "If you can take the train or bike . . . , that's good," he said.[191] "[I]t's easy on the wallet and annoys Putin."[192] Obviously, there are parallel environmental advantages as well.

2. Clean Energy

Along with energy efficiency, another way to use less fossil fuel is to rely more on clean energy, including wind, solar, geothermal, nuclear, hydroelectric, and hydrogen. Fortunately, the cost of wind and solar has declined significantly in recent years, making them increasingly competitive even without subsidies.[193]

So far, clean energy has been used mainly to generate electricity. This has been an effective way to burn less fossil fuel, since electric power plants are responsible for about 38% of all energy generated in the U.S.[194] The progress so far has been significant: in 2021, only 60% of electricity in the U.S. came from fossil fuels, compared with 21% from nuclear and 19% from renewable energy.[195]

Utility Bills and Climate Emissions (Apr. 26, 2022), https://www.aceee.org/press-release/2022/04/us-light-bulb-standards-will-cut-utility-bills-and-climate-emissions [https://perma.cc/W7FT-WZER].

189. Kit Kennedy, *The Role of Energy Efficiency in Deep Decarbonization*, 48 ENV'T L. REP. 10030, 10056 (2018).

190. *Energy Saver: Heat Pump Systems*, U.S. DEP'T OF ENERGY, https://www.energy.gov/energysaver/heat-pump-systems [https://perma.cc/4NG3-3RP5].

191. *Ukraine Conflict: Save Energy and Annoy Putin, Germans Told*, BBC (Apr. 15, 2022), https://www.bbc.com/news/world-europe-61117828 [https://perma.cc/JC36-TRDS] (quoting Robert Habeck).

192. *Id*.

193. LAZARD, LEVELIZED COST OF ENERGY+ (Version 15.0 2021), https://www.lazard.com/research-insights/levelized-cost-of-energyplus [https://perma.cc/LF29-Z8NB].

194. In 2021, the U.S. generated 36.7 quadrillion BTU of electricity, while all energy sources in the U.S. totaled 97.3 quadrillion BTU, so electricity's share was just under 38%. Notably, only about one third of electricity generated is actually sold to customers because about two thirds of the energy is lost during the generation process. The amount sold (12.9 quadrillion BTU) is only about 18% of the total energy used in the U.S. (73.5 quadrillion BTU). *U.S. Energy Facts Explained*, U.S. ENERGY INFO. ADMIN. [hereinafter *U.S. Energy Facts*], https://www.lazard.com/research-insights/levelized-cost-of-energyplus/ [https://perma.cc/9AY5-3QCP] (noting 36.7 of 97.3 quadrillion BTUs).

195. *Id.*

Another 37% of energy in the U.S. is used for transportation.[196] For decades, virtually all of this energy has come from fossil fuel—and, specifically, from petroleum.[197] Yet EVs can break petroleum's monopoly, since the electricity powering them can come from clean energy (or, for that matter, from coal or natural gas). Fortunately, the performance and range of EVs has improved significantly. There also is a growing network of charging stations,[198] although this effort has a long way to go.[199]

Like energy efficiency, clean energy has the potential to offer national security and environmental advantages. Again, using less fossil fuel not only reduces emissions and pollution, but also eases dependence on the wrong fossil fuel suppliers.

B. ARE WE REALLY USING LESS FOSSIL FUEL?

Even so, before policymakers conclude that a policy or technology really is a "win-win," they need to dig deeper. A key question is how much, if at all, it *actually* reduces the demand for fossil fuel.

1. Rebound

For example, a fuel-efficient car is supposed to use less fuel. But what if drivers respond by putting more miles on the car, since each additional mile is cheaper? Similarly, what if homeowners with heat pumps turn up the thermostat? If energy efficient products are used more, they do not save as much energy. This "rebound effect," as it is called, reduces the national security and environmental advantages of energy efficient technology, since fossil fuel consumption declines less than expected.[200]

196. *Id.*

197. *See id.* (stating that 90% came from petroleum and 4% came from natural gas in 2021).

198. Rachel Wolfe, *I Rented an Electric Car for a Four-Day Road Trip. I Spent More Time Charging It Than I Did Sleeping*, WALL ST. J. (June 3, 2022, 3:53 PM), https://www.wsj.com/articles/i-rented-an-electric-car-for-a-four-day-road-trip-i-spent-more-time-charging-it-than-i-did-sleeping-11654268401?mod=e2tw [https://perma.cc/89B8-WXCY] ("The government is spending $5 billion to build a nationwide network of fast chargers, which means thousands more should soon dot major highways.").

199. As an anecdotal illustration of this challenge, the Wall Street Journal asked a reporter to drive an electric car from New Orleans to Chicago and back. Her experience was not encouraging. *See id.* ("It turns out not all 'fast chargers' live up to the name.").

200. Paul E. Brockway, Steve Sorrell, Gregor Semieniuk, Matthew Kuperus Heun & Victor Court, *Energy Efficiency and Economy-Wide Rebound Effects: A Review of the Evidence and its Implications*, 141 RENEWABLE & SUSTAINABLE ENERGY REV. 110781, 110782 (2021) (noting that "the evidence suggests economy-wide rebound effects may erode more than half of the potential energy savings from improved energy efficiency").

2. Life Cycle Calculations

Similarly, to determine how much fuel a new technology actually saves, we need to know how much is used not just in *operating* it, but also in *manufacturing* and *powering* it. For example, compared with a gasoline-powered car, less energy is needed to run an EV, but more is required to manufacture it because extra energy is needed to build the battery.[201] EVs make up for this disadvantage by using less energy when driving.[202] But *how much* less depends on how the electricity was generated. If it comes from solar or wind, the EV cuts fossil fuel demand more than if it comes from coal.[203] This sort of "life cycle" analysis is needed to determine how effective a new technology is in cutting demand for fossil fuel, and thus in reducing emissions, pollution, and the national security risks from depending on the wrong fossil fuel suppliers.

C. NEW NATIONAL SECURITY RISKS: "JUST WHEN I THOUGHT I WAS OUT . . ."

Using less fossil fuel elicits another challenge as well: the transition to clean energy poses national security risks of its own. So as much as the U.S. and it allies would like to stop protecting insecure suppliers and funding adversaries, they will not necessarily get their wish. This Section shows that clean energy imposes parallel burdens. One is reminded of a famous line from *The Godfather*: "Just when I thought I was out, they pull me back in."[204]

1. Defense Externalities: The Electrical Grid

For one thing, the U.S. and its allies become even more vulnerable to attacks on power plants, power lines, and other infrastructure. Since electricity is the most effective way to harness clean energy, using more of it means depending more on this grid.

There already are familiar risks from relying on the grid. Blackouts disrupt communications, finance, business, law enforcement, health care,

201. *Electric Vehicle Myths*, EPA (Dec. 22, 2022), https://www.epa.gov/greenvehicles/electric-vehicle-myths#Myth5 [https://perma.cc/NDK7-E95M] ("Some studies have shown that making a typical EV can create more carbon pollution than making a gasoline car. This is because of the additional energy required to manufacture an EV's battery.").

202. *Id.*

203. Karin Kirk, *Electrifying Transportation Reduces Emissions AND Saves Massive Amounts of Energy*, YALE CLIMATE CONNECTIONS (Aug. 7, 2022), https://yaleclimate connections.org/2022/08/electrifying-transportation-reduces-emissions-and-saves-massive-amounts-of-energy [https://perma.cc/2W2F-24TV] (noting that electricity generated with coal uses 31% less energy than gasoline to power an EV, while electricity from natural gas uses nearly 50% less, and electricity from renewables uses up to 75% less energy).

204. THE GODFATHER: PART III (Paramount Pictures 1990).

and the delivery of water, food, and other essential goods and services.[205] To avoid these hardships, the grid must be protected from extreme weather and natural disasters, as well as from cyber and physical attacks[206]—a lesson emphasized, sadly, by Russia's repeated attacks on Ukraine's grid in 2022.[207]

Yet these risks are bounded today because electricity is not the only game in town. It provides only 38% of the energy consumed in the U.S.[208] Petroleum and other fossil fuels are the main sources for transportation,[209] heating, and industrial processes.[210] Admittedly, the infrastructure for these fuels is also vulnerable. Pipelines can be hacked[211] or sabotaged,[212] refineries can be damaged in fires[213] or natural disasters,[214] oil depots can be attacked,[215] and the like. Yet the fact that this infrastructure is separate from the grid—and, for that matter, scattered across the country—offers useful diversification. If some pipelines, refineries, and gas stations go offline, others still function. Likewise, if the grid fails today, most homes will still

205. *See, e.g.*, CRITICAL NAT'L INFRASTRUCTURES, REPORT OF THE COMMISSION TO ASSESS THE THREAT TO THE UNITED STATES FROM ELECTROMAGNETIC PULSE (EMP) ATTACK vii (2008) ("Should significant parts of the electrical power infrastructure be lost for any substantial period of time, the Commission believes that the consequences are likely to be catastrophic, and many people may ultimately die for the lack of the basic elements necessary to sustain life in dense urban and suburban communities.").

206. *See e.g.*, U.S. GOV'T ACCOUNTABILITY OFF., ELECTRICITY GRID CYBERSECURITY: DOE NEEDS TO ENSURE ITS PLANS FULLY ADDRESS RISKS TO DISTRIBUTION SYSTEMS 11 (2021), https://www.gao.gov/assets/gao-21-81.pdf [https://perma.cc/3SNX-CM3Z] ("[The U.S. grid is] increasingly at risk from cyberattacks."); TRAVIS FISCHER, INST. ENERGY RSCH., ASSESSING EMERGING POLICY THREATS TO THE U.S. POWER GRID: HOW REGULATIONS, MANDATES, AND SUBSIDIES UNDERMINE ELECTRIC RELIABILITY 1 (2015), https://www.instituteforenergyresearch.org/wp-content/uploads/2015/02/Threats-to-U.S.-Power-Grid.compressed.pdf [https://perma.cc/6KDG-MECU] ("[T]hreats to the consistent delivery of electricity put modern life itself at risk.").

207. MacDonald, *supra* note 20.

208. *See U.S. Energy Facts*, *supra* note 194 (offering data for 2021).

209. *Id.* (noting that transportation used 26.9 of 73.5 quadrillion BTU, of which 90% came from petroleum in 2021).

210. *Id.* (stating that 78% of power for industry and 50% for residences came from fossil fuel in 2021).

211. *See, e.g.*, Cammy Pedroja, *Colonial Pipeline Hackers Used Unprotected VPN to Access Network: Report*, NEWSWEEK (June 4, 2021, 6:19 PM), https://www.newsweek.com/colonial-pipeline-hackers-used-unprotected-vpn-access-network-report-1597842 [https://perma.cc/B2N8-KZW5].

212. *Probe into Nord Stream Pipeline Leaks Has Strengthened Suspicions of 'Sabotage,' Sweden Says*, NBC NEWS (Oct. 6, 2022, 9:45 AM), https://www.nbcnews.com/news/world/nord-stream-pipeline-leaks-sabotage-suspicion-sweden-russia-ukraine-rcna50999 [https://perma.cc/PT84-RJRD].

213. Barbara J. Powell, *BP's Ohio Refinery May Stay Shut into 2023 After Deadly Fire*, BLOOMBERG (Sept. 27, 2022, 12:36 PM), https://www.bloomberg.com/news/articles/2022-09-27/bp-toledo-refinery-fire-repairs-may-extend-into-early-2023 [https://perma.cc/L6WT-MFNV].

214. *Damaged Oil Refinery Closing; Parish Weighs Economic Impacts*, ASSOCIATED PRESS (Nov. 10, 2021), https://apnews.com/article/hurricane-ida-floods-business-mississippi-river-storms-cc7d00516965e67c8c1b64baf8af8f32 [https://perma.cc/7JNV-CFRC] (stating that a Louisiana refinery closed after sustaining damage during Hurricane Ida).

215. Matt Clinch, *Yemen's Houthis Claim Attack on Aramco Facility After reports of a Huge Fire in Saudi city of Jeddah*, CNBC (Mar. 25, 2022, 12:03 PM), https://www.cnbc.com/2022/03/25/reports-of-huge-fire-at-aramco-oil-facility-in-saudi-arabia.html [https://perma.cc/PU5S-JKCC].

be heated and most cars will still work.[216] But if all homes are heated with electricity and all cars are EVs, this will no longer be true.

In short, tapping clean energy means depending more on the grid. As a result, its security—and, more generally, its effectiveness—become even more essential.

2. Defense Externalities from Nuclear Power

The grid's vulnerability is an example of a broader point: although fossil fuels have national security costs, so do other energy sources, and the risks from these new sources need to be addressed.

This is certainly true of nuclear power. On the one hand, it has national security advantages in easing dependence on problematic fossil fuel suppliers. For example, France has relied less on Russian natural gas because 70% of its electricity comes from nuclear plants.[217] In contrast, Germany has been in a weaker position because it started phasing out nuclear power in 2011.[218]

On the other hand, nuclear power requires uranium. While some uranium suppliers are secure and friendly (such as Canada, Australia, and India),[219] others are not. For example, Kazakhstan (the world's largest producer) shares a border with Russia, as do Uzbekistan and Ukraine.[220] Meanwhile, Russia itself is a "top ten" producer, as is China.[221]

216. Admittedly, fossil fuel infrastructure runs in part on electricity. For example, gas station pumps are powered with electricity, as are some components of pipelines, but backup generators can keep them functioning. *See* Kenza Moller, *How Do Gas Stations Pump Without Electricity?*, ABC NEWS (Sept. 8, 2017, 11:15 AM), https://www.abcactionnews.com/simplemost/how-do-gas-stations-pump-without-electricity [https://perma.cc/ZA77-2BWX]. In principle, backup generators also could replace the grid, but far more of them would be needed. For example, the number of generators needed to power all the *gas stations* in the U.S. is a tiny fraction of the number needed to power all the *cars*.

217. Usually, 70% of France's electricity comes from nuclear power. Unfortunately, a number of France's nuclear plants required maintenance in the summer of 2022, forcing France to import electricity at record prices. Sam Meredith, *France's Nuclear Energy Strategy—Once Its Pride and Joy—Faces Big Problems This Winter*, CNBC (Oct. 5, 2022, 1:05 AM), https://www.cnbc.com/2022/10/05/frances-nuclear-heavy-energy-strategy-faces-big-problems-this-winter.html [https://perma.cc/TN58-6YYC].

218. *See* David Frum, *The West's Nuclear Mistake,* ATLANTIC (Dec. 8, 2021), https://www.theatlantic.com/ideas/archive/2021/12/germany-california-nuclear-power-climate/620888 [https://perma.cc/8JYT-GSLS].

219. *World Uranium Mining Production*, WORLD NUCLEAR ASS'N, https://world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx [https://perma.cc/9VKN-99NU] (noting that Canada, Australia, and India were, respectively, the third, fourth, and ninth largest producers in 2021).

220. *Id.* (noting that Kazakhstan, Uzbekistan, and Ukraine were, respectively, the first, fifth, and tenth largest producers in 2021).

221. *Id.* (explaining that Russia and China were, respectively, the sixth and eighth largest producers in 2021). Rounding out the "top ten" list, Namibia and Niger were, respectively, the second and seventh largest producers. *Id.*

Along with dependence on uranium, another risk is the security of the reactor itself. During a war, its core could be breached by missiles or artillery, or staff responsible for safety protocols could be incapacitated or driven away. Unfortunately, these risks became all too real in 2022 when Russian troops captured the Zaporizhzhya nuclear power plant in Ukraine.[222] Reactors also need protection from terrorist attacks, including truck bombs, plane crashes, and attempts to trigger a meltdown. The waste from reactors also must be secured, so terrorists cannot build dirty bombs. After the attacks on September 11, 2001, security at U.S. nuclear facilities was upgraded to address these threats.[223]

3. Defense Externalities: Clean Energy Raw Materials

Like nuclear power, other types of clean energy also ease some national security burdens, while creating others. A key challenge is the need for specialty minerals, such as cobalt and lithium.[224] More are needed for solar panels, wind turbines, electricity networks, and EVs than for fossil fuel systems. "A typical electric car requires six times the mineral inputs of a conventional car," the IEA has observed, "and an onshore wind plant requires nine times more mineral resources than a gas-fired power plant."[225] To scale up clean energy, the global economy will need far more of these minerals—four times more in 2040 to meet the goals of the Paris Accords and six times more to hit net-zero globally by 2050.[226]

Yet to source these minerals, the U.S. and its allies rely heavily on imports.[227] Most come from only a handful of suppliers, since production "is more concentrated than that of oil or natural gas."[228] Unfortunately, "[m]uch

222. Yulia Kesaieva, Olga Voitovych & Sana Noor Haq, *New Rocket Strike on Ukraine Nuclear Plant, as UN Watchdog Warns of 'Disaster'*, CNN (Aug. 7, 2022, 12:48 PM), https://www.cnn.com/2022/08/07/europe/zaporizhzhia-power-plant-nuclear-disaster-intl/index.html [https://perma.cc/K3F2-7F99].

223. Gwyneth Cravens, *Terrorism and Nuclear Energy: Understanding the Risks*, BROOKINGS (Mar. 1, 2002), https://www.brookings.edu/articles/terrorism-and-nuclear-energy-understanding-the-risks [https://perma.cc/QR86-5UUU].

224. For example, EV batteries need lithium, nickel, cobalt, manganese, and graphite, while the magnets in wind turbines and EV motors require rare earth elements, and electricity networks need copper and aluminum. *See* INT'L ENERGY AGENCY, THE ROLE OF CRITICAL MINERALS IN CLEAN ENERGY TRANSITIONS, WORLD ENERGY OUTLOOK SPECIAL REPORT 5 (2022).

225. *Id.*

226. *Id.* at 8.

227. From 2016 to 2019, "100% of graphite and manganese was imported," the U.S. Department of Energy reported. "76% of cobalt was imported, and about 50% of lithium and nickel was imported in 2020." *From 2016-2019, Over 90% of U.S. Lithium Imports Came from Argentina and Chile*, OFF. EFFICIENCY & RENEWABLE ENERGY (Feb. 14, 2022), https://www.energy.gov/eere/vehicles/articles/fotw-1225-february-14-2022-2016-2019-over-90-us-lithium-imports-came [https://perma.cc/7XFU-69LB].

228. INT'L ENERGY AGENCY, *supra* note 224, at 11.

of it comes from countries that are not our friends," as Mark Mills has observed.[229]

For example, more than two-thirds of the world's cobalt comes from the Democratic Republic of Congo,[230] which has been wracked by factional violence and protests in recent years.[231] Likewise, the U.S. and its allies depend heavily on Gabon for manganese, as well as on Chile and Argentina for lithium.[232] China is the main supplier of rare earths,[233] the global leader in processing other clean energy minerals,[234] and a determined buyer of mines all over the world.[235]

Depending on other countries for these minerals poses familiar national security risks. Like with oil, the U.S. and its allies will feel pressure to defend insecure suppliers in a crisis, while also funding hostile suppliers' harmful policies. "New geopolitics around the minerals for net zero may well emerge," S&P Global has warned, "which will echo the geopolitics that have long surrounded oil and natural gas."[236]

Fortunately, there are ways to reduce these national security costs. For one thing, the U.S. and its allies should ramp up efforts to recycle minerals, so newly-mined sources are less critical. In addition, they should try to replace minerals from an insecure supplier with alternatives that are easier to access (for example, by building batteries with lithium iron phosphates

229. Mark P. Mills, *Green Energy's Overseas Dependence*, NAT'L REV. ONLINE (July 5, 2020), https://www.manhattan-institute.org/green-energy-depends-overseas-materials-components [https://perma.cc/4K8M-KZV2].

230. Dionne Searcey, Michael Forsythe & Eric Lipton, *A Power Struggle Over Cobalt Rattles the Clean Energy Revolution*, N.Y. TIMES (Nov. 20, 2021), https://www.nytimes.com/2021/11/20/world/china-congo-cobalt.html [https://perma.cc/Y8W2-L2ES].

231. Nicholas Bariyo, *Surging Violence in Congo Turns Peacekeepers Into Targets*, WALL ST. J. (July 27, 2022, 12:52 PM), https://www.wsj.com/articles/surging-violence-in-eastern-congo-turns-peacekeepers-into-targets-11658940728?reflink=integratedwebview_share [https://perma.cc/6BVM-DML7] ("[D]ozens of armed groups have been waging war with the nation's army for nearly three decades."); *see generally* SIDDHARTH KARA, COBALT RED: HOW THE BLOOD OF THE CONGO POWERS OUR LIVES (2022) (chronicling human rights abuses and damage to environment in Congo's cobalt mining industry).

232. Bariyo, *supra* note 231.

233. U.S. DEP'T OF ENERGY, WIND ENERGY: SUPPLY CHAIN DEEP DIVE ASSESSMENT 21 (2022) ("Global production is concentrated in China, with all processing of heavy rare earth elements—including dysprosium and terbium—taking place there." (citation omitted)).

234. INT'L ENERGY AGENCY, GLOBAL SUPPLY CHAINS OF EV BATTERIES 2 (2022) [hereinafter GLOBAL SUPPLY EV]; Bordoff & O'Sullivan, *supra* note 33 ("China is decades ahead in the development of critical minerals . . . .").

235. *See, e.g.*, Searcey et al., *supra* note 230 (stating that China controls fifteen of Congo's nineteen cobalt mines); *see also* CLIMATE CHANGE INTERNATIONAL, *supra* note 142, at 6 (2022), ("Competition will grow to acquire and process minerals and resources used in key renewable energy technologies. China is in a strong position to compete . . . .").

236. S&P GLOB., THE FUTURE OF COPPER: WILL THE LOOMING SUPPLY GAP SHORT-CIRCUIT THE ENERGY TRANSITION? 67 (2022), https://ihsmarkit.com/info/0722/futureofcopper.html [https://perma.cc/4AM4-7WVV].

instead of cobalt).[237]

Likewise, the U.S. and its allies should encourage domestic mining. The good news is that they actually have deposits of most of the relevant minerals. But the bad news is that opening new mines is quite challenging, especially in democracies. Many projects whither on the vine, while successes usually require a decade or more of planning, negotiation, and construction to complete.[238] "[D]isruptions from labor strikes, protests, environmental activism, domestic political rivalries, governmental shifts, and contractual disputes and renegotiations . . . delay projects and investment," S&P Global has warned.[239] "Brownfield and greenfield development of new projects turn on the complex interaction of permitting and policy, contracts and politics, and businesses and civil society . . . ."[240] Unfortunately, some environmental groups are adamantly opposed to mining, even for minerals needed to reduce emissions.[241] Like when they oppose fossil fuel projects, these activists will find allies among local residents and economic competitors. Again, we see the authoritarian comparative advantage in extractive industries.[242]

Seeking to change this dynamic, the Inflation Reduction Act offered substantial subsidies for domestic mining and recycling. For example, half of the EV tax credit is available only if enough of the minerals in the battery were extracted and processed in the U.S. (or in a country with a free trade agreement with the U.S.) or were recycled in North America.[243]

Yet even with these subsidies, domestic mining and recycling cannot proceed without permits. Although Congress considered a permitting reform bill in 2022, it was not enacted.[244] "[T]he United States is still in some early

237. Searcey et al., *supra* note 230.

238. S&P GLOB., *supra* note 236, at 69 ("In nearly every jurisdiction, a new mine seeking permission today would not be productive until the late 2030s.").

239. *Id*. at 66.

240. *Id.*

241. *See, e.g.*, MEADHBH BOLGER, DIEGO MARIN, ADRIEN TOFIGHI-NIAKI & LOUELLE SEELMANN, EUROPEAN ENV'T BUREAU & FRIENDS OF THE EARTH EUROPE, 'GREEN MINING' IS A MYTH: THE CASE FOR CUTTING EU RESOURCE CONSUMPTION (Rachel Tansey ed., 2021), https://friendsoftheearth.eu/wp-content/uploads/2021/10/Green-mining-myth-report.pdf [https://perma.cc/A744-8H6Z].

242. *See supra* Section III.D.

243. In December of 2022, the Treasury offered preliminary guidance about EV mineral requirements. *See* U.S. TREASURY, ANTICIPATED DIRECTION OF FORTHCOMING PROPOSED GUIDANCE ON CRITICAL MINERAL AND BATTERY COMPONENT VALUE CALCULATIONS FOR THE NEW CLEAN VEHICLE CREDIT 2 (2022) [hereinafter U.S. TREASURY]. According to the Treasury, "North America" means the U.S., Canada, and Mexico. *Id.* at 2 n.2. Likewise, the term "free trade agreement" includes "at minimum, the comprehensive trade agreements of the United States with the following countries: Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordan, South Korea, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, and Singapore." *Id.* at 3. Notably, this list does not include Japan or U.S. allies in Europe.

244. *See* Colin Mortimer, *Manchin's Permitting Reform Effort Is Dead. Biden's Climate Agenda*

days of scrutinizing the existing web of federal and local mining permits and addressing NIMBY-ism," Jane Nakano observed, "[so] a domestic supply chain is years away at best."[245]

4. Funding Externalities: Clean Energy Manufacturing

The U.S. and its allies depend on other countries not just for raw materials, but also for the finished product. The main concern is China, a formidable geopolitical rival, [246] which has become the world's leading manufacturer of clean energy technology.[247]

China has seven of the world's top ten solar manufacturers,[248] and produces over 75 percent of the world's EV batteries.[249] While the U.S. and its allies are less dependent on China for wind turbines, this could change. For land-based turbines, the U.S. is a leading manufacturer (though it faces stiff competition).[250] For offshore turbines, however, the U.S. relies on European suppliers,[251] but China is ramping up, "buil[ding] more offshore wind turbines in 2021 than every other country did in the past five years."[252]

Could Be a Casualty, VOX (Dec. 16, 2022, 12:04 PM), https://www.vox.com/policy-and-politics/2022/12/12/23500140/permitting-reform-inflation-reduction-act-congress-manchin [https://perma.cc/XB8K-25W6].

245. Jane Nakano, *IRA and the EV Tax Credits—Can We Kill Multiple Birds with One Stone?*, CTR. STRATEGIC & INT'L STUDS. (Sept. 15, 2022), https://www.csis.org/analysis/ira-and-ev-tax-credits%E2%80%94can-we-kill-multiple-birds-one-stone-0 [https://perma.cc/GB65-K3ZF].

246. *See* BIDEN-HARRIS NATIONAL SECURITY STRATEGY, *supra* note 16, at 23 ("The PRC is the only competitor with both the intent to reshape the international order and, increasingly, the economic, diplomatic, military, and technological power to do it."); 2022 U.S. ANNUAL THREAT ASSESSMENT, *supra* note 13, at 4 ("China increasingly is a near-peer competitor, challenging the United States in multiple arenas—especially economically, militarily, and technologically—and is pushing to change global norms and potentially threatening its neighbors."); *see also* Julian E. Barnes, *China Poses Biggest Threat to U.S., Intelligence Report Says*, N.Y. TIMES (Apr. 13, 2021), https://www.nytimes.com/2021/04/13/us/politics/china-national-security-intelligence-report.html [https://perma.cc/GP8H-Z5FP].

247. Searcey et al., *supra* note 230 ("[China has] followed a disciplined playbook . . . to dominate the world's emerging clean energy economy.").

248. David M. Kuchta, *Where Are Solar Panels Made? Why Your Manufacturer Matters*, TREEHUGGER, https://www.treehugger.com/where-are-solar-panels-made-5194436 [https://perma.cc/GKF7-SQY9]. The other three are in the U.S., South Korea, and Canada. When the U.S. imports completed solar panels (or "modules"), they come from Malaysia, Vietnam, Thailand, and South Korea, but the components mainly are from China. *Id.*

249. GLOBAL SUPPLY EV, *supra* note 234, at 2 ("Today's battery and minerals supply chains revolve around China.").

250. U.S. DEP'T OF ENERGY, WIND ENERGY SUPPLY CHAIN DEEP DIVE ASSESSMENT 25 (2022), https://www.energy.gov/sites/default/files/2022-02/Wind%20Energy%20Supply%20Chain%20Report%20-%20Final.pdf [https://perma.cc/9CUC-BMSF]. The main competitors, who produce low-cost components, are Indonesia, South Korea, Vietnam, and India. *Id.* at 26. China focuses more on building offshore wind turbines. *See id.* (naming China, Europe, and Taiwan as major manufacturers of offshore wind facilities).

251. *Id.* at 26.

252. Ariel Cohen, *China's Wind Power Push Threatens US Strategic Interests*, FORBES (May 23, 2022, 10:00 AM), https://www.forbes.com/sites/arielcohen/2022/05/23/windy-times-in-american-

Unfortunately, depending on China for clean energy could pose the same three risks, discussed above, as depending on rivals for fossil fuel. First, these purchases could fund policies that undermine U.S. interests, such as China's efforts to control the South China Sea and Taiwan. Second, clean energy exports could give China leverage (for example, to stop exporting to countries that oppose its geopolitical agenda). Thus, just as Russia has weaponized natural gas while invading Ukraine, China might do the same with EV batteries and solar panels while attacking Taiwan. Third, China's exports could also fund repressive policies at home, such as the use of forced labor to produce solar panels.[253]

Admittedly, even without clean energy, the U.S. and its allies already depend on China for other important products, ranging from semiconductors and cell phones to surgical masks. Even so, adding clean energy to this list is still significant—not just because the list grows longer—but also because energy is so fundamental in (literally) powering a modern economy.

While this sort of economic interdependence is not always bad—indeed, it can moderate potentially hostile regimes, as noted above—these benefits do not always materialize, as Germany learned in buying fossil fuel from Russia. Is China a safer bet? Although President Xi's assertive foreign policy is not reassuring in this regard,[254] the relationship between China and the West is complex. Over time, it could become either more confrontational or more cooperative. The goal here is not to offer a definitive prediction, but to highlight a meaningful risk.

Again, like with fossil fuel, the best way to mitigate funding externalities is to depend more on production in the U.S., Europe, and other friendly countries. In fact, Congress tried to encourage this sort of "friend-shoring" in the Inflation Reduction Act of 2022. Along with providing billions of dollars in subsidies directly for clean energy manufacturing in the U.S., Congress set conditions on other subsidies, so they would be available only for products with supply chains in the U.S. or other treaty partners.[255]

energy-policy [https://perma.cc/3WZK-P2QU].

253. *See* Laura T. Murphy & Nyrola Elimä, SHEFFIELD HALLAM UNIV. HELENA KENNEDY CTR. FOR INT'L JUST., IN BROAD DAYLIGHT: UYGHUR FORCED LABOUR AND GLOBAL SOLAR SUPPLY CHAINS 7-8 (2021) (alleging that China uses forced labor to produce polysilicon).

254. Jo Inge Bekkevold, *What Xi's First Decade Tells Us About the Next*, FOREIGN POL'Y (Oct. 13, 2022, 6:15 AM), https://foreignpolicy.com/2022/10/13/xi-jinping-china-ccp-communist-party-congress-geopolitics [https://perma.cc/GR6T-GX9B] ("[Under Xi], Beijing has adopted a more assertive foreign policy with increased use of coercive diplomacy.").

255. For example, the statute creates a new advanced manufacturing production credit "for domestic manufacturing of components along the supply chain for solar modules, wind turbines, battery cells and modules, and critical minerals processing." WHITE HOUSE, BUILDING A CLEAN ENERGY ECONOMY: A GUIDEBOOK TO THE INFLATION REDUCTION ACT'S INVESTMENTS IN CLEAN ENERGY AND CLIMATE ACTION 26 (2023) [hereinafter BUILDING A CLEAN ENERGY ECONOMY], https://www.

This is not to say that the Inflation Reduction Act has executed this policy flawlessly. For one thing, the definitions of which countries count as "friend-shoring" vary by provision,[256] and have prompted complaints from U.S. allies.[257]

In addition, the Inflation Reduction Act also tries to "pick winners," choosing which technologies get larger subsidies, which get smaller ones, and which get none at all. As I have emphasized elsewhere, government institutions often lack the expertise and incentives to make this sort of judgment effectively.[258] As Part VI emphasizes below, a better strategy is to rely on policies that do not depend on the government to make these judgments, such as Pigouvian taxes.[259]

To sum up, clean energy can mitigate one national security risk (depending on the wrong fossil fuel suppliers) while creating another (relying on the wrong clean energy suppliers). To address this new risk, the key is to "friend-shore" the relevant minerals and manufacturing (and, of course, to do this the right way).

whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf [https://perma.cc/5MGV-32EW]. The statute also includes Defense Production Act funding for "[n]ew domestic production facilities projects for heat pumps (air- or ground-source), heat pump water heaters, or heat pump system components where domestic production would address a clear supply-chain vulnerability." *Id.* at 32. In addition, the statute "includes billions of dollars to support vehicle manufacturers looking to expand their domestic production of clean vehicles." *Id.* at 47. An expanded credit for purchasers of electric vehicles is available only if vehicles are assembled domestically and an increasing percentage of components and minerals in their batteries are "sourc[ed] or process[ed] in the United States or from trusted trade partners." *Id.* at 46. Similarly, the production and investment tax credits for renewable energy are increased by 10% for projects that meet domestic content requirements. *Id.* at 13–14. The same is true of the clean electricity production tax credit and the clean electricity investment tax credit. *Id.* at 18–20.

256. In the EV credit, for example, the sourcing requirement varies, depending on whether the minerals were extracted or recycled. If extracted, they need to come from the United States or "any country with which the United States has a free trade agreement in effect." I.R.C. § 30D(e)(1)(A)(i). In contrast, if the minerals are recycled, this recycling must take place in "North America." *Id.*

257. For example, when Treasury offered initial guidance in December of 2022 on which countries qualify as treaty partners under the statute's EV mineral requirements, Japan and U.S. allies in Europe were not included. *See* U.S. TREASURY, *supra* note 243. These (and other) supply chain requirements in the statute have inflamed tensions with U.S. allies. *See* Andrew Ross Sorkin, Ravi Mattu, Bernhard Warner, Sarah Kessler, Stephen Gandel, Michael J. de la Merced, Lauren Hirsch & Ephrat Livni, *Could Biden's Climate Agenda Trigger a New Trade War?*, N.Y. TIMES (Dec. 6, 2022), https://www.nytimes.com/2022/12/06/business/dealbook/biden-climate-trade-europe.html [https://perma.cc/W4E7-GBP3] ("Europe is growing hot over the Biden administration's Inflation Reduction Act, . . . At issue is a portion of the law that offers $369 billion in subsidies and tax breaks to companies that develop green technologies . . . in North America."). One way to broaden the list of eligible suppliers is to include countries with collective defense arrangements with the U.S., including Japan and NATO. *See* John Bozzella, *What If No EVs Qualify for the EV Tax Credit? It Could Happen*, ALL. FOR AUTO. INNOVATION (Aug. 5, 2022), https://www.autosinnovate.org/posts/blog/what-if-no-evs-qualify-for-the-ev-tax-credit [https://perma.cc/2ZJ7-AVF7].

258. Schizer, *Energy Subsidies*, *supra* note 6, at 277–89.

259. *See infra* Section VI.A.1.

D. NEW ENVIRONMENTAL HARMS

Just as clean energy has national security costs, as well as benefits, the same is true of its environmental effects. While the benefits (such as reducing emissions and pollution) are very significant, they are not free.

1. Avian Impacts of Wind and Solar

For one thing, wind turbines and solar panels can harm birds and bats. These risks are regularly invoked to block clean energy projects.[260] Although regrettable, these species impacts should not keep the U.S. and its allies from using renewable energy. As Professor Michael Gerrard has explained, we face a choice between saving "birds now or birds later."[261] Halting these projects may save some birds now, but "won't some of the animals we are trying to protect be gone anyway [because of climate change], together with untold numbers of others?"[262] Faced with this tradeoff, policymakers should target the greater threat, which is climate change.[263] Unfortunately, some environmentalists resist this logic. "Rather than climate denial, the environmental community has tradeoff denial," Professor Gerrard has observed."[264]

2. Mining for Clean Energy Minerals

Clean energy has another set of environmental costs as well: mining for the necessary minerals can cause pollution, water shortages, accidents, and disruption of local communities and habitats.[265] Invoking these risks, some environmental groups oppose mining for these minerals in the U.S. and E.U.[266]

Again, this is a mistake. As with the impact on birds, pollution from these mines is an unavoidable cost of combatting climate change. "[W]e need

260. *See, e.g.*, Michael B. Gerrard, *Save Birds Now or Birds Later*, ENV'T F. 39, 39 (May/June 2015) (describing the failure of the Cape Winds project).

261. *Id.*

262. *Id.*

263. *Id.* ("The current system of U.S. environmental law, with its multiple delays and veto points, may be incompatible with the scale and pace of the transformation of the energy system that is needed to meet the climate problem.").

264. Michael B. Gerrard, *A Time for Triage,* ENV'T F. 38, 40 (Nov./Dec. 2022).

265. Iris Crawford, *Ask MIT Climate: Will Mining the Resources Needed for Clean Energy Cause Problems for the Environment?*, MASS. INST. TECH. CLIMATE PORTAL (July 21, 2022), https://climate.mit.edu/ask-mit/will-mining-resources-needed-clean-energy-cause-problems-environment [https://perma.cc/33ZG-Q7N2].

266. *See, e.g.*, Aaron Mintzes, *Harmful Mining Provisions in the Inflation Reduction Act*, EARTHWORKS (Aug. 4, 2022), https://earthworks.org/blog/harmful-mining-provisions-in-the-inflation-reduction-act [https://perma.cc/HC27-VP3H] (opposing mining incentives in the Inflation Reduction Act for minerals needed for clean energy).

to be in an era of triage," Michael Gerrard has urged, "where we save what we can but recognize that there are things we'll have to give up."[267] Moreover, if these minerals are going to be extracted somewhere, isn't it better to do it in jurisdictions with meaningful environmental regulation? The U.S. and E.U. are likely to be more responsible than many current suppliers.

3. Pollution and Accidents From Nuclear Energy

Like wind and solar power, nuclear power also poses environmental tradeoffs. On the one hand, the advantages are quite significant. No greenhouse gas is emitted[268] and, unlike with wind and solar, output does not vary with the weather.[269]

On the other hand, nuclear power poses two familiar risks, which prompt staunch opposition from some environmentalists. First, there is radioactive waste, which must be disposed of safely. Second, there also is a risk of accidents. Fortunately, these have been rare. In the U.S., the most significant one, a partial meltdown at the Three Mile Island plant in 1979, had only negligible effects on public health and the environment.[270] In contrast, the meltdowns at Fukushima in Japan in 2011 and at Chernobyl in the Soviet Union in 1986 were quite serious, causing disease and death from radiation exposure and also rendering some areas uninhabitable for decades.[271] Yet these tragedies were the product of unique circumstances: a tsunami in Japan, and a blend of human error and dysfunctional efforts to conceal the incident in the Soviet Union.[272]

267. Gerrard, *supra* note 264.

268. *Three Reasons Why Nuclear is Clean and Sustainable*, OFF. OF NUCLEAR ENERGY (Mar. 31, 2022), https://www.energy.gov/ne/articles/3-reasons-why-nuclear-clean-and-sustainable [https://perma.cc/44SM-49YN].

269. Alex Brown, *Climate Change is Shifting State Views on Nuclear Power*, STATELINE (June 15, 2022), https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2022/06/15/climate-change-is-shifting-state-views-on-nuclear-power [https://perma.cc/XHX2-W5HE] ("If you build your whole grid around intermittent renewables, you have times and days of the year where you don't have any wind or sun . . . . Baseload power is critical, and nuclear is the cleanest form of baseload power." (quoting Connecticut state Senator Norm Needleman)).

270. *Five Facts to Know About Three Mile Island*, OFF. OF NUCLEAR ENERGY (May 4, 2022), https://www.energy.gov/ne/articles/5-facts-know-about-three-mile-island [https://perma.cc/W4WT-YRVH].

271. Richard Gray, *The True Toll of the Chernobyl Disaster*, BBC (July 25, 2019), https://www.bbc.com/future/article/20190725-will-we-ever-know-chernobyls-true-death-toll [https://perma.cc/L3L3-4Z3U].

272. Michael Fitzpatrick, *Nuclear Power is Set to Get a Lot Safer (and Cheaper)—Here's Why*, CONVERSATION (Apr. 11, 2017, 6:46 AM), https://theconversation.com/nuclear-power-is-set-to-get-a-lot-safer-and-cheaper-heres-why-62207 [https://perma.cc/2V42-3RLL] ("The reactors that are being constructed today benefit from 60 years of experience gained in the design and operation of nuclear power plants around the world.").

With the right safety features and regulation, the risks from nuclear power should be quite limited. For example, new reactors have passive cooling systems that work even if power has been knocked out—the problem at Fukushima—as well as "core catchers" that contain radiation more effectively.[273]

Arguably, then, the risks of *not using* nuclear power are greater than the risks of *using* it. For example, after Germany began phasing out nuclear power as a response to Fukushima, its economy became even more dependent on Russian natural gas. This choice turned out badly not just for national security, but also for the environment: when the gas stopped flowing, Germany ramped up its use of coal, spewing more emissions and pollution into the air.

E. TIMING: A GRADUAL TRANSITION

Although replacing fossil fuel with clean energy has the potential to be a "win-win"—protecting both national security and the environment—a number of new national security and environmental risks must be addressed. In addition, there is another daunting challenge: for now, the world's supply of clean energy is not even close to adequate. In 2021, renewables generated only 7% of the world's energy. Paired with nuclear and hydroelectric power, the non-carbon total rose to just 18%. As Table 1 shows, fossil fuel still provided 82% of the world's energy:

TABLE 1. Share of Global Energy By Source in 2021

Fuel	*Amount (Exajoules)*	*Percentage*
Oil	184.21	31%
Natural Gas	145.35	24%
Coal	160.10	27%
Nuclear	25.31	4%
Hydroelectric	40.26	7%
Renewables	39.91	7%
Total	595.15	100%

Notes: This data comes from BP Statistical Review of World Energy 9 (71st ed. 2022).

273. *Id.*

The market share of clean energy can increase, to be sure, but this progress inevitably will be gradual. Consumers do not replace cars and heating systems all that frequently. Even if they did, there are not enough EVs, heat pumps, solar panels, and wind turbines to accommodate everyone at once. As of now, we do not have enough factories to build them—or, for that matter, enough raw materials.

For example, replacing all petroleum-powered cars on the road today would require 1.39 billion EVs, whose batteries would need massive quantities of lithium, cobalt, and other minerals.[274] But according to the Geological Survey of Finland, "[p]reliminary calculations show that global reserves, let alone global production, may not be enough to resource the quantity of batteries required."[275]

There is a similar challenge with copper. Since it is essential for power infrastructure, renewable generation, and EVs, global demand is expected to double by 2035.[276] According to S&P Global, the global supply cannot grow fast enough to meet the goal of net-zero global emissions by 2050.[277] "Unless massive new supply comes online in a timely way," they warn, "the goal of Net-Zero Emissions by 2050 will be short-circuited and remain out of reach."[278]

The bottom line, then, is that the world has no realistic choice but to keep depending on fossil fuel for years to come. So although it is important to reduce demand for fossil fuel over time—the first part in this Article's two-part proposal—it also is necessary to implement the second part: tapping new sources of supply.

274. SIMON P. MICHAUX, GEOLOGICAL SURVEY OF FINLAND REP.: ASSESSMENT OF THE EXTRA CAPACITY REQUIRED OF ALTERNATIVE ENERGY ELECTRICAL POWER SYSTEMS TO COMPLETELY REPLACE FOSSIL FUELS iv (2021), https://tupa.gtk.fi/raportti/arkisto/42_2021.pdf [https://perma.cc/B4FM-65HC] ("The mass of lithium ion batteries required to power the 1.39 billion EV's [sic] . . . would be 282.6 million tonnes.").

275. *Id.* "In theory, there are enough global reserves of nickel and lithium if they were exclusively used just to produce li-Ion batteries for vehicles," Michaux estimates. "To make just one battery for each vehicle in the global transport fleet (excluding Class 8 HCV trucks), it would require 48.2% of 2018 global nickel reserves, and 43.8% of global lithium reserves. There is also not enough cobalt in current reserves to meet this demand and more will need to be discovered." *Id.*

276. S&P GLOB., *supra* note 236, at 3.

277. *Id.* at 9 (predicting that supply will fall twenty percent below what is needed).

278. *Id.* There are parallel challenges in building enough renewable powerplants. MICHAUX, *supra* note 274, at ii–iii (estimating that an additional 221,594 renewable power plants will have to be built, compared with an existing global stock of only 46,423 stations, and explaining that this large differential "reflects the lower Energy Returned on Energy Invested (ERoEI) ratio of renewable power compared to current fossil fuels").

V. TAPPING NEW SOURCES OF FOSSIL FUEL IN ENVIRONMENTALLY RESPONSIBLE WAYS

As Parts I and II showed, new sources of fossil fuel enhance national security when they come from the U.S. and other secure and friendly countries, and thus ease dependence on insecure or hostile suppliers. Yet notwithstanding these advantages of new sources, the IEA and other influential voices have called for an end to fossil fuel development.[279] At times, the Biden Administration has also gestured in this direction, although at other times it has supported more drilling in response to rising energy prices, legal constraints, geopolitical imperatives, and political concerns.[280]

It is naïve—and, ultimately, misguided—to end fossil fuel development in the near term. On the contrary, to protect national security, the U.S. and its allies need to keep adding new wells and infrastructure in the right countries. Even so, this needs to be done in an environmentally responsible way. How can the U.S. and its allies tap new fossil fuel sources while still reducing emissions and pollution? This Part proposes three strategies to do both at once: first, new sources should be as "clean" as possible; second, they should replace, instead of adding to, sources that pose national security risks; and third, new sources should be temporary instead of permanent.

A. INCREASE CARBON EFFICIENCY OF SECURE AND FRIENDLY SOURCES

As emphasized above, a key national security goal is to use less oil and gas from Russia, Venezuela, and Iran, and more from countries like the U.S., Brazil, Mexico, and Canada. If these friendly and secure sources also offer environmental advantages, developing them advances both national security and environmental goals. To pursue this "win-win" scenario, policymakers should look for ways to reduce the carbon and pollution footprints of these sources. How can we get more energy from them, while generating the *same* levels of emissions and pollution—or, ideally, *reducing* these levels?

1. Flaring

For one thing, we should get more energy from fuel we already burn. Unfortunately, massive amounts of natural gas are burned (or "flared") at the wellhead. No one uses this energy, but it still produces significant emissions and pollution.[281]

279. *See* Schizer, *Energy Subsidies*, *supra* note 6. For a discussion, see *infra* Section VI.B.

280. *See infra* Section V.C.4.

281. Zubin Bamji, *We Can End Routine Gas Flaring by 2030. Here's How*, WORLD BANK BLOGS (Mar. 1, 2021), https://blogs.worldbank.org/energy/we-can-end-routine-gas-flaring-2030-heres-how [https://perma.cc/93YJ-D87Y] (explaining that flared gas emits 400 MM metric tons of CO_2-equivalent emissions and pollution each year).

This means a great deal of energy is wasted: about eight percent of global natural gas production (accounting for six percent of global emissions).[282] "If half of the amount of gas flared annually [across the globe] was used for power generation," Zubin Bamji observed, "it could provide about 400 billion kilowatt-hours of electricity – that's roughly the annual electricity consumption of Sub-Saharan Africa."[283] In the U.S. alone, gas worth $10.6 billion was flared between 2012 and 2020.[284]

Why is so much natural gas wasted? Unfortunately, there is no infrastructure to bring it to market. This gas comes from oil wells, which have infrastructure to transport oil, but not gas.[285] When gas cannot be delivered to consumers, the easiest alternatives are either to burn it or—even worse—to release it into the atmosphere.[286]

But instead of wasting this gas, we should find ways to use it—and, thus, to increase the supply of energy without increasing emissions (since this gas will be burned anyway). One option is to build pipelines to take it to market.[287] Indeed, flaring is less common in Texas than in North Dakota because there are more pipelines.[288] Where pipelines are not economical, facilities to use this gas can be added near the well, including small-scale generators, "micro" compression and liquefaction facilities, and petrochemical plants.[289] If these solutions are not viable, the gas can be stored underground.[290]

282. U.S. DEP'T OF ENERGY, FLARING AND VENTING REDUCTION RESEARCH & DEVELOPMENT ACTIVITIES 3 (2021) [hereinafter FLARING AND VENTING REDUCTION], https://www.energy.gov/sites/default/files/2021-08/Flaring%20and%20Venting%20Report%20to%20Congress%20Report.pdf [https://perma.cc/9ZKX-GC7R].

283. Bamji, *supra* note 281.

284. Nicole Sadek, Zoha Tunio & Sarah Hunt, *Flaring Profits: The Economics of Burning Gas*, CRONKITE NEWS (Feb. 24, 2022) https://cronkitenews.azpbs.org/howardcenter/gaslit/economics.html [https://perma.cc/2K6W-2ASM] (estimating 3.5 trillion cubic feet using gas prices in effect at the time).

285. Patrick Springer, *North Dakota's Gas Flaring Rate Seven Times Higher Than Next-Highest State, Study Finds*, INFORUM (Dec. 4, 2022, 12:10 PM), https://www.inforum.com/news/north-dakota/north-dakotas-gas-flaring-rate-7-times-higher-than-next-highest-state-study-finds [https://perma.cc/MHG4-T7F6] (noting that flaring occurs at oil wells, not natural gas wells).

286. Releasing (or "venting") it is even more harmful because the main component of natural gas, methane, is a potent greenhouse gas. FLARING AND VENTING REDUCTION, *supra* note 282, at v.

287. RYSTAD ENERGY, COST OF FLARING ABATEMENT 45 (2022), https://blogs.edf.org/energyexchange/files/2022/02/Attachment-W-Rystad-Energy-Report-Cost-of-Flaring-Abatement.pdf [https://perma.cc/6NSC-WUWA] ("Gathering is typically the most cost-effective method of preventing flaring . . . .").

288. Springer, *supra* note 285 ("[F]laring in North Dakota is largely driven by a lack of infrastructure. Infrastructure capacity constraints account for 84% of flaring in North Dakota and 64% in Texas . . . .").

289. RYSTAD ENERGY, *supra* note 287, at 54, 59, 72; *see also* FLARING AND VENTING REDUCTION, *supra* note 282, at 11–13.

290. RYSTAD ENERGY, *supra* note 287, at 64.

2. Methane Leaks

Natural gas also is wasted when it leaks from wells and pipelines. Like flaring, these leaks increase emissions without generating useful energy,[291] so plugging them should be a priority. EPA proposed new rules on leaks in November of 2021, as well as supplemental rules a year later.[292] The Inflation Reduction Act also introduced a charge on methane leaks in some circumstances.[293] Analyzing the details of these measures is beyond this Article's scope. The goal here is not to determine whether they are the best ways to target leaks, but to emphasize the importance of addressing this issue.

3. Carbon Capture, Utilization, and Storage ("CCUS")

Still another way to reduce environmental harms from fossil fuel is to capture and store CO_2, so it is not released into the atmosphere. For example, emissions from power plants can be piped to old oil and gas wells.[294] "Carbon capture, utilisation and storage (CCUS) so far has not lived up to its promise," the IEA has observed, but "[s]tronger climate targets and investment incentives are injecting new momentum into CCUS."[295] The U.S. tax code offers a tax credit for carbon capture, which the Inflation Reduction Act made more generous.[296] Again, the details of this credit are beyond this Article's scope.

4. Replace Coal With Natural Gas

Along with reducing emissions and pollution from specific types of fuel, policymakers also should change the *mix* of fuel. Specifically, a determined effort is needed to replace coal with natural gas.

291. *See supra* Section III.A.3 (noting that methane is a dense greenhouse gas).

292. *See* EPA, Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 86 Fed. Reg. 63110 (Nov. 15, 2021), https://www.federalregister.gov/documents/2021/11/15/2021-24202/standards-of-performance-for-new-reconstructed-and-modified-sources-and-emissions-guidelines-for [https://perma.cc/A6E9-VVEZ]; EPA, Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 87 Fed. Reg. 74702 (Dec. 6, 2022), https://www.federalregister.gov/documents/2022/12/06/2022-24675/standards-of-performance-for-new-reconstructed-and-modified-sources-and-emissions-guidelines-for [https://perma.cc/6RHX-NREY].

293. Jason Lindquist, *Cover Me, Part 2—Inflation Reduction Act's New Methane Charge Takes Aim at Emissions*, RBN ENERGY (Sept. 28, 2022), https://rbnenergy.com/cover-me-part-2-inflation-reduction-act-new-methane-charge-takes-aim-at-emissions [https://perma.cc/489S-32YV].

294. *About CCUS*, INT'L ENERGY AGENCY (Apr. 2021), https://www.iea.org/reports/about-ccus [https://perma.cc/HJK7-ELTE].

295. *A New Era for CCUS*, INT'L ENERGY AGENCY (2020), https://www.iea.org/reports/ccus-in-clean-energy-transitions/a-new-era-for-ccus [https://perma.cc/V8A9-5DW4].

296. *See* I.R.C. § 45Q; *see also* BUILDING A CLEAN ENERGY ECONOMY, *supra* note 255, at 67–70 (describing IRA provisions on industrial decarbonization and carbon management).

Since the U.S. has ample reserves of both, they offer similar national security advantages.[297] Yet burning coal produces nearly twice as many emissions as burning natural gas, as well as more pollution.[298] Admittedly, natural gas poses the additional risk of methane leaks, as noted above.[299] But as long as this problem is addressed, replacing coal with natural gas reduces emissions and pollution.[300]

Indeed, this switch has helped U.S. emissions decline substantially in recent years, as noted above.[301] Yet there is a lot of room for improvement, since coal still accounts for about 27% of the world's energy,[302] as well as 11% of all energy used in the U.S.[303]

As a result, U.S. exports of natural gas do double duty. Not only do they enhance national security (by replacing Russian gas), but they also protect the environment (by replacing coal). For the same reasons, bringing natural gas to Europe from the Eastern Mediterranean is also good for both national security and the environment, so it is unfortunate that the Biden Administration has impeded this effort, at least initially, as noted above.[304]

B. EXTRA SUPPLY SHOULD REPLACE, INSTEAD OF ADDING TO, EXISTING SOURCES

As the previous Section showed, when the U.S. and its allies tap new sources of fossil fuel, they should favor cleaner ones. This Section adds a second environmental safeguard: in tapping new sources, the goal should be

297. *See supra* Section I.C.2.

298. *Carbon Dioxide Emissions Coefficients*, *supra* note 149.

299. *See supra* Section III.A.3.

300. *Id*.

301. *Id*.

302. Of the 92.97 Exajoules of energy the U.S. consumed in 2021, 10.57 Exajoules (or 11%) came from coal. Similarly, of the 595.15 Exajoules of energy the world consumed in 2021, 160.10 Exajoules (or 26.9%) came from coal. *See* BP, BP STATISTICAL REVIEW OF WORLD ENERGY 9 (71st ed. 2022), https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf [https://web.archive.org/web/20230407184949/https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf].

303. *U.S. Energy Facts*, *supra* note 194.

304. *See supra* notes 1–3 and accompanying text. Just as natural gas should replace coal, there are analogous gains from replacing "heavy" oil with "light" oil. For example, using less Russian oil arguably is good not only for national security, but also for the environment; it is heavier and more sour than most U.S. crude. Hausmann, *supra* note 97 ("Russian oil is heavier than most OPEC or US oil, meaning that it generates more carbon dioxide per unit of energy. It is also sour, meaning that it contains a lot of sulfur, a nasty contaminant."). For a comparison of the environmental effects of different types of crude oil, see D. Nathan Meehan, Hassan M. El-Houjeiri & Jeffrey S. Rutherford, *Carbon Intensity: Comparing Carbon Impacts of Middle East and US Shale Oils*, SOCIETY OF PETROLEUM ENGINEERS 3–6 (2018), https://onepetro.org/SPESATS/proceedings-abstract/18SATS/All-18SATS/SPE-192166-MS/215513 [https://perma.cc/85Y4-EYVM].

to stabilize—not increase—global supply.

Fortunately, increasing supply should not be necessary. Rather, to protect national security, the key is to fill a gap. If one supplier suddenly stops selling (because of an invasion or revolution) or should not be allowed to sell (because its revenue funds harmful conduct), another supplier needs to step in—not to *add* to global supply, but to *replace* the insecure or hostile source.

This reality reduces the tension with environmental goals. As long as new sources just fill a gap in the market, emissions and pollution should not increase. Overall, the same quantity of fossil fuel is burned; it just comes from different countries. Indeed, if friendly and secure sources are cleaner than the oil and gas they replace, as the previous Section recommended, global emissions and pollution would decline.

To be clear, this happens only if the insecure or hostile supplier's oil and gas actually come off the market. This is quite likely for insecure sources, whose production is disrupted by an invasion or revolution. But with a hostile exporter, exiting the market is not automatic. If they want to keep selling, boycotts or other sanctions are needed to stop them. The key question, noted above, is whether these sanctions are effective.[305] If not, adding new wells would *increase* global supply, instead of just *stabilizing* it, and thus could generate additional emissions and pollution.

To avoid this problem, new sources ideally should be elastic. They should increase production as insecure or hostile producers cut back, while reducing production as these other producers ramp up.

Is this feasible? The good news is that, at least to an extent, it happens automatically in response to market prices. On the one hand, if insecure or hostile producers *cut* production, prices rise, motivating secure and friendly suppliers to increase production. On the other hand, if insecure or hostile producers *maintain* their production, prices do not rise (or, at least, they revert after an initial panic). As a result, there is no market-based incentive to produce more (and, obviously, policymakers do not need to intervene with other incentives).

Yet, although prices provide some protection from oversupply (and the extra emissions and pollution it triggers), they are not a sure-fire solution. Suppliers sometimes respond slowly to changes in price, expecting prices to be volatile and waiting to see whether a trend endures.[306] In addition, some

305. *See supra* Section II.B.

306. Nick Lioudis, *Oil and Gas Production Timelines*, INVESTOPEDIA, https://www.investopedia.com/ask/answers/061115/how-long-does-it-take-oil-and-gas-producer-go-drilling-

suppliers are able to adjust more quickly than others, as emphasized above.[307] When prices rise, how fast can they bring more product to market? When prices fall, how rapidly can they cut production? Producers vary widely in this regard; for example, Saudi Arabia is fast, U.S. offshore wells are slow, and so forth.[308]

The bottom line, then, is that tapping new sources of fossil fuel does not increase emissions or pollution if this new supply stabilizes (but does not increase) global supply. The same amount of fossil fuel is used, but it comes from different countries. This outcome is more likely when the new suppliers are flexible, so they can respond more quickly to market prices (and, therefore, to underlying shifts in global supply).

C. IN ADDING NEW CAPACITY, RETAIN FLEXIBILITY TO MAKE IT TEMPORARY

This brings us to a third way to minimize environmental harm from tapping new sources of oil and gas: ideally, this extra supply should be reversible, producing only as long as it is needed. This Section shows how U.S. shale can offer this flexibility and explains how policymakers can leverage it.

1. U.S. Shale Has the Potential to Ramp Up Quickly

For one thing, shale producers can increase production fairly quickly, enabling them to replace suppliers that have become unavailable. Shale producers are not as fast as Saudi Arabia—which, as noted above, often can bring additional barrels to market within thirty days—but they are quicker than most other producers.[309] In general, shale producers take between six and twelve months to react to price changes.[310] So when prices spike, these suppliers have the ability (and usually also the incentive) to increase production.

"Shale oil developments require relatively low amounts of initial capital and can be developed in relatively short order, making shale oil highly sensitive to price increases," Bordoff, Halff and Losz have explained.[311] "In contrast with the rest of the industry, which is highly concentrated, the shale

production.asp [https://perma.cc/Z6JL-YD5E] ("[C]hronic volatility . . . gives producers another reason not to rush longer-term supply decisions.").

307. *See supra* Section I.C.3.*ii*.

308. *Id.*

309. *Id.*; BORDOFF ET AL., *supra* note 61, at 20 ("[S]hale oil supply cannot be ramped up quite as quickly as OPEC spare capacity can be activated.").

310. *See* BORDOFF ET AL., *supra* note 61, at 26.

311. *Id*. at 20.

oil industry is fragmented and made up of myriad small companies that are nimble, dynamic, innovative, and responsive to market changes."[312]

Admittedly, before a well is drilled—in a shale formation or anywhere else—years may be required to find the right location and secure permits. But this does not slow down well-run energy companies. They constantly explore and lease new sites and secure permits, sometimes years before they ever intend to drill there. As a result, these firms have an inventory of sites already approved. "The idea is that if there are delays with permitting or other land issues," one analyst explained, "that the management team will have flexibility in deciding where they want to drill and not run short on options."[313]

Obviously, they still have to drill the well, but drilling in shale is a lot faster than drilling offshore.[314] To shorten the time even further, companies can drill the well, cap it, and then complete the process later when they actually need the oil or gas.[315]

2. U.S. Shale Also Can Slow Production Quickly

Not only can U.S. shale producers ramp up quickly to fill a gap in the market, but they also can ramp down when extra production is no longer needed. As a result, shale wells are well positioned to replace, instead of supplementing, other production.

A more traditional well, whether drilled onshore or offshore, usually lasts twenty years or more.[316] As a result, it has more potential to become a stranded asset, which keeps pumping even after it is no longer needed.

312. *Id*.

313. Gary Gentile & Starr Spencer, *Fuel for Thought: US Oil, Gas Industry Not Keen on Playing 'Swing Producer' Role, Despite Government Pleas*, S&P GLOB. (Mar. 15, 2022), https://www.spglobal.com/commodityinsights/en/market-insights/blogs/oil/031522-fft-us-oil-gas-swing-producer-energy-prices-inflation-granholm [https://perma.cc/DPX8-GRSC] (quoting oil analyst Nathan Hasbrook).

314. "Drilling an offshore well can take three to four months and cost $120 million to $160 million per well," Nick Lioudis explains, "with the most complex drilling projects taking as long as a year." Lioudis, *supra* note 306. In contrast, a shale well takes about ten weeks to drill. *See id.* (Explaining that it takes two to four weeks to drill the well, a week to prepare for hydraulic fracturing, ten days for fracturing, a week to add production tubing, and another two to three weeks in which oil or gas is still mixed with sand).

315. *Time Between Drilling and First Production Has Little Effect on Oil Well Production*, U.S. ENERGY INFO. ADMIN. (Sept. 10, 2019), https://www.eia.gov/todayinenergy/detail.php?id=41253 [https://perma.cc/L8QT-XEBD] ("Some oil wells are completed shortly after drilling is completed, but other wells remain drilled but uncompleted (DUC) for several months or years.").

316. *From Inception Through Completion: The Life Cycle of a Well*, ENERGY HQ (2017), https://energyhq.com/2017/08/from-inception-through-completion-the-life-cycle-of-a-well [https://perma.cc/G2S3-VFNL] ("Oil and natural gas production of one well can last up to 20–30 years.").

In contrast, shale wells have much shorter useful lives. Hydraulic fracturing usually enables them to pump only for a year or two.[317] To keep producing, the firm needs another round of hydraulic fracturing or a new well. If demand has declined—so prices have fallen—the firm will not have the incentive to make this additional investment. "Unlike other types of oil projects, shale oil production declines steeply after initial production," Bordoff, Halff and Losz have explained.[318] "Another distinctive quality of shale projects is their relatively high ongoing costs, which makes shale production sensitive to price declines as well."[319]

These differences give shale a significant edge over conventional wells, such as the Willow Project in Alaska, which the Biden Administration green-lighted in March 2023.[320] Unlike shale wells, Willow is expected to have a thirty-year useful life.[321] Will the world still need Willow's oil in thirty years? With a fast enough transition to clean energy proceeds, the answer could well be "no." Arguably, then, approving Willow and other long-lived conventional projects is a mistake. Instead, the better approach is to rely more on shale to increase U.S. production.

In short, the geology of shale wells makes them much less likely to become stranded assets. They can ramp up to fill gaps in the market, and then slow production when there is excess supply.

3. Reversible Infrastructure

While shale producers can get oil and gas out of the ground quickly, it still needs to be refined and brought to market. This requires an elaborate infrastructure, including pipelines, refineries, and LNG terminals. Unlike shale wells, infrastructure take years to build.

317. Hausmann, *supra* note 97 ("From an environmental standpoint, US oil and gas projects have the advantage of being quick to execute and wind up. A tight oil or gas well produces over 85% of its output in the first two years, whereas traditional oil fields can take up to a decade to develop and then run for decades . . . .").

318. BORDOFF ET AL., *supra* note 61, at 20.

319. *Id*.

320. Ella Nilsen, *The Willow Project has Been Approved. Here's What to Know About the Controversial Oil-Drilling Venture*, CNN (Mar. 14, 2023, 3:46 PM), https://www.cnn.com/2023/03/14/politics/willow-project-oil-alaska-explained-climate/index.html [https://perma.cc/R74T-EW3C]. The project was first approved by the Trump Administration in 2020, and Biden Administration officials have indicated that legally they had no choice but to allow it to proceed, but many environmental advocates are not persuaded by this claim. *Id.*

321. Victoria Petersen, *Alaska's Willow Project Promises Huge Amounts of Oil—and Huge Environmental Impacts,* HIGH COUNTRY NEWS (Aug. 3, 2022), https://www.hcn.org/articles/north-energy-industry-alaskas-willow-project-promises-huge-amounts-of-oil-and-huge-environmental-impacts [https://perma.cc/JX72-R9M3] (noting that Willow is expected to produce 180,000 barrels per day for 30 years).

i. Infrastructure Approvals: A Key Lever for the Government

A key question is whether this infrastructure is already in place. The answer varies with the location of the drilling, as well as the type of fossil fuel. In places where the infrastructure is adequate, shale producers already have the potential to serve as swing producers. But in other places, costly infrastructure investments are still needed, especially for natural gas, to take full advantage of their rapid reaction time. For example, the U.S. needs more LNG terminals to do more to replace Russian natural gas in Europe. Yet although a number of new export terminals have been built and more are under construction, the Biden Administration decided in January 2024 to "pause" the issuance of permits for new projects.[322]

In these efforts to ramp up production, the division of labor between the private sector and the government should be emphasized. In the U.S., private firms have significant discretion about how many wells to drill. In contrast, the government plays a critical role in major infrastructure projects. Under current law, the permitting process is as protracted as it is significant; a project cannot proceed unless the relevant agencies sign off. Deciding whether to do so is one of the main ways the government can either encourage or slow U.S. production.

In making these judgments, policymakers should balance the various considerations highlighted in this Article. How important is it to replace Russia? Or to have greater potential to replace Middle Eastern suppliers? Is the new source of oil and gas cleaner or dirtier than other sources? Would it really replace these other sources, or just supplement them?

ii. Investing in Infrastructure to Leverage the Flexibility of Shale

While these are context-specific judgments, the recommendation here is to err on the side of building more infrastructure. We should build it, even if we will not always use it.

This approach enables the U.S. and its allies to leverage the flexibility of shale production. On the one hand, when more fossil fuel is needed to replace insecure or hostile suppliers, the infrastructure is there to bring it to market. On the other hand, when there is too much supply—so shale producers are ramping down—the infrastructure does not need to be fully utilized.

322. *See U.S. LNG Export Capacity to Grow as Three Additional Projects Begin Construction*, U.S. ENERGY INFO. ADMIN. (Sept. 6, 2022), https://www.eia.gov/todayinenergy/detail.php?id=53719 [https://perma.cc/PR6E-8SRT]; *see also* Shidler, *supra* note 119 (discussing impact of pause on export permits to countries that do not have free trade treaties with the U.S.).

Admittedly, this approach raises two potential concerns. First, once this infrastructure is built, we might keep using it longer than we should. For instance, what if we hope to stop using fossil fuel in fifteen years, but a pipeline has a thirty-year useful life? If the pipeline is built, there will be a temptation to use it for thirty years, instead of just fifteen.[323]

The solution to this problem is for infrastructure approvals to be contingent. In licenses and permits, the government should reserve the right to shut the infrastructure down before the end of its useful life. In the above example, the permit could allow the government to close the pipeline after fifteen years. This provides flexibility to respond to changed circumstances. In fifteen years, if the primary concern is climate and pollution, policymakers can shutter the pipeline. But if national security looms especially large, it can remain in use. Put another way, it is better to make permits contingent than to refuse to issue them at all—as the Biden Administration has done in "pausing" new LNG export permits—so the infrastructure is there when it is needed.

Admittedly, even if a contingent permit is granted, this does not mean that the project will proceed. This brings us to the second issue: limits on the use of infrastructure reduce its value to the private sector. The risk of an early shut down may keep projects from being built, even if they are urgently needed now. For example, the U.S. should build LNG terminals to be able to support its European allies and weaken Russia. But what if the risk of an early shut down discourages the private sector from building them?

The answer is for the government to help fund some projects. This is not meant as a handout to the fossil fuel industry, but as a response to the national security and environmental externalities highlighted in this Article. In some cases, investing in an LNG facility is more cost-effective than supplying military aid to Russia's neighbors. Likewise, shutting down this facility when it is no longer needed may well be cheaper than building seawalls or repairing damage from storms. In short, the market failures discussed in this Article justify a government role, along with government expenditures.

"[G]overnments," Bordoff and O'Sullivan have observed, "could develop innovative tools to plan for obsolescence."[324] For example, one approach would be for the government to pay compensation (for example,

323. Jason Bordoff & Megan L. O'Sullivan, *The New Energy Order*, FOREIGN AFFS. (July/Aug. 2022), https://www.foreignaffairs.com/articles/energy/2022-06-07/markets-new-energy-order [https://perma.cc/2Z5F-B9MQ] ("[S]uch investments should not create obstacles to climate action by strengthening economic forces that oppose faster progress because they have vested financial interests in today's energy system.").

324. *Id.*

the infrastructure's appraised value) in shutting down infrastructure after a period of time (for example, fifteen years). Another would be for the government to cover a share of the cost up front in exchange for acquiring ownership (or the right to shut the infrastructure down) after a preset term of years.[325]

In deciding which infrastructure projects to approve, policymakers should also consider whether they can be retooled for another purpose. An advantage of natural gas pipelines, for instance, is that they might someday transport hydrogen, a potential source of clean energy.[326]

Is investing in pipelines and other infrastructure the best use of public money? Obviously, rigorous judgments are needed about how this investment stacks up against other ways to address national security and environmental risks. But in some cases, reversible infrastructure is likely to be the most cost-effective way to pursue these goals.

4. So Why Did U.S. Shale Production Not Increase More Rapidly After Russia Invaded Ukraine?

With the right infrastructure, U.S. shale producers have the potential to avert (or at least dampen) supply shocks. Yet admittedly, they did not play this role after Russia invaded Ukraine in 2022. Even as prices spiked, they were slow to increase production.[327]

Even so, there were context-specific reasons for their hesitation, which will not necessarily recur. For one thing, the industry had just weathered the coronavirus pandemic, which slashed global demand, requiring steep production cuts, and plunged a number of producers into bankruptcy. This bruising experience made firms cautious about ramping up quickly.[328]

325. *See id.* ("[Governments] might favor the permitting of hydrocarbon infrastructure investments with shorter payback periods, condition that permitting on having a right to pay to wind down the asset after a specified time, or shorten the payback period by lowering the cost of capital for private firms in exchange for the right to retire the asset after the investment yields a certain return.").

326. Vera Eckert, Stephen Jewkes & Isla Binnie, *Europe's Gas Firms Prime Pipelines for Hydrogen Highway*, REUTERS (Nov. 18, 2021, 6:28 AM), https://www.reuters.com/business/cop/europes-gas-firms-prime-pipelines-hydrogen-highway-2021-11-18 [https://perma.cc/2JDX-A88N].

327. Dan Eberhart, *Why U.S. Shale Producers Aren't Riding to the Rescue Despite Tight Oil Supplies*, FORBES (Sept. 19, 2022, 11:51 AM), https://www.forbes.com/sites/daneberhart/2022/09/19/why-us-shale-producers-arent-riding-to-the-rescue-despite-tight-oil-supplies [https://perma.cc/V3NE-RWXW] ("Despite intense market signals that more supply is needed, shale producers say a bailout is not in the cards.").

328. Paul H. Tice, *Why U.S. Oil and Gas Producers Aren't Solving the Energy Crisis*, WALL ST. J. (Mar. 15, 2022, 12:30 PM), https://www.wsj.com/articles/why-american-producers-arent-solving-energy-crisis-price-hike-rise-oil-gas-wells-fracking-shale-lng-climate-change-green-russia-11647354744 [https://perma.cc/KB28-CA9X].

For firms that were willing to increase production, there was another barrier: the pandemic caused a host of supply chain bottlenecks. Like in other industries, shale producers struggled to get enough equipment and employees to increase production.[329]

Economic losses during the pandemic also burned investors. For years, they had provided capital even though shale producers were not (yet) profitable, prioritizing production increases and accepting that profits would come eventually. But the pandemic changed Wall Street's attitude. After a wave of losses and bankruptcies, earnings—not increased production—became the priority.[330] Executive compensation was adjusted to reflect this shift,[331] and the inventory of wells declined.[332] Yet the good news is that shale producers delivered record profits in 2022, which were turbocharged by a surge in oil and gas prices. Hopefully, these profits will ease investor concerns about expansion going forward.

Even so, there is still another barrier to overcome—one rooted in policy and perception, rather than in market dynamics. Before Russia invaded Ukraine, the Biden Administration's rhetoric and policies sent a clear signal that fossil fuel production should decline.

"I want you to just take a look . . . I want you to look in my eyes," Joe Biden said as a presidential candidate.[333] "I guarantee you, I guarantee you we are going to end fossil fuel and I am not going to cooperate with them, OK?"[334] In this spirit, he pledged to stop auctioning oil and gas leases on federal land. "And by the way," he said, "no more drilling on federal lands, period. Period, period, period."[335] On his first day in office, President Biden canceled the Keystone Pipeline.[336] Less than a week later, he imposed a

329. Eberhart, *supra* note 327 ("Part of this is down to supply chain issues, inflation, and infrastructure constraints . . . .").

330. Gentile & Spencer, *supra* note 313 ("E&Ps have restricted their capital budgets in recent years and given generous percentages of their cash flows to shareholders.").

331. *See* Eberhart, *supra* note 327 ("Compensation incentives for executives in the shale industry are now dominated by cash return targets rather than production growth targets.").

332. Jinjoo Lee, *Oil's Other Strategic Reserve Is Running Low, Too*, WALL ST. J. (Nov. 9, 2022, 7:30 AM), https://www.wsj.com/articles/oils-other-strategic-reserve-is-running-low-too-11667963507 [https://perma.cc/7X66-HVDN] (noting decline in number of drilled but uncompleted wells among shale producers).

333. Thomas Phippen, *Biden Keeping His Promise to 'End Fossil Fuel' Increased Gas Prices, RSC Memo Shows*, FOX BUS. (Mar. 28, 2022, 8:14 AM), https://www.foxbusiness.com/politics/biden-fossil-fuel-gas-prices-promise-republican-study-comittee-memo [https://perma.cc/G9SH-XNPT].

334. *Id*.

335. Libby Cathey, *Infuriating Climate Activists, Biden Expands Oil Drilling on Public Land*, ABC NEWS (Apr. 18, 2022, 2:17 PM), https://abcnews.go.com/Politics/infuriating-climate-activists-biden-expands-oil-drilling-public/story?id=84148098 [https://perma.cc/YMC6-FFXD] (quoting Joe Biden's pledge at a 2020 townhall in New Hampshire).

336. Ben Lefebvre & Lauren Gardner, *Biden Kills Keystone XL Permit, Again,* POLITICO (Jan. 20,

"pause [on] new oil and natural gas leases on public lands or in offshore waters . . . ."[337]

Yet as energy prices started to rise—and then spiked after Russia invaded Ukraine—the Biden Administration began walking back this message. They resumed leasing federal land after a district court enjoined the "pause,"[338] and agreed to allow more leases as a compromise to pass the Inflation Reduction Act.[339] President Biden also began urging U.S. companies to increase production (while also criticizing them for profiting from higher prices).[340]

Even so, U.S. oil and gas producers were skeptical about the Administration's shift in policy and rhetoric. "The Biden administration's anti-fossil fuel policies and messaging have not helped the investment environment," observed the CEO of an oil services firm.[341] "The White House may ask producers for more supply today, but their policy priorities seek to eliminate the need for that additional supply within five years."[342] This pessimistic assessment was reinforced when the Biden Administration stopped issuing new LNG export permits early in 2024.

2021, 5:01 AM), https://www.politico.com/news/2021/01/20/joe-biden-kills-keystone-xl-pipeline-permit-460555 [https://perma.cc/XR6W-2QXN].

337. Tackling the Climate Crisis at Home and Abroad, Exec. Order No. 14,008, Sec. 208, 86 Fed. Reg. 7169 (Jan. 27, 2021).

338. *See generally* State of La. v. Biden, 543 F. Supp. 3d 388 (W.D. La. 2021) (enjoining Biden Administration from implementing a "pause" on new oil and gas leases on public lands and in offshore waters, and holding that president does not have authority to override statutes requiring auctions for these leases).

339. *See* Jake Bittle, *The Inflation Reduction Act Promises Thousands of New Oil Leases. Drillers Might Not Want Them*, GOV'T EXEC. (Aug. 11, 2022), https://www.govexec.com/oversight/2022/08/inflation-reduction-act-promises-thousands-new-oil-leases-drillers-might-not-want-them/375698 [https://perma.cc/Q6NB-Z7S8] ("[B]ecause the so-called Inflation Reduction Act bears the imprint of swing-vote Senator Joe Manchin, it . . . reinstates old auctions that the Biden administration has tried to cancel and . . . . requires that the government auction millions of acres of oil and gas leases before it can auction acreage for wind and solar farms.").

340. Josh Boak, *Biden Calls for More Production and Lower Profits in Letter to U.S. Oil Refiners*, PBS (June 15, 2022, 11:46 AM), https://www.pbs.org/newshour/nation/biden-calls-for-more-production-and-lower-profits-in-letter-to-u-s-oil-refiners [https://perma.cc/J9RT-3L4P] ("Your companies need to work with my Administration to bring forward concrete, near-term solutions that address the crisis." (quoting letter from President Biden to U.S. oil refiners)); Rachel Frazin, *Biden Sends Mixed Signals to Oil Industry*, THE HILL (Mar. 24, 2022, 6:00 AM), https://thehill.com/policy/energy-environment/599473-biden-sends-mixed-signals-to-oil-industry [https://perma.cc/QW9P-M5V8] ("The administration has asked U.S. oil and gas producers to drill more as Russia's invasion of Ukraine has pushed gasoline prices higher. But it has also taken a somewhat hostile tone, blaming the industry for not bringing prices down quickly enough.").

341. Eberhart, *supra* note 327.

342. *Id*.

This chilling effect was unfortunate. Since the U.S. and its allies will rely on fossil fuel for years to come, discouraging new development comes at a cost.

To sum up, developing extra supply in the market for oil and gas has advantages for national security, but potential costs for the environment. Yet there are three ways to square this circle. First, policymakers should aim to make these new fossil fuel investments as "clean" as possible. Second, in adding new capacity, the goal should be to replace other fossil fuel sources, not to add to them. Third, the new sources should be flexible, so they can be ramped up and dialed back, as needed. In these ways, the U.S. and its allies can bring new oil and gas online while still reducing emissions and pollution.

VI. REGULATORY STRATEGY

As the last two Parts have shown, the U.S. and its allies need to reduce demand for fossil fuels, while also tapping new sources in environmentally responsible ways. This Part outlines a regulatory strategy to advance these goals. The best approach is a mix of Pigouvian taxes, targeting the various national security and environmental costs discussed in this Article. Unfortunately, this strategy has not gained any political traction in the U.S., at least so far.

As a fallback, some commentators (and, indeed, a number of celebrities) have called for a moratorium on new fossil fuel development. Yet this would be a mistake, as a moratorium would actually harm both national security and the environment.

Instead, the better approach is an incremental effort to alter the mix of energy sources over time. To guide this effort, this Part proposes a heuristic called "the marginal efficiency cost of energy": policymakers should account for all the social costs of each source (for example, U.S. oil, Russian natural gas, U.S. coal, nuclear, and so forth)—not just private costs, but also national security and environmental costs—and then proceed step-by-step, looking for opportunities over time to replace high social cost sources with low social cost sources. To advance this agenda, policymakers can rely on whatever policy instruments are available, including permits, licenses, regulations, mandates, and subsidies.

A key challenge in implementing this agenda is regulatory fragmentation. A policymaker responsible solely for environmental risks will not have the incentives (and possibly also the expertise) to consider national security risks, and vice versa.

Lining up political support is also a challenge, but this Article's approach—emphasizing both the environment and national security—could

prove helpful. At the risk of dramatically oversimplifying U.S. politics, the environment tends to be more of a priority for the left, while national security tends to be more of a priority for the right. The key to bipartisan support could well be policies that advance both sets of goals. In other words, the right coalition could be both green and red, white, and blue.

A. PIGOUVIAN TAXES

As I (and many others) have written elsewhere, arguably the best way to deal with negative externalities in energy is with Pigouvian taxes, which add these third-party costs to the price.[343] This Section outlines the advantages of this regulatory approach, and briefly discusses how it can be used to target threats not only to the environment (which are well understood), but also to national security (which have received less attention). Yet since carbon taxes have attracted very little political support in the U.S., the discussion of Pigouvian taxes here is brief.

For the same reason, this Article does not offer a separate discussion of cap and trade. It is well understood that this regulatory strategy—which sets limits on an activity and issues tradable permits that authorize a designated level of it—offers similar benefits as Pigouvian taxes, so there is no need for a separate analysis here.

1. Efficiency of Pigouvian Taxes

Pricing externalities is a very efficient way to mitigate them. With a carbon tax, for example, if emissions from a gallon of gasoline cause fifty cents of harm to the climate, a tax of fifty cents per gallon is added to the price at the pump.[344] A tax also is imposed on other sources of climate harms, including natural gas, coal, jet fuel, propane, livestock, chemicals, and so on. Since the harms from these various activities are not the same, a well-crafted carbon tax is calibrated to reflect these variations.

In implementing a Pigouvian tax, the regulator's most important job is to estimate the externalities as accurately as possible—a responsibility that is difficult, to be sure, but also limited.[345] The good news is that adding these

343. *See* Schizer, *Energy Subsidies*, *supra* note 6, at 267–70.

344. *See* Mitch Ratcliffe, *Helping Future Generations Cover the Cost of a Gallon of Gasoline Today*, EARTH911 (Feb. 23, 2023), https://earth911.com/inspire/pay-social-cost-of-carbon-today [https://perma.cc/3K93-U67K] (noting that the Biden Administration estimated the social cost of carbon at $51 per ton for 2021, which implies a carbon tax of 50 cents per gallon, and that the Biden Administration might increase the estimate to $190 per ton, which implies a carbon tax of $1.84 per gallon).

345. In a cap-and-trade system, the key step is to set the quantity, not the price. *See generally* Louis Kaplow & Steven Shavell, *On the Superiority of Corrective Taxes to Quantity Regulation*, 4 AM. L. & ECON. REV. 1 (2002).

costs to the price of goods and services fixes the market failure. Once regulators accomplish this, they can rely on the market to address the externality as efficiently as possible.

Instead of a "one-size-fits-all" approach, consumers have broad discretion to mitigate the relevant harm in whatever way is easiest for them. In response to a carbon tax, for instance, consumers can adjust their behavior in a host of ways: they can take mass transit, carpool, telecommute, move closer to work, get a car with a more fuel-efficient internal combustion engine, drive a hybrid, buy an EV, install solar panels on their roof, lower the thermostat in the winter, buy heat pumps and energy-efficient appliances, turn off the lights when they leave the room, use energy efficient bulbs, install better insulation, eat less meat, and much more. In dozens of choices every day, they can reduce their carbon footprint.[346]

Pigouvian taxes also offer similar flexibility to businesses. For example, by increasing gasoline prices, a carbon tax motivates auto manufacturers to prioritize fuel efficiency. Again, there are a host of ways to do this, including lighter materials, more efficient internal combustion engines, hybrids, EVs, and so on.[347]

With a subsidy, the government would have to pick which approaches to support—something the government usually lacks the incentives and expertise to do well.[348] With a carbon tax, by contrast, the government does not have to make this sort of a judgment. Instead, the tax motivates businesses to respond to the problem. They compete for customers by experimenting with different approaches.[349]

2. The Perils of Picking Winners: EVs versus Hybrids

Sadly, the problems with "picking winners" were on full display in the Inflation Reduction Act. For example, it offers a generous subsidy for EVs, but no subsidy for hybrids, which have both a battery and a gas tank. At one level, this makes sense. EVs have a smaller carbon footprint, so the switch from a gasoline-powered car to an EV reduces emissions approximately twice as much as the switch to a hybrid.

But this analysis does not take account of an important downside of EVs: their batteries are a lot larger because, unlike hybrids, they can't run on gasoline as a backup power source. So compared with a Toyota Camry

346. *See* Schizer, *Energy Subsidies*, *supra* note 6, at 277 (describing range of potential responses to national security tax).

347. *Id*. at 278 (noting that tech neutral taxes allow the government to rely on private sector competition).

348. *Id*. at 278–81.

349. *Id*.

hybrid, a Chevy Bolt's battery is sixty times larger, and thus requires sixty times more lithium and other minerals. Hopefully, this differential won't matter over time, as the global supply of the relevant minerals expands.

But for now, this supply is quite constrained. This means that the same quantity of scarce minerals can produce either one Chevy Bolt or sixty Toyota Camry hybrids. Although a Bolt is about twice as effective at reducing emissions as a hybrid on a one-for-one basis, the analysis is very different when one Bolt is compared—not to a single hybrid—but to sixty of them. Are emissions reduced more by replacing one gasoline-powered car with a Bolt, or sixty gasoline-powered cars with sixty Toyota Camry hybrids? The sixty hybrids reduce emissions twenty-nine times more than a single Bolt![350]

In other words, once the analysis incorporates the scarcity of minerals—and thus the number of cars that actually can be produced—Congress's decision to subsidize only hybrids, and not EVs, is questionable. The broader point, of course, is that Congress is not well positioned to pick one technology over another. Again, this is the great advantage of a carbon tax. It spares Congress from making these choices. After setting a price for emissions, Congress can rely on the market to develop the most cost effective ways to reduce them, such as hybrids in the short term and EVs in the long term.

3. A Menu of Pigouvian Taxes on Energy

Like carbon taxes, Pigouvian taxes on pollution and national security harms have the same advantages. For example, since coal causes more pollution than other fossil fuels, adding this cost to the price of coal motivates consumers and businesses to use less of it and favor cleaner alternatives.

To internalize the externalities discussed in this Article, four types of Pigouvian taxes are needed: first, a carbon tax; second, a tax on pollution; third, a tax to cover the cost of defending access to energy from insecure or unstable sources (including petroleum, specialized minerals used in clean energy, and uranium); and, finally, the cost of funding exporters that engage in aggressive or repressive conduct (including oil and gas from Russia and Iran, clean energy from China, and so forth).

350. *See* Steve Hanley, Reducing Carbon Emissions — Hybrid Vs. Plug-In Hybrid Vs. Battery Electric, CLEAN TECHNICA (June 14, 2019), https://cleantechnica.com/2019/06/14/reducing-carbon-emissions-hybrid-vs-plug-in-hybrid-vs-battery-electric [https://perma.cc/P48Y-EJC8] (relying on analysis of Kevin F. Brown).

4. Defense Externalities: A Tax on Oil

As an example of a tax on defense externalities, consider the case of oil. Should this tax apply to *all* oil, or only to barrels imported *from insecure suppliers*? In other words, should it be a version of a gasoline tax, or a tariff?

The argument for a broader tax, which would apply even to domestic production, is that oil is fungible. Using it exposes the U.S. to supply shocks, and the prospect of these shocks motivates the U.S. to defend insecure suppliers (even ones that do not sell oil in the U.S.). By taxing all oil, policymakers would reduce demand for oil overall, thereby mitigating these risks.

In contrast, the case for the narrower tax, which would apply only to imports from insecure suppliers (such as those in the Middle East), is that the U.S. incurs extra defense costs only to protect *these* suppliers, not suppliers in the U.S., Canada, and other secure countries. Favoring the latter (with either an exemption or a lower rate) would encourage more production in North America and other secure locations.

Notably, the U.S. could probably differentiate among these suppliers without violating its trade commitments. Under the General Agreement on Tariffs and Trade ("GATT"), countries have significant latitude to protect national security.[351]

Even so, distinguishing among suppliers poses a number of administrability challenges. For example, how feasible would it be to trace the origin of crude oil?[352] What if crude from different sources is blended together?[353]

If these administrability issues can be addressed, the right approach may be to impose two taxes: one on all oil used in the U.S., regardless of where it is produced, and another on imports from insecure suppliers (so these imports are subject to both taxes). Yet a definitive analysis of this issue is beyond this Article's scope.[354]

351. *See* General Agreement on Tariffs and Trade art. XXI, Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 (Security Exceptions).

352. *See* Georg Zachmann, Ben McWilliams & David Kleimann, *How a European Union Tariff on Russian Oil Can Be Designed,* BRUEGEL (Apr. 29, 2022), https://www.bruegel.org/blog-post/how-european-union-tariff-russian-oil-can-be-designed [https://perma.cc/6B7Z-7S6B] ("Anti-circumvention measures must play a prominent role," including the policing of ship-to-ship transfers, which "have been used by countries including Iran and Venezuela to evade sanctions.").

353. *See id.* ("Shell mixed 49% Russian diesel with 51% diesel of other origin, conferring non-Russian originating status onto Russian produce in order to disguise purchases of Russian oil.").

354. A number of other implementation issues would arise as well. For instance, at what point in the production process would the tax be imposed? What penalties and enforcement mechanisms would be appropriate? Would the tax still apply to crude that is imported, refined in the U.S., and then exported?

5. Funding Externalities: A Tariff on Russian Oil

A tax can be used to internalize the cost not only of defending insecure exporters (such as Kuwait), but also of funding threatening exporters (such as Russia). This sort of tax is supposed to reduce the revenue of rogue exporters, but this does not always happen. In some cases, the tax ends up hurting consumers, instead of the hostile exporter.[355]

The key question is, "who has more bargaining power?" To illustrate the difference, let us use a stylized example in which the global price of oil is $75 per barrel and the U.S. and E.U. impose a $25 per barrel tariff on Russian oil.

Let us start with the optimistic scenario. Assume that consumers have a lot of bargaining power (because, for example, they can either use less oil or buy it from other producers), while Russia cannot afford to cut production. In this case, Russia absorbs the tariff: the global price stays at $75, forcing Russia to cut its price to $50 to remain competitive. In this situation, the tariff does its job. It reduces Russia's revenue—shifting Russia's producer surplus to the taxing jurisdictions—so Russia has less money for the war in Ukraine.[356]

Unfortunately, this successful outcome is not inevitable. Instead, another possibility is that the tariff ends up hurting U.S. and E.U. consumers, without reducing Russia's export revenue very much. This happens if Russia is the one with the bargaining power (for example, because it can afford to stop selling or can sell to other buyers, but consumers cannot cut their consumption or rely on other suppliers). In this case, consumers bear the economic burden of the tax.[357] Russia raises its price to $100 (so it still gets $75 pre-tax per barrel), and the global price rises to $100. In this situation, the tariff does not reduce Russia's revenue, at least by much. The modest advantage of this policy is that higher prices should reduce demand a bit in the short term—and, presumably, more over time as consumers find ways to

355. *See* Ricardo Hausmann, *The Case for a Punitive Tax on Russian Oil,* PROJECT SYNDICATE (Feb. 26, 2022), https://www.project-syndicate.org/commentary/case-for-punitive-tax-on-russian-oil-by-ricardo-hausmann-2022-02 [https://perma.cc/6GWY-DJZ5] ("The more *elastic* the *demand*, the more the producer bears the cost of the tax because consumers have more options. The more *inelastic* the *supply*, the more the producer—again—bears the tax, because it has fewer options."); Zachmann et al., *supra* note 352 ("This success of [a tariff on Russian oil] would rely on the assumption that the EU can more easily find alternative oil suppliers than Russia can find alternative buyers."); JOHN STURM, KAI MENZEL & JAN SCHMITZ, THE SIMPLE ECONOMICS OF OPTIMAL SANCTIONS: THE CASE OF EU-RUSSIA ENERGY TRADE 11 (2022) ("EU-optimal tariff is . . . larger when Russia has a smaller supply elasticity.").

356. STURM ET AL., *supra* note 355, at 7 ("This reduction in price makes Russian producers worse off, as shown by their smaller 'producer surplus' region . . . . Meanwhile, the EU collects the full change in Russian producer surplus as tariff revenue.").

357. *Id.* at 9 ("We conclude that—in the extreme case of inelastic EU demand—a tariff on imports from Russia is totally ineffective at damaging the Russian economy . . . .").

adjust—so Russia sells fewer barrels.[358]

What does the evidence suggest about Russia? Instead of a tariff, the U.S. immediately stopped buying Russian oil, while the E.U. phased down its purchases more gradually. In response, Russia redirected its exports to China, India, and other countries that have not joined these boycotts. But as noted above, Russia has had to sell at a discount of approximately 25%. This lack of bargaining power suggests that if the U.S. and E.U. decided to impose a 25% tariff, instead of a boycott, Russia would be willing to keep selling at a 25% discount (as they already do in selling to China and India).[359]

So, what is the difference? Either way, Russia loses this 25%. The question is who gets it. With the tariff, it would go to the taxing countries (for example, the U.S. and members of the E.U.). With the embargo, it goes to buyers in China, India, and other countries that keep buying discounted Russian crude.

In December of 2022, the U.S. and its allies imposed another sanction: a cap on the price of Russian oil. Instead of a total ban on insuring and transporting Russian oil—a policy that was about to go into effect, and might have triggered a supply shock—the U.S. and its allies made an exception for Russian oil, as long as it was selling below $60 per barrel.[360] Notably, Russian crude was already trading below this level because of the discount, as discussed above.[361] This price cap presumably gave India and China even more leverage to demand discounts, while also avoiding a supply shock by allowing Russia to keep selling crude. But eventually, Russia found ways to avoid this cap, for instance, by cobbling together its own fleet to ship oil (and overcharging on shipping as a way to make up for the discount).[362]

358. *Id.* at 9–10 (observing that a tariff that increases prices reduces consumer demand, causing Russia to sell fewer barrels).

359. Indeed, they might be willing to sell at an even steeper discount, if only because their production costs are so low. "[T]he numbers are staggering," Hausmann has observed. "[E]ven if the oil price fell to $6 per barrel (it's above $100 now), it would still be in [the Russian state oil company's] interest to keep pumping: Supply is truly inelastic in the short run." Hausmann, *supra* note 355 (noting that Rosneft's marginal cost is estimated to be $5.67 per barrel); *see also* Hannes Lenk, *The Costs of War: How Tariffs Could Help Europe Give Up Russian Oil and Gas*, SWEDISH INST. FOR EUR. POL'Y STUDS. 1 (2022), https://www.sieps.se/en/publications/2022/the-costs-of-war-how-tariffs-could-help-europe-give-up-russian-oil-and-gas [https://perma.cc/9AKS-BXEA] ("Russian suppliers would struggle to offload the huge volume destined for the EU elsewhere, and would be forced to sell at a discount.").

360. Chris Cook & David Sheppard, *Russian Crude Being Shipped to India Under G7 Price Cap*, FIN. TIMES (Dec. 27, 2022), https://www.ft.com/content/41237fe7-210d-406c-a22a-2e17a79f7381 [https://perma.cc/8H8Z-CXH8] ("The G7 price cap was designed to keep Russian oil flowing to avert supply shortages, but at a price of $60 a barrel or lower in order to squeeze the Kremlin's revenues.").

361. *Id.* ("Putin has acknowledged that most Russian oil was already trading at or below $60 a barrel, saying 'the ceiling they have suggested is in line with the prices we are selling at today.' ").

362. *Id.* (noting that India has continued buying Russian crude under the price cap); *see also* Shidler, *supra* note 119 (discussing how Russia has evaded the cap).

Although Russia was forced to accept discounts in selling oil, it has more bargaining power in selling natural gas. Because it is much harder to reroute, as noted above, Europe cannot easily replace Russian natural gas, at least in the short term. This means a tariff on Russian natural gas is likely to hurt E.U. consumers, not Russia, at least in the near term.[363] Indeed, even without a tariff, Russia has dramatically cut its gas shipments to Europe, as noted above, causing prices to spike and pressuring Europe to ration natural gas.[364]

6. Political Constraints

While Pigouvian taxes have obvious advantages, which have prompted most of our allies to adopt carbon taxes,[365] the political track record in the U.S. is discouraging. Indeed, few U.S. politicians have been willing even to propose carbon taxes.[366] Instead, the Obama and Biden Administrations usually favored subsidies for green technology—a choice I have criticized elsewhere.[367]

Since a carbon tax still seems to be a political dead letter, a national security tax presumably also is a hard sell, at least in ordinary circumstances. Yet perhaps the idea could gain traction in a time of crisis.

For example, what if President George W. Bush had proposed a tax on petroleum (or on petroleum imports) in response to the terror attacks on September 11? Like Nixon going to China, a former oil executive like President Bush had added credibility in making this case. To rally support, he could have argued that the tax would weaken regimes that fund terrorism. Given the groundswell of support for a vigorous response to 9/11, one wonders whether a promising opportunity was missed.

A more recent crisis—Russia's invasion of Ukraine—could also have justified a different national security tax: a tariff on Russian oil, like the one discussed above. The President already had statutory authority to impose this

363. Lenk, *supra* note 359, at 1 ("The price elasticity of oil is not the same as that of gas . . . . The market for gas . . . is localized and Russia holds a quasi-monopoly . . . . [So] in the short term only a fraction of Russian natural gas could be replaced with supplies from other countries or with LNG.").

364. *See supra* Section II.A.2.

365. *See* Olivia Lai, *What Countries Have a Carbon Tax?*, EARTH.ORG (Sept. 10, 2021), https://earth.org/what-countries-have-a-carbon-tax [https://perma.cc/KN7K-XDDA] (noting that twenty-seven countries have a carbon tax, including Canada, Japan, Korea, Mexico, the U.K., and the European Union).

366. A modest exception is a tax on methane emissions in the Inflation Reduction Act of 2022. This narrow measure taxes emissions of some large natural gas and petroleum wells, LNG facilities, and pipelines. JONATHAN L. RAMSEUR, CONG. RSCH. SERV., R47206, INFLATION REDUCTION ACT METHANE EMISSIONS CHARGE: IN BRIEF 3–9 (2022), https://crsreports.congress.gov/product/pdf/R/R47206 [https://perma.cc/6YZ7-R686].

367. *See* Schizer, *Energy Subsidies*, *supra* note 6, at 278–81.

tariff.[368] But instead, the Biden Administration initially opted to ban imports. A few weeks later, Treasury Secretary Janet Yellen floated the idea of a tariff with U.S. allies,[369] but the focus quickly shifted to the price cap, discussed above.[370] Maybe the concern was that a tariff might raise prices—and thus hurt U.S. and E.U. consumers, instead of Russia—but as noted above, this seems unlikely for oil.[371]

In any event, the glaring absence of these proposals—even in times of crisis—is not an encouraging sign. Since the political prospects for Pigouvian taxes in the U.S. seem to be dim, at least for now, let us turn to potential alternatives.

B. MORATORIUM ON NEW EXPLORATION AND INFRASTRUCTURE: A FLAWED STRATEGY

In principle, one option is a moratorium on new fossil fuel development and infrastructure. We may be stuck using existing wells and pipelines for many years, the logic goes, but let's at least stop adding more.

This idea has gained significant traction. The International Energy Agency supports it.[372] The Biden Administration showed some sympathy for this approach early on, and returned to it in pausing LNG export permits, as noted above.[373] Seattle and Vancouver have banned new fossil fuel infrastructure and development,[374] while other state and local governments

368. According to a Congressional Research Service Report, the authority President Biden used to ban imports, the International Emergency Economic Powers Act ("IEEPA"), could also have been used to impose tariffs. CATHLEEN D. CIMINO-ISAACS, NINA M. HART, BRANDON J. MURRILL & LIANA WONG, CONG. RSCH. SERV., IF12071, RUSSIA'S TRADE STATUS, TARIFFS, AND WTO ISSUES (2022), https://crsreports.congress.gov/product/pdf/IF/IF12071[https://perma.cc/2AYD-F49Q] ("President Biden cited IEEPA when banning the import of certain products of Russian origin . . . . Thus, even if Congress does not impose a blanket revocation of Russia's MFN treatment, the President could rely upon IEEPA . . . to impose tariffs on Russian imports.").

369. *See* Andrew Duehren & Laurence Norman, *U.S. Floats Tariff on Russian Oil as EU Oil-Sanction Talks Drag On*, WALL ST. J. (May 17, 2022, 1:57 PM), https://www.wsj.com/articles/u-s-floats-tariff-on-russian-oil-as-eu-oil-sanction-talks-drag-on-11652803552 [https://perma.cc/V3DU-SJPS].

370. *See supra* Section VI.A.4; *see also* David Wessel, *The Story Behind the Proposed Price Cap on Russian Oil*, BROOKINGS (July 5, 2022), https://www.brookings.edu/blog/up-front/2022/07/05/the-story-behind-the-proposed-price-cap-on-russian-oil [https://perma.cc/9EZ4-8642] ("One textbook solution to keeping oil flowing from Russia but reducing its revenues would be for major importers to impose a tariff on Russian oil . . . . Secretary Yellen floated that idea, but it didn't go anywhere.").

371. *See supra* Section VI.A.4.

372. *See* NET ZERO BY 2050, *supra* note 9, at 21.

373. *See supra* Section V.C.3.

374. *Washington County Passes Moratorium on New Fossil Fuel Infrastructure*, YALE ENV'T 360 (Jan. 29, 2019), https://e360.yale.edu/digest/washington-county-passes-moratorium-on-new-fossil-fuel-infrastructure [https://perma.cc/2AB6-M8XT]; *In Our View: Fossil-Fuel Moratorium a Key Step for Climate*, COLUMBIAN (Dec. 9, 2021, 6:03 AM), https://www.columbian.com/news/2021/dec/09/in-our-view-fossil-fuel-moratorium-a-key-step-for-climate [https://perma.cc/45NR-4MRT].

have taken more limited steps.[375] A number of advocacy groups have also urged a moratorium. Calling for a "nonproliferation treaty" for fossil fuels, Fossil Fuel Treaty.org claims endorsements from 101 Nobel Laureates, 2900 scientists, hospitals representing over 100,000 doctors, 230 legislators from 60 countries, Hawaii's state legislature, London's City Council, the Foreign Minister of Tuvalu, and the Vatican.[376] "Keep it in the ground" has drawn support from a number of prominent celebrities.[377] The same drumbeat has been sounded also by Oil Watch,[378] Clean Water Action,[379] and "LINGO," which is short for "Leave it in the ground." "What is clear today is that looking for more fossil fuels needs to stop," LINGO urged.[380] "Allowing it to continue is like allowing a child to buy more sweets, when we already know its teeth are rotten and it has diabetes."[381]

Nevertheless, a moratorium on new development and infrastructure is a bad idea. The risks to national security are obvious. The world would have to depend solely on existing production and, as emphasized above, too many wells are in countries that either have to be defended or are themselves threats.[382] The decades-long useful life of these wells, moreover, is much longer than the typical two-year life of a well in U.S. shale. If new U.S. wells could not be drilled, shale production would fall dramatically, and the global economy would become even more dependent on the wrong producers.

Instead, the better course for national security, as emphasized above, is to rely increasingly on new production in the U.S. and other secure and friendly countries, while cutting back purchases from rogue exporters (for example, Russia and Iran) and insecure sources (for example, in the Middle East). This would not be possible with a moratorium.

Ironically, a moratorium also would harm the environment, locking us into a status quo that wastes energy and uses the wrong fossil fuels. As

375. *See The Latest Local Wins in Phasing Out Fossil Fuels*, STAND.EARTH (July 18, 2021), https://www.stand.earth/blog/people-vs-big-oil/stop-oil-trains-now/latest-local-wins-phasing-out-fossil-fuels [https://perma.cc/6NND-Q3G5].

376. FOSSIL FUEL NON-PROLIFERATION TREATY, https://fossilfueltreaty.org [https://perma.cc/6CTP-UQAV] (last visited Feb. 9, 2023).

377. #KEEPITINTHEGROUND, http://keepitintheground.org [https://perma.cc/7MTG-497M] (last visited Feb. 9, 2023) ("*400 Organizations Call on World Leaders: End New Fossil Fuel Development*.").

378. OILWATCH, https://www.oilwatch.org/about-us [https://perma.cc/CN3W-WUJN] (last visited Feb. 9, 2023).

379. *Take Action: Fossil Fuel Moratorium*, CLEAN WATER ACTION, https://www.cleanwateraction.org/empowernj-petition [https://perma.cc/WRT7-PDDC] (last visited Feb. 9, 2023).

380. *Global Fossil Fuel Exploration Moratorium*, LINGO, https://www.leave-it-in-the-ground.org/resources/exploration-moratorium [https://perma.cc/WW9U-ZH9N] (last visited Feb. 9, 2023).

381. *Id.*

382. *See supra* Section III.D (discussing authoritarian comparative advantage in extractive industries).

emphasized above, we need new pipelines to help end flaring.[383] Likewise, we should keep replacing coal with natural gas, an effort that requires more natural gas wells and infrastructure, including more LNG export terminals.[384] In short, changing the mix of the fossil fuels we use would help the environment, but a moratorium would stand in the way.

C. A BETTER APPROACH: INCREMENTAL SUBSTITUTIONS BASED ON THE MARGINAL EFFICIENCY COST OF ENERGY

Instead of a moratorium, a better strategy is to rely on incremental change. To vet these reforms, this part offers a heuristic called "the marginal efficiency cost of energy." In essence, the idea is to consider all the social costs of energy—environmental and national security costs, along with private costs—and to hunt for ways to replace costlier sources with more efficient ones.

To be clear, the goal here is not to grant *new* power to regulators, but to help them make wiser use of the power they *already have*. They should use this framework in all the choices they are called upon to make, including decisions about permits, regulations, rates, leases, moratoriums, and subsidies. Whenever regulators make these judgments, they should compare alternative sources of energy, account for all their social costs, and favor the most (socially) efficient ones.

1. Parallel Problems: Tax and Energy

In offering this approach, this Article applies an idea from public finance, developed by Joel Slemrod and Shlomo Yitzhaki, called "the marginal efficiency cost of funds."[385] Notably, the problem they addressed—how to determine which marginal changes in the tax system improve efficiency[386]—resembles the challenge here in four important ways.

First, in each case, the goal is to figure out how to provide an additional unit of output at the lowest possible cost. In one case, the output is tax revenue, while in the other it is energy.

Second, in each case, there are several options for producing this additional output. Another dollar of tax can be collected with an income tax, wealth tax, value added tax, estate tax, carbon tax, or some other tax. For

383. *See supra* Section V.A.1.

384. *See supra* Section V.A.4.

385. Joel Slemrod & Shlomo Yitzhaki, *The Costs of Taxation and the Marginal Efficiency Cost of Funds*, 43 IMF STAFF PAPERS 172 (1996).

386. *Id.* at 183 ("[W]e offer a tractable methodology that can evaluate marginal changes in tax systems and take account of all five components of the cost of tax systems. The methodology is based on the concept of the marginal cost of public funds.").

each type of tax, a range of adjustments can be considered, including in rates, audits, penalties, and particular rules. Like tax revenue, additional energy also can be generated in many ways. The next kilowatt hour can come from Russian natural gas, German coal, U.S. oil, solar panels from China, wind turbines from the U.S, or a host of other sources.

How do we know which option is most efficient? This brings us to the third parallel between tax and energy: each option has its own unique mix of costs, which often involve tradeoffs. In tax, there are administrative costs (such as when staffers write rules and auditors check returns), compliance costs (when accountants prepare returns), substitution effects (when taxpayers respond by working fewer hours or saving less), evasion costs (when taxpayers cheat), and avoidance costs (when taxpayers pursue legal tax minimization strategies). Likewise, in energy, there are different types of environmental and national security externalities, as well as private costs.

Fourth, making a change can increase some costs, while reducing others. For example, if Congress starts requiring foreign banks to share information about U.S. depositors, this change in the tax system increases compliance costs (as banks prepare these reports) and administrative costs (as the IRS reviews them), but (hopefully) reduces evasion costs (as taxpayers stop hiding money in offshore banks). Likewise, switching from German coal to Russian natural gas reduces environmental harms, while increasing national security risks.

2. The Answer in Tax Policy: Marginal Efficiency Cost of Funds

When there are a host of options, and each offers a unique mix of different costs, what should policymakers do? For one thing, they need to account for all the relevant costs. "[I]f an essential part of the problem is overlooked," Slemrod and Yitzhaki observed, "partial models may give incorrect answers."[387]

Policymakers then should strive to reduce the sum of these various costs, so they can collect a specified amount of revenue as efficiently as possible. The key is to figure out which features of the tax system are more costly, and to replace them with more efficient alternatives. "In reality, the MECF [marginal efficiency cost of funds] of different instruments can differ," Slemrod and Yitzhaki showed, "and it is feasible to raise revenue utilizing only those policy instruments with a relatively low MECF."[388]

387. *Id.* at 175.
388. *Id.* at 188–89.

For example, what if the same amount of revenue can be raised either by eliminating a deduction or by raising the tax rate? Policymakers should pick the one with the lowest total social costs, including administrative costs, compliance costs, and tax-motivated changes in taxpayer behavior. "One can calculate the MECF for alternative ways of raising revenue," Slemrod and Yitzhaki explained, "and other things being equal, the one with the lowest MECF is the one that should be recommended."[389]

3. The Answer in Energy Policy: Marginal Efficiency Cost of Energy

The same approach should be used in energy policy. Like another dollar of revenue, another kilowatt hour can be generated in various ways. What is the social cost of each alternative?

Like in tax policy, it is essential to account for all the costs. Again, the established practice among some commentators and government agencies to omit national security costs is simply wrong.[390] Hopefully, the invasion of Ukraine in 2022—and the ensuing scramble to replace Russian oil and gas on short notice—has discredited this misguided approach.

Instead, policymakers should consider the five different types of costs emphasized in this Article: first, private costs (X); second, climate externalities (C); third, pollution externalities (P); fourth, defense externalities (D); and, fifth, funding externalities (F). (In accounting for all these costs, this heuristic seeks to replicate the effect of a menu of Pigouvian taxes, which was recommended above.)[391]

The cost of producing another kilowatt hour from a specific source—that is, this source's "marginal efficiency cost of energy" ("MECE")—must include all of these costs. For example, assume that two sources of energy are available, *A* and *B*. To decide which to favor, policymakers should calculate the MECF of each one:

$$MECE_A = [X_A + C_A + P_A + D_A + F_A] / kWh$$

$$MECE_B = [X_B + C_B + P_B + D_B + F_B] / kWh$$

After comparing these two options, policymakers should favor the one with the lowest total social cost. So, if $MECE_A > MECE_B$, policymakers should favor *B*.

For example, if *A* is U.S. coal and *B* is U.S. natural gas, policymakers should replace coal with gas. More generally, within the set of sources with

389. *Id.* at 194.
390. *See supra* Sections I.D. & II.C.
391. *See supra* Section VI.A.2.

comparable national security impacts (such as energy produced in the U.S.), policymakers should favor ones with environmental advantages (for example, natural gas instead of coal). This is analogous to a Pareto improvement: one goal is advanced, without setting the other back.[392]

The same analysis holds if *A* is Russian natural gas and *B* is U.S. natural gas. Within a set of energy sources with comparable environmental impacts (for example, natural gas), policymakers should favor ones with national security advantages (gas produced in the U.S., instead of in Russia). Again, policymakers can advance one goal, without losing ground on the other.

Policymakers also can trade off environmental and national security benefits. Since the goal is to minimize the *sum* of the relevant costs, it usually makes sense to accept a modest increase in some costs in exchange for major reductions in others.[393]

D. REGULATORY EXPERTISE AND STABILITY

To make these judgments effectively, policymakers need the right information, expertise, and incentives—but this is a tall order. Just understanding the relevant technology and markets is hard enough. Yet energy policy is even harder because of its implications for the environment and national security. Therefore, a truly interdisciplinary effort is needed. Wise decisions require a keen understanding not only of the relevant science, markets, and law, but also of defense strategy and foreign policy.

While the U.S. government as a whole has expertise on this diverse range of issues, these experts are not all in the same agency. On the one hand, EPA (and their counterparts at the state level) understand environmental challenges and the laws governing them. On the other hand, the Pentagon, State Department, and various intelligence agencies know the nuances of defense and foreign policy. Meanwhile, other institutions master the details of trade and industrial policy (for example, Treasury, Commerce, and Department of Energy ("DOE")), oil and gas drilling (state and local agencies), approval of oil and gas exports (DOE and Federal Energy Regulatory Commission ("FERC")), fuel economy standards and vehicle emissions (the National Highway Traffic Safety Administration, EPA, state

392. Strictly speaking, the step is not Pareto optimal, at least from a global welfare perspective, since helping U.S. national security can hurt the leaders and citizens of geopolitical rivals. For example, reducing Putin's export revenue is good for the U.S. and its allies—and certainly for Ukraine—but not necessarily for Russians, and certainly not for Putin himself. But as noted above, the goal of this Article is not to maximize global welfare, but to enhance security of the U.S. and its allies, while also protecting the environment. *See supra* Section I.A.1.

393. This sort of step can satisfy Kaldor-Hicks efficiency, but not Pareto efficiency (even by analogy).

regulators), the regulation of nuclear power (Nuclear Regulatory Commission), disposal of nuclear materials (DOE), the regulation of electricity (FERC and state public utility commissions), and the regulation of pipelines (FERC, Department of Transportation, and state agencies).

There is room to wonder whether this fragmented structure serves us well enough. Are these various regulators accounting for all the relevant costs? Are they valuing them the same way? For example, when regulators develop U.S. fuel economy standards, they should account not just for pollution and emissions, but also for the national security costs of defending access to petroleum. Yet unfortunately—and, indeed, somewhat unfathomably—they have omitted this important national security cost, as noted above.[394] National security costs are not easy to value, to be sure. But like with the social cost of carbon, the best available estimate should be developed and periodically updated. The Office of Information and Regulatory Affairs (or some other body of experts) should ensure that the same estimate is used throughout the government.

The problem with our fragmented system of energy regulation is not only one of information and expertise, but also of decision-making authority. There are different ways to pursue our various policy goals, but no single agency has broad enough jurisdiction to compare them all and pick the best one. For example, as this Article has emphasized, one way to counter Russian influence is with diplomacy, covert capabilities, and military force. Another is to "starve the beast" by weaning Europe off Russian energy, whether with the right fossil fuel infrastructure (for example, to deliver U.S. natural gas) or with the wider use of alternative energy and energy efficient technology. Yet these various alternatives each fall under the jurisdiction of a different cluster of government institutions. If some are more promising than others, does anyone actually have the authority—and, for that matter, the incentives—to compare all the relevant options and pick the best ones?

As if this were not hard enough, still another challenge is worth emphasizing. Energy policy goals cannot be achieved overnight. They require sustained effort and investment over the course of years, or even decades. This means that a measure of stability is needed in U.S. policy.

But unfortunately, there have been wild gyrations from one administration to the next. For example, nurturing renewable energy was a high priority under President Obama, a lower priority under President Trump, and a high priority again under President Biden. Likewise, tapping domestic oil and gas was a high priority under President Trump, but not

394. *See supra* note 78 and accompanying text.

under President Biden, at least initially, as noted above.[395] Unfortunately, mixed signals and constant changes in priorities come at a cost; without certainty, the private sector is less likely to invest, experiment, and innovate.

To sum up, two things should be clear. First, whoever is responsible for energy policy needs to have a broad enough mandate to consider all the relevant issues. Second, there should be a measure of policy stability from one administration to the next, so long-term goals can be pursued effectively.

The good news is that there is an institution that checks both of these boxes and, of course, is charged with these responsibilities under the constitution: the U.S. Congress. Although individual committees have specialized mandates, Congress as a whole has more general jurisdiction, so members are supposed to see "the big picture." Their decisions also have unique legitimacy, since they answer directly to the people.

Admittedly, there is a familiar challenge in relying on Congress: political deadlock often prevents it from acting. But in a way, this weakness is also a strength: once legislation is enacted, it is quite hard to repeal, so a measure of stability is assured even as the White House changes hands. As a result, congressional action on these issues is especially valuable.

To administer the relevant statutes, Congress should consider consolidating more responsibilities under a single energy regulator with broad jurisdiction. On the one hand, if the priority is political accountability, the model could be a cabinet-level department like Homeland Security. On the other hand, if the priority is independence and policy stability, the model could be an independent agency like the Federal Reserve. For instance, just as the Federal Reserve has a dual mandate to target both inflation and unemployment, this energy regulator could have a triple mandate to (1) assure that the supply of energy is cheap and reliable; (2) strengthen national security; and (3) protect the environment.

In any event, an analysis of the right institutional division of labor is beyond this Article's scope. The goal here is to flag these issues, not to resolve them. After all, designing the right structure for crafting energy policy—one that accesses all the relevant information, creates the right incentives, and accords with constitutional norms—is a complex task. It warrants hundreds of pages of analysis, not just a few paragraphs.

395. *See supra* Section V.C.4.

E. POLITICAL ECONOMY: A "RED, WHITE, AND BLUE—AND GREEN" COALITION

The same is true of the political dynamics driving energy policy—another issue that is beyond this Article's scope, but still is critically important. After all, in reflecting on the recommendations here, one might easily say, "This is all fine in theory, but could any of this ever actually happen in our polarized political environment?"

While Congress did pass climate legislation in 2022, it used reconciliation instead of its regular process so the Vice President could cast the deciding vote in the Senate. Doesn't this suggest that the prospects for more robust legislation are dim?

Not necessarily. For one thing, the legislation made it past the finish line because Joe Manchin, the deciding vote in the Senate at the time, insisted that the bill should include support for both clean energy and fossil fuels. This is not to say that the relevant provisions were the right ones. Rather, the point is that there could be a coalition—even a bipartisan one—for efforts to promote clean energy, while also encouraging environmentally responsible fossil fuel development, as this Article has urged.

How does this sort of effort, which pursues multiple goals at once, help to attract political support? A cynic would observe that it appeals to more interest groups, and thus may draw a measure of support from both environmental groups and fossil fuel producers.

But there is another political advantage as well: national security has broad political appeal, especially in times of crisis. Invoking this goal allows legislation to resonate not only with voters who are passionate about the environment, but also with voters who want to thwart terrorism, block the global ambitions of America's adversaries, and support our troops. As emphasized above, these are not necessarily the same voters. As a result, energy policy that is grounded in both the environment and national security is likely to attract a broader coalition.

CONCLUSION

This Article has shown that energy policy must consider risks not only to the environment, but also to national security. It is important to account for the costs of securing access to energy (defense externalities) and of funding exporters that engage in harmful conduct (funding externalities), even though a number of commentators have argued over the years that these costs should not be considered.

This Article has offered guidance about how energy policy can protect

both national security and the environment. The key goal for national security is to depend less on insecure or hostile suppliers. To do so, while also reducing emissions and pollution, policymakers need to pursue a two-part agenda: they should reduce the demand for fossil fuels, while also tapping new sources of supply in environmentally responsible ways. Pigouvian taxes would be an effective way to implement this agenda. Alternatively, policymakers could use the heuristic proposed in this Article, the marginal efficiency cost of energy, to replace high (social) cost energy sources with more efficient alternatives.

Generating the requisite political support will require compromise, as well as an alliance between supporters of the environment, on one hand, and national security, on the other. Ultimately, the policy goals, as well as the political coalition supporting them, need to be red, white, and blue—and also green.