REINVENTING THE CORE U.S. TECHNOLOGY THROUGH THE 'PUSH' OF NEW REGULATION LEVERAGING MARKET 'PULL'

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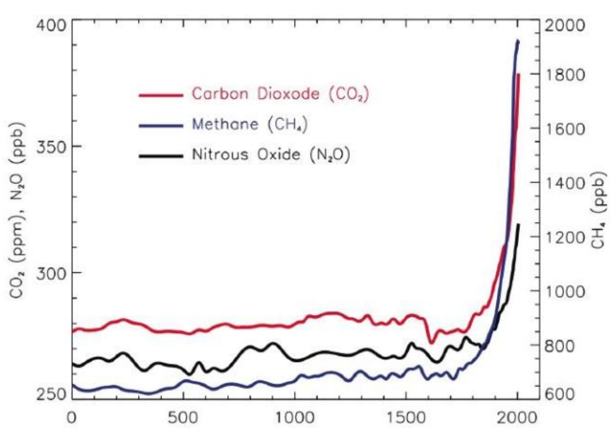
I. TECHNOLOGY, CHANGE, THE FUTURE

Recent headlines broadcast that the process of government is broken, that nothing can move through the Congress which is deadlocked, with government at an impasse.[1] Yet, for the second most important invention in history and the most important invention of the last one thousand years, [2] fundamental technological change is in motion through new unilateral executive action. This fundamental change alters how we derive electricity and whether the Planet is rescued from the mounting ravages of climate change.

Climate change is the most significant international issue confronting all nations in the twenty-first century. After 800 years of Greenhouse Gas (GHG) levels hovering between 175-250 parts per million (ppm) of concentration in the atmosphere, they have now increased to about 400 ppm and are climbing rapidly.[3] And the earth is warming and sea level is rising.[4]

Figure 1:
Concentrations of Greenhouse Gases



1. Thomas E. Mann, *Why Washington D.C. is Broken - and How it Can be Fixed*, SCHOLARS STRATEGY NETWORK (Oct. 2012), https://www.scholarsstrategynetwork.org/sites/default/files/ssn_key_findings_mann_on_hyperpartisanship_and_extremism.pdf.

2. James Fallows, *The Fifty Greatest Breakthroughs Since the Wheel*, ATLANTIC MONTHLY (Nov. 2013). Electricity finished behind only the movable type printing press. Electricity is essential to operate seven other "top fifty" inventions of all time: The Internet, computers, air-conditioning, radio, television, the telephone, and semiconductors. *Id.*

3. *See infra* Fig. 1. Pieter Tans & Ralph Keeling, *Trends in Atmospheric Carbon Dioxide*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://www.esrl.noaa.gov/gmd/ccgg/trends/ (last visited Jan. 24, 2016).

4. RISING TEMPERATURES, http://wwf.panda.org/about_our_earth/aboutcc/problems/rising_temperatures/. (last visited Jan. 24, 2016); SEA LEVEL RISE, http://wwf.panda.org/about_our_earth/aboutcc/problems/rising_temperatures/sea_levels/. (last visited Jan. 24, 2016).

GHG annual emissions increased about 70% between 1970 and 2004, with the combustion of fossil fuels accounting for 70% of GHG emissions, electric power generation responsible for 40% of CO_2 emissions, and coal-fired electric power generation accounting for about 70% of the emissions in this sector.[5] Global energy-related emissions are expected to increase 57% from 2005 to 2030.[6] At current rates of energy development, energy-related CO_2 emissions in 2050 would be 237% of their current levels under the existent pattern.[7] And it is estimated that life as we know it, and strife in the world, would change fundamentally with the resultant warming.[8]

This is the issue for the twenty-first century. The United Nations International Panel on Climate Change 2014 report concludes that in order to maintain world warming below an additional 2°C, there must be a 40-70% reduction of GHG emissions from 2010 levels by no later than 2050.[9] Electricity production accounts for less than 5% of U.S. economic activity, yet accounts for approximately one-quarter of emissions of certain criteria air pollutants.[10] Figure 2 illustrates that with carbon dioxide constituting 82% of all GHG emissions in the United States, the electric sector of the economy exceeds transportation, agriculture, industry and the commercial and residential sectors of the economy in its emission of GHGs. Of the four primary GHGs, the electric power sector emits CO_2 and methane, the two primary GHGs.

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5. Joëlle de Sépibus, *The Liberalisation of the Power Industry in the European Union and its Impact on Climate Change: A Legal Analysis of the Internal Market in Electricity*, SWISS NAT'L CTR. OF COMPETENCE IN RES., Working Paper No. 2008/10, 2008, 2-4 (2008), http://phase1.nccr-trade.org/images/stories/Brown%20Bags/de20Sepibus_EU20lib20CC--final.pdf.

6. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-151, INTERNATIONAL CLIMATE CHANGE PROGRAMS: LESSONS LEARNED FROM THE EUROPEAN UNION'S EMISSIONS TRADING SCHEME AND THE KYOTO PROTOCOL'S CLEAN DEVELOPMENT MECHANISM 48 (2008), http://www.gao.gov/assets/290/283397.pdf.

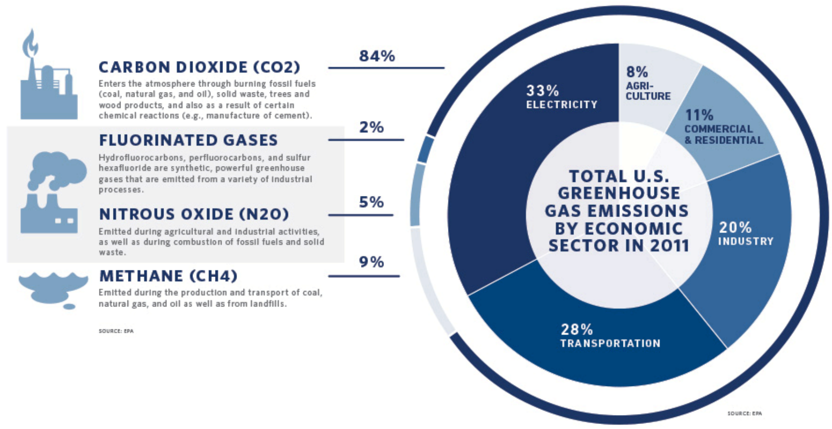
7. *See* William C. Ramsay, *Energy Technology Perspectives: Scenarios and Strategies to 2050*, INT'L ENERGY AGENCY (July 14, 2006), http://www.unece.lsu.edu/biofuels/documents/2007July/SRN_020.pdf (Press Conference at OECD Tokyo Center).

8. *See generally* Bill McKibben, *Global Warming's Terrifying New Math*, ROLLING STONE (July 19, 2012), http://www.rollingstone.com/politics/news/global-warmings-terrifying-new-math-20120719.

9. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014 SYNTHESIS REPORT 20 (Nov. 1, 2014).

10. According to the Environmental Protection Agency in 2014, power generation was responsible for seventy percent of the oxides of sulfur dioxide (SO_2), 13% of nitrogen oxide (NO) and 40% of the carbon dioxide (CO_2) emissions in the United States. U.S. ENVTL. PROT. AGENCY, AIR EMISSIONS (May 22, 2014), http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html.

Figure 2:
U.S. Greenhouse Gas Pollutions



The Congressional Research Service concluded that "in 2010, fossil fuels accounted for [78%] of U.S. primary energy production."[11] Ergo, climate change becomes primarily a power sector issue. Currently, the electric system relies primarily on coal-fired technology resources: 406 U.S. coal-fired power plants produce about 95% of the coal-fired power in the United States, accounting for approximately half of total U.S. electricity production in 2009, at an average cost of 3.2 cents/Kwh.[12] Approximately 10% of these older coal-fired power plants produce about 43% of the CO_2 emissions.[13]

To address CO_2 emissions at all, we must address the electric power sector, and in the U.S. and many countries in the world, this means first addressing coal. Coal use is the first largest target for federal CO_2 reduction strategies to meet a 30% reduction level.[14] Coal has been the dominant source of electric production in the U.S. and the world since the first harnessing of electricity 135 years ago.[15]

This article maps and examines the regulatory incentives and economic dynamics in a legally regulated world. In the federalist structure of U.S. governance, it is possible for one level of government, alone, to alter the fundamental way in which essential

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11. MOLLY F. SHERLOCK, CONG. RESEARCH SERV., R41953, ENERGY TAX INCENTIVES: MEASURING VALUE ACROSS DIFFERENT TYPES OF ENERGY RESOURCES, at Summary (2012), https://www.hsdl.org/?view&did=722543.

12. *What Cost Energy? What Market Prices Fail to Reveal*, 22 THE ELECTRICITY J. 3 (Dec. 2009).

13. *Id.*

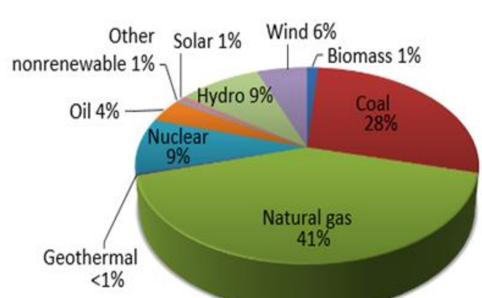
14. *See infra* Sect. III A.

15. *See* STEVEN FERREY, THE NEW RULES: A GUIDE TO ELECTRIC MARKET REGULATION 260 (Pennwell Pub., 1st ed. 2001). *See also supra* fig. 2.

infrastructure is implemented.[16] From the "push" provided by recent federal and state regulation, and the "pull" of economic market forces, U.S. GHG emissions in the industry sector have declined.[17] Some of this is due to the "pull" of the recent recession in demand for power and the market "pull" of decreasing prices of natural gas due to new hydro-fracking technologies,[18] for which gas serves as an alternative fossil fuel to coal for electric power generation. Natural gas power electric generating capacity and renewable energy power generating capacity are beginning to supplant coal generation just in the last five years, as shown in Figure 3.

This is significantly abetted by state, and to a lesser degree federal, regulatory incentive "pushes." This article analyzes all in context. Section II examines in detail the legality of the "push" of federal tax policy and the policy and legal challenges to the "push" of state renewable portfolio standards and net metering which are shifting core U.S. power technology from fossil fuels to renewable energy. Section III advances to the "pull" of market forces which are making less polluting fossil fuels than coal viable substitutes going forward and the major economic break-through of solar distributed generation competing with fossil fuels. We highlight the new challenge of solar power's intermittency fitting into a non-intermittent U.S. electric system. Both of these market "pulls" create alternatives to significantly mitigate the unsupportable trajectory of global warming emissions.

Figure 3:
Total U.S. Power Generation Capacity[19]



16. *See infra* Sect. II B.

17. *See* U.S. ENVTL. PROT. AGENCY, INDUSTRY SECTOR EMISSIONS, http://epa.gov/climatechange/ghgemissions/sources/industry.html (last visited Jan. 24, 2016).

18. U.S. ENERGY INFO. ADMIN., EMISSIONS OF GREENHOUSE GASES IN THE U.S. (Mar. 31, 2011), http://www.eia.gov/environment/emissions/ghg_report/ghg_carbon.cfm.

19. DENSITY OF POWER PLANTS BY OPERATING CAPACITY: CONTINENTAL UNITED STATES, http://www.snl.com/Images/Infographics/us_power_generation_big.jpg (last visited Jan. 24, 2016).

The "pushes" and "pulls" examined in Sections II and III utilize different legal mechanisms sanctioned by distinct regulatory law. Section IV analyzes, in context, these critical legal distinctions governing the "push" and "pull" of modern power sector incentives. The federal tax base underwrites federal renewable energy incentives, and is totally distinct from the state retail electric rate base of all consumers of electric power which underwrites state renewable portfolio standards and net metering incentives. The legal precedent surrounding the state rate base requires vertical and horizontal equity that are not required in federal tax policy. We examine how policy can violate precedent.

There are winners and losers depending on which legal incentives are used to implement the transition in power technology. Section V enters this legal maelstrom to navigate the distinct law and regulation of how we change fundamental technology for the second most important invention of all time and rescue the climate. Here, the law will determine the effective policy and the future of the Planet. There will be winners and losers. We start next with the "push."

II. THE "PUSH" OF FEDERAL AND STATE POLICY

A. Federal Tax "Push"

The federal government provides incentives for the energy sector through the tax system. The particular energy technologies subsidized through the federal tax incentives have changed over recent years. Figure 4 displays the cost of tax incentives for various fossil fuel and renewable technologies over an almost forty-year period ending in fiscal year 2015.[20] A recent shift to incentives for renewable power is evident. For producing most of U.S. power today, coal and other fossil fuels which together produce two-thirds of U.S. power, since the recent shift, now receive less than half of the subsidy amounts.[21] A recent shift to incentives for renewable power is visible, first occurring during the Bush Administration in 2008.

Examining the specifics, the primary federal energy incentives are delivered through tax credits and depreciation. There is nothing atypical about this: world governments subsidize gasoline, electricity and other energy in the amount of $1.9 trillion a year.[22]

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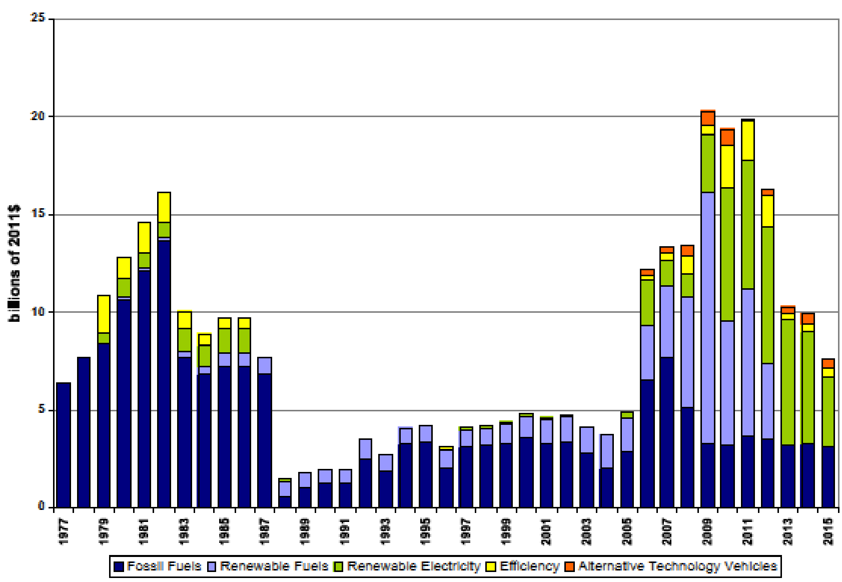
20. Sherlock, *supra* note 11, at fig. 2.

21. *Id.*

22. Press Release, Int'l Monetary Fund, IMF Calls for Global Reform of Energy Subsidies: Sees Major Gains for Economic Growth and the Environment, Press Release No. 13/93 (Mar. 27, 2013), http://www.imf.org/external/np/sec/pr/2013/pr1393.htm; *see also*

The predominate direction of U.S. federal tax incentives has shifted recently from underwriting coal to support of renewable power.

Figure 4:
Projected Annual Cost of
Energy-Related Tax Incentives[23]
(Fiscal year 1977 – Fiscal year 2015)



The value of federal tax support for the energy sector was estimated to be $19.1 billion in 2010 and $16.6 billion in 2012.[24] Of this, approximately one-third ($6.3 billion) was given for tax incentives for the use of renewable fuels.[25] "Another $6.7 billion can be attributed to tax-related incentives supporting various renewable energy technologies,"[26] and targeted tax incentives for the use of fossil energy resources amounted to $2.4 billion.[27] "In 2010, nearly half of the tax incentives for renewables benefitted biofuels,"[28] and "[f]rom 2009 onwards, the increased costs associated

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Howard Schneider, *IMF, citing $1.9 trillion in government subsidies, calls for end to energy 'mispricing'*, WASH. POST (Mar. 27, 2013), http://articles.washingtonpost.com/2013-03-27/business/38059145_1_climate-change-energy-subsidies-imf-officials.

23. *See* Sherlock, *supra* note 11, at fig. 2.

24. *Id.* at 6.

25. *Id.* at 6–7, table 2.

26. *Id.* at Summary.

27. *Id.* at 6-7, table 2.

28. *Id.* at 10 ("Of the estimated $19.1 billion in energy tax provisions in 2010, an estimated $6.3 billion, or [thirty-three percent], went toward supporting biofuels.").

with incentives for renewable electricity are largely attributable to the Section 1603 grants in lieu of tax credit program."[29]

As of August 2011, renewable developers had received $28.5 billion in grants and loan guarantees from the Obama Administration.[30] About a quarter of this amount flowed through the U.S. Treasury Section 1603 grant program.[31] The remainder is commitments through the Section 1705 loan guarantee program for thirty-two different projects.[32] As of May 2013, the 1603 program had approved 9000 grants for $18.5 billion, $17 billion of which were received for wind projects.[33]

Table 1 displays the estimated revenue cost of various federal energy tax incentives for recent years.[34] Renewable energy has dominated fossil fuels for the past five years.

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29. *Id.* "The Section 1603 grant option is not available for projects that began construction after December 31, 2011. However, since grants are paid out when construction is completed and eligible property is placed in service, outlays under the Section 1603 program are expected to continue through 2017." *Id.* "Outlays under the Section 1603 grant program are projected to be $4.1 billion for FY2012. Under current law, wind property must be placed in service prior to the end of calendar year 2012 to qualify for the Section 1603 grant. To qualify for the grant, eligible biomass, geothermal energy, landfill gas, trash, hydropower, and marine and hydrokinetic property must be placed in service by the end of 2013. By FY2015, outlays under the Section 1603 grant program are projected to fall to $1.2 billion. The placed-in-service deadline for solar, geothermal heat pump, fuel cell, microturbine, and combined heat and power (CHP) property is the end of 2016. For FY2017, projected outlays are $0.1 billion." *Id.* at 10 n. 32.

For additional background, *see generally* PHILLIP BROWN & MOLLY F. SHERLOCK, CONG. RESEARCH SERV., R41635, ARRA SECTION 1603 GRANTS IN LIEU OF TAX CREDITS FOR RENEWABLE ENERGY: OVERVIEW, ANALYSIS, AND POLICY OPTIONS (2011), http://arechives.republicans.energycommerce.house.gov/Media/file/PDFs/110911CRS1603report.pdf.

30. Jeffrey Ryser, *Cash, Loan Guarantee Programs for Renewable Development Now Total up to $28.5 Billion*, ELECTRIC UTIL. WK., Aug. 8, 2011, at 3.

31. *Id.*

32. *Id.*

33. TIGTA: *Some Renewable Energy Groups May Have Double-Dipped on Tax Credits*, ENERGY & CLIMATE REP. (BNA) (Feb. 27, 2014).

34. MOLLY F. SHERLOCK, CONG. RES. SERV. 7-5700, ENERGY TAX INCENTIVES: MEASURING VALUE ACROSS DIFFERENT TYPES OF ENERGY RESOURCES 6-7 tbl. 2 (Mar. 19, 2015) (displaying the Joint Committee on Taxation and the Department of the Treasury data).

Table 1:
Estimated Revenue Cost of Energy Tax Provisions: Fiscal Years 2010 through 2012 (Dollar value in billions)[35]

Provision:	2010	2011	2012
Fossil Fuels			
Expensing of Exploration and Development Costs for Oil & Gas	0.7	0.8	0.8
Percentage Depletion for Oil & Gas	0.5	0.9	0.9
Amortization of Geological & Geophys. Costs for Oil & Gas Exploration	0.1	0.1	0.1
Fifteen-year Depreciation for Natural Gas Distribution Lines	0.1	0.1	0.1
Election to Expense fifty percent of Qualified Refinery Costs	0.7	0.8	0.7
Amortization of Air Pollution Control Facilities	0.1	0.2	0.2
Credits for Investments in Clean Coal Facilities	0.2	0.2	0.2
Excise Tax Credits for Alternative Fuel Mixtures	N/A[36]	0.2	0.2
Subtotal: Fossil Fuels	*2.4*	*3.3*	*3.2*
Renewables			
Production Tax Credit (PTC)	1.4	1.4	1.6
Investment Tax Credit (ITC)	(i)[37]	0.5	0.5
Accelerated Depreciation for Renewable Energy Property	0.3	0.3	0.3

Table 2 summarizes and contrasts energy production and energy tax incentives.[38] The analysis presented in these tables highlights only energy subsidies provided through the tax code, and does not examine direct or indirect energy subsidies.[39]

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35. *Id.*
36. N/A "indicates that the provision was not listed in the 2010 tax expenditure tables." SHERLOCK, *supra* note 34, at 8.
37. "(i) indicates a positive estimated revenue loss of less than $50 million." *Id.*
38. *Id.* at 8-9 tbl. 3 (calculated using data presented in *supra* tbls. 1, 2).
39. *Id.* at 14. In contrast to U.S. Energy Information Agency (EIA) studies, this includes Section 1603 grants in the place of tax credits as a tax-related provision. The EIA lists the Section 1603 grants in place "of tax credits as a direct expenditure." *Id.*

Table 2:
Comparing Energy Production
and Energy Tax Incentives:
Fossil Fuels and Renewables, 2010[40]

	Production		**Tax Incentives**	
	Quadrillion Btu	**Dollar % of Total**	**Billions of Dollars**	**Dollar% of Total**
Fossil Fuels	58.5	78.0%	$2.4	12.6%
Renewables	8.1	10.7%	$13.0	68.1%
Renewables (excluding hydroelectric)	5.6	7.4%	$13.0	68.1%
Renewables (excluding biofuel & tax incentives)	6.2	8.3%	$6.7	35.1%
Renewables (excluding hydroelectric, biofuels & tax incentives)	3.7	4.9%	$6.7	35.1%

Table 3 presents tax subsidies to electricity production by fuel type.[41] Again, as of this date, fossil fuels receive a much smaller percentage allocation than their share of electric production. Although 44.9% of generation in 2010 can be attributed to coal, coal received an estimated 10% of tax incentives.[42] Again, renewable energy subsidies dominate fossil fuel subsidies for the recent years. Correspondingly, renewable sources receive a much larger share than their share of electric production.

40. *See id.* at 8-9 tbl. 3.
41. *Id.* at 15 tbl. 4. The data is taken from the EIA. *Id.*
42. *Id.* at 14. This is similar to the EIA's data for 2007, "where 47.6% of generation was attributable to coal, 12.7% of total federal financial support for electricity production was provided to coal." *See also id.* at 17 tbl. 6.

Table 3:
Subsidies to Electricity
Production by Fuel Type, 2010
(Dollar value in millions)

	Production		**Federal Financial Incentives**		
Fuel Type	**FY2010 Net Generation (billion kWh)**	**% of Total**	**Tax Subsidies**	**Other Subsidies**	**% of Total**
Coal	1,851	44.9%	486	703	10.0%
Nat. Gas & Petrol. Liquid	1,030	25.0%	583	72	5.5%
Nuclear	807	19.6%	908	1,591	21.0%
Renewables	425	10.3%	1,347	5,212	55.3%
Biomass	57	1.4%	54	61	1.0%
Geothermal	16	0.4%	1	199	1.7%
Hydropower	257	6.2%	17	198	1.8%
Solar	1	0.0%	99	869	8.2%
Wind	95	2.3%	1,178	3,808	42.0%
Transmission/ Distribution	(i)	(i)	58	924	8.2%
Total	**4,091**	**100%**	**3,382**	**8,502**	**100%**

In the past seven years, there have been substantial U.S. federal tax incentives for renewable energy development. The fossil fuel-related tax incentives are estimated by the Congressional Research Service to reduce federal tax revenues by $20.6 billion between 2013 and 2017; during the same period "the total cost of tax-related provisions supporting the production of renewable energy (tax expenditures and grants designed to replace tax expenditures) is estimated to be $39.6 billion."[43] The federal incentive impact is significant: "Since President Obama took office, the U.S. has increased solar electricity generation by more than ten-fold, and tripled electricity production from wind power…[we will be]

43. Molly F. Sherlock & Margot L. Crandall-Hollick, *Energy Tax Policy: Issues in the 112th Congress* 14-15 (Mar. 28, 2012). "Of this total for renewable energy, $17.2 billion is for outlays under the Section 1603 grants in lieu of tax credits program." *Id.* The cost of tax expenditure and excise tax incentives for renewables, not counting the Section 1603 grants, is estimated to be $22.4 billion from 2013 and 2017. *Id.* "Historically, the primary tax incentive for renewable electricity has been the production tax credit (PTC). The American Recovery and Reinvestment Act . . . substantially modified this incentive, allowing projects eligible for the renewable PTC or investment tax credit (ITC) to claim a one-time grant in lieu of the tax credits." *Id.*

doubling wind and solar electricity generation in the United States — once again — by 2025."[44]

Notwithstanding these tax credits and incentives, the United States has been criticized as ranking near the bottom of the thirty-four OECD countries (along with Canada, Mexico, and Chile) in terms of effective national energy tax rates to limit national carbon dioxide emissions.[45] The United States was criticized for not taxing energy use for heating, process use, and electricity, although some U.S. states do tax some of these uses.[46] However, the states have put forth significant effort to promote renewable energy and limit carbon emissions.

B. State Incentive Renewable Power "Push"

The states have undertaken the lion's share of renewable energy policy initiatives in the past two decades, sculpting sustainable energy initiatives, including, primarily, the use of:

- Net Metering: in 88% of states[47]
- Renewable portfolio standards: in 65% of states[48]

Each of these can be a powerful stimulant to sustainable renewable energy deployment in a market economy: each provides a financial inflow at either the point of project construction or generation of renewable electric power.

1. State Renewable Portfolio Standards

Renewable Portfolio Standards ("RPS") require electric utilities and other retail electric providers to include in their retail sales a specified percentage of electricity supply annually from renewable energy sources.[49] Such standards create and account for Renewable Energy Credits ("RECs") associated with production of each megawatt-hour of generation from an eligible renewable energy facility. RECs can be associated with utility-owned generation, or

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44. CUTTING CARBON POLLUTION IN AMERICA, http://www.whitehouse.gov/energy/climate-change (last visited Jan. 24, 2016).

45. OECD, TAXING ENERGY USE: A GRAPHICAL ANALYSIS 31 (2013), http://www.keepeek.com/oecd/media/taxation/taxing-energy-use_9789264183933-en#page1; Rick Mitchell, *U.S. Lags on Using Energy Taxes to Achieve Environmental Goals, OECD Data Shows*, 36 INT'L ENV'T REP. (BNA) 228 (2013).

46. Mitchell, *supra* note 45.

47. *See infra* Section II B 2.

48. *See infra* Section II B 1.

49. *See Renewable Portfolio Standards*, NAT'L RENEWABLE ENERGY LAB., http://www.nrel.gov/tech_deployment/state_local_governments/basics_portfolio_standards.html.

regulated utilities and retailers can acquire tradable RECs from independent power producers; the RECs exist as a separate commodity to be traded and transferred, if allowed by the state.[50]

a. Policy Variations on Portfolios

As a matter of global policy, fourteen nations mandate RPS programs, and additionally, several nations allow their states to implement RPS.[51] Twenty-nine U.S. states and the District of Columbia have some form of RPS.[52] These mandatory RPS programs cover about half of nationwide retail electricity sales.[53] The RPS programs in the states are very different in terms of what technologies qualify. The required state percentage of energy delivered from renewables currently ranges from 2%-40% of annual retail sales in different state programs, as shown in Figure 5. Some southern and rocky-mountain states which tend to have the most amount of coal-fired generation, are less likely to be among the twenty-nine U.S. states which have renewable portfolio standards.[54] The current RPS standards are projected to add 76,750 Mw of additional renewable generation by 2025.[55] In order to comply with the RPS requirements, electric utilities can purchase RECs from eligible renewable generation.

A number of variations for resource portfolios are possible, including a renewable resource portfolio requirement, a DSM portfolio requirement, and a fossil plant efficiency portfolio requirement.[56] All state RPS programs are distinct with no identical design to another program. The required percentage of renewable power is different in each state. The timelines are different, qualifications of renewable technology are different, waiver provisions are different, enforcement penalties are different,

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50. Ryan Wiser & Galen Barbose, *Renewables Portfolio Standard in the United States: A Status Report with Data Through 2007*, LAWRENCE BERKELEY NAT'L LAB. 1 (Apr. 2008), http://emp.lbl.gov/sites/all/files/REPORT%20lbnl-154e-revised.pdf.

51. *See* DATABASE OF ST. INCENTIVES FOR RENEWABLES & EFFICIENCY, SUMMARY TABLES, http://programs.dsireusa.org/system/program/tables (last visited Jan. 24, 2016).

52. *See* DATABASE OF ST. INCENTIVES FOR RENEWABLES & EFFICIENCY, DETAILED SUMMARY MAPS, http://www.dsireusa.org/resources/detailed-summary-maps/ (last visited Jan. 24, 2016).

53. *See* Wiser & Barbose, *supra* note 50.

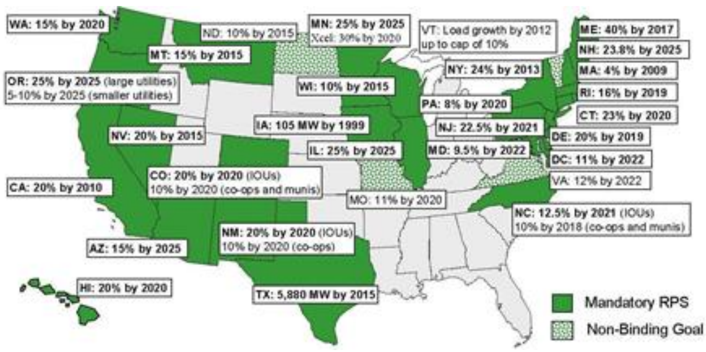
54. *See* NAT'L RENEWABLE ENERGY LAB., RPS POLICIES (2013), http://www.nrel.gov/tech_deployment/state_local_governments/images/map_solar_dgrps.jpg

55. Brad Plummer, *The Biggest Fight Over Renewable Energy is Now in the States*, WASH. POST, Mar. 25, 2013.

56. A renewable resource portfolio requirement would involve vertically integrated utilities or generating companies being required to develop renewable resources as a certain proportion of their generation capacity. DSM portfolio requirements would require vertically integrated distribution companies and electricity brokers to acquire DSM resources up to a certain fraction of their aggregate customer demand. The utility would have the option of implementing the DSM itself or purchasing efficiency savings from customers or ESCOs.

regulated entities are different, credit trading schemes are different, off-sets are different, and compliance mechanisms are different.

Figure 5:
RPS by State



Approximately 40% of U.S. electric load is covered by a state RPS program or by a renewable purchase obligation program. It is estimated that roughly half of new renewable energy power capacity in the U.S. over the last decade has occurred in states with RPS programs in place.[57] Over 90% of these capacity additions have come from wind power, with biomass and geothermal resources in second and third position.[58] The current RPS standards are projected to add 76,750 MW of additional renewable generation by 2025.[59]

Connecticut,[60] Maine,[61] Maryland,[62] New Hampshire,[63] New Jersey,[64] New York,[65] Pennsylvania[66] and the District of Columbia[67] have tiered RPS programs. Tiers provide the states with the flexibility to require different percentages of energy from various renewable energy sources within the tier. Figure 6 illustrates the installed new wind capacity by state for 2012. Of note, many of the

57. Ryan Wiser, et al., *The Experience with Renewable Portfolio Standards in the United States*, ELEC. J. (2007) (quoting an estimate by Black & Veatch that half of the capacity equals approximately 5,500 MW).

58. *Id.*

59. Brad Plummer, *supra* note 55.

60. CONN. DEPT. OF ENVTL. PROTECTION, 2013 COMPREHENSIVE ENERGY STRATEGY FOR CONN. (Feb 19, 2013), http://www.ct.gov/deep/lib/deep/energy/cep/2013_ces_executive_summary_final.pdf.

61. ME. REV. STAT. ANN. 35-A. 32, § 3210-C(2) (2006).

62. MD. CODE ANN., [Pub. Util. Cos.] § 7-701 (2004).

63. N.H. REV. STAT. ANN. § 362-F:1 (2007).

64. N.J. STAT. ANN. § 48:3-49 (1999).

65. N.Y. COMP. CODES R. & REGS. 03. E § 0188 (2004).

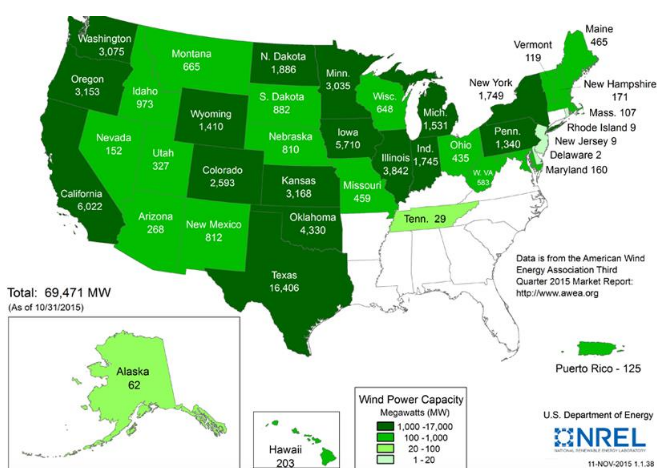
66. Pa. Const. Stat. § 75.62(e) (2005).

67. D.C. CODE § 34-1431 (2005).

states which had significant coal-fired generation (Texas, Pennsylvania, Illinois, Indiana) have now installed significant wind generation.

It is estimated that 45% of the 4,300 MW of wind power installed in the U.S. between 2001 and 2004 was motivated by state renewable portfolio standards, while an additional 15% of these installations were motivated by state renewable energy trust funds and subsidies.[68] In those states that have RPS programs, more than 90% of renewable energy additions (and more than 80% of average capacity supplied) are from wind power, with biomass a distant second and limited geothermal resource development. Wind installed is displayed in Figure 6. A study predicts that state renewable portfolio standards will stimulate the development of 52,000 MW of new renewable energy projects between 2005 and 2020,[69] approximately 80% of which is expected to come from wind power projects.[70] While wind generation is not a comparable base load source of energy as is coal, there is an ongoing substitution phenomenon.

Figure 6:
2012 Installed Wind Energy Capacity (in Mw)



68. Ryan Wiser & Mark Bollinger, *Balancing Cost and Risk: The Treatment of Renewable Energy in Western Utility Resource Plans* 1 (Aug. 10, 2005), https://emp.lbl.gov/sites/all/files/REPORT%20lbnl%20-%2058450_0.pdf.

69. *Renewable Energy: The Bottom Line*, GLOBAL ENERGY DECISIONS (Consulting Report 2005), http://www.academia.edu/8619158/Renewable_Energy_The_Bottom_Line_2005_. The report calculates that 40,000 of the new 52,000 MW will be new wind projects. It calculates that the capital investment will be $53 million in this capacity. The study indicates that additional transmission capacity will be necessary for this new wind development.

70. *Id.* This report looks at North American RPS impact on renewable energy.

b. Cost and Benefit

The typical national cost to the utility to purchase RECs is approximately a 40% increase in cost of the value of the wholesale power itself (not the total cost of retail bundled cost including taxes).[71] For a utility in Massachusetts, the REC purchase price is currently about 120% the wholesale cost of the power itself.[72] With solar RECs, in some states, the solar REC price is averaging 500% over the value of the power in terms of the cost to utilities for solar RECs.[73] The ACP penalty price to the utility of not complying can be more than 1000% the value of the power involved.[74] The price impact on retail ratepayers of RPS-mandated renewable energy programs has been estimated to range between a 0.1% increase in retail rates (in Maine, Maryland, New Jersey, and New York) to up to 1.1% retail rate impact in Massachusetts.[75]

Satisfying the California goal of having 33% of electricity supplied by renewable resources by 2020 is estimated by the California PUC to require the expenditure of approximately $115 billion.[76] According to PUC member John Bohn, there should be more honesty about these facts and costs.[77]

Both National Grid and Northeast Utilities, the parent company of NStar, the utility which owns Boston Edison Company, submitted testimony supporting the goals of the Massachusetts solar program but raising concerns about its costs. National Grid personnel submitted testimony saying the price supports for solar "are set at very high levels relative to the revenues necessary to incentivize solar installations."[78] National Grid estimated the cost of $3.95 per month per residential customer to pay for the Massachusetts RPS program, expected to rise by $1 per month by 2015.[79]

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71. Author's calculation assuming a trading price of $15-20 for a state REC.

72. Author's calculation, assuming $60/REC selling price, with wholesale power being transacted in ISO-NE at approximately an average price of $50/Mwh.

73. Author's calculations with Massachusetts solar RECs selling in the $220-500/SREC trading range.

74. Author's calculation, comparing an ACP of $550/SREC in Massachusetts with the $50/Mwh average price of power.

75. Ryan Wiser, et al., *The Experience with Renewable Portfolio Standards in the United States*, 20 ELEC. J. 8, 16 (May 2007). An impact of not more than approximately one percent is forecast to be the cost of this implementation.

76. Lisa Weinzimmer & Lynn Corum, *California Challenge Looks Bigger and Bigger Among Economic Woes*, ELEC. UTIL. WEEK (Jan. 18, 2010).

77. *Id.*

78. Bruce Mohl, *Green Energy Costs Raising Concerns*, COMMONWEALTH MAG. (Aug. 8, 2013), http://www.commonwealthmagazine.org/Voices/Back-Story/2013/Summer/004-Green-energy-costs-raising-concerns.aspx.

79. *Id.*

c. Is Coal a "Renewable" Resource as a Matter of Law?

Coal is not usually considered a renewable resource that would be eligible for an RPS program. However, states can define "renewable" resources as anything that they wish to cross-subsidize through their RPS systems. While not the norm, some states allow coal to qualify to create RECs within their RPS programs.[80]

Certain unconventional state RPS technology definitions and requirements are shown in Table 5. Pennsylvania is the only state that has a tiered system that requires a 10% share from the tier which includes coal power as renewable and an 8% share from the tier that does not include coal.[81] Ohio includes coal with carbon reduction and also has advanced nuclear listed in its acceptable technology listing, defined as "energy technology consisting of generation III technology as defined by the nuclear regulatory commission or other later technology."[82] Michigan includes coal-fired power with carbon capture-and-storage (CCS).[83]

Table 5:
States with Unconventional RPS
Renewable Energy Requirements as of 2014

State	Provision
Michigan	"(i) A gasification facility. (ii) An industrial cogeneration facility. (iii) A coal-fired electric generating facility if 85% or more of the carbon dioxide emissions are captured and permanently geologically sequestered. (iv) An electric generating facility or system that uses technologies not in commercial operation on the effective date of this act."
Ohio	"'Clean coal technology' means any technology that removes or has the design capability to remove criteria pollutants and carbon dioxide from an electric generating facility that uses coal as a fuel or feedstock as identified in the control plan requirements in paragraph (C) of rule 4901:1-41-03 of the Admin. Code."
Penn.	"Electricity generated from combustion of waste coal in facilities when the waste coal was disposed of or abandoned prior to July 31, 1982, or disposed of thereafter in a permitted coal refuse disposal site regardless of when disposed of. Facilities combusting waste coal shall use, a minimum, a combined fluidized

80. MICH. COMP. LAWS § 460.1003 (2008); OHIO ADMIN. CODE 4901:1-40 (2009); 75 PA. CONS. STAT. § 75.62 (2005).
81. PA. CONS. STAT. § 75.62(b) (2005).
82. OHIO ADMIN. CODE 4901:1-40 (2009).
83. MICH. COMP. LAWS § 460.1003 (2008).

	bed boiler and be outfitted with a limestone injection system and a fabric filter particulate removal system. Alternative energy credits shall be calculated based upon the proportion of waste coal utilized to produce electricity at the facility. Applicants may petition for waste coal from non-permitted sites to be qualified for alternative energy resource status. The Commission may grant such petitions at its discretion."

In 2009, the West Virginia legislature amended its RPS program to include the use of new clean coal technologies as eligible along with renewable energy projects. Massachusetts allows coal-derived fuels producing power to qualify for RPS. [84] The alternative resources would include gasification of coal with carbon capture and storage, combined heat and power, flywheel storage, and other alternatives.[85]

d. Legal Vulnerabilities

There was a successful suit alleging that Massachusetts renewable energy tradable energy credits under capped incentives violated the Constitution. [86] The program was successfully challenged on Constitutional grounds in 2010 by TransCanada Corporation, the owner of a Maine wind project. [87] The suit alleged that Massachusetts's limitation on eligible solar Renewable Energy Credits ("SRECs") as well as issuance of long-term power purchase contracts only to Massachusetts companies, discriminated against out-of-state renewable energy projects in violation of the dormant Commerce Clause of the U.S. Constitution. [88] Massachusetts immediately settled the litigation so as to avoid a court decision, providing that TransCanada would be eligible for these programs.[89]

"Statutes that discriminate by 'practical effect and design,' rather than explicitly on the face of the regulation, are similarly subjected to heightened scrutiny." [90] A state cannot regulate to

84. M.G.L. c. 25A Section 11F, 11F ½, 225 C.M.R. 14.00-16.00.

85. 225 C.M.R. 16.00.

86. Transcanada Power Mktg., Ltd. v. Bowles, No. 4:10-cv-40070-FDS (D. Mass. 2010). *See also* E. Ailworth, *State Looking to Settle Suit Over Law on Clean Energy*, BOSTON GLOBE (May 27, 2010), http://www.boston.com/business/articles/2010/05/27/lawsuit_hits_mass_law_promoting_local_energy_providers/.

87. *Id.*

88. *Id.*

89. MASS. DEP'T. OF ENERGY RES., PARTIAL SETTLEMENT AGREEMENT WITH TRANSCANADA, http://www.mass.gov/eea/docs/doer/renewables/solar/settlement-agreement.pdf.

90. Tri-M Grp., LLC v. Sharp, 638 F.3d 406, 427 (3d Cir. 2011) (citing Am. Truching Ass'n, Inc. v. Whitman, 437 F.3d 313, 319 (3d Cir. 2006) (quoting C & A Carbone, Inc. v. Town of Clarkstown, 511 U.S. 383, 394 (1994).

favor, or require use of, its own in-state energy resources,[91] nor can it, by regulation, harbor energy-related resources originating in the state.[92]

In-state fuels cannot be required to be used by a state even for the rationale to satisfy federal Clean Air Act requirements.[93] States cannot give income tax credits solely to in-state producers.[94] The courts have determined that electrons in interstate commerce cannot be traced.[95] The Supreme Court has found states to have impermissibly favored in-state economic interests over out-of-state economic interests by precluding out-of-state producers from shipping products directly to in-state consumers,[96] and providing property tax exemptions to in-state entities that primarily serve state residents but not to in-state entities which principally serve interstate clientele.[97]

A dormant Commerce Clause violation cannot "be avoided by 'simply invoking the convenient apologetics of the police power.'"[98] Minnesota enacted a statute to bar certain types of power use in the state or electric power that is created outside the state with this fuel and transmitted into the state.[99] Minnesota also banned the import of foreign coal or coal-produced power into Minnesota for power generation.[100] The law bans Minnesota utilities from importing power from new coal plants outside the state, and raises the cost of future purchases of coal power by assigning environmental costs to use of the fuel.[101] The act prohibits construction of new coal plants in the state and restricts utilities from creating any more long-term power-purchase agreements for coal-derived energy from other states.[102]

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91. Wyoming v. Oklahoma, 502 U.S. 437, 454-56 (1992); Alliance for Clean Coal v. Craig, 840 F. Supp. 554, 560 (N.D. Ill. 1993).

92. New England Power Co. v. New Hampshire, 455 U.S. 331, 339 (1982).

93. Alliance for Clean Coal v. Miller, 44 F.3d 591, 596-97 (7th Cir. 1995).

94. New Energy Co. of Indiana v. Limbach, 486 U.S. 269, 271, 278-80 (1988). *See also* Or. Waste Sys. v. Dep't of Envtl. Quality, 511 U.S. 93, 99-100 (1994) (a greater surcharge on disposal of in-state waste than on disposal of out-of-state waste facially discriminated against interstate commerce).

95. New York v. FERC, 535 U.S. 1, 7 n. 5 (2002); Fed. Power Comm'n v. Fla. Power & Light Co., 404 U.S. 453, 458 (1972).

96. Granholm v. Heald, 544 U.S. 460, 473-74 (2005).

97. Camps Newfound/Owatonna, Inc. v. Town of Harrison, 520 U.S. 564, 576-77 (1997).

98. S. Pac. Co. v. Ariz. ex rel. Sullivan, 325 U.S. 761, 779-80 (1945) (citing Kansas City So. Ry. v. Kaw Valley Drainage Dist., 233 U.S. 75, 79 (1914); Buck v. Kuykendall, 267 U.S. 307, 315 (1925).

99. North Dakota v. Heydinger, No. 11-CV-3232, 2014 WL 1612331, *1 (D. Minn. 2012).

100. Minnesota-based utilities operate power plants in west-central North Dakota's coal-producing region. The power stations are fueled by nearby lignite mines. The law made exceptions for Minnesota coal projects. 2007 Minn. Laws Ch. 136, art. 5, § 3; MINN. STAT. § 216H.03, subd. 3.

101. *Id.* Next Generation Energy Act, MINN. STAT § 216H.03 (2007).

102. *Id.* Exemptions were made for the proposed Excelsior Energy integrated gasification combined cycle (IGCC) plant in northern Minnesota, the Big Stone II coal plant

Since the power was in interstate commerce, North Dakota and others challenged Minnesota's Next Generation Energy Act on dormant Commerce Clause grounds.[103] Such a future ban has been upheld, if not based on geographic location.[104] The federal court in Minnesota addressed balkanization if states regulate energy in addition to the FERC-approved Midcontinent Independent System Operator ("MISO"), the area's regional transmission organization: "[s]uch a scenario is just the kind of competing and interlocking local economic regulation that the Commerce Clause was meant to preclude."[105]

The Minnesota federal court announced that "any attempt directly to assert extraterritorial jurisdiction over persons or property would offend sister States and exceed the inherent limits of the State's power."[106] It held that Minnesota had acted clearly to affect commerce occurring outside the state, and this was a per se violation of the Commerce Clause.[107] The court declined to even need or be required to reach the issue of whether there was undue discrimination in the substance of the Minnesota statute.[108]

The Minnesota court treated electricity distinctly from other energy sources, which it is both in terms of its physics and its status in American law.[109] Wyoming overturned an Oklahoma statute involving only a 10% allocation of the market to in-state producers, and as a result of the statute, the market changed from use of almost all out-of-state coal to "the utilities purchased [in-state] Oklahoma coal in amounts ranging from 3.4% to 7.4% of their annual needs, with a necessarily corresponding reduction in purchases of Wyoming coal."[110]

North Dakota and representatives of its coal industry also sued Minnesota on Article VI grounds alleging it imposes Constitutional violations when it affects the wholesale price and transmission of

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in South Dakota, and the Maple Grove-based Great River Energy's Spiritwood Station plant in North Dakota. MINN. STAT. § 216B.1694, (2008); 2009 Minn. PUC LEXIS 6; 2010 Minn. PUC LEXIS 458.

103. Next Generation Energy Act, MINN. STAT., § 216H.03 (2007).

104. Norfolk Southern Corp. v. Oberly, 822 F.2d 388 (3d Cir. 1987).

105. North Dakota v. Heydinger, 15 F. Supp. 3d 891, 918 (D. Minn. 2014) (internal citations omitted).

106. *Id.* at 911 (citing Edgar v. MITE Corp., 457 U.S. 624, 642 (1982)).

107. *Id.* at 918-19.

108. *Id.* at 911-12.

109. Steven Ferrey, *Inverting Choice of Law in the Wired Universe: Thermodynamics, Mass and Energy*, 45 WM. & MARY L. REV. 1839 (2004); FERREY, LAW OF INDEPENDENT POWER 2-8, 2-9 (34th ed., 2014); Ferrey, ENVIRONMENTAL LAW, *supra*, at 568.

110. Wyoming v. Oklahoma, 502 U.S. 437, 455 (1992). *See also* Alliance for Clean Coal v. Miller, 44 F.3d 591, 596 (7th Cir. 1995) (Even though the Act did not compel use of Illinois coal or forbid use of out-of-state coal, by the statute encouraging use of Illinois coal, it "discriminate[d] against western coal by making it a less viable compliance option for Illinois generating plants.")

power within exclusive federal authority regarding wholesale electricity pricing.[111] Just as the federal court ruled that it didn't need to reach the second step or claim under the Commerce Clause challenge regarding undue discrimination, it also didn't need to reach the separate additional Constitutional issue under the Supremacy Clause.[112] Having found the state statute unconstitutional because of its "attempt directly to asset extraterritorial jurisdiction over persons or property . . . exceed[ing] the inherent limits of State's power,"[113] the court did not need to proceed to any of the additional constitutional challenges.

Most recently, and at the highest federal court level yet, Justice Richard Posner, for the Seventh Circuit Court of Appeals in a unanimous decision,[114] citing as authority on RPS programs, a 2012 law review article authored by Professor Ferrey,[115] in *dicta,* declared unconstitutional a state limiting state renewable portfolio standards to in-state generation, as a violation of the Commerce Clause: "[it] trips over an insurmountable constitutional objection. Michigan cannot, without violating the commerce clause of Article I of the Constitution, discriminate against out-of-state renewable energy."[116] Justice Scalia, concurring in the majority prior opinion in *West Lynn Creamery,* submitted that, "a state subsidy would clearly be invalid under any formulation of the Court's guiding principle" for "dormant" Commerce Clause cases.[117]

2. State Incentive "Push" of New Metering

a. Program Regulatory Variations

The Energy Policy Act of 2005 ("EPACT") encouraged the widespread adoption of net metering policies at the state level.[118] Under EPACT, state regulatory commissions and electric utilities are

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111. Heydinger, 15 F. Supp. 3d at 916. Plaintiffs include North Dakota, Basin Electric Power Cooperative, North American Coal Corp., Great Northern Properties LP, Missouri River Energy Services, Lignite Energy Council, and Minnkota Power Cooperative Inc. *Id.* at 899.

112. *Id.*

113. *Id.* at 119 (citing Edgar v. MITE Corp., 457 U.S. 624, 643 (1982)).

114. Ill. Commerce Comm'n v. FERC, 721 F.3d 764 (7th Cir. 2013).

115. *Id.* at 776 (citing Steven Ferrey, *Threading the Constitutional Needle with Care: The Commerce Clause Threat to the New Infrastructure of Renewable Power*, 7 TEXAS J. OIL, GAS & ENERGY L. 59, 69, 106–07 (2012)).

116. *Id.* at 776.

117. West Lynn Creamery, Inc. v. Healy, 512 U.S. 186, 208 (1994) (Scalia, J., concurring).

118. 16 U.S.C. § 2621(d)(11) (2012); SOLAR ELEC. POWER ASS'N, RATEMAKING, SOLAR VALUE AND SOLAR NET ENERGY METERING – A PRIMER 1, https://www.solarelectricpower.org/media/51299/sepa-nem-report-0713-print.pdf (last visited Jan. 24, 2016) ("SEPA PRIMER").

required to make net metering services available upon request.[119] Forty-four states and the District of Columbia have some form of net metering policy, while seven states (Alabama, Idaho, Mississippi, South Dakota, Tennessee and Texas) do not have net metering.[120] As of 2003, there were approximately 7000 net metering customers in the United States,[121] and in 2010, there were 150,000.[122] Each of the forty-three state net metering programs is distinct. There are differences as to allowable sizes of units, vintage and longevity of credits, ability to cash out credits, eligible classes of customers, and eligible technologies.[123]

Under net metering, when the customer purchases and uses electricity from the distribution company, the meter runs forward; when more electricity is produced from the facility than is consumed by the customer, the excess is sent to the electricity grid, running the meter in reverse direction and reversing the net accounting of power flow.[124] By turning the meter backwards, and because only a single rate applies to a single meter, net metering effectively compensates the generator at the full retail rate (which includes that approximately two-thirds of the retail bill is attributable to transmission, distribution, and taxes) for transferring just the wholesale energy commodity—the power itself.[125] In essence, it receives for that power an amount that could be above the utility's avoided cost and the wholesale cost of power, and reflects distribution investments made by the utility, not the independent renewable generator.

b. Costs and Benefits

Associated Industries of Massachusetts ("AIM") voiced concern about the Massachusetts plan to further green technologies, which it claimed could cost $10 billion for wind and solar power subsidies over a single decade.[126] AIM estimated that the cost could be

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119. 16 U.S.C. § 2621(d)(11) (2012).

120. SEPA PRIMER, *supra* note 118, at 1.

121. Energy Information Administration (EIA), *infra* note 267.

122. *Id.*

123. *See* SUMMARY TABLES, *supra* note 53.

124. *See* DATABASE ST. INCENTIVES FOR RENEWABLES & EFFICIENCY, GLOSSARY http://www.dsireusa.org/glossary/ ("When a customer's generation exceeds the customer's use, electricity from the customer flows back to the grid, offsetting electricity consumed by the customer at a different time during the same billing cycle.").

125. *See id.* ("In effect, the customer uses excess generation to offset electricity that the customer otherwise would have to purchase at the utility's full retail rate."). As to whether electricity is a "good" or a "service" and how it should be treated under the law, see STEVEN FERREY, THE NEW RULES: A GUIDE TO ELECTRIC MARKET REGULATION 211–31 (2000).

126. Letter from Robert A. Rio, Vice President, Assoc. Indus. of Mass., to Susan Leavitt, Dept. of Energy Res., http://www.mass.gov/eea/docs/doer/renewables/solar/aim-robert-rio.pdf

$800 million annually, an increase of almost 30% in distribution charges.[127] In addition, $10 billion of subsidies could be distributed to the sector according to AIM.[128] Massachusetts had the third highest electric costs in the country prior to any of these subsidies.

Utility National Grid was already seeking distribution rate increases of 18% in 2009.[129] National Grid estimated that net metering cost will more than double between summer 2013 and the end of the year ($0.09/month to $0.23/month), and then more than triple again by the end of 2014 ($0.93/month).[130] This currently represents 5.4% of the typical residential customer bill, before all the projected increases.[131] National Grid estimated publicly that the separate net metering cost more than doubled between summer 2013 and the end of 2013, and will more than triple from the 2014 amount again by the end of 2015. $4.04 monthly is the cost of the two green energy mandates, which represents 5.4% of the typical Grid customer's monthly bill of $74.38/month, not including the state energy efficiency mandates which cost the typical customer another $4.70 a month.[132]

Figure 7 illustrates the cost of power in different states. The states with the most expensive retail electric power in the country are those with net metering and RPS programs. While this is not necessarily the key causal link, any of these state incentive programs increase the costs which are passed on in their entirety to retail customers.

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127. Steven Ferrey, *Sale of Electricity*, *in* THE LAW OF CLEAN ENERGY: EFFICIENCY AND RENEWABLES (M. Gerrard ed. 2011).

128. *Id.*

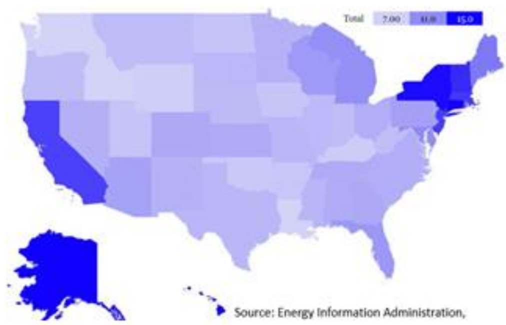
129. *Id.*

130. *Id.*

131. *Id.*

132. *Id.*

Figure 7:
Avg. Electricity Price, 2012
(in cents/kwh)



Federal courts in 2013, including the Supreme Court,[133] the federal circuit courts of appeals,[134] federal trial courts,[135] plus FERC,[136] confronted seven specific federal cases alleging that state regulation of energy violated the Supremacy Clause and/or the Commerce Clause of the Constitution. At both the trial and appellate court levels, the states have lost on a significant legal claim of petitioners. Net metering remains in forty-four states, and RPS in twenty-nine states.

The significant "push" of state incentives for renewable power remains a significant factor in the move toward renewable power and away from coal-fired power technology. The National Energy Reliability Council ("NERC") has been concerned that the renewable portfolio standards ("RPS") in twenty-nine states and four Canadian provinces, which cross-subsidize certain non-fossil sources of power production, could cause

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133. American Trucking Ass'n. v. City of Los Angeles, 133 S. Ct. 2096 (2013); City of Arlington v. FCC, 133 S. Ct. 1863 (2013).

134. Entergy Nuclear Vt. Yankee v. Shumlin, 733 F.3d 393 (2d Cir. 2013); Illinois Commerce Comm'n, *supra* note 114; Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070 (9th Cir. 2013).

135. Entergy Nuclear Vt. Yankee v. Shumlin, 838 F. Supp. 2d 183, 233 (D. Vt. 2012); Rocky Mountain Farmers Union v. Goldstene, 843 F. Supp. 2d 1071, 1099 (E.D. Cal. 2011); PPL EnergyPlus, LLC v. Nazarian, 2013 WL 5432346 (D. Md. 2013) *aff'd* 753 F.3d 467 (4th Cir. 2014) (field preemption and conflict preemption on wholesale power prices); PPL Energyplus, LLC v. Hanna, 2013 WL 5603896 (D.N.J. Oct. 11, 2013), *aff'd* PPL Energyplus, LLC v. Solomon, 766 F.3d 241 (3d Cir. 2014) (field preemption on wholesale power prices and rates).

136. FERC Order on Petitions for Declaratory Order, In re: California Public Utilities Commission, Southern California Edison Company, Pacific Gas and Electric Company, San Diego Gas & Electric Company, 132 FERC P 61047 (F.E.R.C.), 61337–38 (2010).

early substitution of traditional coal-fired power with renewable power, and simultaneously decrease grid reliability.[137]

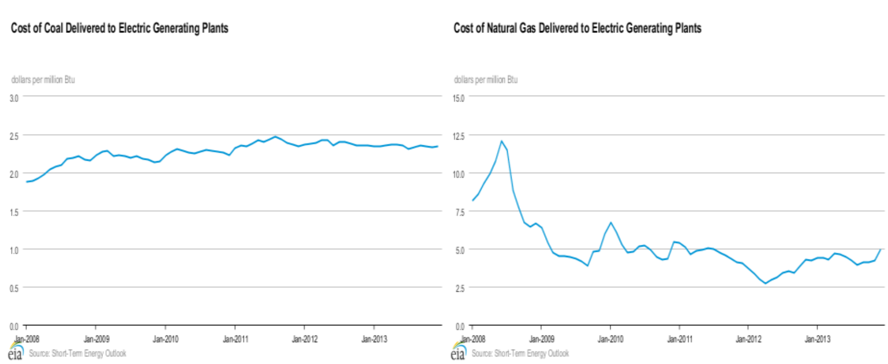
III. THE "PULL"' OF ECONOMIC COMPETITION FOR TECHNOLOGY

A. Natural Gas Changes Its Molecular Policy Weight

1. Taking the Plunge

The United States polity operates within a market economy. Basic economics exert a fundamental influence on how electricity is produced in the U.S. Figure 8 illustrates that in the last eight years, natural gas prices have fallen precipitously to one-third of their prior value.[138] They now are only a modest premium over coal prices compared on a comparison of energy value of the fuels, as shown in Figure 8.

Figure 8: U.S. Coal and Natural Gas Prices, 2008-2013[139]



As shown, natural gas is cost-competitive with the traditionally much cheaper cost of coal for power generation, and has the added benefit of gas producing only approximately one-half as much CO_2 as coal, no particulate matter criteria pollutants, no SO_2 criteria pollutant emissions, and the ability to emit less NOx.[140] New

137. PUBLIC UTILITIES FEAR THAT GHG CUTS MIGHT THREATEN ELECTRICITY SUPPLY, RELIABILITY (July 28, 2008), http://insideepaclimate.com/.

138. Gail Teverberg, *Why U.S. Natural Gas Prices are so Low-Are Changes Needed?,* OUR FINITE WORLD (Mar. 23, 2012), http://ourfiniteworld.com/2012/03/23/why-us-natural-gas-prices-are-so-low-are-changes-needed/.

139. *Id.*

140. AM. GAS ASS'N, ENVIRONMENTAL BENEFITS OF NATURAL GAS, http://www.aga.org/environmental-benefits-natural-gas (last visited Dec. 9, 2014).

combined-cycle gas turbines, a spin-off technology from the aviation industry, has transformed the economics of the industry, by providing a more efficient means to convert energy inputs to electric output.[141]

Gas-fired units burn a 'cleaner' fuel than coal, typically causing less maintenance expenses for units which burn gas compared to coal or oil. Counting associated fuel handling, operation and maintenance expenses, gas now is cheaper (per MMBTu) than coal.[142] Gas is cheaper for producing electricity than solar or wind power. Based on this economic "pull" of lower market prices, there is now a reason for utilities and independent power generators to dispatch and run less coal generation in favor of gas and/or renewable energy sources, thereby receiving some of the federal tax "push" and state renewable incentive RPS or net metering "push."

2. Additional Supply

The ability to access new reserves of natural gas in the United States has spurred hydraulic fracturing which could supply energy to the United States for nearly a century, contributing now to these historically low natural gas prices.[143] Hydraulic fracturing is the process in which a drill permeates the earth vertically to a predetermined depth, usually 5,000-8,000 feet.[144] The borehole is then turned horizontally allowing it to reach hundreds of feet of additional shale, previously inaccessible through conventional drilling methods.[145] Hydraulic fracturing is economically significant in that it allows for multiple wells to be constructed from a single platform or pad. Although this reduces surface impact due to decreased number of wells, horizontal wells typically cost $3-5 million to complete.[146]

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141. *See* STEVEN FERREY, LAW OF INDEPENDENT POWER § 2.9 (34th ed. 2014).

142. *See* Figure 8.

143. *Environmental and Social Implications of Hydraulic Fracturing and Gas Drilling in the United States: An Integrative Workshop for the Evaluation of the State of Science and Policy Workshop Report*, 22 DUKE ENVTL. L. & POL'Y F. 306 (2012).

144. The concept of hydrofracking has been attempted since the late 1940s. Brigid Landy & Michael B. Reese, *Getting to "Yes": A Proposal for a Statutory Approach to Compulsory Pooling in Pennsylvania*, 41 ENVTL. L. REP. 11044 (2011), http://www.elr.info/articles/vol41/41.11044.pdf. The use of propants such as sand or ceramic beads to hold the small cracks open was added. CALIFORNIA ENERGY COMM'N, SIGNIFICANT EVENTS IN THE HISTORY OF LNG, http://www.energy.ca.gov/lng/documents/significant_events_lng_history.pdf. The recovery rate is claimed by the natural gas industry to be around 80%. *Id.*

145. Joel Burcat, et al., *Dialogue: Nuts & Bolts of Marcellus Shale Drilling and Hydraulic Fracturing*, ENV'T & NATURAL RES. PRACTICE GRP. (2011), http://www.elr.info/articles/vol41/41.10587.pdf.

146. Montgomery Carl, *Hydraulic Fracking: History of an Enduring Technology* (Dec. 2010), http://www.spe.org/jpt/print/archives/2010/12/10Hydraulic.pdf.

The Marcellus Shale contains an estimated basin area of 95,000 square miles, and is the second largest reserve of natural gas in the world, only exceeded by a gas field which reaches Iran and Qatar.[147] The Marcellus Shale is significant in terms of its location and important because it is along the route of pipelines coming from Louisiana, Oklahoma, and Texas and is very close to Northeast consumer markets, which is the section of the nation which consumes much of the natural gas in the United States.[148] Gas-drilling operations in the Marcellus Shale use an average of 3,000,000 gallons of water in the process of drilling and fracturing a well.[149] In addition to the Marcellus shale in Pennsylvania, the Utica shale extends from Central New York into Eastern Ohio, the Bakken shale extends from Central Canada into North Dakota and Eastern Montana, the Barnett shale is in Texas, and the Mowry shale is in Wyoming.[150] These known shale deposits are displayed in Figure 9.

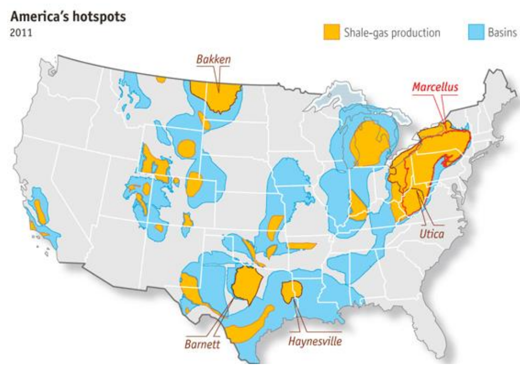
147. James R. Ladlee, *Why does Marcellus Shale Hold so much Natural Gas?*, http://www.clintoncountypa.com/resources/CCNGTF/pdfs/articles/12.23.10%20%20Why%20does%20Marcellus%20Shale%20Hold%20so%20much%20Natural%20Gas.pdf. (last visited Jan. 24, 2016).

148. *See* http://www.naturalgas.org/shale/gotshale.asp.

149. GROUND WATER PROT. COUNCIL, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: A PRIMER 64 (2009), http://energy.gov/sites/prod/files/2013/03/f0/ShaleGasPrimer_Online_4-2009.pdf; *see also* PA. STATE COOPERATIVE EXTENSION, WATER WITHDRAWALS FOR DEVELOPMENT OF MARCELLUS SHALE GAS IN PENNSYLVANIA 2 (2010), http://pubs.cas.psu.edu/freepubs/pdfs/ua460.pdf. When water is injected underground, it is mixed with additives such as friction reducers, biocides, and acids. While these chemicals typically compose less than 0.5% of the hydraulic fracturing fluid by volume, a well that consumes 3,000,000 gallons of water also uses approximately 15,000 gallons of additives, which are transported to well sites to be stored and mixed, and ultimately are part of the liquid waste. Daniel J. Soeder & William M. Kappel, *Water Resources and Natural Gas Production From the Marcellus Shale* 4 (2009), http://pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf. *See also*, Abby J. Kinchy & Simona L. Perry *Can Volunteers Pick Up the Slack? Efforts to Remedy Knowledge Gaps About the Atershed Impacts of Marcellus Shale Gas Development*, 22 DUKE ENVTL. L. & POL'Y F. 306 (2012).

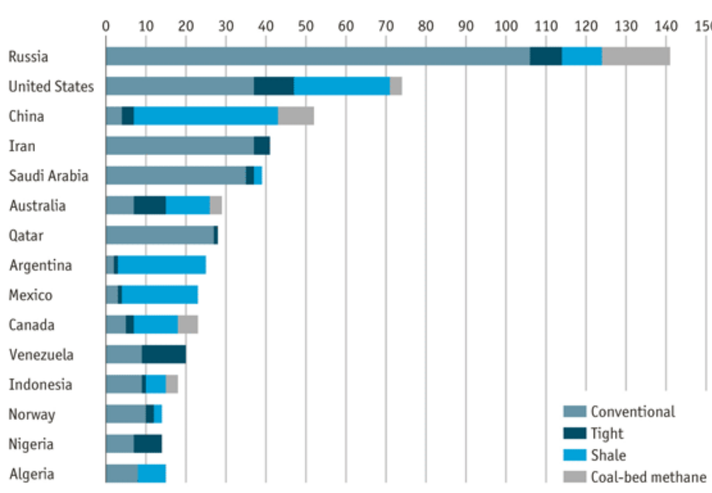
150. *Id.*

Figure 9:
U.S. Shale Gas Production



The recently exploited shale gas now already contributes one-third of America's gas supplies.[151] In terms of supply, the U.S. has now the second largest supply of gas in the world, as shown in Figure 10.[152]

Figure 10:
Recoverable Natural Gas Reserves[153]



151. *An Unconventional Bonanza*, THE ECONOMIST (July 14, 2012), http://www.economist.com/node/21558432.

152. *Which Countries are the Largest Consumers and Producers?*, INT'L ENERGY AGENCY, http://www.iea.org/aboutus/faqs/gas/ (last visited Dec. 9, 2014).

153. *Natural Gas Reserves*, THE ECONOMIST (June 5, 2012), http://www.economist.com/blogs/graphicdetail/2012/06/focus.

The reserves of shale gas in major world countries are displayed comparatively in Figure 11. This illustrates the potential self-sufficiency and export potential of select countries in the world. It is unclear whether natural gas will serve as a transition fuel for electricity production between historic coal-fired power and renewable power, or whether investing in infrastructure to accommodate increased natural gas development will lock nations into natural gas use for decades.[154] Natural gas currently is used for 24% of the United States total energy production,[155] and 29% of electric production.[156]

Figure 11:
Shale Gas Reserves
(trillion cubic feet)

In addition to the reduced dependence on foreign oil, substituted natural gas use has the potential to greatly reduce global warming.[157] The main byproduct when burning natural gas is carbon dioxide, a major greenhouse gas. Another natural gas byproduct, unburned methane, is molecule-for-molecule many times more potent than CO_2 in terms of global warming.[158] However, if a

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154. *Workshop Report, Environmental and Social Implications of Hydraulic Fracturing and Gas Drilling in the United States: An Integrative Workshop for the Evaluation of the Science and Policy*, 22 DUKE ENVTL. L. & POL'Y F. 306 (2012).

155. NATURAL GAS, http://www.ourenergypolicy.org/wp-content/uploads/2012/04/Natural_Gas_09-11-17_clean_0.pdf (last visited Dec. 9, 2014).

156. *Id.* at 2-3.

157. Brad Plumer, *Can Natural Gas Help Tackle Global Warming? A Primer*, WASH. POST (Aug. 20, 2012), http://www.washingtonpost.com/blogs/wonkblog/wp/2012/08/20/can-natural-gas-really-help-tackle-global-warming-heres-everything-you-need-to-know/.

158. *See* STEVEN FERREY, UNLOCKING THE GLOBAL WARMING TOOLBOX: KEY CHOICES FOR CARBON RESTRICTION AND SEQUESTRATION 15, tbl. 2-1 (2010).

small amount leaks into the atmosphere in the drilling process, gas can cause even more global warming effect than coal.[159]

3. International Dimensions

As recently as year 2000, shale was not being exploited.[160] This has changed dramatically. Shale gas now contributes one-third of America's natural gas supplies and its share is increasing.[161] Before the discovery of these U.S. shale deposits, the country was preparing to become a significant importer of natural gas in the form of liquefied natural gas ("LNG").

The U.S. has been importing LNG for four decades.[162] The first LNG import facility began operation in Boston's Distrigas facility in 1971. There are twelve existing LNG import facilities located in the lower-48 states, up from three existing thirty years ago.[163] The forty proposed new LNG import facilities in the U.S., have now been partially realized with the dozen existing LNG import facilities in the U.S. now applying for LNG export licenses from the Federal Energy Regulatory Commission.[164] America has gone from having fast-depleting gas supplies to now having 100 years or more of gas supplies at current consumption rates.[165]

Only one-third of all gas is traded across borders, compared with two-thirds of oil.[166] Gas has no uniform global price, as does oil. In America, as well as in Britain and Australia, it is traded freely and prices are set through competition.[167] In continental Europe, most gas is delivered through pipelines and sold on long-term contracts linked to the price of oil, for which it used to be seen as a substitute. Asia relies heavily on imports of LNG[168] from Indonesia and

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159. Bill McKibben, *Why Not Frack*, N.Y. REV. OF BOOKS (Apr. 26, 2012).

160. *Gas Works: Shale Gas is giving a big boost to America's Economy*, THE ECONOMIST (July 14, 2012), http://www.economist.com/node/21558459.

161. *Id.*

162. Unconventional Bonanza, *supra* note 151.

163. Gas Works, *supra* note 160.

164. FED. ENERGY REGULATORY COMM'N, EXISTING FERC LNG IMPORT FACILITIES, http://www.ferc.gov/industries/gas/indus-act/lng/lng-existing.pdf.

165. Gas Works, *supra* note 160.

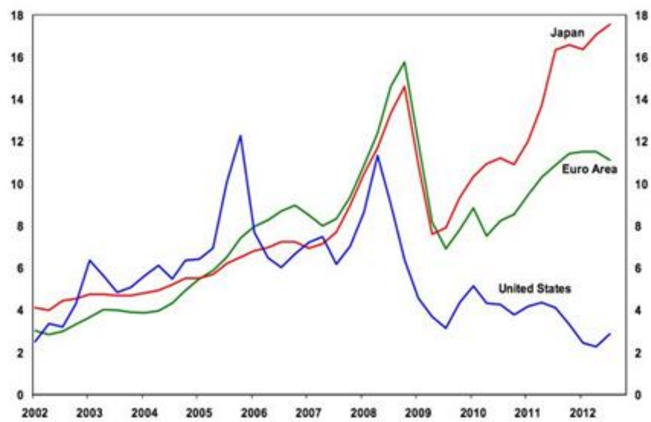
166. Unconventional Bonanza, *supra* note 151.

167. *Id.*

168. *Id.* "Stranded gas", too far from its markets to go down a pipe, can be turned into a liquid by cooling it to -162°C, shipped in specialist tankers and turned back into gas at its destination.

elsewhere, at higher prices competitive with oil prices.[169] The relative prices of imported natural gas in the United States, Europe, and Japan, are displayed in Figure 12.

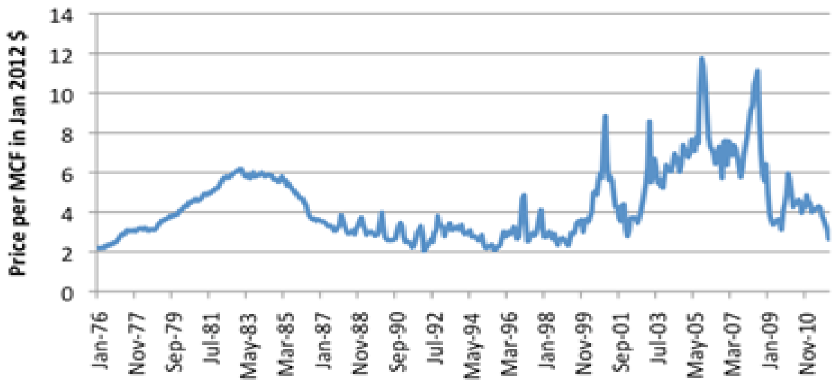
Figure 12:
Natural Gas Prices by Region
in US per Million Btus



Because of gas shale supply, the real price of natural gas (adjusted to reflect inflation and expressed in constant real dollars) in 2012 is about the same as it was in 1976, as shown in Figure 13.

169. Synapse Energy Economics, for the Civil Society Institute, *Water Constraints on Energy Production*, (Sept. 12, 2013), http://0-op.bna.com.library.law.suffolk.edu/env.nsf/id/rlen9bgpzl/$File/Water%20Constraints%20on%20Energy%20Production.pdf; *see also* Rachel Leven, *Renewable Energy Institute Urges Policy Makers to Encourage Water Research, Renewable Energy Use*, ENERGY & CLIMATE (BNA) (Sept. 12, 2013). "Stranded gas", too far from its markets to go down a pipe, can be turned into a liquid by cooling it to -162°C, shipped in specialist tankers and turned back into gas at its destination.

Figure 13:
U.S. Natural Gas Prices, Jan. 2012

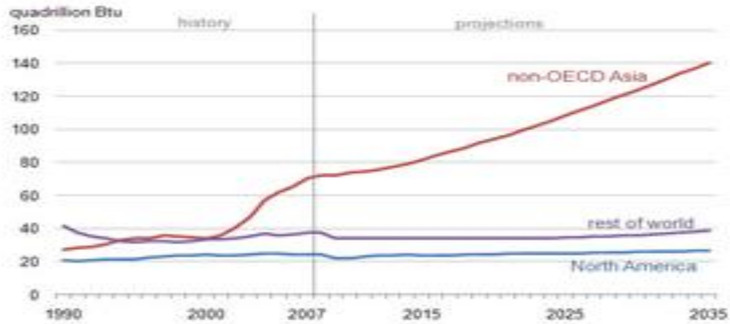


Compared to other parts of the world, because of the low price of natural gas in the U.S., the competitive, delivered price for LNG is also low, as illustrated in Figure 14.

Figure 14:
World LNG Estimated Sept. 2013 Landed Prices

While gas use is increasing in the U.S. power sector, coal use is increasing internationally, as shown in Figure 15. In many developing countries, coal use for power generation is still the current choice for expansion.

Figure 15:
Who is Using More Coal?



4. The Driver of Price and Environmental Impacts

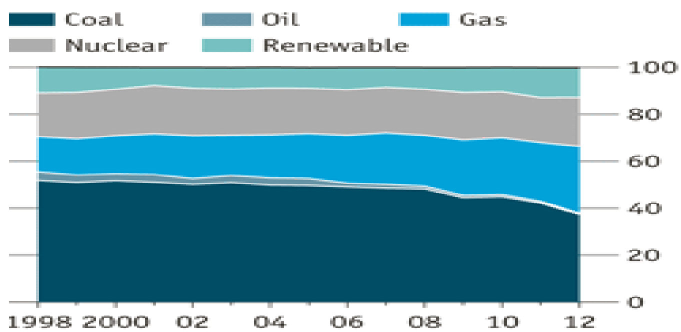
With the extra supply from shale deposits, gas prices are near their lowest levels in the past fifteen years.[170] U.S. natural gas prices over 35 recent years is shown in Figure 13. Current natural gas prices, expressed in constant dollars, are now about the same as where they were in 1976.[171] Gas and coal are changing their positions of fuel dominance. From 2006 to 2012, gas use increased 25%, moving from providing 20% of America's electricity to nearly 25%, with coal declining from more than half its traditional use a few years before to 36% in 2012.[172] U.S. power production, showing the decrease in use of coal, and commensurate increase in use of gas and renewable power, is shown in Figure 16. Coal's loss is offset by natural gas' gain.

170. Gas Works, *supra* note 160.

171. *Id.*

172. *Id.* In 2011 coal-generated power was down to 42%, its lowest level since at least 1949, when records began. *Id.*

Figure 16:
U.S. Electricity Generation Mix



The capacity for U.S. power generation is shown in Figure 3. Natural gas generation capacity has now exceeded coal generation capacity by almost 50%. Yet because of the marginal cost of operation, more coal-fired generation has traditionally been dispatched and operated. Now, the actual generation amount of both coal and gas-fired power are closer to being equal.[173]

There are ripple effects to other feed-stock uses of fossil fuels. The petrochemicals industry uses fossil fuels to make chemicals such as methanol and ammonia for fertilizer[174] and other raw materials less expensive for major sectors of the economy, including automobiles, agriculture, household goods, and construction.[175] This cumulative effect could add 0.5% a year to the United States' GDP over the next five years, according to UBS.[176]

Coal-fired generation has decreased from 50% of total U.S. generation a decade ago, to less than 40% today.[177] With today's low natural gas costs around $4/mcf there is 3.3 cents of fuel cost in a kilowatt hour of electricity plus operations and maintenance without any contribution to the gas facility's capital costs. None of the legal and regulatory impacts itemized above have yet reduced that amount of coal use and generation, but promise to do so in the future.

In the next five years, under increasing competition from shale gas and the Environmental Protection Agency's regulations on

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173. *See supra* text at notes 157 and 173.

174. *Gas Works*, *supra* note 160. Switching naphtha, derived from oil, to ethane, derived from gas, has price advantages.

175. *Id.* This could yield one million additional American factory jobs by 2025. *Id.*

176. *Id.* It could also save the average American household almost $1,000 a year. *Id.*

177. Stephen Lacey, *U.S. Coal Generation Drops 19 Percent In One Year, Leaving Coal with 36 Percent Share of Electricity*, CLIMATE PROGRESS (May 14, 2012), http://thinkprogress.org/climate/2012/05/14/483432/us-coal-generation-drops-19-percent-in-one-year-leaving-coal-with-36-percent-share-ofelectricity/.

power plants emissions, U.S. coal demand will fall to a 30-year low, while weak economic growth, a shift to renewable energies and improved energy efficiency will trim European demand, according to IEA Executive Director Maria van der Hoeven.[178]

Figure 8 compares the declining cost of natural gas in the U.S. with coal prices. Because of substitution of gas-fired power for coal-fired power, America's GHG emissions decreased 450 million tons annually, the biggest decline of any country.[179] Natural gas combustion produces significantly less emissions of CO_2 and less of the four of the six criteria air pollutants emitted from fossil-fuel fired power generation and regulated by federal law and EPA:[180]

- the amount of carbon dioxide produced by natural gas is about 25% less than oil and almost half as much as coal
- carbon monoxide (92 parts per billion compared to roughly 450 ppb for oil or coal)
- sulfur dioxide (1 ppb for gas versus versus 1,122 ppb for oil and 2,591 ppb for coal)
- almost no nitrogen oxide which burning other fossil fuels does release
- almost no particulate matter.

If the obstacles can be overcome, more gas and lower prices will mean a rise of 50% in global demand for gas between 2010 and 2035, according to the International Energy Agency ("IEA").[181] The IEA forecasts that abundant use of gas could raise atmospheric concentrations of CO_2 to 650 parts per million causing temperature to rise 3.5 degrees Celsius, which is more than many experts believe is safe.[182]

B. Renewable Power Becomes More Cost-Competitive

There has been a radical change in the cost of distributed renewable power generation. A big change is ushered in through the technological and cost declines of wind and solar photovoltaic ("PV")

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178. Rick Mitchel, *IEA Says Climate Pledges Won't Halt Global Growth in Coal Demand to 2019*, ENV'T REPORTER (BNA) (Dec. 15, 2014).

179. Alex Trembath, *Coal Killer: How Natural Gas Fuels the Clean Energy Revolution*, BREAKTHROUGH INST., 4 (2013), http://thebreakthrough.org/images/main_image/Breakthrough_Institute_Coal_Killer.pdf.

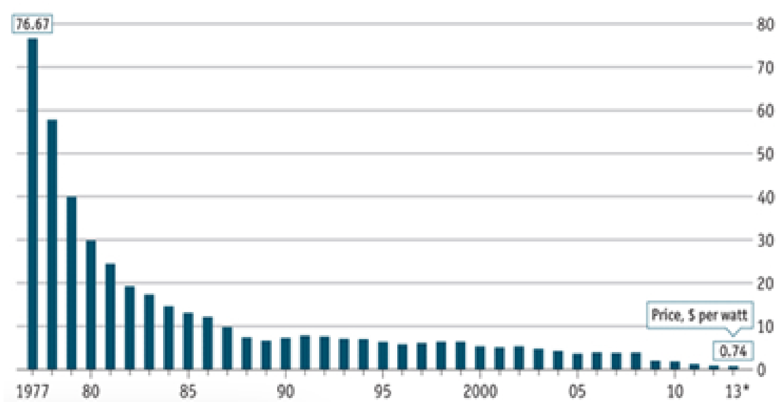
180. *See* STEVEN FERREY, ENVIRONMENTAL LAW: EXAMPLES & EXPLANATIONS 575 (6th ed. 2013).

181. Unconventional Bonanza, *supra* note 151.

182. Bill McKibben, *supra* note 159.

distributed generation. The cost to install photovoltaic solar panels has fallen dramatically by about 60% in 'hard' costs. PV module prices have experienced a decline from ~$1.90 watt in 2009 to $0.70/watt, and lower in some regions of the world.[183] Inverter prices, for the equipment necessary to convert photovoltaic direct current to alternating current so that it can be moved on the grid, have also declined by more than 60% in cost from $0.60-$1.00+/watt in 2005 to under $0.20/watt in 2013.[184] In the United States, non-hardware "soft" costs for residential systems now account for over 50% of total system.[185] The dramatically reduced price of solar PV cells is shown in Figure 17.

Figure 17:
Price of PV Cells



Since 2008, the price of the photovoltaic panels has fallen by 75%, and solar installations have multiplied by 1,000%.[186] In the United States, there were more than 300,000 "distributed" behind-the-meter solar PV installations installed in 2012, almost all in the forty-four net metering states.[187] One additional rooftop solar

183. Wilson Rickerson, *Residential Prosumers-Drivers and Policy Options*, IEA-RETD 9 (June, 2014) (relying on Jade Jones, *Regional PV Module Pricing Dynamics: What You Need to Know*, PV NEWS 32 (12), 1, 9–10 (2013)).

184. *Id.* (relying on Ian Clover, *IHS Cuts Global Inverter Market Forecast in Face of Dramatic Price Drops*, PV MAGAZINE (Oct. 16, 2013)). *See also* Navigant Consulting Inc., *A Review of PV Inverter Technology Cost and Performance Projections*, NREL/SR-620-38771, National Renewable Energy Laboratory (2006).

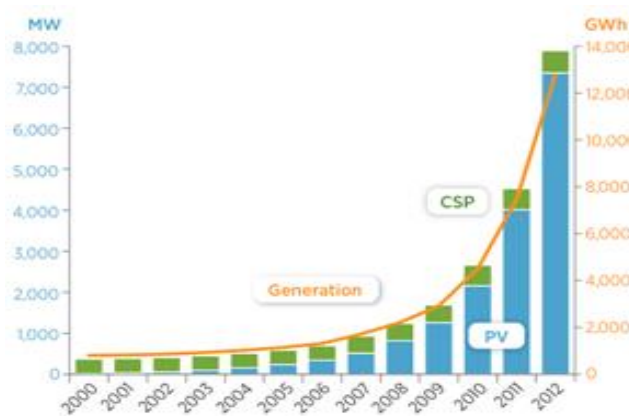
185. *Id.* at 72 (relying on Joachim Seel, et al., *Why are Residential PV prices in Germany So Much Lower than in the United States? A Scoping Analysis* (2013) (noting that costs are $3.34/watt in 2011 in the U.S., compared to $0.62/watt in Germany)).

186. Ker Than, *As Solar Power Grows, Dispute Flares Over U.S. Utility Bills*, NAT'L GEO. (Dec. 24, 2013), http://news.nationalgeographic.com/news/energy/2013/12/131226-utilities-dispute-net-metering-for-solar/.

187. *Id.*

system was being installed every four minutes in 2013 in the United States.[188] The sheer amount of solar is impressive, though the eight GW of solar installed in the U.S. today is still less than 1% of U.S. electricity production.[189] This has allowed the solar photovoltaic market to grow at an average rate of more than 40% each year since 2000.[190] This growth is shown in Figure 18.

Figure 18:
U.S. Solar Development



Solar energy is forecast to be cost competitive with retail electricity prices in forty-seven U.S. states by 2016, with maintenance of current subsidies, according to Deutsche Bank.[191] These subsidies can increase the value of solar projects by 700% compared to other projects.[192] With significant subsidies, solar power already has reached grid parity in Arizona, California, Connecticut, Hawaii, Nevada, New Hampshire, New Jersey, New Mexico, New York, and Vermont.[193] Demand for rooftop solar paired with energy storage systems is predicted to reach new installations worth $1 billion in the U.S. within four

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188. *Id.*

189. Peter Kind, *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business*, EDISON ELEC. INST. 1 (Jan. 2013), http://www.eei.org/ourissues/finance/documents/disruptivechallenges.pdf.

190. *Id.* at 10.

191. Ari Natter, *Solar Energy to Reach 'Grid Parity' in Nearly All States by 2016, Deutsche Bank Predicts*, BNA (Oct. 27, 2015). This is based on the assumption that the cost of solar systems will decline by about 20% more from less than $3 per watt installed to less than $2.50 per watt installed by 2016, resulting in a price in those states from 9-14 cents/Kwh, and lowered financing cost for solar projects. The average cost of residential electricity in the U.S. in 2013 was 12.12 cents/Kwh, and was 8.95 cents/Kwh in 2004. These assumptions factor in the 30 percent investment tax credit for solar energy, which is scheduled to drop to 10 percent at the end of 2016.

192. Author's calculation.

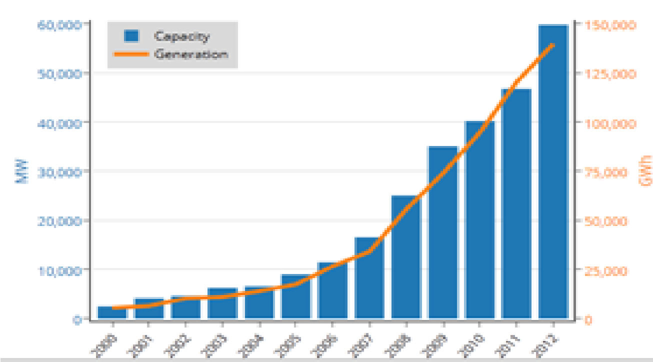
193. Natter, *supra* note 192.

years; approximately 318 Mw of solar-storage capacity will be in operation in the U.S. by 2018.[194]

Wind power growth since 2000, on a curve similar to that for solar energy development, is illustrated in Figure 19. Since 1999, the Pacific Northwest alone has installed more than 7,000 Mw of additional wind generating capacity,[195] which is expected to increase to 14,000 Mw by 2020.[196] While wind generation is not a comparable base load source of energy as is coal, there is an ongoing substitution phenomenon. Coal-fired generation has decreased from 50% of total U.S. generation a decade ago, to slightly over 40% in 2012 and less than 40% today.[197]

Wind generating capacity in the U.S. is forecast by the U.S. Department of Energy to increase by about 23% between 2014 and 2016, with utility-scale solar capacity to increase more than 60% in the same period.[198] 6.4% of electricity generation comes from hydropower and 6.7% from other renewable energy sources, the latter of which is expected to increase to 7.9% by the end of 2016.[199]

Figure 19:
U.S. Wind Development



Source: National Renewable Energy Lab's 2012 Renewable Energy Data Book

194. Ehren Goossens, *Solar-With-Batteries Market to Hit $1 Billion In U.S. by 2018, Research Company Projects*, ENV'T REP. (BNA) (Dec. 19, 2014).

195. BPA Final Record of Decision in Docket OS-14 – Oversupply Rate Proceeding at P-1, http://www.bpa.gov/Finance/RateCases/OS-14RateProceeding/Pages/default.aspx.

196. Comments of BPA in FERC Docket No. RM10-11-000 at 1 (April 12, 2010).

197. Lacey, *supra* note 177.

198. Ari Natter, *Installation of Wind, Solar Facilities to Lead Gains in Power From Renewables, EIA Says*, ENERGY & CLIMATE REP. (BNA) (Jan. 13, 2015). About half of this new solar capacity is expected to be added in California.

199. *Id.*

C. Mitigating the Impact of Intermittency of Certain Renewable Power

Base-load generation is usually provided by a coal-fired plant, and these plants run continuously because they have long start-up and cool-down periods.[200] Base-load generation typically is supplied by a coal-fired or nuclear plant that runs continuously because these plants have slow start-up and require cool-down times if not run continuously.[201] Substitution of wind and solar power, both intermittent and uncontrollable sources of power over time, will be dispatched in lieu of conventional base-load power.

New, intermittent wind and solar renewable resources cannot supply reliable base load power, as they demonstrate a relatively low availability factor in the 10% to 40% range of all hours during a week or month.[202] Wind generators have plant effective capacity factors of 20% to 30%.[203] Wind and solar are not reliable as peak power, because they are not available reliably on call. The intermittency of solar power on a daily basis is illustrated in Figure 20, showing a 4:1 oscillation of power output hour-by-hour.

According to the National Energy Resource Council ("NERC"), which is responsible for maintaining U.S. grid reliability, regulating and sequestering carbon emissions will compromise grid reliability.[204] Adding too many sustainable resources could negatively affect grid reliability, until cost-effective electricity storage is perfected.[205] There is debate as to how much is too much: studies conducted by NREL have shown that more than one-third of the electricity in the western United States could

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200. *See* U.S. ENERGY INFO. ADMIN., THE CHANGING STRUCTURE OF THE ELECTRIC POWER INDUSTRY 2000: AN UPDATE, EIA-0562(00) 8–13 (2000), http://www.eia.gov/cneaf/electricity/chg_stru_update/update2000.pdf (discussing the difficulty of bringing base-load generators online and offline, and discussing coal as the primary source for U.S. generation because of its use as a base-load-generation fuel).

201. *See* U.S. ENERGY INFO. ADMIN., ELECTRICITY IN THE UNITED STATES–GENERATION, SALES & CAPACITY, http://www.eia.gov/energyexplained/index.cfm?page=electricity_in_the_united_states#tab2 (last visited Jan. 24, 2016) [hereinafter *Electricity in the United States*] (explaining base-load generating units).

202. *See* FERREY, LAW OF INDEPENDENT POWER, *supra* note 141, § 2:11 (noting inability of intermittent sources to serve as base-load resource).

203. WORLD NUCLEAR ASS'N, RENEWABLE ENERGY AND ELECTRICITY, http://www.world-nuclear.org/info/Energy-and-Environment/Renewable-Energy-and-Electricity/ (last visited Jan. 24, 2016).

204. Charles Davis, *Public Utilities Fear that GHG Cuts Might Threaten Electricity Supply, Reliability*, CLEAN ENERGY REP. (July 28, 2008), http://www.cleanenergyreport.com.

205. Jeff Postelwait, *NERC: Climate Change Rules Could Hurt Generation Reliability*, POWER ENG'G (Nov. 18, 2008), http://pepei.pennnet.com/Articles/Article_Display.cfm?ARTICLE_ID=345518&p=6.

come from wind and solar power without installing significant amounts of backup power or new interstate transmission lines.[206]

Peak power demand has been increasing over time as a percentage of average demand. In 2008, New England's grid operator, ISO New England, had about 31,024 megawatts of rated summer generating capacity to serve a peak demand of 27,970 megawatts.[207] This, however, did not allow for the recommended 15% to 20% surplus for equipment repairs and unit unavailability.[208] Moreover, the peak power demand has been increasing over time as a percentage of average demand.[209] In 1980, New England peak capacity was 154% of average load, which increased to 159% in 1990, and further increased to 175% in 2000.[210] Commentators predict that power demand peaks will continue an upward trend.[211] Climate change and greater cooling requirements are likely to exacerbate these trends, as a function of increasing air-conditioning usage during the summer peak days. New York City, for example, has a peak demand almost twice its average load.[212]

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206. GE ENERGY, WESTERN WIND AND SOLAR INTEGRATION STUDY 314-15 (May, 2010), http://www.nrel.gov/docs/fy10osti/47434.pdf.

207. FERC, NEW ENGLAND ELECTRIC MARKET: OVERVIEW AND FOCAL POINTS, https://www.ferc.gov/market-oversight/mkt-electric/new-england/2007/05-2007-elec-ne-archive.pdf. (last visited Jan. 24, 2016).

208. *Id.* For current data on generating capability and demand, see ISO NEW ENG., GENERATION AND RESOURCES, http://www.iso-ne.com/genrtion_resrcs/index.html.

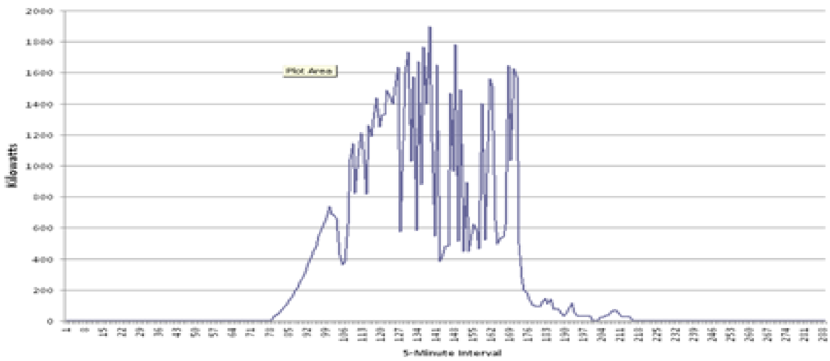
209. *See* Braintree Electric Light Dep't, No. EFSB 07-1/D.T.E./D.P.U. 07-5, at 77 (Mass. Energy Facilities Siting Board Feb. 29, 2008), http://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=07-5%2FEFSB071%2F22908findec.pdf.

210 *See* GORDON VAN WEILE, ENSURING LONG TERM RELIABILITY OF NEW ENGLAND'S REGIONAL ELECTRICITY SYSTEM, ISO NEW ENG., 15 (2006), http://www.iso-ne.com/pubs/pubcomm/pres_spchs/2006/iso-ne_platts_gvw.pdf.

211. *See* ISO NEW ENG., 2006–2015 FORECAST REPORT OF CAPACITY, ENERGY, LOADS, AND TRANSMISSION 1–2 (2006), http://www.iso-ne.com/trans/celt/report/2006/2006_CELT_Report.pdf.

212. Lisa Wood, *New York Readies for Stimulus Funds with Order to Utilities on Metering Pilots*, ELEC. UTIL. WEEK, Feb. 16, 2009, at 33.

Figure 20:
Daily Solar Output, Mass.



The existing modern back-up power peaking capacity is dramatically short of where it needs to be, despite the fact that power systems have enough total resources.[213] This shortfall is compounded by a lack of either dual-fuel or less-polluting gas-fuel alternatives.[214] After analyzing this situation, ISO New England concluded that "[a] lack of fast-start resources in transmission-constrained subareas could require the ISO to use more costly resources to provide these necessary services. In the worst case, reliability could be degraded."[215]

Most of the existing back-up peaking capacity currently installed in the grid is not the newer aero-derivative quick-start technology.[216] Quick-start technology allows the generator to go from a cold start to full power production in less than ten minutes,[217] which falls within the most demanding category for start time

213. *Cf.* ISO NEW ENG., REGIONAL SYSTEM PLAN 5 (2006), http://iso-ne.com/static-assets/documents/trans/rsp/2006/rsp06_final_public.pdf (noting that a system needs more than just a certain level of resources to meet demand for electricity; it also needs certain types of resources).

214. *See id.*

215. REGIONAL SYSTEM PLAN, *supra* note 213.

216. Regarding the small amount of peaking or backup generation in systems, see, for example, Montgomery Energy Billerica Power Partners, No. EFSB 07-2, 2009 WL 1532821, at *10, *13 (Mass. Energy Facilities Siting Bd. Mar. 3, 2009). The bulk of fossil-fueled power generation was built prior to 1990, when aeroderivative quick-start technology began to be used for power generation. U.S. ENERGY INFO. ADMIN., EXISTING ELECTRIC GENERATING UNITS BY ENERGY SOURCE, 2008 (2008), http://www.eia.gov/cneaf/electricity/page/capacity/capacity.html. Demand for additional generating technology has only been increasing at one to two percent annually, so new additions during the past two decades constitute a distinct minority of installed generation. U.S. ENERGY CONSUMPTION, MAXWELL SCH. OF SYRACUSE UNIV., http://wilcoxen.maxwell.insightworks.com/pages/804.html (last updated Apr. 10, 2006).

217. Braintree Electric Light Dep't, No. EFSB 07-1/D.T.E./D.P.U. 07-5, at 94 n.67 (Mass. Energy Facilities Siting Board Feb. 29, 2008).

maintained by grid system operators.[218] Power is therefore nearly instantaneously available, avoiding the need to spin and operate the generator before consumers demand that power.[219]

Conventional, non-aero-derivative generators take hours to bring their temperatures up gradually from a cold start, and similarly must slowly ramp down their temperatures when they shut down.[220] These "spinning," non-quick-start reserve units also expel a less contained more profligate profile of environmental emissions when operating at partial capacity.[221] One analysis of coal-plant cycling against intermittent renewable power's hourly variations found that emissions during cycling were 8% higher for sulfur dioxide and 10% higher for nitrogen oxides than emissions of the same compounds during constant operation.[222] Moreover, while generators spin to increase their temperatures to their design values, the power that these units produce may or may not be used by the grid, thus incurring power "uplift" costs to the grid.[223] The grid (and, ultimately, power consumers) incurs this multiple loss whether or not these units are ever required to supply power during the peak time of the day.[224]

IV. "PUSH" OR "PULL" ECONOMICS AND KEY TECHNOLOGY

A. Tax Bases

The tax base and the rate base are very different species. While the "pull" of declining market prices in a competitive market lowers ultimate prices to consumers, the "push" of regulatory incentives for particular types of power is passed on to consumers and raises costs in two different ways. First, federal tax credits for certain types of

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218. *Id.* at 94. ISO New England has separate reserve markets for ten-minute nonspinning reserve capacity and thirty-minute operating reserves. ISO NEW ENG., ANCILLARY SERVICES MARKET ENHANCEMENTS WHITE PAPER 3 (2004), http://www.iso-ne.com/pubs/whtpprs/asm_wht_paper.pdf. Many units have to "spin" to meet either of these criteria. Michael Milligan & Brendan Kirby, *Utilizing Load Response for Wind and Solar Integration and Power System Reliability* 7 (2010), http://www.nrel.gov/docs/fy10osti/48247.pdf.

219. *Cf.* Braintree Electric Light Dep't, No. EFSB 07-1/D.T.E./D.P.U. 07-5 at 79 (Mass. Energy Facilities Sitting Board Feb. 29, 2008) (explaining that the reserve market serves as a "real-time backup supply to ensure continuity of service to system customers even in the event of an unexpected outage or other system contingency").

220. *See id.* at 97.

221. Montgomery Billerica Energy Power Partners, No. EFSB 07-02, 2009 WL 1532821 at *12 (Mass. Energy Facilities Siting Board Mar. 3, 2009).

222. Nicolas Puga, *The Importance of Combined Cycle Generation Plants in Integrating Large Levels of Wind Power Generation*, 23 ELEC. J. 33, 38 (2010).

223. *See id.* at 34.

224. *See id.*

power decrease the receipt of federal corporate taxes, increasing the share of federal revenues which must be raised through personal income or other taxes or fees. Second, state incentives for certain energy supply technologies, such as renewable portfolio standards or net metering, are passed through entirely as additional expenses not to taxpayers, but to utility rate payers.[225] This raises the retail price of electricity to consumers.

States with a significantly larger amount of lower cost hydroelectric, nuclear, coal, and gas-fired power, such as California,[226] oddly have the highest prices of retail electricity. California, with one of the most assertive regulatory incentives for renewable power, and a disproportionate amount of lower-cost power supply, has the highest consumer costs for retail electricity of any of the contiguous 48 states.[227] Some of this is due to the significant costs of the "push" of state incentives for certain types of power, all of which result in higher retail consumer prices for the power.

Federal income tax taxpayers paying for federal tax incentives are not the same group as utility electricity ratepayers. Almost everyone in America is a consumer of electricity and thus a utility ratepayer. However, approximately 50% of the American population does not pay income tax.[228] Federal and most state income taxes typically have "no tax" thresholds and deductions, which exempt certain lower-income taxpayers from any income tax.[229] So, federal tax incentives are indirectly borne by that approximately half of the population which pay personal income taxes on a progressive tax basis with increasing marginal income tax rates based on amount of income.

B. Rate Bases

By contrast, electricity is priced as a commodity and service for which every consumer pays for the value. There are different rates for different groups of electricity consumers, such as commercial, residential, industrial, and municipal consumers. Each group rate is designed to reflect the costs of serving these consumers.

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225. Tom Tiernan, *Attention to Good Standby Rates Seen Key as Distributed Generation Plays Bigger Role,* ELEC. UTIL. WK., Dec. 31, 2012, at 10.

226. CAL. ENERGY ALMANAC, TOTAL ELECTRICITY SYSTEM POWER, http://energyalmanac.ca.gov/electricity/total_system_power.html (last visited Jan. 24, 2016).

227. *Id.*

228. Michelle Hirsch, *The 50% of Americans Who Don't Pay Income Tax Will Never be a Good Revenue Source*, BUSINESS INSIDER (Aug. 31, 2011), http://www.businessinsider.com/who-pays-no-taxesand-why-theyre-no-pot-of-gold-2011-8.

229. For example, the Massachusetts state income tax exempts all persons from paying any state income tax if they have less than $8,000 of adjusted annual income.

Electricity rates can be somewhat tailored by policy considerations, but not to the degree or extent of progressive federal income taxes. There is no exemption from payment liability or 'free' amount of power in traditional retail utility rate tariffs; all accounts showing a power purchase are collectible pursuant to American law. Utility rates are designed to recover the cost of each commodity and service provided.[230] In principle, every consumer pays for the electricity that he or she consumes.

The retail price of electricity that one is charged is based on its reasonable cost of production determined at the rate proceeding of a state energy regulatory commission. Recovered retail prices include transmission and distribution costs, as well as the cost of generation. The obligation of state retail electricity regulatory commissions is to fairly and equitably allocate investments and expenses of regulated utilities. Public utility law tracks the legal obligation to allocate costs and benefits of electricity service in a manner that is "fair and equitable," "not unduly preferential," "just and reasonable," and "non-discriminatory" among consumers.[231] Table 6 provides an overview of selected state regulatory law which establishes rate principles of selected states.[232]

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230. *How Rates are Set*, CONSUMERS ENERGY, http://www.consumersenergy.com/content.aspx?id=4589 (last visited Jan. 24, 2016).

231. Paul Hibbard, et al., *EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers*, ANALYSIS GRP. 29 (July 2014), http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_epa_clean_power_plan_report.pdf.

232. *Id.* The source at Appendix 4 contains more detailed summaries for the states included in the case studies.

Table 6:
State Ratemaking Practices Addressing
Consumer Impact, Equity and Fairness[233]

State	Bill or Recent Rate Case	Description
California	Public Interest Code, Division 1, Part 1, Chp. 4, 739.6	"The commission shall establish rates using allocation principles that fairly and reasonably assign to different customer classes the costs of providing service to those customer classes, consistent with the policies of affordability and conservation."
Florida	Florida Statute Title XXVII	"In fixing fair, just, and reasonable rates for each customer class, the commission shall, to the extent practicable, consider the cost of providing service to the class, as well as the rate history, value of service, and experience of the public utility; the consumption and load characteristics of the various classes of customers; and public acceptance of rate structures."
Illinois	Illinois Statute 220 ILCS 5/1-102	"…the health, welfare and prosperity of all citizens require the provision of adequate, efficient, reliable, environmentally safe and least-cost public utility services at prices which accurately reflect the long-term cost of such services at prices which accurately reflect the long-term cost of such services and which are equitable to all citizens" and that "variation in costs by customer class and time of use is taken into consideration in authorizing rates for each class."
Iowa	State of Iowa (Mar. 17, 2014)	Explaining a sub-rule related to new RPU-2013-0004 provision " . . . is designed to insure that no customer receives any 'entitlement' to currently existing facilities, and that all customers pay their appropriate share of the utility's cost."
Massachusetts	Rate Case Order-Docket 11-01 (Aug. 1, 2011)	"The rate structure for each rate class is a function of the cost of serving that rate class; and how rates are designed to recover the cost to serve that rate class. The Department has determined that the goals of designing utility rate structures are to achieve efficiency and simplicity as well as to ensure

233. *Id.*

		continuity of rates, fairness between rate classes, and corporate earnings stability."
Minnesota	Minnesota Statute § 216 B.03	"Every rate made, demanded, or received by any public utility, or by any two or more public utilities jointly, shall be just and reasonable. Rates shall not be unreasonably preferential, unreasonably prejudicial, or discriminatory, but shall be sufficient, equitable, and consistent in application to a class of consumers."
New Mexico	NMSA 1978, § 62-8-1	"Every rate made, demanded or received by any public utility shall be just & reasonable."
North Carolina	§62 and §133.8 Subs. h-4	"To provide just and reasonable rates and charges for public utility services without unjust discrimination, undue preferences or advantages…"
Texas	Chp. 25, subchp. J, § 25.234 (effective July 5, 1999)	"Rates shall not be unreasonably preferential, or discriminatory, but shall be sufficient, equitable, and consistent in application to each class of customers, and shall be based on cost."

The principle of maintaining equitable charges to each customer group for the benefits received, across the country is reflected even in utilities providing energy efficiency services paid with rate payer money which help consumers consume less electricity. Table 7 illustrates the amounts collected through consumer utility rates for energy efficiency, as well as the average dollars spent on residential, commercial, and industrial customer classes for energy efficiency programs devoted to each customer group. Relative expenditures for these classes is 46%, 40%, and 14%, respectively-which parallels the total revenues collected for overall utility service from each customer rate class-45%, 37%, and 18%, respectively.[234]

234. *Id.* at 31.

Table 7:
State Energy Efficiency Spending by Customer Class Compared to Revenues, 2012[235]

State	Residential	Commercial	Industrial	Total
Alabama	$9,172	$4,625	$24,131	$37,928
Alaska	$363	$148	$0	$511
Arizona	$65,678	$70,216	$409	$136,303
Arkansas	$18,670	$9,834	$40,696	$69,200
California	$488,578	$559,873	$144,861	$1,193,312
Colorado	$44,040	$67,717	$13,452	$125,209
Connecticut	$58,083	$47,665	$14,742	$120,490
Delaware	$1,860	$0	$0	$1,860
Dist. of Col.	$8,423	$8,760	$0	$17,183
Florida	$281,810	$100,270	$43,436	$425,516
Georgia	$30,794	$13,128	$11,344	$55,266
Hawaii	$2,328	$4,555	$185	$7,068
Idaho	$15,859	$15,734	$32,540	$64,133
Illinois	$78,368	$75,671	$2,658	$156,697
Indiana	$59,112	$20,475	$20,475	$93,467
Iowa	$45,851	$25,852	$51,943	$123,646
Kansas	$10,767	$3,427	$5,869	$20,063
Kentucky	$29,318	$8,358	$2,307	$39,983
Louisiana	$1,065	$3	$0	$1,068
Maine	$7,630	$9,356	$4,579	$21,565
Maryland	$161,413	$66,413	$280	$227,877
Michigan	$71,543	$63,338	$11,008	$145,889
Minnesota	$78,367	$94,601	$52,695	$225,663
Mississippi	$3,725	$1,567	$5,052	$10,344
Missouri	$17,576	$16,020	$254	$33,850
Montana	$6,720	$9,112	$15	$15,397
Nebraska	$6,413	$7,197	$7,741	$20,013
Nevada	$20,013	$15,461	$0	$35,474
New Hamp.	$9,447	$10,888	$339	$20,674
New Jersey	$48,397	$12,867	$3,067	$64,331
New Mex.	$14,890	$10,501	$2,250	$27,641
New York	$338,506	$31,836	$486,577	$856,919
North Car.	$84,693	$55,883	$12,510	$153,086
North Dak.	$8,263	$9,618	$1,998	$19,879
Ohio	$71,711	$56,782	$36,361	$164,854
Oklahoma	$26,155	$12,118	$1,866	$40,139
Oregon	$40,587	$49,355	$29,584	$119,526
Pennsylv.	$140,410	$89,219	$60,161	$289,790
Rhode Isl.	$20,227	$18,740	$11,486	$50,453
South Car.	$41,125	$19,832	$12,562	$73,519
South Dak.	$4,206	$1,701	$1,082	$6,989
Tennessee	$22,789	$15,544	$19,097	$57,430
Texas	$121,730	$78,628	$7,381	$207,739
Utah	$24,578	$14,708	$8,567	$47,853

235. *Id.*

Vermont	$14,474	$19,346	$0	$33,820
Virginia	$21,184	$6,614	$716	$28,514
Washington	$99,204	$85,276	$21,447	$205,927
West Virg.	$40,351	$30,600	$46,831	$117,782
Wisconsin	$40,351	$30,600	$46,831	$117,782
Wyoming	$1,784	$1,762	$1,288	$4,834

Electricity is priced based on its reasonable cost of production and the translation of total cost to "just and reasonable" rates that reflect these costs.[236] Gross revenues must cover the reasonable cost of running the electric system, and the allocation of rates among customer classes to raise those revenues must be made based on the principles of tracking and reflecting costs of serving each reasonably distinct class of customers.[237] Each specific rate to consumers must be "just and reasonable."[238]

A nearly universal legal obligation imposed by federal and state laws on public utilities is the obligation to furnish service and to charge rates that will avoid undue or unjust discrimination among customers.[239] Further, "'undue' or 'unjust' discrimination among customers is prohibited."[240] Policy considerations, such as providing environmental incentives or discounting rates to certain segments of the customer base, must play a subsidiary role in the ultimate rate allocation among customer classes.[241] These principles are embedded in rate decisions of both FERC[242] and state regulatory commissions[243] and in principles used when courts review the application of these principles by regulatory agencies.[244]

"The principles of *horizontal* equity that 'equals should be treated equally,' and *vertical equity* that 'unequals should be treated unequally' . . . [is interpreted to mean] that equal . . . cost causers for the provision of a good or service should pay the same . . . prices."[245] Horizontal equity among different customer classes, based on cost of service, is a goal: it is illegal for a state to set rates that "grant any undue preference or advantage to any person or

236. 16 U.S.C § 824d(a) (2012).

237. *See* Ala. Elec. Coop., Inc. v. FERC, 684 F.2d 20, 27 (D.C. Cir. 1982) ("[I]t has come to be well established that electrical rates should be based on the costs of providing service to the utility's customers, plus a just and fair return on equity.").

238. 16 U.S.C. § 824d(a) (2012).

239. JAMES C. BONBRIGHT, ET AL., PRINCIPLES OF PUBLIC UTILITY RATES 515 (2d ed. 1988). If an electric plant is operating near full capacity, higher charges for on-peak versus off-peak would actually be required to avoid discrimination. *Id.* at 528.

240. CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES: THEORY AND PRACTICE 434 (3d ed. 1993).

241. BONBRIGHT, *supra* note 239, at 524.

242. Ala. Elec. Coop., Inc., 684 F.2d at 21, 27.

243. Mich. Comp. Laws Serv. § 460.557(3)–(4) (LexisNexis 2010); see also Tex. Util. Code Ann. § 36.003(a)–(c) (West 2007).

244. *See* Ala. Elec. Coop., Inc., 684 F.2d at 27.

245. BONBRIGHT, *supra* note 239, at 568.

subject any person to any undue prejudice or disadvantage."[246] An electric power customer only needs to show substantial vertical disparity in rates between customers of the same class in order to raise questions of discriminatory or preferential rates.[247]

Under the Federal Power Act, FERC may only allow "such rates as will prevent consumers from being charged [with] any unnecessary or illegal costs."[248] The burden is on the applicant utility to justify all rates as just and reasonable.[249] Whenever FERC determines that a public utility's rates, charges, or service classifications are unjust, unreasonable, or unduly discriminatory, FERC can determine and order rates that are just and reasonable.[250] FERC can further change a rate or rule it finds unreasonable.[251]

The Federal Power Act prohibits terms of service that are unreasonable or unduly preferential as between different classes of customers.[252] At the federal level of regulation, Section 205 of the Federal Power Act prohibits utilities from granting any "undue preference or advantage to any person or . . . maintain[ing] any unreasonable difference in rates . . . either as between localities or as between classes of service."[253] FERC regulations specify that it is illegal to discriminate in rates between customers of the same class.[254]

Notably, unlawful discrimination may arise under a single rate design where "a uniform rate creates an undue disparity between

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246. 16 U.S.C. § 824d(b)(1) (2012).

247. *See* Pub. Serv. Co. Ind. v. FERC, 575 F.2d 1204, 1212 (7th Cir. 1978), *aff'd sub nom.* City of Frankfort, Ind. v. FERC, 678 F.2d 699 (7th Cir. 1982).

248. NAACP v. Fed. Power Comm'n, 425 U.S. 662, 666 (1976).

249. Nantahala Power & Light Co. v. FERC, 727 F.2d 1342, 1347, 1351 (4th Cir. 1984).

250. 16 U.S.C. § 824e(a) (2012). The court directly answered the issue of current "usefulness" and provided further insight into what types of canceled investments can be included in rate bases: "[T]he Commission's decision to authorize full recovery was just and reasonable and consistent with Commission policy. We are unpersuaded by Norwood's argument that forcing ratepayers to pay for a plant no longer producing electricity conflicts with the regulatory precept that ratepayers should only pay for items "used and useful" in providing service. Although a utility's rate base normally consists only of items presently "used and useful" . . . a utility may include "prudent but canceled investments" in its rate base as long as the Commission reasonably balances consumers' interest in fair rates against investors' interest in "maintaining financial integrity and access to capital markets." Town of Norwood v. FERC, 80 F.3d 526, 531 (D.C. Cir. 1996) (citations omitted).

251. 16 U.S.C. § 824e(a) (2012).

252. 16 U.S.C. § 824d(b) (2012).

253. *Id.*

254. Pub. Serv. Co. Ind. v. FERC, 575 F.2d 1204, 1212 (7th Cir. 1978), *aff'd sub nom.* City of Frankfort, Ind. v. FERC, 678 F.2d 699 (7th Cir. 1982); Wis. Mich. Power Co., 54 Pub. Util. Rep. 3d (PUR) 321 (Fed. Power Comm'n 1964) ("Section 205 [of the Power Act] does not prohibit all rate distinctions but only rate discrimination as between customers of same class."); STEVEN FERREY, THE NEW RULES: A GUIDE TO ELECTRIC MARKET REGULATION 26 (2000).

the rates of return on sales to different groups of customers."[255] If this rate design provides costs of service to one group that are different from costs of service to another, "the two groups are [then], in one important respect, quite dissimilar."[256] It is also illegal for a public utility to "maintain any unreasonable difference in rates . . . as between localities," which, again, is a geographically based discrimination.[257] "The provision and pricing of services to any person(s) should not impose unwarranted economic costs on other person(s)."[258]

Regulatory scrutiny is utilized to ensure that only costs passed on to retail rates are "necessary and prudent."[259] In deciding on utility management prudency in a rate-making proceeding, the regulatory agency must judge whether actions:

> [W]ere prudent at the time, under all the circumstances, considering that the company had to operate at each step of the way prospectively rather than in reliance on hindsight . . . [and] in light of all conditions and circumstances which were known or which reasonably should have been known at the time the decisions were made.[260]

The rate charged to one group should not impose a cost burden derived from a different pricing policy of another group.[261] Additionally, a rate structure should avoid undue discrimination in rate relationships, avoid rate structures that encourage wasteful consumption, and include rates that fairly allocate total cost.[262]

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255. Ala. Elec. Coop., Inc. v. FERC, 684 F.2d 20, 27 (D.C. Cir. 1982).
256. *Id.* at 27.
257. 16 U.S.C. § 824d(b)(2) (2012).
258. BONBRIGHT, *supra* note 239, at 568.
259. Midwestern Gas Transmission Co., 36 F.P.C. 61, 70 (1966), *aff'd sub nom.* Midwestern Gas Transmission Co. v. Fed. Power Comm'n, 388 F.2d 444 (7th Cir. 1968).
260. In re Bos. Edison Co., 46 P.U.R. 431, 438 (Mass. D.P.U. 1982), *enforced sub nom.* Att'y Gen. v. Dep't of Pub. Utils., 455 N.E.2d 414 (Mass. 1983).
261. BONBRIGHT, *supra* note 239, at 568.
262. CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES: THEORY AND PRACTICE 434 (3d ed. 1993) (quoting BONBRIGHT, *supra* note 239, at 291).

V. WINNERS AND LOSERS

"*Washington should not be using taxpayer money to pick winners and losers in the energy industry*."[263]

- Utah Sen. Mike Lee

Some legislators object to using federal tax incentives for certain power generation technologies to the exclusion of other technologies. As now in place, differentiated federal tax incentives and the "push" of state renewable incentives, will promote only certain technologies and exert different impacts in the regions of the country. Winners and losers will result. Federal and state regulatory 'pushes' promote renewable energy.

The "pushes" of regulatory incentives are accentuated by the "pulls" of market forces. Figure 13 illustrates that in the last 5 years, natural gas prices have fallen to one-third of their prior value and are now only a modest premium over coal prices per unit of energy value, as shown in Figure 8. This makes natural gas virtually cost-competitive with the traditionally much cheaper cost of coal for power generation. There is the added environmental benefit of gas producing only one-half as much CO_2 as coal, no particulate matter criteria pollutants, no SO_2 criteria pollutant emissions, and the ability to emit less NOx. Just on changing economics, there is now a reason for utilities and independent power generators to run less coal generation. Market forces are favoring natural gas and certain renewable power technologies.

Certain areas of the country and their regional utilities will be more impacted by these regulatory incentives, which shift incentives away from coal-fired electric power. Figure 21 shows the amount of coal-fired electric generation in each region of the U.S. (shown in the blue percentage in each of the regional pie charts). The 5 regions which are at least half dependent on current coal generation, among the 10 national regions, are the mountain states of the west, the west north central region and the east north central region of the Midwest, the south Atlantic region, the east south central region.

The location of the significant U.S. coal plants, by size, is shown in Figure 22.[264] Coal-fired generation is dominant in the eastern

263. Michael Bastasch, *Podesta: Congress Can't Stop Obama on Global Warming*, THE DAILY CALLER (May 5, 2014) http://dailycaller.com/2014/05/05/podesta-congress-cant-stop-obama-on-global-warming/.

264. Jill Fitzsimmons & Max Greenberg, *Myths and Facts About Coal*, MEDIA MATTERS FOR AMERICA (Sept. 20, 2012), http://mediamatters.org/research/2012/09/20/myths-and-facts-about-coal/190041.

part of the U.S., exclusive of New England, and including certain large coal plants in the Rocky Mountain States utilizing more recently developed Rocky Mountain low-sulfur coal. At the end of 2012, there were 1,308 coal-fired generating units in the United States, totaling 310 GW of capacity. In 2012 alone, 10.2 GW of coal-fired capacity was retired, representing 3.2% of the 2011 total.[265] Units that retired in 2010, 2011, or 2012 were small, with an average size of 97 megawatts ("MW"), and inefficient, with an average tested heat rate of about 10,695 Btu/kWh. In contrast, units scheduled for retirement over the next ten years are larger and more efficient: at 145 MW, the average size is 50% larger than recent retirements, with an average tested heat rate of 10,398 Btu/kWh.[266]

From the "push" provided by recent federal and state regulation, and the "pull" of economic market forces, U.S. global warming emissions will continue to decline. Approximately 62,000 MW of existing coal-fired generating capacity is planned now to be retired through 2016, which is unlikely to be altered whatever the result of pending Supreme Court review of Obama Administration executive orders and regulations affecting coal.[267] The "push" of federal tax policy and state renewable portfolio standards and net metering will shift core U.S. power technology from fossil fuels to renewable energy. The "pull" of market forces, which are making natural gas cost-competitive with coal, and dramatically declining costs of solar generation, change the economics and technology of power. From the "push" provided by recent federal and state regulation, and the "pull" of economic market forces, U.S. global warming emissions will continue to decline. The "push" of federal tax policy and state renewable portfolio standards and net metering will shift core U.S. power technology from fossil fuels to renewable energy. The "pull" of market forces, which are making natural gas cost-competitive with coal, and dramatically declining costs of solar generation, change the economics and technology of power.

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265. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2014, http://www.eia.gov/forecasts/aeo/er/index.cfm; U.S. ENERGY INFO. ADMIN., AEO2014 PROJECTS MORE COAL-FIRED POWER PLANT RETIREMENTS BY 2016 THAN HAVE BEEN SCHEDULED (Mar. 10, 2014) http://www.eia.gov/todayinenergy/detail.cfm?id=15031.

266. *Density of Power Plants by Operating Capacity: Continental United States*, SNL ENERGY (July 9, 2014), http://www.snl.com/Global_Financial_Analysis_Infographics.aspx.

267. Mario Parker, *Supreme Court Review of EPA Regulations Won't Save Coal-Fired Plants, ICF Reports*, ENV'T REP. (BNA) (Jan. 15, 2015).

Figure 21:
Electric Generation Sources

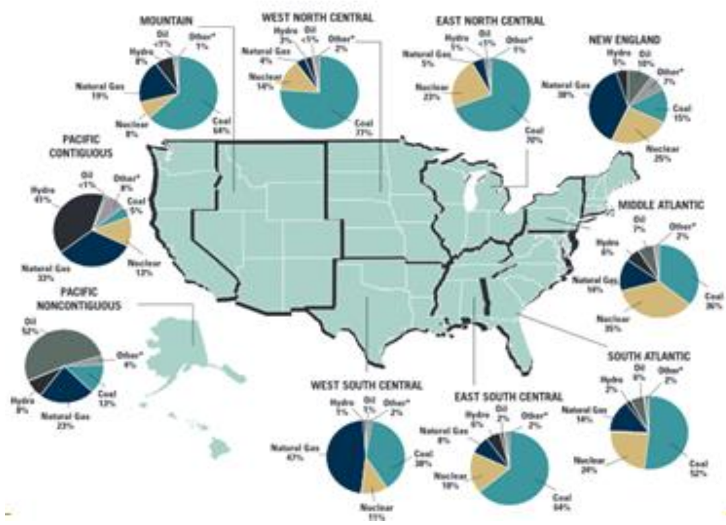

Figure 22:
Coal Consumption Key Points

There are winners and losers in the selection of incentives for how we change fundamental technology affecting the second most important invention of all time and rescue the climate. Natural gas and renewable energy power generating capacity are beginning to supplant coal generation. The choice of law and regulation will fundamentally determine the effective policy and the future of the Planet.