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Regulatory Carrots and Sticks in Climate Policy: Some Political Economic Observations

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ARTICLE

REGULATORY CARROTS AND STICKS IN CLIMATE POLICY: SOME POLITICAL ECONOMIC OBSERVATIONS

*by: Jason Scott Johnston**

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I. Introduction

This Article sets out an informal political economic theory which explains the relative permanence of regulatory carrots—legislative subsidies and mandates for product use—versus the transience of regulatory sticks—traditional costly regulatory requirements. After setting out the elements of this theory, I illustrate it with the dramatic rise in the Obama Administration and abrupt cessation in the Trump Administration of attempts to use conventional U.S. environmental regulatory sticks to end the U.S. coal industry. The Article turns then to describe a concrete example of a regulatory carrot—the U.S. corn ethanol mandate—that has survived despite overwhelming evidence that its environmental benefits, if any, are far outweighed by its environmental and economic costs.

This Article concludes by discussing subsidies for solar energy. These subsidies, found throughout the world, continue despite growing economic evidence that the economic benefits from solar power—particularly the profits that accrue from making solar photovoltaic ("PV") panels—will be highly concentrated geographically, with few countries sharing in the economic rents from solar power mandates. There is evidence that this concentration will not result because particular counties' regulatory carrots are more generous and effective, but because production of renewable energy products and services such as crystalline silicon solar PV cells and modules are capital intensive with pronounced economies of scale. When this is true, international competition in such nationally subsidized, capital intensive renewable energy industries may interact with government-determined demand for renewable energy products in a way that turns the ordinary rules of supply and demand on their head. Lower costs and prices may lead to a contraction or inward shift in subsidized demand, so that the demand expansion necessary for competitive market conditions may not be realized. At the same time, the environmental benefits from solar power are, at least so far, small at best. Thus for most countries, solar power has generated higher electricity prices with few environmental or economic benefits. And yet—as further evidence for my positive theory of the persistence of carrots—in the United States, solar subsidies were not only retained but, in the case of solar PV panels, actually strengthened by the imposition of import tariffs.

II. The Political Economics of Climate Change Sticks and Carrots

In the climate change arena and perhaps more generally, legislative carrots are statutory programs that subsidize or mandate the use of a particular product or service. As discussed further below, the federal Renewable Fuel Standard ("RFS"), which originated in the 2005 Energy Policy Act, mandates that billions of gallons of renewable fuel be blended into gasoline. While that law is a stick of sorts, in that it mandates that gasoline refiners and blenders meet a renewable blend quota, it has massively stimulated demand for corn, the primary ethanol feedstock. It has thereby provided a carrot in the form of a demand subsidy for corn growers, landowners, and ethanol refiners. Another carrot, also discussed below, comes in the form of legislation mandating that electricity suppliers purchase a minimum amount of electric power from solar- or wind-powered generating facilities.

By regulatory sticks, I mean regulations that impose costly compliance requirements on firms.[1] By imposing emission reduction requirements, virtually all traditional federal environmental statutes enable agencies such as the federal Environmental Protection Agency ("EPA") to impose regulatory sticks. Those traditional statutes, however, generally consist of vague commands to a regulatory agency to regulate to achieve a "safe" level of risk, or to lower emissions of some type if it "finds such regulation is appropriate and necessary."[2] Such vague statutes give discretion to the EPA to impose costly regulatory requirements, but they also retain a continuing opportunity for members of Congress to intervene to lobby that agency to lessen regulatory costs to politically important industries.[3]

From the point of view of political economics, the key difference between federal legislative carrots and federal regulatory sticks is that legislative carrots confer concentrated benefits with diffuse costs while regulatory sticks impose concentrated costs with diffuse benefits. In addition to this core political-economic difference, there is a crucial institutional distinction. Legislation is the product of majority voting in Congress. Costly regulation is the product of executive branch agency interpretation and implementation of statutes that Congress passed. As I now explain, for both political-economic and institutional reasons, it is much more likely that inefficient regulatory sticks can be removed than that similarly inefficient legislative carrots will be ended.

A. *Legislative Carrots*

Consider carrots first. Once in existence, legislative carrots generate economic rents that create present day capitalized gains, which drive up the stakes for beneficiaries, thus rationally motivating them to in-

1. Jason Scott Johnston, *A Game Theoretic Analysis of Alternative Institutions for Regulatory Cost-Benefit Analysis*, 150 U. Pa. L. Rev. 1343, 1363–64 (2002).

2. 42 U.S.C. § 7412(n)(1)(A) (instructing the EPA to regulate hazardous air pollutants from fossil fuel powered electricity generating plants if it "finds . . . regulation is appropriate and necessary after considering the results of a study" of "the hazards to public health reasonably anticipated to occur as a result of emissions by [power plants] of [hazardous air pollutants]"); Michigan v. EPA, 135 S. Ct. 2699, 2711 (2015) (holding that in determining whether a regulation is "appropriate," the EPA must consider the costs of compliance).

3. *See* Johnston, *supra* note 1, at 1399–1400.

vest very large amounts to make sure that they keep the carrots.[4] To see the value of a legislative carrot, consider one that takes the form of a $1 per year increase in the net profit of producers of a particular product. This profit increase can be thought of as arising from a direct increase in demand, such as the increase in demand for corn or renewable electricity generated by the ethanol mandate and renewable energy subsidies discussed at greater length below. With an interest rate given by r, the present value of the $1 carrot is given by $1/r.[5] Thus with an interest rate, for example, of .04, the creation of an ethanol subsidy increasing net profits per acre of corn by $1 per year would increase the present value of that acre by $25.

Given this multiplier effect, once the carrot is factored into the market prices of capital assets such as land, buyers of such capital assets have a great deal to lose from elimination of the legislative subsidy. In the above example, if the $1 subsidy was equal to a 50% increase in net profits, then loss of that subsidy would mean a catastrophic 50% decrease in the value of the land. Legislative carrots thus create both high stakes in legislative conflicts over their retention and the wealth that makes beneficiaries effective advocates for their interests.

Legislative carrots are, almost by definition, targeted at particular industries and activities. Such industries, such as the ethanol and solar power industries discussed below in more detail, are quite literally creatures of legislation. While they may differ in some respects, all firms within such an industry have a shared interest in retaining the legislative carrots that have created the industry.

Opponents of inefficient legislative carrots thus face concentrated beneficiaries whose stakes in and resources available for a contest to remove them reflect the capitalized value of the carrots. The natural opponents of carrots are people who bear the costs of the activities incentivized by carrots—such as higher food prices due to the ethanol mandate discussed in detail below. Often, however, such costs are large in the aggregate but diffused over millions of individuals, such as consumers of higher priced food. A foundational insight of public choice theory is that given such small individual stakes, it may be economically irrational for individuals who bear the costs of even grossly inefficient legislative carrots to lobby Congress for their repeal.[6]

As the history of the environmental movement shows, however, non-profit organizations can and do form to represent the aggregate stakes and interests of diffuse losers from legislative carrots. Yet even

4. Gordon Tullock, *Efficient Rent Seeking, in* TOWARD A THEORY OF THE RENT SEEKING SOCIETY 97–112 (James M. Buchanan, Robert D. Tollison & Gordon Tullock, eds., 1980) (providing the basic insight that the benefits of legislation set the stakes in conflict games to get and retain such benefits).

5. That is, the present value of the $1 per year increase in net profits is given by = $1/r.

6. *See generally* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS (1965).

if such groups have formed, they face very large transaction costs in seeking to eliminate legislative carrots. The courts are largely closed to them. Under Article I (Section 8, Clause 1) of the U.S. Constitution, Congress has the power to "levy taxes to provide for the common defense and general welfare of the United States." With really only one exception—where Congress attaches conditions to a state's receipt of federal funds—the Supreme Court has been clear that the courts are not in the business of interpreting "general welfare" to impose limits on Congress's exercise of the spending power.[7]

It is true that some exercises of the congressional spending power may ultimately open the courts to opponents of the spending. The National Environmental Policy Act of 1970 ("NEPA") was passed to empower citizen litigants (meaning environmental groups) to bring lawsuits requiring federal agencies to assess the environmental impacts of its projects before proceeding with them. Inasmuch as such projects do represent congressional spending, NEPA gives a right to challenge the process by which that power is ultimately exercised. As Richard Esptein argues elsewhere in this volume, NEPA's procedural requirements can impose such significant costs that not only federal projects, but primarily private projects, are ultimately killed.

Even NEPA challenges are limited, however, by the constitutional requirement that a plaintiff have standing to sue (meaning for environmental groups that some individual members have standing).[8] Standing doctrine may be viewed in large part as designed to keep political disputes about the exercise of the spending power out of the courts. Thus, for those who suffer the costs of legislative spending—carrots—the remedy is to lobby Congress for repeal.

Lobbying Congress for repeal of a legislative carrot that has already been capitalized into privately held assets is, to say the least, a Herculean undertaking. Those who seek repeal of the legislative carrot must approach a very large number of congressional members whose constituents do not get concentrated benefits from the carrot, but rather bear diffuse costs. To be sure, they can offer such representatives an opportunity to go on record as opposing federal-legislative programs that generate only costs to their constituents. This may seem like an attractive policy position. But taking such a position may be disastrous

7. South Dakota v. Dole, 483 U.S. 203, 213 (1987) (setting out a four-part test that limits the kinds of conditions that Congress can impose on state receipt of federal funds).

8. Summers v. Earth Island Inst., 555 U.S. 488, 496 (2009) (holding that five conservation groups lacked standing to challenge U.S. Forest Service ("USFS") regulations that exempt small timber sales from the notice, comment, and appeal process generally required under the National Forest Management Act, reaffirming the rule that a plaintiff has standing only to sue for concrete and particularized individual injury and not for a generalized policy disagreement, and clarified also that even when the plaintiff is just alleging that statutory procedures have not been followed, the plaintiff must show harm to a "concrete interest").

to a member, for it may well disturb the implicit terms of a congressional deal. In order to get votes in favor of legislation that generated concentrated benefits for home district or state constituents, members may have engaged in log-rolling deals under which they voted for other legislative programs that imposed diffuse costs on their home constituents but brought concentrated benefits to other members' states or districts. To be more concrete, were a non-corn state member to reverse course and support repeal of the ethanol mandate, she would risk losing the votes of members of the ethanol coalition for legislation that brings concentrated benefits to her own state or district.

There is rigorous econometric evidence that such log-rolling deals affect congressional voting.[9] Asking a member of Congress to vote for repeal of a legislative carrot that they have supported in exchange for other members' votes in favor of their own home-benefiting carrot is asking a legislator to renege on a deal. Such behavior risks future retaliation by other members. Given the miniscule individual cost to taxpayers who bear the cost of even a grossly inefficient legislative carrot, it is unlikely that a campaign ad trumpeting how a member voted to kill such an inefficient carrot can compensate for the potential loss of votes for similarly inefficient programs that confer concentrated benefits on her own constituents.

B. *Regulatory Sticks*

A regulatory program that threatens future compliance costs creates an incentive for actors potentially subject to such regulation to incur present day costs to prevent such regulation. However, unlike legislative carrots, regulatory sticks generate an immediate decrease in the value of firms subject to regulation. While for future or potential regulation this value decrease reflects only the (discounted) expected future regulatory cost, whether already imposed or merely threatened, costly regulatory sticks lower the capital value of regulatory targets by making them riskier. On the margin, this decrease in value reduces the resources available to contest regulation. Indeed, in the case of targeted industries, costly regulation can lead to the successive bankruptcy of firms, weakening and eventually eliminating entire industries who are no longer around to contest regulation.

In addition to threatening sometimes catastrophic costs, environmental regulations impose concentrated rather than diffuse costs. The structure of modern environmental statutes virtually ensures that firms within particular industries all face similar regulatory costs. Under the Clean Air Act, for example, the regulation of air pollutants from mobile sources—such as cars and trucks—depends on the vehi-

9. *See* Thomas Stratmann, *The Effects of Logrolling on Congressional Voting*, 82 Am. Econ. Rev. 1162, 1170 (1992).

cle type and the pollutant. Firms within the industry making the same products have the same regulatory compliance costs. For other industries, such as the electricity generating sector, the same is true. To see how strong the tendency is for environmental regulations to impose concentrated, versus diffuse costs, one needs only recall the EPA's refusal to regulate greenhouse gas ("GHG") emissions according to the letter of the Clean Air Act. Under the clear language of the Clean Air Act, any stationary source emitting more than 100 or 250 tons of a regulated pollutant must obtain a federal permit. Because this would have subjected literally hundreds of thousands if not millions of businesses to GHG regulations, the EPA "reinterpreted" the statute to say that for greenhouse gases, permits were required only for those source emitting more than 100,000 tons per year.[10] This drastically reduced the number of businesses bearing the cost of the GHG regulations.

Targets of costly regulations have available a wide array of strategies to prevent regulatory costs from being imposed on them. These include strategies that are not available to those who bear the costs of legislative carrots. First, as argued above, Congress passes vague legislation in part so that members have an ongoing opportunity to influence the implementation of such vague statutory commands. Hence when targeted industries lobby the relevant regulatory agency, such as the EPA, to not regulate or regulate weakly, they may begin by calling upon their congressional representatives for help.

Second, if such lobbying fails, and a costly regulation is finalized, then regulatory targets can seek judicial review. While constitutional standing for those who bear the costs of legislative carrots is always an issue, standing for an industry or individual facing regulatory costs is, if not completely certain, almost so.[11] After all, to establish standing to seek judicial review, a regulatory target just has to plead that it will

10. Util. Air Regulatory Grp. v. EPA, 134 S. Ct. 2427, 2438 (2014).

11. *See* Charles H. Haake & Raymond B. Ludwiszewski, *Standing Up for Industry Standing in Environmental Regulatory Challenges*, 42 B.C. ENVTL. AFF. L. REV. 305 (2015) (discussing a series of relatively recent decisions that the D.C. Circuit has attempted to set out in an approach to industry standing, which would isolate the costs of particular regulations from the cost of the regulatory program of which they are a part, rejecting standing if the costs of the particular regulation are impossible to specify as sufficiently "concrete"); *Util. Air Regulatory Grp.*, 134 S. Ct. at 2438 (rejecting this approach when it simply decided the substantive issues by rejecting the EPA's so-called tailoring rule, which would have re-interpreted the clear language of the Clean Air Act requiring federally approved permits for any stationary source emitting more than 100 or 250 tons of a pollutant to mean that for greenhouse gases, permits were required only for those source emitting more than 100,000 tons per year); Haake & Ludwiszewski, *supra*, at 330 ("[o]nce the Tailoring Rule was struck down, there was no pillar with which the EPA could support the rest of its regulatory program. The Supreme Court held that the EPA could not reasonably read the CAA's PSD [Prevention of Significant Deterioration] and Title V [stationary source permitting] provisions as applying to GHG emissions precisely *because* the Agency lacked the authority to 'tailor' the statute to make such a regulatory program work in practice.").

suffer a concrete injury from the regulation. Compliance costs constitute a concrete injury.

As litigation against Obama-era GHG emission regulations proved, however, the federal courts have become so deferential to agency assessment of the science said to justify a regulation, and also of the agency's interpretation of a statute, that an industry plaintiff faces long odds in getting an agency regulation reversed. Sometimes the agency's regulatory interpretation of the statute is so obviously contrary to the statutory language that a court will strike down the regulatory interpretation.[12] But most often, Obama-era GHG regulations survived judicial review.[13]

But there is a final venue for regulatory targets to challenge costly regulation: the ballot box. The political accountability of executive branch agencies is one of the two core justifications for judicial deference to agency interpretation and implementation of vague statutory commands under *Chevron v. National Resources Defense Council.*[14] If people do not like a president's regulatory agenda, they can change that agenda by voting to replace that president with a new one. Moreover, it may well be that the incentive to impose electoral penalties on politicians who have not reined in costly regulatory actions targeting particular industries is greater, the bigger and more catastrophic are those costs. After all, once an industry has been pushed into near bankruptcy by regulations issued by a particular federal executive, there is no more bargaining to be done with that executive. The only thing to do is to replace the executive with a new one. While costly, this is likely far easier than attempting to repeal some of the terms of complex, multi-issue congressional legislation whose overall structure represents an implicit deal among dozens of constituencies and hundreds of representatives.

III. The Impermanence of Costly Climate Regulatory Sticks

In a January 2008 interview with the San Francisco Chronicle editorial board describing his climate change regulatory agenda, then-presidential candidate Barack Obama said, "[s]o if somebody wants to build a coal fired [electricity generating] plant they can. It's just that it

12. *See Util. Air Regulatory Grp.*, 134 S. Ct. at 2443.

13. Coalition for Responsible Regulation v. EPA, 684 F.3d 102, 121 (D.C. Cir. 2012) (holding that there was "substantial" evidence supporting the EPA's finding that GHG emissions were reasonably likely to endanger the public health or welfare, ignoring arguments that the EPA's finding was simply a long paraphrase of assessment reports by the Intergovernmental Panel on Climate Change and that such deference by a U.S. regulator to a body appointed and controlled by officials of other governments was never anticipated by Congress).

14. Chevron U.S.A., Inc., v. Nat. Res. Def. Council, Inc., 467 U.S. 837, 865 (1984).

will bankrupt them."[15] The Obama Administration's regulatory agenda did indeed take aim at coal-fired electricity utility generating units and the U.S. coal industry more generally. Within a year of Obama's election, the Obama Administration EPA concluded that GHG emissions were reasonably likely to endanger human health or welfare.[16] This endangerment finding was then the basis for a series of further regulatory actions. The Obama era EPA regulated GHG emissions from stationary air pollution sources under the Clean Air Act's ("CAA's") Prevention of Significant Deterioration ("PSD") program. Under that program, new and modified major sources of air pollution would be required to comply with the Best System of Emission Reduction ("BSER") air pollution control standards. In the case of new or modified coal burning electric utility generating plants, the EPA declared that the BSER for new coal burning electric utility generating units was a boiler utilizing carbon capture and sequestration ("CCS") technology.[17] Because there is no commercially available CCS system for such plants, and no prospect for any such system in the near or medium term, this PSD regulation was tantamount to requiring that coal burning plants be replaced by natural gas fired facilities.[18] As for existing coal burning electricity generating units, the EPA's "Clean Power Plan" would have directed the states to implement steps to replace coal burning facilities with solar- and wind-powered electricity generation in order to dramatically reduce GHG emissions from the power sector by 2030.[19]

In addition to targeting GHG emissions from coal burning power plants, the Obama Administration's EPA promulgated CAA regulations imposing costly requirements on such plants to cut their emissions of mercury and other air toxics, requiring reductions in emissions of sulfur dioxide and oxides of nitrogen (the Cross State Air Pollution Rule), limiting coal waste in streams (the Stream Protection Rule), and imposing a three-year moratorium on coal leases on federal lands, costlier standards for landfills where coal ash is disposed, a

15. Erica Martinson, *Uttered in 2008, Still Haunting Obama*, POLITICO (Apr. 5, 2012, 11:37 PM), https://www.politico.com/story/2012/04/uttered-in-2008-still-haunting-obama-in-2012-074892 [https://perma.cc/7QHL-JCHD].

16. 40 C.F.R. § 202(a) (2009).

17. *See* Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,510, 64,548 (Oct. 23, 2015) (to be codified at 40 C.F.R., pts. 60, 70, 71, and 98).

18. After spending at least $7.5 billion, the Southern Company was ordered by Mississippi regulators to cease construction on its Kemper CCS plant. The plant will not be completed and will not be operated as a coal-burning plant. *See* Russell Grantham, *Southern Co. Hits Off Switch on 'Clean Coal' Experiment*, ATLANTA J. CONST., (June 28, 2017), https://www.ajc.com/business/southern-hits-off-switch-clean-coal-experiment/xepTP8eKYV31vHlQuVEQRO/ [https://perma.cc/B6A2-C9YS].

19. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,661, 64,663 (Oct. 23, 2015) (to be codified at 40 C.F.R. pt. 60).

new occupational safety and health rule requiring that coal miners be given costly real time monitors of their exposure to coal dust, and a rule overriding traditional state authority under the CAA by directly imposing federal standards limiting emissions from the burning of fossil fuels at power plants and other industrial facilities in order to limit "haze" at a group of U.S. national parks, monuments, and wilderness areas.[20] This long list of the Obama Administration's regulatory actions targeting the coal industry did not all survive court challenges. As noted above, the Supreme Court struck down part of the PSD rule applied to existing coal burning electric generating facilities,[21] and the mercury and air toxics rule in its entirety.[22] However, although cheap natural gas was also responsible for the decline of the coal industry, many blamed the raft of Obama Administration EPA regulations for the loss of about 50,000 coal industry jobs over the period 2008–2012.[23]

These job losses were concentrated in two states, Kentucky and West Virginia.[24] For those who may question whether Presidents and political parties are held politically accountable for regulatory actions, West Virginia and Kentucky provide a very clear answer in the affirmative. It is true that as the coal industry has declined over the last several decades, so too has the influence of the strongly Democrat coal miners' union.[25] However, by 2016, the Republican party had succeeded in persuading voters in these states that the Democrat party was strongly committed to an anti-fossil fuel regulatory agenda, and by 2018 both states—one, West Virginia, once solidly Democrat—have become solidly Republican.[26]

With the election of President Trump in 2016, the entire Obama-era regulatory attack on coal has been reversed. The Clean Power Plan is in the process of being repealed,[27] and the Trump Administration is

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20. *See The Obama Administration Targets Coal Every Which Way it Can*, Inst. for Energy Res. (Sept. 19, 2016), https://www.instituteforenergyresearch.org/analysis/obama-administration-targets-coal-every-way-can/ [https://perma.cc/C4V8-3R5B] (discussing the long list of targeted regulatory actions).

21. Util. Air Regulatory Grp. v. EPA, 134 S. Ct. 2427, 2449 (2014).

22. Michigan v. EPA, 135 S. Ct. 2699, 2712 (2015).

23. *See* Drew Haerer & Lincoln Pratson, *Employment Trends in the U.S. Electricity Sector, 2008–2012*, 82 Energy Pol'y 85, 90 (2015) (discussing job loss).

24. *Id.* at 95.

25. Gary Harki, *From Blue to Red: How the Decline of the Coal Union Helped Republicans Have a Stronghold in West Virginia*, 100 Days in Appalachia, https://www.100daysinappalachia.com/2017/02/15/blue-red-decline-coal-union-helped-west-virginia-become-republican-stronghold/ (last visited Aug. 16, 2018) [https://perma.cc/63AM-H3JY].

26. *Id.*

27. Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 82 Fed. Reg. 48,035, 48,035 (Oct. 16, 2017) (to be codified at 40 C.F.R. pt. 60).

reviewing other rules—such as the Mercury and Air Toxics Rule[28]—with every sign that they too will likely be repealed. Within a matter of months, the Trump Administration has undone virtually the entire complex package of regulatory sticks targeting the coal industry that the Obama Administration promulgated.

This is not the first time that environmental regulatory actions imposing large costs on particular industries have been quickly rescinded by a new Presidential Administration. Perhaps the most significant opinion in contemporary administrative law, *Motor Vehicles Manufacturers' Assoc. v. State Farm*, involved a decision by the newly elected Reagan Administration to rescind a NHTSA regulation requiring the installation of passive restraints (passive seat belts and airbags) in automobiles.[29] Along with the Trump Administration's actions to repeal regulations targeting the coal industry, the *State Farm* facts illustrate how quickly regulations imposing large costs concentrated on particular industries can be withdrawn with the election of a new President supported by those industries.

The political economics within the executive branch and the regulations it promulgates directly illustrate the impermanence of regulatory sticks. With electoral contests rewarding presidential candidates for relatively extreme regulatory positions, one would predict rapid swings in regulatory policy. Such swings are disciplined only by whatever constraints are imposed by courts in judicial review of regulatory action. With deferential courts, regulatory sticks are likely to exhibit dramatic swings.

IV. Legislative Carrots that Last and Last

While the Clean Power Plan and many other Obama-era CAA regulations targeting the coal burning electric utility industry will not be implemented by the Trump Administration, the other side of the Obama-era climate policy, federal financial support of various types for renewable power, has displayed remarkable resiliency. Expiration of funding under the 2009 stimulus (the American Reinvestment and Recovery Act) led to a 23% decline in total federal energy subsidies. Despite this, from 2010 through 2013, federal renewable energy subsidies increased by 54%, from $8.6 billion to $13.2 billion.[30] On a $/MW

28. Timothy Cama, *Court Delays EPA Mercury Rule Case While Trump Reviews*, The Hill (Apr. 27, 2017, 5:08 PM), http://thehill.com/policy/energy-environment/330960-court-delays-epa-mercury-rule-case-while-trump-reviews [https://perma.cc/NB6G-27CX].

29. Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29 (1983).

30. James Conca, *Why Do Federal Subsidies Make Renewable Energy So Costly?*, Forbes (May 30, 2017, 6:00 AM), https://www.forbes.com/sites/jamesconca/2017/05/30/why-do-federal-subsidies-make-renewable-energy-so-costly/#507461a128ce [https://perma.cc/XP2B-XZHK], *see also* Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2016, U.S. Energy Info. Admin. (Apr. 24, 2018), https:/

basis, solar received by far the largest subsidies of any electric power source, getting roughly 300 times the subsidies for hydrocarbons and nuclear before the expiration of ARRA funding and still 40 times greater subsidies even after the expiration of the 2009 stimulus funding.[31] Even more recently, despite attempts by some legislators to remove them, the tax reform package passed by Congress in 2018 retained tax credits for wind power generation through 2019, and similar credits for solar power generation through 2021. This legislation also retained the $7,500 federal tax credit for consumers purchasing electric cars.[32]

The United States is of course not alone in subsidizing renewable energy. The state of California—whose economy is larger than the vast majority of nation states in the world today—has aggressively subsidized wind and solar power and the purchase of electric cars by California consumers. In 2012, California voters passed Proposition 39, which allocates $2.5 billion (from a change in tax law) for clean energy development, this on top of up to (potentially) $11 billion also allocated to clean energy development from revenues from the sale of "carbon allowances" under that state's cap-and-trade program to reduce greenhouse gasses. Proposition 39 funding was generally viewed as supplementing the California Solar Initiative ("CSI"), the state's key incentive for solar energy systems. With a $2.2 billion budget spread over ten years, CSI's total funding is close to Proposition 39's potential funding amount. The CSI program began in 2007 and has been widely credited with creating an industry for solar rooftop installers.[33] Rooftop solar installation in California steadily increased until about 2016,[34] when (due in part to a change in the way rooftop solar production was credited to homeowners' electricity bills) it slowed significantly.[35] Fueled by subsidies and mandates, by 2018, the California solar industry employed more than 86,000 workers, and had

/www.eia.gov/analysis/requests/subsidy/ [https://perma.cc/8294-MP45]; UNIV. TEX. ENERGY INST., FEDERAL FINANCIAL SUPPORT FOR ELECTRICITY GENERATION TECHNOLOGIES 17 (2017), https://energy.utexas.edu/sites/default/files/UTAustin_FCe_Subsidies_2018_Jan.pdf [https://perma.cc/9NDW-LRUQ].

31. UNIV. TEX. ENERGY INST., *supra* note 30, at 4.

32. Cassandra Sweet, *What the New Tax Law Means for Renewables*, GREENBIZ (Jan. 11, 2018, 1:39 AM), https://www.greenbiz.com/article/what-new-tax-law-means-renewables [https://perma.cc/3U2V-HWEE].

33. Rory Carroll, *As U.S. Hesitates, California Pours Billions into Green Energy*, REUTERS (Nov. 14, 2012, 2:05 AM), https://www.reuters.com/article/us-clean-energy-california/as-u-s-hesitates-california-pours-billions-into-green-energy-idUSBRE8AD0F720121115 [https://perma.cc/6AB2-W4VL].

34. *See California Solar Statistics*, GO SOLAR CAL., https://www.californiasolarstatistics.ca.gov/reports/monthly_stats/ (last updated Aug. 15, 2018) [https://perma.cc/K8LN-VNM4].

35. Trefis Team, *Why the U.S. Residential Solar Market Has Slowed Down*, FORBES (June 2, 2017, 1:59 PM), https://www.forbes.com/sites/greatspeculations/2017/06/02/why-the-u-s-residential-solar-market-has-slowed-down/#375fb0e31939 [https://perma.cc/V8DA-TC5Y].

accumulated sufficient political clout that the California Energy Commission voted unanimously to require all new homes to install solar panels.[36]

California also subsidizes the purchase of electric vehicles. California rebates $2,500 of the cost of an electric vehicle to the consumer (and $1,500 of the cost of a hybrid car), and by February 2018 had spent about $500 million in such rebates for 222,000 auto purchases.[37] Under the Clean Vehicles Initiative (Assembly Bill 1184), the California rebate would have increased to $10,000 at point of purchase. That bill would have spent $3 billion, almost six times more than the nearly $500 million California has spent on electric vehicle rebates. A primary motivation for the bill was the fear that the $7,500 federal tax credit for the purchase of an electric vehicle would expire in 2017. When it became clear that the federal rebate would be renewed, support for another $3 billion subsidy for electric vehicles diminished in the California legislature. But there is every reason to expect continuing pressure for an increase in California's electric vehicle rebate. The federal rebate for electric vehicle purchases now expires when a manufacturer sells 200,000 such vehicles, making additional Tesla and General Motors electric vehicle sales ineligible.[38] Moreover, an increase in California's subsidy continues to be justified by the vast existing shortfall between the 324,000 electric vehicles sold in California thus far and the state's goal of selling 1.5 million electric vehicles by 2025.[39]

These U.S. and California renewable subsidies and mandates are relatively recent legislative programs. However, there is an older program, the federal ethanol mandate, whose history carries important lessons regarding the political hurdles in eliminating such subsidies and mandates, even when they are widely recognized as having failed to achieve any of their stated legislative goals.

A. *The Ethanol Mandate*

The use of ethanol as a gasoline additive came about because it was a substitute for methyl tertiary butyl ether ("MTBE"). Ironically, perhaps, the market demand for MTBE was itself entirely a creature of

36. Ivan Penn, *California Will Require Solar Power for New Homes*, N.Y. TIMES (May 9, 2018), https://www.nytimes.com/2018/05/09/business/energy-environment/california-solar-power.html (last updated Aug. 14, 2018) [https://perma.cc/36J7-GTEV].

37. *CVRP Rebate Statistics*, CLEAN VEHICLE REBATE PROJECT, https://cleanvehiclerebate.org/eng/rebate-statistics [https://perma.cc/6YDW-K5N7].

38. James B. Stewart, *Electric Vehicle Tax Credit Survives, But G.M. and Tesla Aren't Cheering*, N.Y. TIMES (Jan. 11, 2018), https://www.nytimes.com/2018/01/11/business/electric-vehicles-taxes-tesla-gm.html [https://perma.cc/8YZK-YJ5Q].

39. Rob Nikolewski, *Plan to Spend $3B For Electric Car Rebates Dies in Legislature*, SAN DIEGO UNION-TRIB., (Sept. 7, 2017, 1:40 PM), http://www.sandiegouniontribune.com/business/sd-fi-ting-bill-20170907-story.html [https://perma.cc/V76H-ESKF].

regulatory sticks.[40] One of the earliest actions taken by the EPA in actually implementing the 1972 CAA was to ban lead as a performance-enhancing additive from gasoline. Refiners responded in the late 1970's by substituting MTBE for lead. Demand for MTBE was further enhanced by the 1990 CAA Amendments, which required the use of reformulated gasoline in heavily polluted urban areas with severe summertime ground level ozone pollution.[41] MTBE turned out to solve both the ozone problem in those places and the wintertime carbon monoxide pollution problem that beset other urban areas. It also produced large reductions in auto emissions of benzene, various oxides of nitrogen, and the volatile organic compounds ("VOCs") that react with sunlight to create summertime ozone.

In the early 2000's, however, a number of cities such as Santa Monica, California, discovered that MTBE had leaked from refineries' underground storage tanks and contaminated city water supplies. Lawsuits followed, and by 2005, a group of large gasoline refiners was on the verge of paying almost a half billion dollars to public water providers in seventeen states for the alleged harm done by MTBE groundwater contamination. Despite evidence that MTBE—a relatively low potency VOC—was rarely detected in drinking water, and when detected was found in only very tiny amounts,[42] by 2005, over two dozen states had banned MTBE as a gasoline additive.

Like MTBE, ethanol-blended gasoline reduces auto "tailpipe" emissions of carbon monoxide, VOCs, and benzene. With bans on MTBE, ethanol emerged as a natural market substitute to MTBE for CAA compliance. Ethanol is also known as ethyl alcohol and is commonly produced by fermenting starches released from milled biostocks—in the U.S., most commonly corn. This process produces both beverage and fuel grade ethanol. The Model T, produced by Ford in

40. *See* Thomas O. McGarity, *MTBE: A Precautionary Tale*, 28 Harv. Envtl. L. Rev. 281, 337 (2004).

41. *MTBE, Oxygenates, and Motor Gasoline*, U.S. Energy Info. Admin., https://www.eia.gov/outlooks/steo/special/pdf/mtbe.pdf (last updated Mar. 6, 2000) [https://perma.cc/6LKU-RFRQ] ("The reformulated gasoline (RFG) program [created by the CAA Amendments of 1990] requires reductions in automobile emissions of ozone-forming volatile organic compounds during the summer high-ozone season, and of toxic air pollutants and nitrogen oxides during the entire year in certain areas of the United States. Reformulated gasoline requires a minimum 2.1 percent oxygen by weight when averaging, which corresponds to approximately 11.7 volume percent MTBE or 5.8 volume percent ethanol.").

42. Pamela R. D. Williams et al., *The Risk of MTBE Relative to Other VOC's in Public Drinking Water in California*, 24 Risk Analysis 621, 621 (2004); Pamela R. D. Williams, *MTBE in California's Public Drinking Water Wells: Have Past Predictions Come True?*, 12 Envtl. Forensics 270, 288 (2011) (finding that over the period 1996–2011, MTBE was detected (at least once) in California public drinking water wells at a rate of only from 0.4 to 0.9%) ("[D]espite repeated sampling, MTBE has been detected in only 1 or 2 years for most public drinking water wells that have ever been found to contain MTBE at any concentration level.").

1908, was actually designed to run on fuel grade ethanol, gasoline, or a blend of the two.[43]

Production costs of ethanol are high relative to gasoline, however, and it was not until the oil crisis of the 1970's that the federal government began to subsidize ethanol to lower U.S. dependence on imported oil. The oldest significant subsidy was a federal tax credit (more precisely, an exemption) that originated with the Energy Tax Act of 1978.[44] This gave ethanol producers a $0.40 per gallon tax exemption from the gasoline excise tax.[45] In 1982, the Surface Transportation Act increased the gasoline excise tax to $0.09 per gallon, but also increased the ethanol exemption to $0.60 per gallon.[46] In 1990, the Omnibus Budget Reconciliation Act decreased the ethanol exemption from $0.60 to $0.54, but also extended the tax credit to 2000.[47] In 1998, the Transportation Efficiency Act of the 21st Century further reduced the ethanol tax exemptions to $0.51 per gallon but extended it to last until 2007.[48] Finally, in 2004, with the passage of the American Jobs Creation Act, Congress created the Volumetric Ethanol Excise Tax Credit ("VEETC"). The VEETC changed the ethanol subsidy from an excise tax exemption to a blender tax credit. The VEETC gave ethanol blenders (primarily large oil companies) a $0.51 per gallon tax credit for ethanol blended with gasoline that had at least 10% ethanol. In 2008, the VEETC was renewed but lowered to $0.45 per gallon of ethanol.[49] It is estimated that in 2009 alone, the VEETC cost U.S. taxpayers $5.16 billion.[50]

Despite this long history of federal subsidies, as of 2004, ethanol production in the U.S. was only at 120,000 barrels per day, far short of the 187,000 barrels per day production level necessary for it to entirely replace MTBE as a gasoline additive.[51] However, not long after the passage of the VEETC, the Energy Policy Act of 2005 ("EPAct") was enacted.[52] With this law, Congress created a new demand for ethanol production that dwarfed the demand for ethanol as an MTBE replacement (and made the VEETC largely redundant, yet that tax credit

43. Amy Diggs, *The Expiration of the Ethanol Tax Credit: An Analysis of Costs and Benefits*, 19 POL'Y PERSP. 47, 47 (2000).

44. *See A History of Federal Support for the Ethanol Industry*, ALTERNATIVEENERGYSOURCESINFO.COM, http://www.alternativeenergysourcesinfo.com/ethanol-subsidies-history.html (last visited Aug. 15, 2018) [https://perma.cc/W2NZ-YML3].

45. *Id.*

46. *Id.*

47. *Id.*

48. *Id.*

49. *See* Diggs, *supra* note 43, at 48–49.

50. The VEETC expired in 2011. *The Volumetric Ethanol Excise Tax Credit: History and Current Policy*, TAXPAYERS FOR COMMON SENSE (Apr. 2011), https://www.taxpayer.net/agriculture/the-volumetric-ethanol-excise-tax-credit-history-and-current-policy/ [https://perma.cc/KPA7-H38G].

51. *See* McGarity, *supra* note 40, at 290.

52. Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594.

lasted until 2011). The EPAct required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012, and the Energy Independence and Security Act of 2007[53] ("EISA") quadrupled the amount of required renewable fuel to 36 billion gallons by 2022.[54] The EPAct was charged with implementing the renewable fuel standard ("RFS"), and it steadily increased the amount of required renewable fuel blending, reaching 15.2 billion gallons for 2012, far exceeding the statutory goal of 7.5 billion gallons.[55] While ethanol-blended gasoline is not the only way to meet the RFS in these laws, by 2016, it had become by far the most popular, with more than 95% of the automobile fuel sold in the U.S. consisting of 90% gasoline and 10% ethanol.[56]

The RFS is not the only federal mandate or subsidy increasing the demand for or supply of ethanol. According to the U.S. Department of Energy, there are now almost two dozen federal laws that create incentives for ethanol production.[57] However, the RFS in particular amounted to massive shift outward in the demand for ethanol.

This shift in demand had predictable consequences. The producer price index for ethanol jumped by 24.8% in 2006.[58] Even after suppliers responded by adding ethanol refining capacity, the ethanol price index increased another 6.7% in 2007 and 8.9% in 2008.[59] By 2010, farmers diverted such large share of corn to ethanol production that ethanol prices fell by 8.3%, while animal feed prices rose by 7.3%. From 2005–2014, ethanol prices increased by 38% (an annual increase of 4.8%).[60]

B. *Ethanol and the Demand for Corn*

As a matter of chemistry, it is possible to produce ethanol from a variety of plant feedstocks. However, the only two feedstocks that

53. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492.

54. *Id.* at 1522. EISA also added diesel fuel to the renewables mandate program, set volume requirements for specific categories of renewable fuel, such as cellulistic ethanol, and required the EPA to apply lifecycle greenhouse gas performance standards to different renewable fuels.

55. *Renewable Fuel Annual Standards*, ENVTL. PROTECTION AGENCY, https://www.epa.gov/renewable-fuel-standard-program/renewable-fuel-annual-standards (last visited Aug. 20, 2018) [https://perma.cc/9KJH-7TE4].

56. *See Almost All U.S. Gasoline is Blended with 10% Ethanol*, U.S. ENERGY INFO. ADMIN. (May 4, 2016), https://www.eia.gov/todayinenergy/detail.php?id=26092 [https://perma.cc/G2LY-PK3K].

57. *See Federal Laws and Incentives for Ethanol*, U.S. DEP'T OF ENERGY, https://www.afdc.energy.gov/fuels/laws/ETH/US (last updated Apr. 21, 2017) [https://perma.cc/QZ2G-3GQD].

58. Wander Cedeño, *Beyond the Numbers: What Happened to Ethanol Producer Prices After Passage of the Renewable Fuel Standard?*, 5 U.S. BUREAU LAB. STAT. 4 (July 2016), https://www.bls.gov/opub/btn/volume-5/pdf/what-happened-to-ethanol-producer-prices-after-passage-of-the-renewable-fuel-standard.pdf [https://perma.cc/7W7L-JQ8U].

59. *Id.*

60. *Id.*

have proven to be economically feasible for mass production are those that are sucrose- or starch-based.[61] In the U.S., sugarcane and sugar beets, sucrose-based feedstocks, are produced in only limited areas of the country and are very expensive to use for ethanol because they command high prices in the food market. Corn has relatively cheap production costs, can be grown in many areas of the country, and is less valuable for food. Therefore, corn has emerged as the lowest cost starch-based feedstock for ethanol in the U.S.

According to the U.S. Department of Agriculture, corn used for ethanol increased from about 1.5 billion bushels in 2005 to 4.1 billion bushels in 2009, a 170% increase.[62] Indeed, although total corn production increased by 3.2 billion bushels between 2000–2009, corn used for ethanol increased by 3.9 billion bushels. Whereas in 2005, only about 18% of the domestic corn supply went to ethanol, by 2014, 44% of U.S. corn production was used for ethanol.[63] Since the increase in corn used in ethanol accounted for more than the total increase in production, with corn yields (bushels per acre) constant over this period, corn production was diverted from other uses (such as food production) and farmers increased the amount of land planted with corn.[64] Economic simulation studies predicted that most of the increase in corn production would come from farmers switching from planting soybeans to planting corn.[65] USDA researchers found that this prediction was confirmed, at least for the two-year period 2006–2008, when 53% of the increase in acres planted with corn came from soybean farms.[66] However, the largest percentage increase in corn acreage occurred on cotton and wheat farms.[67] Nationally, moreover, soybean acreage did not fall over the 2006–2008 period.[68] While there was a big shift toward corn and away from soybeans in the traditional corn belt states such as Iowa, Nebraska, Illinois, and Minnesota, there was an increase in soybean acreage and an even larger increase in corn acreage in more arid, wheat belt states such as Kansas and South Dakota (states that are now referred to as part of the "western corn belt").[69]

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61. Landon Stevens et al., *Ethanol and Renewable Fuel Standard*, Inst. Pol. Econ. 5, http://www.strata.org/wp-content/uploads/ipePublications/Ethanol-and-RFS-Full-Report.pdf (last visited Aug. 13, 2018) [https://perma.cc/6YH2-4HYH].

62. *Id.*

63. Cedeño, *supra* note 58, at 2.

64. Steven Wallander, et al., *The Ethanol Decade: An Expansion of U.S. Corn Production, 2000-09,* U.S. Dep't Agric. 3 (Aug. 2011), https://ageconsearch.umn.edu/bitstream/117982/2/EIB79.pdf [https://perma.cc/43HF-WT5D].

65. *Id.* at 8.

66. A two-year period was studied in order to control for typically annual crop rotations.

67. Wallander et al., *supra* note 64, at 8–11.

68. *Id.* at 8.

69. *Id.* at 6.

C. *The Costs of Corn Ethanol*

1. Limited Greenhouse Gas Reductions but Big Increases in Corn Prices and Acreage Devoted to Corn Production

Over the years of ethanol subsidies, evidence has mounted that the environmental benefits of ethanol subsidies are likely much smaller than originally hoped and not worth their cost. The primary environmental benefit from blending ethanol into gasoline is a reduction in net carbon-dioxide emissions, relative to gasoline. The net reduction occurs because although burning ethanol, just like burning gasoline, releases CO2, corn plants used to produce ethanol absorb CO2 each year as they grow. But just as with petroleum production, the ethanol production process itself emits CO2 at several stages: growing the corn, transporting it to ethanol refineries, converting corn to ethanol at those refineries, and distributing and blending ethanol with gasoline. According to one study, even when blended at 30% rates, CO2 emissions from production and conversion of corn-based ethanol are so high that there is little potential overall reduction in CO2 emissions.[70]

Moreover, whether corn-based ethanol lowers CO2 emission relative to gasoline depends upon what was being done with the cropland before corn was grown on it. Work indicates that when the land was previously uncultivated, as in the U.S Conservation Reserve Program ("CRP"), even corn-based ethanol produced by low CO2 emission natural gas-powered refineries have higher lifecycle CO2 emissions than gasoline.[71] Simulation studies predicted that CRP land, as well as carbon rich grasslands, would be converted to corn production as a result of the RFS, and there is evidence that this is exactly what occurred.[72] One study found that over the 2008–2012 period, corn crops expanded to grasslands and lands that had not been used for agricul-

70. Bo Zhang et al., *Optimizing Blendstock Composition and Ethanol Feedstock to Reduce Gasoline Well-to-Pump CO2 Emission*, 105 ENERGY PROCEDIA 3642, 3643 (2017); *see* Brian C. Murray et al., *How Effective are Renewable Energy Subsidies in Cutting U.S. Greenhouse Gases?*, 104 AM. ECON. REV. PAPERS & PROC. 569, 572–73 (2014) (looking more generally at the effect of subsidies and tax breaks for renewables, observing that another reason that the ethanol subsidy has not lowered CO2 emissions is that the subsidy lowers the price of gasoline, "leading to a classic rebound effect that increases emissions from higher gasoline use").

71. Jason Hill et al., *Climate Change and Health Costs of Air Emissions from Biofuels and Gasoline*, 106 PROC. NAT'L ACAD. SCI. 2077, 2078 (2009).

72. Silvia Secchi & Bruce A. Babcock, *Impact of High Corn Prices on Conservation Reserve Program Acreage*, 13 IOWA AGRIC. REV. 1, 4 (2007) (finding that even at $3 per bushel corn prices, almost 40%of existing land in the CRP would be taken out of that program and devoted to corn production); XIAOGUANG CHENA & MADHU KHANNAB, INDIRECT LAND USE EFFECTS OF CORN ETHANOL IN THE U.S: IMPLICATIONS FOR THE CONSERVATION RESERVE PROGRAM 5 (2014).

ture since the early 1970's and were less suitable for agriculture.[73] As discussed earlier, the USDA found a marked movement of corn and soy cultivation into dryer western corn belt areas in North Dakota, South Dakota, Nebraska, Minnesota, and Iowa. Confirming this, Wright and Wimberly found that over the 2006–2011 period in this region, about one million acres of grasslands with high-erosion risk and drought vulnerability were converted to corn or soy production.[74]

Conversion to corn production of grasslands and lands that would otherwise be in CRP entails a host of environmental costs, not only carbonization (as carbon sinks are lost) but also the destruction of ecosystems and the value they confer, including the loss of recreational hunting and tourism opportunities.[75] And these are not the only environmental costs of corn-based ethanol. Hill et al. found that regardless of whether an ethanol refinery is powered by natural gas, coal, or corn stover, fine particulate (PM 2.5) emissions from the life-cycle ethanol-production process are higher than from the gasoline production process.[76]

Given the serious environmental costs and limited or non-existent efficacy of corn-based ethanol in reducing GHG emissions, it is perhaps unsurprising that American environmentalists have turned strongly against the federal ethanol subsidies.[77] In addition to the harmful environmental effects just mentioned, environmentalists have criticized ethanol as reducing gasoline mileage in automobiles, contributing to declining bee populations, and adding toxic pollutants into drinking water.[78] On the other hand, environmentalists' original hope—that ethanol subsidies would eventually move from supporting environmentally harmful corn-based ethanol to environmentally helpful biofuels such as cellulosic ethanol—has proven to be chimerical. By the spring of 2018, environmentalists such as the National Wildlife Federation were supporting a Democrat-sponsored bill that would phase out the corn-ethanol subsidy as part of the RFS.[79]

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73. Tyler J. Lark, J. Meghan Salmon & Holly K. Gibbs, *Cropland Expansion Outpaces Agricultural and Biofuel Policies in the United States*, 10 ENVTL. RES. LETTERS 6 (2015).

74. Christopher K. Wright & Michael C. Wimberly, *Recent Land Use Change in the Western Corn Belt Threatens Grasslands and Wetlands*, 110 PROC. NAT'L ACAD. SCI. 4134, 4134–38 (2013).

75. Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases through Emissions from Land-Use Change*, 319 SCI. 1238, 1238 (2008).

76. Hill et al., *supra* note 71, at 2077.

77. C. Ford Runge, *The Case Against More Ethanol: It's Simply Bad for Environment*, YALE ENV'T 360 (May 25, 2016), https://e360.yale.edu/features/the_case_against_ethanol_bad_for_environment [https://perma.cc/5KUV-K2X9].

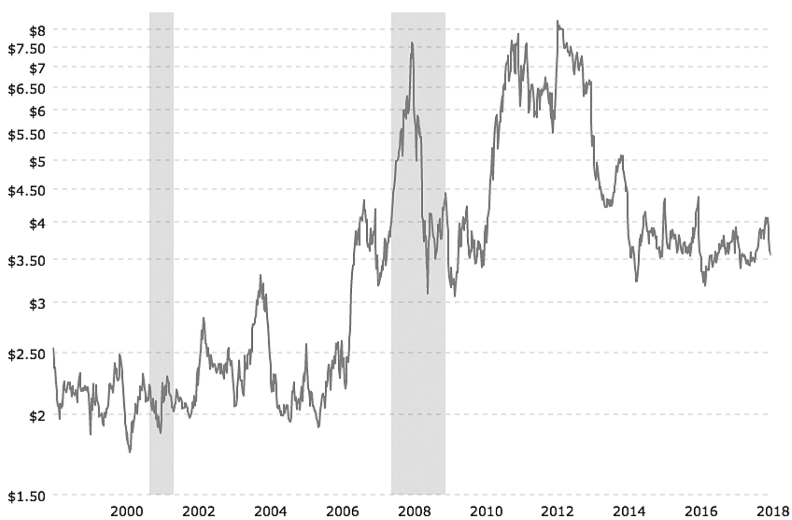
78. *See id.*; Emily Cassidy, *More Ethanol Means More Toxic Water Pollution*, AGMAG (Jan. 19, 2016), https://www.ewg.org/agmag/2016/01/more-ethanol-means-more-toxic-water-pollution#.Wy1Xu6knb64 [https://perma.cc/EJ5U-VSVB].

79. Ben Wolfgang, *Environmental Groups Back Ted Cruz, Republicans on Overhaul of Renewable Fuel Standard*, WASH. TIMES (Mar. 15, 2018), https://

The environment was not the only loser from the federal ethanol mandate. As can be seen from Figure 1 below, corn prices increased rapidly between 2006–2008, the period after the RFS was enacted and then expanded.[80] To be sure, the ethanol mandate is not the only thing determining corn prices. Weather fluctuations—such as the severe drought that contracted supply and increased price in 2012—can cause big short-term price changes. Over longer periods, international demand impacts prices—especially demand from China, where domestic $9–10 corn price supports are so high that since 2013, massive amounts of corn have been imported from the U.S. (despite 65% tariffs imposed on imports over quotas).[81] Still, using a variety of methods, researchers have estimated that the ethanol mandate in the RFS increased corn prices by 20–30%.[82] Thus, the ethanol mandate directly harmed consumers.

FIGURE 1

Corn Prices (Per Bushel) Since 1998



www.washingtontimes.com/news/2018/mar/15/renewable-fuel-standard-promoting-ethanol-shunned-/ [https://perma.cc/SAY8-P5FM].

80. *Corn Prices-45 Year Historical Chart,* MACROTRENDS, http://www.macrotrends.net/2532/corn-prices-historical-chart-data (last visited Aug. 8, 2018) [https://perma.cc/8GRP-6QP3].

81. Qianrong Wu & Wendong Zhang, *Of Maize and Markets: China's New Corn Policy*, CARD AGRIC. POL'Y REV., (2016), https://www.card.iastate.edu/ag_policy_review/article/?a=59 [https://perma.cc/PR9G-5TDD].

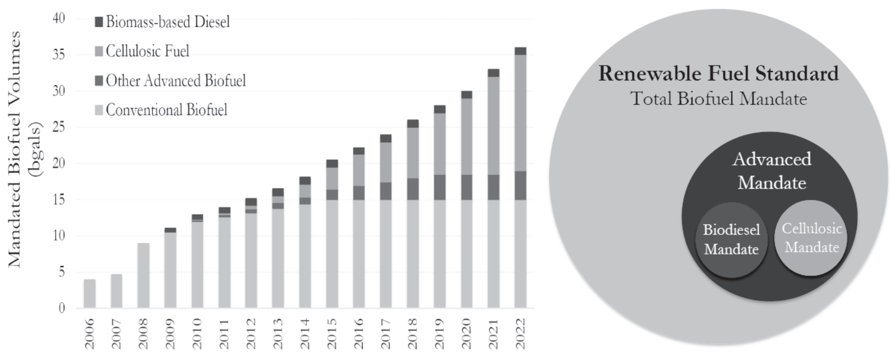
82. Catherine Hausman et al., *Farm Acreage Shocks and Crop Prices: An SVAR Approach to Understanding the Impacts of Biofuels*, 53 ENVTL. & RES. ECON. 117, 118, 119 (2012); Michael J. Roberts & Wolfram Schlenker, *Identifying Supply and Demand Elasticities of Agricultural Commodities: Implications for the U.S. Ethanol Mandate* 4 (Nat'l Bureau of Econ. Research, Working Paper No. 15921, 2013); Colin Carter et al., *The Effect of the U.S. Ethanol Mandate on Corn Prices* 1, 33 (2012) (unpublished manuscript) (on file with UC Davis Department of Agricultural and Resource).

2. Ethanol Mandates and the Automobile Gasoline Market

Beyond increasing corn acreage and corn prices, the RFS impacted the gasoline refining market. To fully understand the impact of the RFS on refiners requires a bit more detail on how the RFS mandate actually has been implemented by the EPA. The RFS mandate under EISA actually consists of a number of "nested" mandates within the overall renewable fuel mandate.[83] The law mandates the use of "advanced biofuels." One advanced biofuel is biodiesel, which has specific mandated amounts. As shown in Figure 2 below, "advanced biofuels" also include cellulosic biofuels.[84]

FIGURE 2

RFS Under the 2007 EISA



(a) RFS2 Mandates (b) Nested Mandate Structure

Note: The left figure graphs the EISA statutory RFS2 mandates from 2006-2022, and the right figure graphs the nested structure of the mandate.

While the EISA sets mandated amounts of different biofuels, the EPA administers the program and has discretion in setting annual mandates. Figure 3 below shows the amounts of various renewable fuels that the EISA required and actually ordered by the EPA pursuant to rulemakings.[85] Note that the EISA does not set any required amount of corn ethanol. Instead, the "mandate" for corn ethanol is implicit, equal to the difference between the total renewable fuel mandate and the advanced biofuel mandate.

83. Giancarlo Moschini et al., *The Renewable Fuel Standard in Competitive Equilibrium: Market and Welfare Effects*, 99 AM. J. AGRIC. ECON. 1117, 1119 (2017).

84. Gabriel E. Lade et al., *Policy Shocks and Market-Based Regulations: Evidence from the Renewable Fuel Standard* 4, 6 (Ctr. for Agric. & Rural Dev., Working Paper 16-WP 565, 2016), https://lib.dr.iastate.edu/cgi/viewcontent.cgi?refererHTtps://www.google.com/&httpsredir=1&article=1584&context=card_workingpapers [https://perma.cc/8HU3-29MN].

85. Moschini et al., *supra* note 83.

FIGURE 3

Statutory Mandates, EPA Final Rulings, and 2022 Scenario (Billions of Gallons)

	2015		2016		2017		2022	
	EISA	EPA	EISA	EPA	EISA	EPA	EISA	Projected
Renewable fuel	**20.5**	**16.93**	**22.25**	**18.11**	**24.0**	**19.28**	**36.0**	**20.787**
Advanced biofuel	5.5	2.88	7.25	3.61	9.0	4.28	21.0	5.787
Biodiesel	≥ 1.0	1.73	≥ 1.0	1.90	≥ 1.0	2.00	≥ 1.0	. . . [a]
Cellulosic biofuel	3.0	0.123	4.25	0.230	5.5	0.311	16.0	0.787 [b]
Non-cellulosic advanced biofuel	*2.5*	*2.757*	*3*	*3.38*	*3.5*	*3.969*	*5*	*5*
Corn ethanol	*15*	*14.05*	*15*	*14.5*	*15*	*15*	*15*	*15*

Note: Superscript [a]indicates that biodiesel is produced as needed (assumed to be the marginal advanced fuel); [b]indicates a linear trend projection based on 2014-2017 EPA rulings ($R^2 = 0.998$). All quantities are in ethanol-equivalent gallons except for biodiesel, which are in physical volume.

As can also be seen from Figure 3, since 2015, the amount of renewable fuel that the EPA has actually required varies tremendously from what Congress required in the EISA. That law gives the EPA authority to waive the mandated amount, and the EPA has exercised that authority to drastically reduce the required amount of advanced biofuels, in particular more or less zeroing out the cellulosic ethanol requirement.[86] Cellulosic ethanol is produced from cellulose, sugars on the cell walls of plants. Cellulosic ethanol can be produced from a variety of feedstock crops, such as switchgrass. The problem is that the cost of producing cellulosic ethanol has been prohibitive, and the existing technology and production capacity are far too small to meet the cellulosic-ethanol goals of the EISA.[87] Faced with this reality, whereas the EISA called for 5.5 billion gallons of cellulosic ethanol in 2017, the EPA required only 0.311 billion gallons.[88]

The only advanced biofuel to reach commercial viability is biodiesel. Biodiesel is made by refining a variety of feedstocks, including recycled cooking oil, soybean oil, and animal fats. In fact, U.S. monthly biodiesel production rose from just over 60 million gallons in December 2009[89] to nearly 150 million gallons in December 2017.[90]

86. EPA's waiver authority is created by Clean Air Act, 42 U.S.C. § 7545 (o)(7)(A) (2012).

87. *See* M. Woodson & C.J. Jablonowski, *An Economic Assessment of Traditional and Cellulosic Ethanol Technologies*, 3 ENERGY SOURCES 372, 373 (2008).

88. Robert Rapier, *Cellulosic Ethanol Falling Short of the Hype*, FORBES (Feb. 11, 2018), https://www.forbes.com/sites/rrapier/2018/02/11/cellulosic-ethanol-falling-far-short-of-the-hype/#666b707d505f [https://perma.cc/DZ7R-G5ZW] (stating that EISA called for 5.5 billion gallons of cellulosic ethanol in 2017); *Renewable Fuel Standard Program: Final Renewable Fuel Standards for 2017, and the Biomass-Based Diesel Volume for 2018*, EPA,https://www.epa.gov/renewable-fuel-standard-program/final-renewable-fuel-standards-2017-and-biomass-based-diesel-volume (last visited Sept. 14, 2018) [https://perma.cc/X8BE-K85N] (stating that the EPA required only 0.311 billion gallons of cellulosic ethanol in 2017).

89. Monthly Biodiesel Production Report Archives, U.S. ENERGY INFO. ADMIN. (May 4, 2012), https://www.eia.gov/biofuels/biodiesel/production/archive/2011/2011_12/biodiesel.php [https://perma.cc/3X8U-SFXE].

As can be seen from Figure 3, recognizing that biodiesel is the only commercially available advanced biofuel, the EPA has steadily increased the biodiesel mandate.

For present purposes, the various renewable fuel types under the EISA matter because the mandates for different categories are an important determinant of the cost to regulated entities of meeting the RFS mandate. The regulated entities under the EISA are refiners, blenders, and importers of gasoline and diesel. Each year, the EPA determines a blend requirement for these entities by dividing the amount of each type of fuel specified in its final rule by projected gasoline and diesel sales for the year.[91] For example, if the EPA required one billion gallons of biodiesel for a particular year and estimated that 100 billion gallons of gasoline would be sold, then each refiner or blender would be obliged to buy biodiesel equal to 1% of its gasoline sales. This amount is known as the renewable volume obligation ("RVO").[92] Under EPA regulations, this obligation can be met by either buying that amount of biodiesel, or buying Renewable Identification Numbers ("RINs").[93] Every gallon of biofuel produced or imported in the U.S. generates an RIN, a credit that is detached from the biofuel as soon as it is sold or blended. Under this trading scheme, a refiner or blender can comply with the RFS mandate by either buying and blending its required amount, or buying RINs from other refiners and blenders. In this Article's biofuel example, the refiner can either buy and blend biodiesel equal to 1% of its sales, or instead blend no biodiesel but buy biodiesel RINs equal to 1% of its gasoline sales.

RIN 'types' correspond to the biofuel categories described above. Conventional RINs (called D6 RINs) generated by corn ethanol may be applied only toward the total renewable fuel mandate. Biodiesel RINs (called D4 RINs) can be applied to meet any of the mandates—biodiesel, advanced, or the total renewable fuel requirement.[94] Up until 2013, regulated entities over-complied with the total RFS mandate, accumulating about 2.6 billion gallons in banked conventional RINs by 2013.[95] This can be seen from Figure 4 below, which compares gasoline prices to the price of a conventional corn-based ethanol RIN. As

90. Monthly Biodiesel Production Report Archives, U.S. ENERGY INFO. ADMIN. (Feb. 28, 2018), https://www.eia.gov/biofuels/biodiesel/production/archive/2017/2017_12/biodiesel.php [https://perma.cc/K548-CT3D].

91. Gabriel E. Lade et al., *Ex Post Costs and Renewable Identification Number (RIN) Prices Under the Renewable Fuel Standard* 5 (Res. for the Future, Discussion Paper No. 15-22, 2015), http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-15-22.pdf [https://perma.cc/CPD8-NQ4Z] [hereinafter Lade et al., *Ex Post Costs and RIN Prices*].

92. *Id.* at 5–6.

93. *Id.* at 6. There is some leeway, as the EPA allows up to 20% of RIN's generated in a given year to be banked and used in the following year, and there is a one-time only option for a firm to carry a deficit in RIN's over to the next year.

94. *Id.* at 19 n.28.

95. *Id.* at 6.

can be seen from the Figure, the price of conventional ethanol RINs was essentially zero until 2013.

To understand the 2013 RIN price spike, we must step back a bit. The demand for ethanol as a gasoline additive is limited by the fact that virtually all gasoline in the United States has 10% ethanol. This is the maximum quantity of ethanol that conventional automobile engines can burn. There are very few cars that can run on the much higher 85% ethanol blend (so-called flex fuel). At 10%, the higher-octane benefit of ethanol approximately offsets its lower energy content.[96] Hence, at a 10% mix, ethanol is almost a perfect substitute for gasoline, and when the ethanol price equals the market price of gasoline, regulated entities break even on their ethanol purchases. Demand for ethanol is perfectly elastic at such a price, up until the ethanol "blend wall" is met. The blend wall is the point where the total quantity of ethanol purchased equals 10% of expected gasoline sales.[97] Beyond this point there is only a very small, albeit price-elastic demand for ethanol used in 15% and 85% blends.

Whether the market demand for ethanol is above or below the EPA mandated amount depends both on what the EPA mandates and on the market demand for 10% ethanol gasoline. If the market demand for gasoline is sufficiently high, the EPA conventional RFS mandate does not matter, as 10% of market gasoline demand—market-determined ethanol demand—exceeds what the EPA requires. In this case, RINs for conventional ethanol have no value and a zero price. As shown in Figure 4 below, this is the situation that prevailed in the ethanol RIN market from 2008 until 2013.[98]

However, if the ethanol mandate increases sufficiently to be above the market-determined blend wall, it becomes physically impossible for regulated entities to meet their conventional ethanol obligation by buying ethanol (or D6 RINs). This is what occurred in 2013. In a proposed rule issued in January 2013, the EPA maintained the EISA's overall biofuel mandate for 2013, pushing the level close to or above the conventional 10% ethanol blend wall.[99] This apparently defied industry expectations that the EPA's long delay in releasing the rule signaled it would relax the mandate.[100]

To avoid being out of compliance, the RFS allows entities to use higher-ranked RINs, biodiesel RINs, to meet their conventional ethanol mandate. Up until 2013, the RFS total mandated amount of biodiesel was relatively high, leading to high biodiesel prices and high

96. Scott Irwin, *Fixing the RFS is Getting Easier and Easier*, FARMDOCDAILY 2 (Feb. 15, 2018), https://farmdocdaily.illinois.edu/2018/02/fixing-the-rfs-is-getting-easier-and-easier.html [https://perma.cc/RC9N-UXP4].

97. *Id.*

98. *Id.*

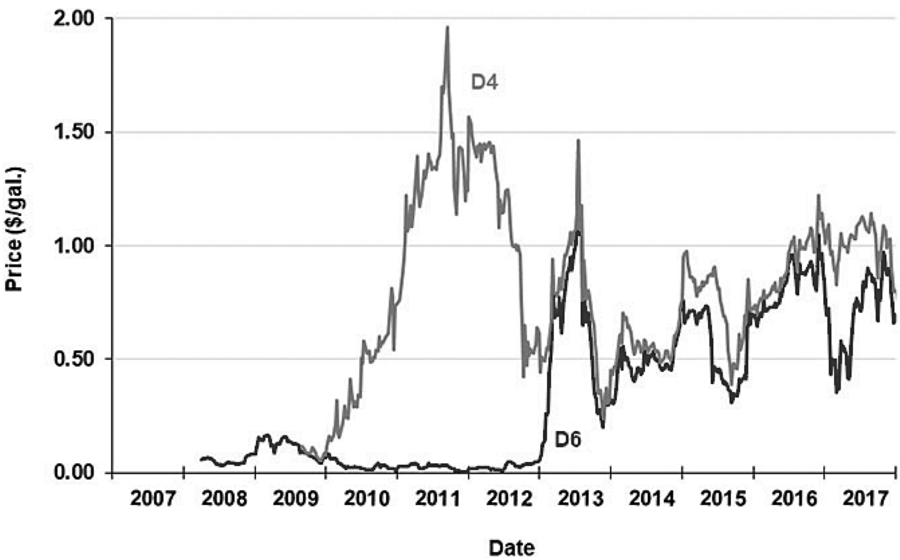
99. Lade et al., *Ex Post Costs and RIN Prices*, *supra* note 91, at 21.

100. *Id.*

biodiesel D4 RINs. Indeed, at their peak in 2011, biodiesel prices reached almost $6 per gallon, and in ethanol equivalents (adjusted according to EPA weight factors such as impacts on GHG emissions) D4 RINs were $2 per gallon.[101] What happened in 2013 is that the biodiesel D4 RINs were seen by regulated entities as the only way to meet the conventional ethanol mandate, making biodiesel the marginal fuel for meeting the ethanol mandate. Hence, as shown in Figure 4, after 2013, prices for conventional D6 RINs roughly equaled prices for D4 biodiesel RINs.[102]

FIGURE 4

Weekly D4 (Biodiesel) and D6 (Ethanol) RINs Price 2007–2018[103]



Between December 2012 and July 2013, the cost of the required bundle of RINs—representing the mandated quantities of various renewable fuel categories—increased from around $0.01 cent per gallon to more than $0.14 per gallon.[104] What one commentator has called the "shock factor"[105] of this dramatic, 1,400% change in regulated en-

101. Irwin, *supra* note 96, at 4.
102. *See* Lade et al., *Ex Post Costs and RIN Prices*, *supra* note 91, at 19 (analyzing the efficiency of the RIN market's response).
103. Irwin, *supra* note 96, at 1.
104. *See* Lade et al., *Ex Post Costs and RIN Prices*, *supra* note 91, at 16–17 (discussing the sharp increase of RIN prices from January 2013 to July 2013).
105. Scott Irwin, *How Much Will the Cost of a RINs Bundle Decline if the Conventional Ethanol Gap Disappears?*, FARMDOCDAILY 4 (Feb. 23, 2018), https://farmdocdaily.illinois.edu/2018/02/how-much-will-the-cost-of-a-rins-bundle-decline.html [https://perma.cc/3DPY-ZB74].

tities' cost of complying with the RFS mandate reverberates still in 2018. RIN prices have steadily increased since 2014 to the point where the RFS compliance cost—determined on the margin by the cost of biodiesel RINs—amounts to a non-negligible tax on gasoline and diesel refiners.

Biodiesel is a very expensive way to reduce carbon-dioxide emissions. As Meiselman explained, the marginal cost curve of biodiesel rises steeply and because it is an almost perfect substitute for petroleum-based diesel, it can remain competitive with such petroleum-based diesel only if the blender cost of petroleum diesel rises along with the blender cost of biodiesel.[106] However, the blender cost of petroleum diesel is relatively constant. Recent work finds that when biodiesel RINs determine the marginal cost of complying with the RFS, there are large losses of diesel fuel consumer surplus.[107] In practical terms, since in the U.S. "diesel fuel consumers" are mostly heavy trucks and trains, their increased cost will likely be passed through to consumers.

Therefore, if the EPA continues toughening the RFS mandate—as the original 2007 EISA requires—with correspondingly high gasoline production—it is likely that gasoline refiners could not meet the RFS mandate with conventional corn ethanol, unless gasoline prices remained at the very low levels seen in 2014–2016. The so-called "blend wall" would bind, and refiners and producers could meet the RFS mandate only by buying much more expensive biodiesel RINs. Gasoline prices have been rising since 2016 (see Figure 5 below).[108] This means that the marginal cost of complying with the RFS will continue to be determined by the cost of biodiesel RINs.

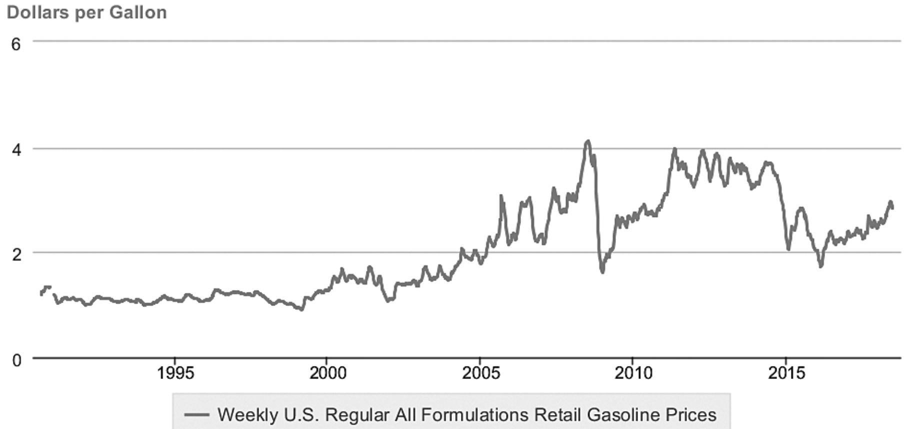
106. Ben Meiselman, Breaching the Blendwall: RINs and the Market for Renewable Fuel 3–4 (Feb. 25, 2016) (unpublished manuscript) (on file with University of Michigan).

107. Christina Korting et al., *Who Will pay for Increasing Biofuel Mandates? Incidence of the Renewable Fuel Standards Given a Binding Blend Wall* 40 (2017), https://dyson.cornell.edu/faculty-research/working-papers/documents/Korting%2C%20de%20Gorter%20and%20Just%20(2017)%20WP.pdf [https://perma.cc/G7R2-W23W].

108. *Weekly U.S. Regular All Formulations Retail Gasoline Price*, U.S. Energy Info. Admin., https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?f=W&n=PET&s=EMM_EPMR_PTE_NUS_DPG (last visited Aug. 23, 2018) [https://perma.cc/H7Y9-7VUW].

FIGURE 5

Retail Gasoline Prices Since 1990



3. Political Arithmetic: Ethanol Costs Likely Vastly Exceed Benefits, Environmentalists and Conservatives Support Repealing the RFS, yet the RFS Survives

Economists' early work attempting to assess the social costs and benefits of alternative renewable fuel policies tended to conclude that mandates such as the RFS might increase social welfare.[109] That work, however, did not foresee the predominance of corn ethanol and its effect in drastically increasing food prices and incentivizing the over-cultivation of marginal or otherwise uncultivated farmlands. Nor did it foresee that the marginal cost of RFS compliance would be determined by the marginal cost of biodiesel, the impact of the high cost of biodiesel on consumer goods transportation costs, and, ultimately, consumer prices. Indeed, because biodiesel is such an expensive way to reduce GHG emissions, it has been estimated that the RFS imposes welfare costs of more than $300 per metric ton of CO2 reduction.[110] Even using the Obama Administration estimates (which assume an unrealistically low ability of economies to adapt to climate change), this is about ten times the benefit of such reduction (social cost of carbon avoided). Overall, given that corn ethanol emits only a little less CO2 than petroleum-based gasoline, whatever environmental benefit is achieved by the RFS is likely small relative to the welfare loss from distorting consumption of food and fuel.[111]

The RFS is thus difficult to justify as an instrument for reducing U.S. GHG emissions. Of course, this was not the only goal of the 2007

109. Harry de Gorter & David R. Just, *The Social Costs and Benefits of Biofuels: The Intersection of Environmental, Energy and Agricultural Policy*, 32 APPL. ECON. PERSP. & POL'Y 4, 6 (2010).

110. Meiselman, *supra* note 106, at 1.

111. *Id.* at 3–4.

EISA: that law also was intended to increase farm income, increase U.S. domestic energy production, and promote energy security. U.S. domestic energy production and energy security have reached unprecedently high levels. But this has everything to do with the adoption of hydraulic-fracturing technology ("fracking") and nothing to do with the EISA. Beginning in late 2008, U.S. shale oil recovered via fracking has doubled U.S. crude oil production over the last 15 years, with the share of shale oil in total U.S. production rising from about 6% in January 2000 to almost 50% at the end of 2014.[112] While reliably predicting the future path of oil prices is impossible,[113] there is solid evidence that the U.S. fracking boom has lowered world oil prices.[114] As for energy security, in November 2017, the U.S. was second only to Russia in total crude oil production, and U.S. oil imports had fallen from roughly 66% of U.S. consumption in 2007 to 38% by November 2017.[115] The U.S. still imports oil, but due to the shale oil fracking boom, the U.S. economy is much less sensitive to the global oil price shocks that have often led to recessions.[116]

The only goal of the RFS in the 2007 EISA that seems to have been realized is to massively increase corn prices and the amount of U.S. agricultural land planted with corn. Many farmers and landowners in the corn belt have benefited from such high prices.[117] However, given the significant costs imposed by the EISA and its relative ineffectiveness in achieving any of its other goals, it may seem surprising that Congress has repeatedly failed to pass legislation eliminating or modifying the corn ethanol subsidy. U.S. Senators have been pressured to drop the ethanol mandate by poultry producers facing higher feed prices[118] and by small oil refineries confronted by dramatic increases

112. Manuel Frondel et al., *The U. S. Fracking Boom: Impacts on Global Oil Prices and OPEC*, IAEE Energy F. 33 (2018), https://www.iaee.org/en/publications/newsletterdl.aspx?id=466 [https://perma.cc/V5LT-GMR8].

113. Christiane Baumeister & Lutz Kilian, *Forty Years of Oil Price Fluctuations: Why the Price of Oil May Still Surprise Us*, 30 J. Econ. Persp. 139, 140 (2016).

114. Frondel et al., *supra* note 112.

115. Ryan Kellogg, *U.S. Shale Boom Has Led to Big Payoffs, But Energy Independence Isn't One – Nor Should it Be*, Forbes (Mar. 5, 2018, 10:33 AM), https://www.forbes.com/sites/ucenergy/2018/03/05/the-u-s-shale-oil-boom-has-led-to-big-payoffs-but-energy-independence-isnt-one-nor-should-it-be/#734d8360d61b [https://perma.cc/JXM7-7SLF].

116. *Id.*

117. *See* Coral Davenport, *Ethanol Mandate, a Boon to Iowa Alone, Faces Rising Resistance*, N.Y. Times (Jan. 31, 2016), https://www.nytimes.com/2016/02/01/us/politics/ethanol-mandate-a-boon-to-iowa-alone-faces-rising-resistance.html [https://perma.cc/G978-UEP3] (stating that in the heart of ethanol country, Iowa, the ethanol mandate has benefited not just farmers and landowners but also created new jobs for workers at the 40 ethanol refineries located in the state who refine Iowa-grown corn into ethanol).

118. *See* Clare Foran, *Senators Could Dethrone King Corn in Ethanol Standards*, Nat'l J. (Dec. 11, 2013), https://www.theatlantic.com/politics/archive/2013/12/senators-could-dethrone-king-corn-in-ethanol-standards/444300/ [https://perma.cc/RUQ2-YZQS].

in the price of RFS RINs.[119] However, legislation modifying or repealing the RFS mandate has repeatedly failed to pass.[120]

Assuming that the RFS mandate's costs do indeed far exceed its benefits, in a world with zero legislative transaction costs, congressional failure to modify or eliminate the ethanol mandate would be puzzling.[121] However, as discussed in Part II, the political economics of repealing legislative carrots are much more complicated than this. Once provisions cutting petroleum-industry subsidies were eliminated, the toughened 2007 RFS received overwhelming support in both chambers.[122] It thus exemplified what has been called a universalistic legislation bargain, one providing legislative carrots to a wide variety of members and their districts/states.[123] Such universalistic legislative pork may be thought as a bill that combines carrots in a single deal, carrots that legislators might otherwise have bargained for in a sequential log-roll. One can easily imagine a non-corn belt federal legislator worrying that if she voted in favor of eliminating the key element in that deal—the RFS—then corn belt representatives could turn against provisions in other bills that brought concentrated benefits to her own constituents.

In the case of ethanol, the complex institutional structure of Congress makes the persistence of inefficient legislation even more likely. The Senate system of representation—where each state gets two Senators, no matter its population or GDP—is probably enough to insure economically-inefficient legislative outcomes. When combined with a committee system that gives gatekeeping power to self- and party-leader-selected committees, the obstacles to efficient legislative bargaining are high.

This is especially true in the case of ethanol. As generally known, Iowa leads the nation in ethanol production. According to the Iowa Farm Bureau, 47% (1.3 billion bushels) of the corn grown in the state goes to ethanol production, and Iowa alone produces nearly 30% of

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119. *See The Consumer and Fuel Retailer Choice Act: Hearing on S. 517 Before the U.S. Senate Env't & Pub. Works Comm.* (2017) (statement of Tom Carper, Delaware Senator).

120. Failures include S. 577, The Corn Ethanol Mandate Elimination Act of 2015, and H.R. 704, The RFS Reform Act of 2015. Both of these acts died after referral to committee (respectively, Senate EPW and House Subcommittee on Energy and Power).

121. R. H. Coase, *The Problem of Social Cost*, 3 J. L. & ECON. 1, 4 (1960).

122. The original house bill, H.R. 6 in the 110th Congress, would have cut petroleum industry subsidies. It passed both chambers, but the majority of Republicans voting in the Senate, 23 out ouf 43, voted against the bill. The bill was amended to retain petroleum industry subsidies, and in this form, it passed with a small minority of only 7 Republican senators and one Democrat voting against it. *See* H.R. 6 (110th): Energy Independence and Security Act of 2007, GOVTRACK, https://www.govtrack.us/congress/bills/110/hr6 (last visited Oct. 9, 2018) [https://perma.cc/DD2N-68TC].

123. *See generally* Emerson M.S. Niou & Peter C. Ordeshook, *Universalism in Congress*, 29 AM. J. POL. SCI. 246 (1985).

America's ethanol.[124] Additionally, "[i]n 2015, the ethanol industry was touted as supporting 39,592 jobs in Iowa—accounting for $4.2 billion of Iowa's GDP and $2 billion of income for Iowa households."[125] Nebraska is the second largest ethanol-producing state (over two billion gallons of corn ethanol from 25 operating plants) and the third largest corn producer, with 23,000 corn farmers planting almost nine million acres with corn.[126] In Illinois (as of 2012), 14 ethanol plants in the state produced 1.7 billion gallons of ethanol, using 670 million bushels of Illinois corn, employing nearly 4,000 workers, and adding about $5.3 billion to the state's economy.[127] Due to the expansion in corn acreage it induced, the ethanol mandate has increased the number of states with strong corn-ethanol interests. In Minnesota, one producer group stated that in 2017, Minnesota produced 1.2 billion gallons of ethanol, 3.9 million tons of dried distillers' grains with solubles ("DDGS"), and 256 million pounds of corn oil. The group claims that in aggregate, ethanol generated $7.13 billion in gross sales for Minnesota businesses and supporting 18,813 jobs.[128] In South Dakota, economists have estimated that the state's ethanol industry grew "more than 441% in sales of ethanol and dried distillers grains since 2004."[129] Sales of ethanol and grain by-products were estimated to have exceeded $2.983 billion, generating indirect business tax revenue in 2012 over $18.5 million, and contributing "about $200 million in direct value added to the state economy."[130] Even in arid Kansas, the state corn growers' association stated that as of 2018, 12 ethanol plants produced nearly half a billion gallons of ethanol.[131]

The corn-ethanol industry is thus significant not just in Iowa, but in at least another half-dozen states. The ethanol mandate thus exemplifies a public program that generates economic benefits to an interest

124. *Ethanol Continues to Deliver for Iowa's Economy*, Iowa Farm Bureau (Sept. 1, 2016), https://www.iowafarmbureau.com/Article/Ethanol-continues-to-deliver-for-Iowas-economy [https://perma.cc/P6F5-BZ9W].

125. *Id.*

126. *Nebraska Agriculture*, Neb. Dep't Agric., http://www.nda.nebraska.gov/publications/ne_ag_facts_brochure.pdf (last visited Aug. 24, 2018) [https://perma.cc/8VCB-FLG9].

127. Cathy Lockman, *Illinois Ranks Among Top States for Ethanol Production*, Farm Flavor (July 19, 2012), https://www.farmflavor.com/illinois/illinois-ag-products/illinois-ethanol-production/ [https://perma.cc/6Z54-GCUX].

128. Minn. Bio-Fuels Ass'n, *Ethanol Industry Contributes $2.17 billion to Minnesota's Economy*, Ethanol Producer Mag. (Feb. 26, 2018), http://ethanolproducer.com/articles/15075/ethanol-industry-contributes-2-17-billion-to-minnesotaundefineds-economy [https://perma.cc/4S5S-LMSP].

129. S.D. Ethanol Producers Ass'n, *SD Ethanol Industry has $3.8 Billion Impact on 2012 Economy*, Ethanol Producer Mag. (July 16, 2013), http://ethanolproducer.com/articles/10058/sd-ethanol-industry-has-3-8-billion-impact-on-2012-economy [https://perma.cc/28MZ-FUZ9].

130. *Id.*

131. *Building Markets for Ethanol*, Kan. Corn, https://kscorn.com/ethanol/ (last visited Aug. 24, 2018) [https://perma.cc/P64L-J3PP].

group—corn growers and ethanol producers—that is both homogeneous and geographically concentrated in a politically important way. On the classic model of how congressional committees operate to distribute the benefits and burdens of pork-barrel projects, one would expect it to be very difficult for Congress to eliminate the ethanol mandate.[132] This has proven to be true, and it is likely true for any legislative climate change carrot that actually creates concrete benefits for relatively homogeneous industries or groups.

V. Over the Cliff: Winners and Losers in Global Competition to Subsidize and Mandate Solar Power

This Part of the article analyzes global competition in the production of solar PV. The story of international competition in the production of solar PV panels suggests a potential end result of the global race among governments to subsidize and mandate the production of renewable energy products for a global market created primarily by these governments' own regulatory requirements for the purchase and use of such products (or services). That end result is that rather than sharing in the profits from national subsidies, a small number of nations—sometimes only one—capture all the profits, with all other nations bearing the costs.

A. *Germany, China and the Solar PV Panel Market*

Rooftop solar panels are assembled from PV cells that convert solar energy into electricity. Perhaps the most commonly found such cells are made from crystalline silicon. The process by which such cells are made begins with polysilicon, from which ingots are grown.[133] The ingots are sliced into wafers, which are then processed to create cells that convert solar energy into electricity.[134] The cells are strung together to create PV modules that are then incorporated into the panels.[135]

Under a program begun in 2000, Germany subsidized solar and wind-power generation with its feed-in-tariff ("FIT").[136] Germany's FIT guaranteed a price far above market price to providers of solar- and wind-generated electric power. The FIT resulted, unsurprisingly, in a massive increase in solar- and wind-generated electric power in

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132. Barry R. Weingast et al., *The Political Economy of Benefits and Costs: A Neoclassical Approach to Distributive Politics*, 89 J. Pol. Econ. 642, 642–43 (1981).

133. Stefan Reichelstein & Anshuman Sahoo, *Cost and Price Dynamics of Solar PV Modules* 13 (Nov. 2015), https://www-cdn.law.stanford.edu/wp-content/uploads/2015/06/Reichelstein-Sahoo-CostandPriceRevision-Nov2015.pdf [https://perma.cc/N38M-24GK].

134. *Id.*

135. *Id.*

136. Jeffrey Ball, *Germany's High-Priced Energy Revolution*, Fortune (Mar. 14, 2017), http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/ [https://perma.cc/WN8X-UTC4].

Germany. In 2010, a full 44% of all solar panels installed worldwide were installed in Germany, and by 2015 Germany had become the world's largest solar market.[137] Additionally, wind and solar provided about one-third of the electricity consumed in Germany.[138] But this increase in renewable electricity—enshrined as national policy by the so-called Energiewende of the Renewable Energy Sources Act (EEG 2012)—has been costly. German households spent $26 billion on renewable electricity surcharges in 2016, and increases in the renewables surcharge are the primary reason that the average German household spent twice as much on electricity in 2016 than they did in 2007.[139]

The German government has consistently portrayed the Energiewende as part environmental and part industrial policy. As an industrial policy—a deliberate government intervention to direct investment and economic growth to certain sectors of the economy—various German government ministries plus the Chancellor Angela Merkel have portrayed the Energiewende as helping German companies innovate to become global market leaders in supplying renewable technologies, thereby increasing employment in renewable energy industries.[140] Germany is an export-driven economy, but the German advantage globally is not in low labor or other input costs, and correspondingly low prices, but in making and exporting highly-engineered machines used to produce machines and goods abroad.[141] German policymakers never expected that their own aggressive pursuit of solar energy would make German companies world leaders in the solar PV module production process. Instead, they anticipated that by giving German firms a head start, those firms would become world leaders in the production and sale of the machines used in the solar PV panel-production process, such as the very high precision cutting tools used to slice ingots into wafers.[142]

Whatever success the Germans have enjoyed in achieving this goal is likely to be temporary. China has quickly become a major world supplier of solar PV cells, and it has the clear goal of becoming a leader in the production of the machines used to produce solar PV cells. As Huang et al., observed, China has a renewable energy pol-

137. *Id.*

138. Richard Martin, *Germany Runs Up Against the Limits of Renewables*, MIT TECH. REV. (May 24, 2016), https://www.technologyreview.com/s/601514/germany-runs-up-against-the-limits-of-renewables/ [https://perma.cc/69JG-UVDS].

139. Ball, *supra* note 136.

140. Wilfried Lütkenhorst & Anna Pegels, GERMANY'S GREEN INDUSTRIAL POLICY, STABLE POLICIES – TURBULENT MARKETS: THE COSTS AND BENEFITS OF PROMOTING SOLAR PV AND WIND ENERGY, INT'L INST. SUSTAINABLE DEV. 8 (2014).

141. John Ydstie, *Germany's Export Machine Draws Both Envy and Ire*, NPR (Jan. 5, 2018, 4:46 AM), https://www.npr.org/2018/01/05/575615220/germanys-export-machine-draws-both-envy-and-ire [https://perma.cc/UAF9-YWSL].

142. Lütkenhorst & Pegels, *supra* note 140, at 45, 47.

icy.[143] It includes many features familiar to American and European policymakers, such as laws requiring power-grid companies to provide grid-connection services and to dispatch the entire amount of electricity generated by renewable energy generators, and others which require generating companies to get specified shares of their power from renewables.[144]

But China also has a renewable energy industrial policy. This policy includes direct funding for research into large scale wind turbines, and other wind power machines and equipment, and, through thirty-eight national energy R&D centers, a number of PV R&D projects.[145] More specifically, "in response to the central government's call for supporting strategic emerging industries, China's state-owned banks have given a huge amount of capital support to domestic PV manufacturers."[146] Of the $41.8 billion USD invested in the global solar industry in 2010, $33.7 billion came from the Chinese government.[147] The China Development Bank ("CDB") was the prime source of this capital infusion. Even after the worldwide economic recession of 2007–2009, the production of solar cells and modules in China continued "to acquire support from both central and local government.[148] In 2009, the CDB . . . provided a line of credit of approximately $30 billion for Chinese solar cell and module manufacturers. . . ."[149] "When the Chinese PV sector "lost its legitimacy" due to the imposition of anti-dumping duties by the European Commission in 2012, the "Chinese central government strengthened its support for Chinese PV by drafting three nationwide, dedicated documents" that "covered almost all aspects of PV, including PV manufacturing, PV generation and PV technology."[150] And the new objectives became "quite specific and ambitious. For example, until [sic] leading polycrystalline silicon manufacturers were to reach a production volume of five tons, leading solar cell manufacturers were to reach a production volume of five GW, and three to four PV machinery manufacturers were to earn annual sales revenue of more than 1 billion CNY (about $0.2 billion USD)."[151]

143. Ping Huang et al., *How China Became a Leader in Solar PV: An Innovation System Analysis*, 64 RENEWABLE & SUSTAINABLE ENERGY REV. 777, 778 (2016).

144. *Id.*

145. Sufang Zhang et al., *Interactions Between Renewable Energy Policy and Renewable Energy Industrial Policy: A Critical Analysis of China's Policy Approach to Renewable Energies*, 62 ENERGY POL'Y 342, 345 (2013) [hereinafter Zhang et al., *China's Policy Approach to Renewable Energies*].

146. *Id.*

147. *Id.*

148. Huang et al., *supra* note 143, at 785.

149. *Id.* at 786.

150. Zhang et al., *China's Policy Approach to Renewable Energies*, *supra* note 145, at 347.

151. *Id.* at 786.

Government subsidies and natural cost advantages have made China the world leader in solar PV cell production. As Zhang et al. stated:

> China's share of the world market in terms of solar PV production has grown from about 1% in 2001 to more than 50% in 2010. In 2011, China manufactured 21 GW of solar cells, representing 60% of the global market. . . . Out of the top 15 solar PV module manufacturers in the world, 9 were Chinese companies which took a share of 30% . . . . Except for automatic printing machines and cutting equipment, the industry is basically able to manufacture special equipment for crystalline silicon solar cells domestically, and homegrown enterprises are now capable of producing silicon-based thin-film cells . . . .[152]

There appears to be some dispute as to whether China has acquired the technological capability necessary to make the machines that are used in the solar PV cell production process. "In 2009, the 48th Research Institute of China Electronic Technology Group Corporation built twenty c-Si solar cell production lines for Chinese solar PV cell manufacturers, which largely consisted of self-developed PV machinery . . . ."[153] According to Huang et al., by this time, "it also became clear that Chinese manufacturers of PV machinery were on the way to becoming serious competitors for foreign machinery manufacturers in the field of the c-Si solar cell machinery in which China specialized. . . . This increased competence resulted in a situation in which about 70% of new manufacturing machines used in Chinese PV c-Si solar cell manufacturing were now being made by Chinese manufacturers."[154] However, Zhang et al. opine to the contrary that "[f]or solar PV technology, although crystalline silicon solar cell technology has reached the international advanced level, the key production technology is lagging behind the international advanced level."[155]

Still, while some Chinese commentators may be dismayed that progress has not been faster, there seems little doubt that China will eventually become the world leader in the production not just of solar PV cells and panels, but in the production of the machines used to make these products. Such trends cast doubt on Germany's ability to use renewable energy policy as a catalyst for the acquisition of new export markets.

Still, what China has done so far in the solar industry has made them the world leader in solar PV production and devastated the U.S. solar PV industry. Over the past several years, some U.S. solar panel

152. Zhang et al., *China's Policy Approach to Renewable Energies*, *supra* note 145, at 347.

153. Huang et al., *supra* note 143, at 785.

154. *Id.*

155. M.M. Zhang et al., *Optimal Design of Subsidy to Stimulate Renewable Energy Investments: The Case of China*, 71 RENEWABLE & SUSTAINABLE ENERGY REV. 873, 875 (2017).

makers (including SunEdison) have gone bankrupt, while others, (such as First Solar) teeter still on the edge of bankruptcy.[156] With its own version of a FIT for solar power, by 2016, China not only made over 50% of the solar PV panels worldwide, but also accounted for more than 50% of global solar PV panel installations.[157]

B. *The Potentially Dismal Economics of the Global Race to Subsidize Renewable Energy Products and Services*

German and Chinese renewable energy industrial policies can be found in many other industrial countries, including of course the United States. Such industrial policies constitute an economic phenomenon which so far as I am aware, has been little studied: international competition in subsidizing industries whose products are intended to lessen or prevent a global public bad. Such industries tend to be capital intensive, with diminishing average and marginal cost. Moreover, because such an industry's output is valuable primarily because it lessens a public bad, the demand for the industries' output is determined politically. Under politically-driven demand, price does not have its traditional economic role, with a lower price increasing the amount demanded. Instead, lower prices may actually shift the demand curve back, contracting demand. Moreover, even if this effect does not occur, if there are strong economies of scale, then the vast majority of national subsidies may be pointless, as a single country—like China—may end up dominating the market.

To analyze this phenomenon, consider a particular worldwide industry for solar PV cells and modules. As for the economics of the solar PV industry, capital expenditure—the upfront cost to build a factory and fill it with production equipment—has a crucial influence on both long-run average total cost pricing and on manufacturing capacity growth rates. The existing literature shows that PV module production is highly capital intensive and that because of this capital intensity, sustained industry growth can only occur with very low operating profit margins.[158] Alternatively, only with technical or financial innovations massively reducing the annual capital expenditure (on property, plant, and equipment) can the industry sustain rapid growth and substantial operating profit margins.[159] With significant economies of scale, there is constant pressure on PV makers to increase

156. John Fialka, *Why China is Dominating the Solar Industry*, SCI. AM. (Dec. 19, 2016), https://www.scientificamerican.com/article/why-china-is-dominating-the-solar-industry/ [https://perma.cc/MLN7-WVF2].

157. *Renewables 2017*, INT'L ENERGY AGENCY (Oct. 4, 2017), https://www.iea.org/publications/renewables2017/ [https://perma.cc/99JH-NVHE].

158. Reichelstein & Anshuman, *supra* note 133, at 32–33.

159. Douglas M. Powell et al., *The Capital Intensity of Photovoltaics Manufacturing: Barrier to Scale and Opportunity for Innovation*, 8 ENERGY ENVTL. SCI. 3395, 3400 (2015).

capacity.[160] In the case of many private, for-profit companies, the competitive pressure for constant capacity increases can be met only by borrowing. Taking on such large amounts of debt, however, increases fixed cost even further, not only reducing the possibility to internally fund growth in the future, but exposing a company to unanticipated demand shortfalls. This seems to be precisely what accounts for the bankruptcy of Suntech, a company that was once the largest solar PV maker in the world.[161]

It is true that in the long run, due to technological progress and learning, capacity becomes more productive and more effective in lowering short term operating costs. When they looked at cost data for ten large solar PV makers, Reichelstein and Sahoo did find evidence that such learning effects should cause a steady decrease in the prices of solar PV modules.[162] However, they also found that the big drop in average sales prices for solar PV modules over the period 2011–2013 was due to excessive additions to manufacturing capacity. Moreover, Reichelstein and Sahoo estimated that in the long run, even though there would be a 27% reduction in production costs with every doubling of industry output, estimated average market prices would be below the economically sustainable price (wages plus fixed plus tax costs) for all industry production levels above 40 GW.[163]

Figure 6 below captures these stylized facts about the supply or production side of the solar PV cell industry. The Figure depicts a situation where the firm has such high fixed capacity costs that long run average cost continuously declines.

160. Alan C. Goodrich et al., *Assessing the Drivers of Regional Trends in Solar Photovoltaic Manufacturing*, 6 ENERGY & ENVTL. SCI. 2811, 2811 (2013).

161. Powell et al., *supra* note 159, at 3401.

162. Reichelstein & Sahoo, *supra* note 133, at 6.

163. *Id.* at 30–31 (noting that even at an industry output of 60 GW, the U.S. Energy Department's market price goal of $0.05/W for PV modules would fall far short of the roughly $2/W price that the industry would need to cover long run marginal cost at that level of output).

FIGURE 6

Natural Monopoly (and Alternatives) in a High Fixed Cost Industry

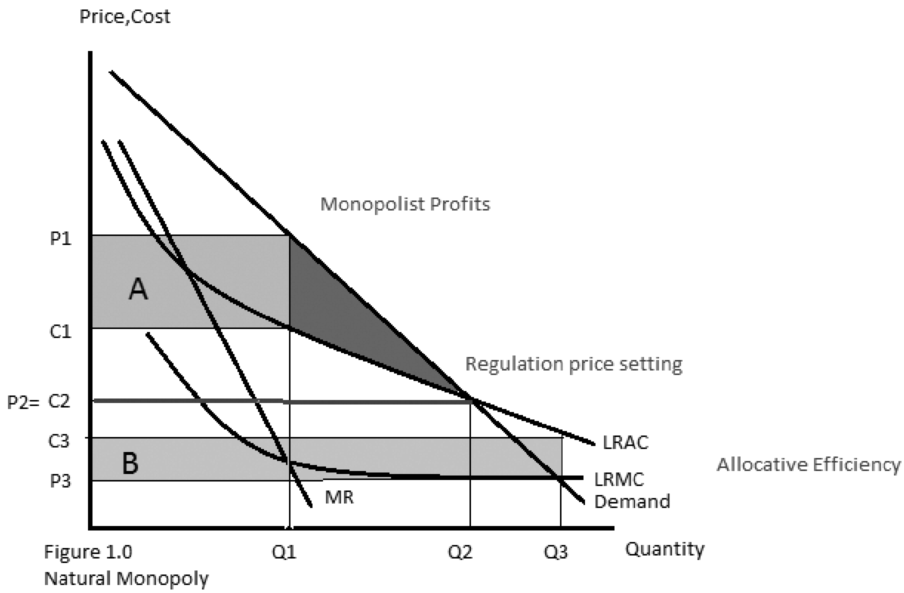

Figure 6 is labeled "natural monopoly," but this is only because given the demand curve drawn, the point where demand equals long run marginal cost—the socially optimal production level implied by free-entry competition—implies a price at which the firm would lose money.[164] This is because the high fixed cost and low marginal cost nature of production means that given the demand, average cost is above marginal cost at the socially optimal level of production. Under these conditions, competition, which forces price equal to marginal cost, is not viable. Firms would either have to be subsidized, or else monopoly would replace competition. The unregulated monopolist would price discriminate, attempting to charge the full willingness to pay that the demand curve depicts. Were the monopolist regulated to prevent price discrimination, the regulator would typically allow the monopolist to charge a price equal to average cost (as depicted in Figure 6).

164. Richard A. Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 548, 548 (1969) ("If the entire demand within a relevant market can be satisfied at lowest cost by one firm rather than by two or more, [in this case] the market is a natural monopoly, whatever the actual number of firms in it. If such a market contains more than one firm, either the firms will quickly shake down to one through mergers or failures, or production will continue to consume more resources than necessary. In the first case competition is short-lived and in the second it produces inefficient results.").

Whether natural monopoly conditions pertain depends upon demand. If the demand curve is steadily shifted outward in Figure 6, it would eventually reach a situation where the competitive outcome of price equals marginal cost occurs where marginal cost is above average cost (and both are increasing). For sufficiently robust demand, competition is viable even in an industry with very high capacity costs. In other words, even with very high capacity-driven fixed costs, a monopoly is only "natural" if demand is insufficiently great.

Figure 6 helps to explain the curious logic of national subsidies for high capacity cost industries that compete in providing goods to lessen global bads. The more nations mandate or subsidize the adoption of renewable electricity, electric cars, and the like, the greater the global demand for such goods. Even though many such industries have high capacity costs and strong economies of scale, global demand means that competition may well be viable. In such an instance, national subsidies for the industries that produce renewable energy products may not be needed, at least in the long run. This is to say that global renewable energy environmental policy may do away with the need for global renewable energy industrial policy.

Under such economic conditions—where the production of renewable energy goods has strong economies of scale—there would likely be only a few countries with renewable energy goods production, but many countries with costly renewable energy mandates and subsidies. That is, for the majority of countries, renewable energy environmental policy would have failed to deliver the jobs and local profits promised as part of renewable energy industrial policy. Most countries would get none of the economic benefits of generating demand for the public good by mandating or subsidizing consumption of renewable energy products. Instead, they would bear only the cost of creating national demand.

Yet the development of worldwide competition in the provision of renewable energy goods is by no means a certainty. Taking solar PV cells as an example, according to Reichelstein and Sahoo, the economically sustainable price—one that covers fixed and variable cost plus taxes—remains below the average sales price in equilibrium until almost 200 GW of output.[165] As 120 GW is a very optimistic forecast of global demand for solar PV in the year 2022, the feasibility of competition in the solar PV market seems doubtful.[166] For global renewable energy markets for which competition is infeasible, virtually all countries would be in the position of subsidizing demand for monopolisti-

165. Reichelstein & Sahoo, *supra* note 133, at 30.

166. *See Forecast of Demand for Solar Photovoltaic Power Globally from 2007 to 2022 (in Gigawatts)*, STATISTA, https://www.statista.com/statistics/500250/solar-photovoltaic-demand-outlook-worldwide/ (last visited Aug. 15, 2018) [https://perma.cc/3X57-BYPF] (forecasting optimistically because it is based on stated Chinese demand goals and figures which may be little relationship to actual Chinese demand).

cally or near monopolistically-produced goods manufactured abroad. As a matter of political economy, this seems unlikely to be sustainable as a political-economic equilibrium.

The bright side of economies of scale and learning in renewable energy product markets is that the price will fall over time. With a typical economic good, falling price means increasing demand. However, matters are more complicated with goods whose demand is primarily due to government mandates and subsidies. On the one hand, environmentalists argue that falling prices for renewable energy justify even more ambitious consumption mandates and subsidies. For example, observing that "solar panels have become much more efficient and less expensive" so that solar power is "now often the same price or cheaper than most other types of electricity," some have argued that California should be even more aggressive in its renewable electricity mandate.[167] On the other hand, once the cost of renewable energy falls so far that it becomes competitive with other types of energy, the need for further subsidies becomes unclear at best. The decrease in renewable electricity production costs has indeed been an important argument for the reduction and eventual elimination of Germany's subsidies.

Thus, to the extent that economies of scale are realized so that we have falling long run average cost for renewables, there are two potential effects on demand. On the one hand, falling prices due to falling costs make more aggressive demand policies less costly; on the other hand, falling costs means that there may be less need for public policies to create demand in the first place. In the first case, where falling prices actually shift the government-generated demand curves outward, competition may become feasible where it would not otherwise have been sustainable. In the second case, where falling costs cause governments to weaken subsidies and mandates, shifting demand curves inward, renewable energy markets may move back toward natural monopoly.

Were a national government to design policies for the future of its domestic renewable energy industry, it would thus need to account for: i) uncertainty of how government-generated demand curves will respond to the realization of economies in the production of renewable energy products, and ii) the very real possibility that it may be left entirely in the position of subsidizing consumption of renewable energy produced by products manufactured in other countries. In other industries with strong economies of scale and capacity-driven declining long run average cost, the economically rational response to the prospect of potential future competition is to install excess capacity to

167. Ivan Penn, *California Invested Heavily in Solar Power. Now There's So Much That Other States are Sometimes Paid to Take It*, L.A. TIMES (June 22, 2017), http://www.latimes.com/projects/la-fi-electricity-solar/ [https://perma.cc/4R7E-E3HB].

deter future entry.[168] It would seem only logical that facing the prospect of potential future complete loss of markets to foreign competitors whose success is in large part due to their own renewable energy demand mandates and subsidies, governments would have an even greater incentive to subsidize excess capacity in domestic renewable energy markets so as to forestall such a dismal future.

From the perspective of my earlier explanation of the persistence of legislative carrots, the existence of strong economies of scale plus subsidized international competition in the markets with domestic subsidization makes such persistence even more likely. When industries benefiting from domestic legislative carrots face potentially devastating international competition, they have a whole new set of arguments in favor of retaining the carrots. It may be argued that even if the success of international competitors is due solely to economics—economies of scale and learning, allowing a heavily subsidized domestic industry such as solar or ethanol to fall victim to international competition would mean that billions of taxpayer dollars have gone for naught. This argument is even stronger when international competitors have received their own domestic subsidies. When this is true, the logical response is to protect subsidized domestic industry from subsidized international competition.

Precisely such a story has played out in the solar PV market, where in late 2017, the U.S. International Trade Commission found that subsidized solar panel imports were causing serious injury to the U.S. solar PV industry and, on this basis, recommended the imposition of tariffs as high as 35%.[169] Such tariffs, of course, go well beyond merely maintaining carrots, for they indirectly tax domestic consumers of international products. The willingness to impose such costs is further evidence of the stubborn persistence of legislative carrots in the climate change arena.

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168. *See* Jeremy Bulow et al., *Holding Idle Capacity to Deter Entry*, 95 ECON. J. 178, 178 (1985); *see also* MICHAEL E. PORTER, COMPETITIVE ADVANTAGE: CREATING AND SUSTAINING SUPERIOR PERFORMANCE 10 (1985).

169. *See* Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75, USITC Pub. 4739 (Nov. 2017) (Final).