INTERNATIONAL POWER ON "POWER"

BY
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Can international power be effectively used to control "power"? Electricity is deemed the second most important invention in human history and is now linked inextricably to irreversible international climate change. Power sector carbon emissions must be solved for a solution to the international problem of climate change. Many large developing countries are underwriting the biggest push in world history into high carbon-emitting coal-fired power, which will destroy world goals. The United Nations scientific panel in late 2014 concluded, with high certainty, that we are passing the point of being able to control increase in world temperature to less than 2 degrees Celsius—3.8 degrees Fahrenheit—the so-called "tipping point" of the Planet's climate. The Kyoto Protocol, the world's attempt at climate control, as it stands today is not sufficient to meet the challenge. Tightening the screws of international law is necessary.

This Article examines the various comparative international, national, and subnational legal tools now addressing what many consider the most pressing world problem, with a comparison of U.S. and international tools. The issue of legal mechanisms is at a critical point—China, India, and the other large developing countries are deploying a massive build-out of coal-fired power generation plants that alone will make world climate goals unattainable, unless different regulatory tools are immediately deployed. This Article assesses where we are going and what international law is and is not doing, and uses these lessons to chart a successful path forward to sustainability.

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I. POWER AT THE CUSP OF INTERNATIONAL CLIMATE

Can international power be effectively used to control "power"? Electricity is regarded as the second most important invention in human history, and is now linked inextricably to irreversible international climate

change.[1] Power occupies a substantial segment of the world economy—several hundred billion dollars of annual transactions in the United States alone.[2] To find a solution to the international challenge of climate change, the problem of power sector carbon emissions must be addressed and solved. There is power over power: Government incentives and demonstrated unilateral executive action in the United States, and a new model for sustainable power in developing countries, are key to solving this international challenge.

Certain newly proven legal models abroad exercise power over power. Internationally, there is now a proven mechanism for advancing renewable power in developing countries.[3] While some developing countries are following this model, many large developing countries are building additional coal plants as fast as they can finance them, rather than primarily developing renewable power. China, India, and other developing countries are underwriting the most rapid push into more high-carbon coal-fired power in history.[4] By contrast, the United States is dramatically shifting away from coal generation to more sustainable alternatives, largely through unilateral executive branch regulatory action. What has transpired in the U.S. is a significant reduction in coal use and development, decreasing coal-fired generation from more than 50% of total United States generation a decade ago to significantly less than 40% today.[5]

This Article addresses the immediate international legal challenge of this century: the necessity to align all world countries to shift power use to address climate change. There is a new climate change pledge transferring an additional $100 billion/year of aid to developing countries—constituting the largest pledged transfer of wealth in human history.[6] To be effective, this fund must be targeted at renewables or other power development that

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1 James Fallows, *The Fifty Greatest Breakthroughs Since the Wheel*, ATLANTIC MONTHLY, Nov. 2013, at 56, 64; *see infra* note 15 and accompanying text (discussing electricity's effect on international climate change).

2 *See* Uday Varadarajan, Climate Policy Initiative, *What Does the U.S. Government Really Spend on Energy?*, http://climatepolicyinitiative.org/2012/03/12/what-does-the-u-s-government-really-spend-on-energy/ (last visited Nov. 21, 2015) (noting that the U.S. government spends between $290 billion and $610 billion on energy).

3 *See generally* Steven Ferrey, *International Alchemy within the Post-Copenhagen World: Transforming Critical Infrastructure across 200 Divergent Economies*, 34 HASTINGS INT'L & COMP. L. REV. 303 (2011) (describing how renewable power has advanced in Asia); Steven Ferrey, [Reinicilizando los Vinculos del Derecho Internacional: Mecanismos y Protocolos *de la* COP 20] PONTIFICAL CATH. OF PERU L. SCH. REVISTA DERECHO & SOCIEDAD (2014).

4 *See infra* Part V.

5 Stephen Lacey, Think Progress, *U.S. Coal Generation Drops 19 Percent In One Year, Leaving Coal with 36 Percent Share of Electricity*, http://thinkprogress.org/climate/2012/05/14/483432/us-coal-generation-drops-19-percent-in-one-year-leaving-coal-with-36-percent-share-of-electricity/ (last visited Nov. 21, 2015).

6 *See infra* Part III.C. (discussing the commitment made by the United Nations Climate Change Conference in Copenhagen).

dramatically reduces warming emissions. Controls on world climate funds are warranted to a degree not present for other forms of international aid.[7]

To be effective, the time is now: The United Nations scientific panel concluded in late 2014, with high certainty, that we are passing the point of being able to control the increase in world temperature to less than 2 degrees Celsius—3.8 degrees Fahrenheit—the so-called "tipping point" of the Planet's climate.[8] So if climate matters, we are at a critical legal precipice. The challenge is not one of technology—as workable renewable energy technologies are abundant and proven—but of effective international, national, and subnational legal mechanisms. However, tightening the screws of international law is necessary: the Kyoto Protocol as it stands today is not sufficient to meet the challenge.[9]

This Article critically examines the various international, national, and subnational legal mechanisms in the United States and abroad, addressing what many consider the most pressing world problem: irreversible climate change. National and regional regulatory law has proven superior to international law to address the problem, although regional legal schemes in the European Union have employed politically inconsistent mechanisms.[10]

This Article compares and analyzes the power exercised over power. Part II sets the scientific foundation for the importance of climate, the accelerating change in climate, and the role of power production and coal use at the center of this change. Part III analyzes international law and legal structures to address climate, focusing on the benefits and shortcomings of the Kyoto Protocol and the European Union climate regulations. Part III also

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7 *See* Steven Ferrey, *Changing Venue of International Governance and Finance: Exercising Legal Control over the $100 Billion per Year Climate Fund?*, 30 WIS. INT'L L.J. 26, 31 (2012) (noting how climate change funding differs from other types of "generic foreign aid").

8 *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014 SYNTHESIS REPORT 18–19 (2015), *available at* https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf (explaining that temperatures one to two degrees Celcius above pre-industrial levels will lead to moderate to high risk of "severe, widespread, and irreversible impacts globally").

9 *See* Steven Ferrey, *Cubing the Kyoto Protocol: Post-Copenhagen Regulatory Reforms to Reset the Global Thermostat*, 28 UCLA J. ENVTL. L. & POL'Y 343, 346 (2011) ("Left unreformed . . . the Kyoto protocol has no chance of success."). The Kyoto Protocol omits coverage of any activities of the three major emitters of carbon in the world (China, United States, and India), as well as 80% of the countries that developed and signed the Protocol, and recently three other major nations, Russia, New Zealand, and Japan, withdrew; there are no enforcement mechanisms, and the Protocol is not effective today. *Id.* at 350, 352; JOHN PRESCOTT, COMMITTEE ON SOCIAL AFFAIRS, HEALTH AND SUSTAINABLE DEVELOPMENT, PARLIAMENTARY ASSEMBLY OF THE COUNCIL OF EUROPE, *CLIMATE CHANGE: A FRAMEWORK FOR A 2015 GLOBAL AGREEMENT* 5 n.5 (2013), *available at* http://www.assembly.coe.int/nw/xml/XRef/X2H-Xref-ViewPDF.asp?FileID=20273&lang=en.

10 *See* Cameron Ferrey & Steven Ferrey, *Past is Prologue: Recent Carbon Regulation Disputes in Europe Shape the U.S. Carbon Future*, 16 MO. ENVTL. L. & POL'Y REV. 650, 655–56 (2009) (discussing regional European Union cap–and–trade strategies); *cf.* Ben Schiller, *Is It Time to Overhaul Europe's Carbon Trading Scheme?*, GUARDIAN, Apr. 28, 2011, http://www.theguardian.com/environment/2011/apr/28/overhaul-europe-carbon-trading-scheme (last visited Nov. 21, 2015) (criticizing the European Union's old climate change approach and proposing "fundamental reforms" such as carbon taxes).

examines Kyoto's Clean Development Mechanism (CDM)[11] as a catalyst for projects in developing countries, and the European Union Greenhouse Gas Emission Trading System (EU ETS) that accommodates and gives monetary value to these CDM credits.

Part IV comparatively analyzes how the United States alternatively addresses carbon at the national and subnational levels. At the federal level, Part IV disaggregates tax policy and recent Obama administration unilateral executive action on a suite of new regulation to limit existing and new coal-fired power plants, evaluating the prospects for long term success with these regulatory initiatives. At the regional and state levels, this Article examines direct incentives of feed-in tariffs (FiTs), renewable portfolio standards (RPS), net metering, and greenhouse gas (GHG) emission restrictions to promote a radical shift to more sustainable power technology.

Part V focuses a microscope on the most important developing countries to look through the shadows of their power development strategies and plans. While enjoying record growth, financial incentives from the Kyoto Protocol CDM program, and unprecedented aid pledges of $100 billion annually, China, India, Indonesia,—three of the four largest populations in the world—and other developing countries are deploying an unprecedented buildout of coal-fired power plants, which alone will make world climate goals unattainable.[12] This provides context for where the world is heading. Part VI concludes with an analysis of the separate legal models which have proven effective in both developed and developing countries to promote sustainability in lieu of high-carbon power. The Article begins with the science of climate and power.

II. CLIMATE CHANGE AND POWER

In terms of warming, it is not the annual emission of unabsorbed carbon into the atmosphere, but the concentration of carbon in the atmosphere from at least the last century of accumulation, which is deemed responsible for climate change.[13] Carbon remains in the atmosphere for at least a

11 Kyoto Protocol to the United Nations Framework Convention on Climate Change art. 12, Dec. 10, 1997, 37 I.L.M. 22 (1998), *available at* http://unfccc.int/resource/docs/convkp/kpeng.pdf [hereinafter Kyoto Protocol].

12 *See infra* Parts II.C, III.A, VI; U.S. CENSUS BUREAU, INTERNATIONAL PROGRAMS COUNTRY RANK (2015), *available at* https://www.census.gov/population/international/data/countryrank/rank.php (click on "2015," "Top 10," and then "Submit").

13 *See, e.g.*, U.S. Envtl. Prot. Agency, *Climate Change Indicators in the United States–Greenhouse Gases*, http://www3.epa.gov/climatechange/science/indicators/ghg (last visited Nov. 21, 2015) ("As greenhouse gas emissions from human activities increase, they build up in the atmosphere and warm the climate . . . ."); U.S. Envtl. Prot. Agency, *Causes of Climate Change*, http://www3.epa.gov/climatechange/science/causes.html (last visited Nov. 21, 2015) ("Since the Industrial Revolution began around 1750, human activities have contributed substantially to climate change by adding CO2 and other heat-trapping gases to the atmosphere. These greenhouse gas emissions have increased the greenhouse effect and caused Earth's temperature to rise.").

hundred years.[14] Of the various sources of carbon emissions, the production of electric power utilizing fossil fuels is the most significant.[15] No developing countries are required to reduce emissions by the Kyoto Protocol, which seeks to limit world carbon emissions.[16] And many developing countries are building coal-fired power generation units at an unprecedented pace which undercuts the ability for arresting tipping over the "tipping point."[17]

A. Climate Change

Climate change is a significant global issue. For the last 800,000 years, Carbon Dioxide (CO_2) levels hovered between approximately 175–300 part per million (ppm) in the atmosphere; they have now increased to 400 ppm.[18] Consequently, the earth is warming and sea levels are rising.[19] 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 these CO_2 emissions, and coal-fired electric power generation accounting for about 70% of the emissions in the electric sector.[20]

Global energy-related emissions are expected to increase 57% from 2005 to 2030.[21] At current rates of energy development, energy-related CO_2 emissions in 2050 would be 237% of their current levels under the existing pattern.[22] There will be fundamental change in human environment and welfare with the consequent warming of the climate.[23]

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14 World Meteorological Organization, *Press Release No. 1002: Record Greenhouse Gas Levels Impact Atmosphere and Oceans*, https://www.wmo.int/pages/mediacentre/press_releases/pr_1002_en.html (last visited Nov. 21, 2015).

15 U.S. Envtl. Prot. Agency, *Overview of Greenhouse Gases*, http://www3.epa.gov/climatechange/ghgemissions/gases/co2.html (last visited Nov. 21, 2015).

16 Kyoto Protocol, *supra* note 11.

17 Brad Plumer, *There Are 2,100 New Coal Plants Being Planned Worldwide—Enough to Cook the Planet*, VOX July 9, 2015, http://www.vox.com/2015/7/9/8922901/coal-renaissance-numbers (last visited Nov. 21, 2015).

18 Jessica Blunden, *2013 State of the Climate: Carbon Dioxide Tops 400 PPM*, CLIMATEWATCH, July 13, 2014, http://www.climate.gov/news-features/understanding-climate/2013-state-climate-carbon-dioxide-tops-400-ppm (last visited Nov. 21, 2015).

19 Intergovernmental Panel on Climate Change, *Climate Change 2007: Working Group I: The Physical Science*, https://www.ipcc.ch/publications_and_data/ar4/wgl/en/faq-2-1.htm (last visted Nov. 21, 2015).

20 J. DE SÉPIBUS, SWISS NAT'L CTR. OF COMPETENCE IN RESEARCH, 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 3–4 (2008), *available at* http://www.phase1.nccr-trade.org/images/stories/publications/IP6/de_Sepibus_EU_libCC_final.pdf.

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

22 WILLIAM C. RAMSAY, INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES: SCENARIOS AND STRATEGIES TO 2050 7 (2006), *available at* http://www.unece.lsu.edu/biofuels/documents/2007July/SRN_020.pdf.

23 *See* The Nature Conservancy, *Climate Change: Threats and Impacts*,

Global emissions need to be in rapid reduction by 2018 in order to have any reasonable chance to avoid climate catastrophe, according to some leading scientists.[24] The international goal of an average 18% reduction achieved by 2020 from 1990 levels by Annex I (developing) countries is not nearly enough to avoid the "tipping point" of a maximum two degrees Celsius rise in global temperature.[25] The United Nations Intergovernmental Panel on Climate Change (IPCC) 2014 report concludes that in order to maintain world warming below two degrees Celsius, there must be a 40%–70% reduction of GHGs emission from 2010 levels by 2050.[26] CO_2 emissions grew 5.9% in 2010, reaching 9.1 Gigatons of Carbon (GtC) (33.5 Gt CO_2) and overshadowing a 1.4% decrease in CO_2 emissions in 2009.[27] The increased combustion of coal represented more than half of the growth in emissions.[28] The World Bank predicts global temperatures could rise by 7.2 degrees Fahrenheit by the end of the century—or sooner, if current modest commitments to curb emissions are not realized.[29]

B. Power's Carbon Push

Power use pushes carbon and climate.[30] With CO_2 constituting 82% of all GHG emissions in the United States, the electric production sector of the economy exceeds transportation, agriculture, industry, and the commercial and residential sectors of the economy in the emission of GHGs.[31]

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http://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts/ (last visited Nov. 21, 2015) (listing "[s]ome of the most dangerous consequences of climate change," including higher temperatures, rising seas, and economic losses).

24 James Hansen et al., *Target Atmospheric CO_2: Where Should Humanity Aim?*, 2 OPEN ATMOSPHERIC SCI. J. 217, 229 (2008) ("Continued growth of greenhouse gas emissions, for just another decade, practically eliminates the possibility of near-term return of atmospheric composition beneath the tipping level for catastrophic effects."); Ferrey, *supra* note 9, at 347 ("Hansen notes that merely waiting until 2018 to stop the 'growth of greenhouse gas Emissions' may make it near impossible to avoid catastrophic effects of warming.").

25 INT'L INST. FOR SUSTAINABLE DEV., SUMMARY OF THE DOHA CLIMATE CHANGE CONFERENCE: 26 NOVEMBER–8 DECEMBER 2012 14 (2012), *available at* http://www.iisd.ca/download/pdf/enb12567e.pdf.

26 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014 SYNTHESIS REPORT 82 (2014), *available at* https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf.

27 Justin Gillis, *Carbon Emissions Show Biggest Jump Ever Recorded*, NY TIMES, Dec. 4, 2011, at A4; Carbon Dioxide Info. Analysis Ctr., *Annual Global Fossil-Fuel Emissions*, http://cdiac.ornl.gov/trends/emis/glo_2010.html (last visited Nov. 21, 2015).

28 Gillis, *supra* note 27, at A4.

29 World Bank, *New Report Examines Risks of 4 Degree Hotter World by End of Century*, Nov. 18, 2012, http://www.worldbank.org/en/news/press-release/2012/11/18/new-report-examines-risks-of-degree-hotter-world-by-end-of-century (last visited Nov. 21, 2015).

30 According to the United States Environmental Protection Agency (EPA) in 2014, power generation was responsible for 70% of the oxides of sulfur (SOx), 13% of the oxides of nitrogen (NOx), and 40% of the carbon dioxide (CO2) emissions in the United States. *See* U.S. Envtl. Prot. Agency, *Air Emissions*, May 22, 2014, http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html (last visited Nov. 21, 2015).

31 The Whitehouse, *Climate Change and President Obama's Action Plan*, http://www.whitehouse.gov/climate-change (last visited Nov. 21, 2015).

Power plants emit more GHGs than any other stationary source category in the United States, generating approximately 40% of all anthropogenic CO_2 emissions in the United States.[32] The Congressional Research Service concluded that "[i]n 2013, fossil fuels accounted for 78.5% of U.S. primary energy production,"[33] as displayed in Table 1.[34] The remaining non-fossil fuel primary energy production was attributed to nuclear electric and renewable energy resources, with shares of 11.4% and 10.1%, respectively.[35]

Table 1: Primary Energy Production by Source, 2013[36]

Source	Quadrillion Btu	Percent of Total
Fossil Fuels		
Coal	20.0	24.4%
Natural Gas	25.0	30.5%
Crude Oil	15.8	19.3%
Natural Gas Plant Liquids	3.5	4.3%
Nuclear		
Nuclear Electric	8.3	10.1%
Renewable Energy		
Hydro-Electric Power	2.6	3.1%
Geothermal	0.2	0.3%
Solar/PV	0.3	0.4%
Wind	1.6	1.9%
Biomass	4.6	5.6%
Total	**81.9**	**100%**

Natural gas power electric generating capacity and renewable energy power generating capacity are beginning to supplant coal generation just in the last five years.[37] Four-fifths of the total energy-related CO_2 emissions permitted to be emitted by 2035 in the so-called "450 Scenario," to keep climate change in manageable dimension below 450 ppm, are already locked in by existing capital stock, including power stations, buildings, and factories.[38] Without further action by 2017, the energy-related infrastructure then in place would generate all the CO_2 emissions allowed in the "450 Scenario" to raise world temperature two degrees for the period up to 2035.[39]

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32 *See* Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392, 22,395 (Apr. 13, 2012).

33 *See* MOLLY F. SHERLOCK, CONG. RESEARCH SERV., R41953, ENERGY TAX INCENTIVES: MEASURING VALUE ACROSS DIFFERENT TYPES OF ENERGY RESOURCES 3 (2015), *available at* http://www.fas.org/sgp/crs/misc/R41953.pdf.

34 *Id.* at 4 tbl. 1.

35 *Id.*

36 *Id.*

37 SNL Energy, *Density of Power Plants by Operating Capacity: Continental United States*, Jul. 9, 2014, http://www.snl.com/Global_Financial_Analysis_Infographics.aspx (last visited Nov. 21, 2015).

38 INT'L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2011 40 (2012), *available at* https://www.iea.org/publications/freepublications/publication/WEO2011_WEB.pdf.

39 *Id.*

The electric power sector offers the most cost-effective opportunities to reduce CO_2 emissions, compared to transportation and other sectors.[40]

C. The Expanding Role of Coal Power

The combustion of coal is deemed responsible for more than half of the growth in emissions.[41] Fifty power plants account for 30% of CO_2 emissions from the U.S. power sector, despite only producing 16% of the nation's electricity.[42] The 50 largest emitting power plants account for more than 2% of global GHGs from the power sector.[43] Countries' recent pledges to fight climate change by cutting their CO_2 emissions are unlikely to dramatically affect global increases in coal use and emissions. According to the International Energy Agency, coal is the fastest-growing fossil fuel internationally, with global demand rising 2.1% annually, driven mainly by China, India, and other expanding Asian economies.[44]

The role of coal is significant in recent history. [45] During the past 150 years, coal has been the dominant energy source for half of this period, and the only energy source consistently among the top three energy sources during the entire period of industrialization. Since its harnessing approximately 135 years ago, electricity has been generated by hydropower and coal-fired power.[46] Coal has been and remains the dominant source of electric production in the United States and the world.[47]

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40 For a comparison of costs of abatement measures across various sectors, see generally Per-Anders Enkvist et al., *A Cost Curve for Greenhouse Gas Reduction*, MCKINSEY QUARTERLY, Feb. 2007, http://www.mckinsey.com/insights/sustainability/a_cost_curve_for_greenhouse_gas_reduction (last visited Nov. 21, 2015) (noting, for example, that the power sector has more abatement potential than other sectors such as transportation, buildings, and agriculture, and provides many cost-effective measures to reduce GHG such as improving energy efficiency, using nuclear energy, and capturing and storing carbon).

41 *See, e.g.*, Lauri Myllyvirta, *China's Fossil Fuel Emissions Fell 3% in 2014*, THE ECOLOGIST, Feb. 27, 2015, http://www.theecologist.org/News/news_round_up/2773053/chinas_fossil_fuel_emissions_fell_3_in_2014.html (last visited Nov. 21, 2015) ("China's coal consumption growth was responsible for more than half of global CO2 emission growth in the past 10 years.").

42 JORDAN SCHNEIDER ET AL., ENVIRONMENT AMERICA RESEARCH & POLICY CENTER AMERICA'S DIRTIEST POWER PLANTS: THEIR OVERSIZED CONTRIBUTION TO GLOBAL WARMING AND WHAT WE CAN DO ABOUT IT 5 (2013) *available at* http://environmentamericacenter.org/sites/environment/files/reports/Dirty%20Power%20Plants.pdf; *50 Power Plants Accounted for 30 Percent Of Carbon Emissions in 2011, Report Says*, 44 Env't Rep. (BNA) No. 36, at 2689, 2705 (Sept. 13, 2013).

43 *50 Power Plants*, *supra* note 42, at 2705.

44 *IEA Says Climate Pledges Won't Halt Global Growth in Coal Demand to 2019*, 45 Env't Rep. (BNA) No. 50, 3640, 3641 (Dec. 19, 2014). "India, averaging 5 percent annual coal demand growth, should pass the U.S. as the world's second-biggest coal consumer by 2019. . . . China, the world's biggest producer and importer of coal, should see coal demand grow 2.6 percent, or 100 million tons, per year to 2019, assuming it maintains an annual gross domestic product growth rate of about 7 percent." *Id.*

45 For an illustration of the use of different energy sources over the past 400 years, see STEVEN FERREY, UNLOCKING THE GLOBAL WARMING TOOLBOX: KEY CHOICES FOR CARBON RESTRICTION AND LEGISLATION 34 Fig. 3-3 (2010).

46 Nat'l Geographic, *Hydropower: Going With the Flow*, http://environment.nationalgeographic.com/environment/global-warming/hydropower-profile/ (last visited Nov. 21,

The electric system historically relies primarily on coal-fired 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/kilowatt hour (Kwh).[48] Approximately 10% of these older coal-fired power plants produce about 43% of the CO_2 emissions.[49] Now, coal and natural gas are supplying an approximately equal share of U.S. energy supply.[50] While gas use is increasing in the U.S. power sector, coal use is increasing internationally.[51] In many developing countries, coal use for power generation is still the current choice for expansion.[52]

Coal is the most carbon-intensive fossil fuel, releasing approximately 29% more carbon per unit of energy generated than does oil, and 80% more than natural gas.[53] Coal-fired power plants also emit significantly more sulfur dioxide (SO_2), nitrogen oxides (NOx), and particulate matter (PM) (three of the six Clean Air Act, Environmental Protection Agency (EPA)-regulated criteria pollutants) per megawatt hour (Mwh) generated compared to natural gas and oil-fired plants, with existing coal units yielding greater emissions per unit of energy produced than newer coal technologies.[54] Coal-fired power generation units also emit more hazardous air emissions, such

2015). *See also* U.S. Dep't of Energy, *A Brief History of Coal Use*, http://www.fe.doe.gov/education/energylessons/coal/coal_history.html (last visited Nov. 21, 2015).

47 *See* U.S. Energy Info. Admin., *History of Energy Consumption in the United States, 1775–2009*, Feb. 9, 2011, http://www.eia.gov/todayinenergy/detail.cfm?id=10 (last visited Nov. 21, 2015); U.S. Energy Info. Admin., *Frequently Asked Questions*, http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3 (last visited Nov. 21, 2015) (stating that coal was the source of 39% of the electricity generated in the United States in 2014); Int'l Energy Agency, *Coal*, http://www.iea.org/topics/coal/ (last visited Nov. 21, 2015) (reporting that "[c]oal currently provides 40% of the world's electricity needs").

48 *What Cost Energy? What Market Prices Fail to Reveal*, ELECTRICITY J., Dec. 2009, at 3 (explaining that the nonclimate external damage from SO_2, NOx, and particulate matter from burning coal costs about 3.2 cents/Kwh and would increase significantly with the inclusion of climate related costs).

49 *Id.*

50 U.S. Energy Info. Admin., *Monthly Coal-and Natural Gas-Fired Generation Equal for First Time in April 2012*, http://www.eia.gov/todayinenergy/detail.cfm?id=6990 (last visited Nov. 21, 2015).

51 U.S. Energy Info. Admin., *Reasons for Projected Natural Gas-Fired Generation Growth Vary by Region*, http://www.eia.gov/todayinenergy/detail.cfm?id=17571 (last visited Nov. 21, 2015) (explaining the reasons behind the growth of natural gas-fired electric power sector); Int'l Energy Agency, *Global Coal Demanded to Reach 9 Billion Tonnes Per Year by 2019*, http://www.iea.org/topics/coal (last visited Nov. 21, 2015) (describing predicted increases in global demand for coal).

52 *See, e.g.*, Ray Ring, *Coal-Export Schemes Ignite Unusual Opposition, from Wyoming to India*, HIGH COUNTRY NEWS, July 25, 2012, *available at* https://www.hcn.org/issues/44.12/coal-export-schemes-ignite-unusual-opposition-from-wyoming-to-india (last visited Nov. 21, 2015) (describing the disturbances that international coal markets have created in both source and consumption communities).

53 STEVEN FERREY, LAW OF INDEPENDENT POWER 6-127 (John Damico, Esq. & Barbara J. Hagen eds., 2013).

54 *Id.* at 6-131.

as mercury, compared to other fossil fuel plants.[55] "Coal is an inherently 'dirty' fuel. Burning it produces sulfur dioxide (SO_2), nitrogen oxides (NOx), particulates, mercury, acid gases, and other pollutants, in greater abundance than other fossil fuels."[56]

III. CARBON STATUTES INTERNATIONALLY IN THE EUROPEAN UNION AND DEVELOPING COUNTRIES

One must either comprehensively address the causes of climate change globally, or if done piecemeal, ineffectively. The Kyoto Protocol, now almost two decades old and a decade into its limitations on carbon, has not achieved it objectives by imposing climate goals and credit incentives for carbon mitigation investments in developing countries, which are "additional."[57] While the world waits to see if a Kyoto subsequent phase can achieve more of the necessary reductions in carbon, there is an additional unprecedented pledge of the largest long-term transfer of wealth in human history to developing countries.[58] There are "incentives" for developing countries and soft "sticks" for developed countries, but still no basis to assess potential success. We examine the carrots and sticks.

A. Internationally: The Kyoto Protocol

The Kyoto Protocol is the international mechanism aimed at controlling the emission of climate change gases to the world biosphere.[59] The European Union separately regulates carbon emissions of its member states to parallel that of the Kyoto Protocol and monetize the value of carbon reductions achieved in otherwise Kyoto-unaffected developing nations.[60] Developing nations also are now poised to benefit from the largest welfare transfer program in history.[61] That transfer is scheduled to provide developing countries with approximately one hundred times the current World Bank or United Nations budget for the purpose of discretionary mitigation of carbon emissions and adaptation to global warming.[62]

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55 *Id.* at 6-132.

56 JAMES MCCARTHY & CLAUDIA COPELAND, CONG. RESEARCH SERV., R41914, EPA'S REGULATION OF COAL POWER: IS A "TRAIN WRECK" COMING? (2011).

57 *See* TOMILOLA AKANLE ENI-IBUKUM, INTERNATIONAL ENVIRONMENTAL LAW AND DISTRIBUTIVE JUSTICE 8 (2014) (discussing "additionality").

58 Ferrey, *supra* note 7, at 30; Juliet Eilperin & Anthony Faiola, *U.S. Pledges Aid, Urges Developing Nations to Cut Emissions*, WASH. POST, Dec. 18, 2009, http://www.washingtonpost.com/wp-dyn/content/article/2009/12/17/AR2009121700165.html (last visited Nov. 21, 2015).

59 Kyoto Protocol, *supra* note 11.

60 European Comm'n, *The EU Emissions Trading System*, http://ec.europa.eu/clima/policies/ets/index_en.htm (last visited Nov. 21, 2015).

61 Ferrey, *supra* note 7, at 30; Eilperin & Faiola, *supra* note 58.

62 *See infra* notes 101–105 and accompanying text.

1. Kyoto's International Mechanism

The Kyoto Protocol was adopted in 1997 at the third session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan.[63] Major developed countries, also known as Annex I parties, committed to reduction targets for the six GHGs suspected of causing global warming in the first compliance period of 2008–2012 and beyond. The Kyoto Treaty requires reduction of six GHGs, which include methane (CH_4), nitrous oxide (NO_2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).[64] Three of the six regulated gases (HFCs, PFCs, and SF_6) were to be reduced by almost all industrialized nations 6%–8% below their 1995 baseline levels.[65] CO_2 and the two other GHGs were to be reduced by most industrialized nations 6%–8% below their 1990 baseline levels by 2012.[66] Emission trading among industrial nations is allowed to supplement countries' efforts to achieve these goals.[67]

The European Community and other industrialized countries[68] agreed to GHG emissions limitations and reduction commitments, while the remaining 155 developing countries among the 192 signatories—including China, the largest GHG emitter among all nations—agreed to nonbinding generic undertakings to limit emissions.[69] Canada has recently withdrawn,[70] while Belarus, Kazakhstan, and Ukraine have stated that they may withdraw from

63 United Nations Framework Convention on Climate Change, *Status of Ratification of the Kyoto Protocol*, http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php (last visited Nov. 21, 2015).

64 Kyoto Protocol, *supra* note 11.

65 *Id.*, art. 3.

66 *Id.*

67 *Id.* A potential purchaser of emission reduction credits can click through information on dozens of projects doing so throughout uncapped regions, such as China, Africa, and Indonesia. *See, e.g.*, CarbonNeutral Company, *Carbon Offsets*, http://www.carbonneutral.com/carbon-offsets (last visited Nov. 21, 2015).

68 The "European community" includes the 28 members of the European Union, plus eight other non-European Union nations in Europe including Belarus, Iceland, Kazakhstan, Liechtenstein, Norway, Switzerland, and Ukraine. Other Annex I parties include Australia, Canada, Japan, New Zealand, and Turkey. United Nations, *List of Annex I Parties to the Convention*, http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php (last visited Nov. 21, 2015).

69 *See* United Nations, *List of Non-Annex I Parties to the* Convention, http://unfccc.int/parties_and_observers/parties/non_annex_i/items/2833.php (last visited Nov. 21, 2015); *See also*, Kyoto Protocol, *supra* note 11 (establishing common but differentiated responsibilities for all parties and setting forth party responsibilities and undertakings); John Vidal and David Adam, *China Overtakes U.S. as World's Biggest CO_2 Emitter*, GUARDIAN, June 19, 2007, http://www.theguardian.com/environment/2007/jun/19/china.usnews (last visited Nov. 21, 2015).

70 *Canada Pulls out of Kyoto Protocol on Climate Change*, USA TODAY, http://www.usatoday.com/news/world/story/2011-12-12/canada-climate-change/51842930/1 (last visited Nov. 21, 2015).

the Protocol.[71] Japan, New Zealand, and Russia—which all participated in Kyoto's first-round commitments through 2012—have not agreed to new targets in the current second commitment period.[72] The net 37 covered Annex I countries subject to Kyoto Protocol carbon emission reductions represent almost 20% of world countries and approximately 40% of world carbon sources.[73] The group of covered countries is responsible for less than half of the world's emissions.

2. Kyoto's Low Carbon CDM Mechanism

The Doha Amendments to extend the Protocol for the period 2013–2020 has not yet been ratified, so the Kyoto-inspired carbon future is still uncertain. Past may be prologue: The April 2008 Bangkok talks following the 2007 United Nations Climate Change conference in Bali concluded that a post-2012 international carbon scheme should look much like the pre-2012 Kyoto regime, including capping and trading of allowances and the creation of additional credits or "offsets" through the existing Kyoto Joint Implementation (JI) and CDM.[74]

The CDM allows projects that reduce GHGs in developing nations to earn certified emission reduction credits (CERs) for each ton of CO_2-equivalent of GHG reduced.[75] Those CERs are then traded or sold to regulated entities conducting activities in Annex I countries, which require emission credits, and simultaneously increase those countries' emission caps allocated in the Protocol.[76] CER credits generate value for a maximum

71 Andrew Allan & Marton Kruppa, *Belarus Negotiator Hints at Kyoto Exit, Says Others Could Follow*, UK REUTERS, Dec. 10, 2012, http://uk.reuters.com/article/2012/12/10/us-climate-talks-kyoto-idUKBRE8B90ZY20121210 (last visited Nov. 21, 2015).

72 PRESCOTT, *supra* note 9, at 4 n.5.

73 There are 195 recognized countries in the world. CIA World Factbook, *World Factbook, Government: World*, https://www.cia.gov/library/publications/resources/the-world-factbook/geos/xx.html (last visited Nov. 21, 2015). The 40% figure can be calculated using the data available here: U.N. Framework Convention on Climate Change, *GHG Data from UNFCCC*, http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php (last visited Nov. 21, 2015).

74 *"Progress" of Bangkok Talks Shows Much Still to be Done for 2009 Global Agreement*, 39 Env't Rep. (BNA) No. 15, at 704 (Apr. 11, 2008). For a description of JI, see United Nations Framework Convention on Climate Change, *Joint Implementation*, http://unfccc.int/kyoto_protocol/mechanisms/joint_implementation/items/1674.php (last visited Nov. 21, 2015). For a description of the CDM, see United Nations Framework Convention on Climate Change, *Clean Development Mechanism*, http://cdm.unfccc.int/about/index.html (last visited Nov. 21, 2015).

75 Kyoto Protocol, *supra* note 11; United Nations Framework Convention on Climate Change, Marrakesh, Morocco, Oct. 29–Nov. 10, 2001, *Report of the Conference of the Parties on its Seventh Session—Part Two: Action Taken by the Conference of the Parties (Vol. II)*, U.N. Doc. FCCC/CP/13/Add.2 dec.17/CP.7, Annex, para. 1(b) (Jan. 21, 2002) [hereinafter Marrakesh Accords].

76 Kyoto Protocol, *supra* note 11, at art. 12(3)(b). Two and one half percent of Emission Reduction Units (ERUs) and CERs were eligible to be carried over to the second phase of implementation after 2012. Marrakesh Accords, *supra* note 75, at dec. 17/CP.7, Annex para. 1(a)–(b).

of seven years with two renewals—twenty-one total years—or a maximum of ten years with no renewal.[77]

CDM projects may be pursued by registration of the credit through Annex I countries.[78] Thus, the CDM activity is credited or monetized by acquisition and registration of the CER by a regulated entity in a developed and Kyoto-regulated Annex I country. The first CDM project credit was registered in February 2005; by 2013, the CDM had approved more than 5,000 offset projects, with another several thousand awaiting approval;[79] by the end of 2015, there will be more than 7,500 CDM projects, creating 4.7 billion potential CERs.[80]

All emissions reduction CERs certified under the CDM are required by the Protocol to be voluntary, real, and additional to any that would occur in the absence of the CDM credit system.[81] "Renewable energy projects alone account for 28 percent [of CDM CERs]. . . . [Methane]-capture and flaring projects, mostly located at large landfills, coal mines, and [Concentrated Animal Feeding Operations], account for another 19 percent."[82]

The other mechanism for shifting credits necessary for carbon emission compliance is JI, where Annex I parties can implement projects domestically or in other Annex I nations that remove GHGs or create additional carbon sinks, which are then quantified as transferable Emission Reduction Unit (ERU) credits.[83] Unlike CDM projects, JI projects are undertaken by and in

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77 *See* Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Montreal, Can., Nov. 28– Dec. 10, 2005, *Addendum—Part Two: Action Taken by the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol at its First Session*, dec. 3/CMP.1, Annex, ¶ 49, dec. 4/CMP.1, Annex II ¶ 29, U.N. Doc. FCCC/KP/CMP/2005/8/Add.1 (Mar. 30, 2006) [hereinafter *2006 COP/MOP-1 Report*] (describing crediting periods for CDM projects).

78 *Id.* at art. 12, app. D.

79 Press Release, United Nations Framework Convention on Climate Change, The Kyoto Protocol's Clean Development Mechanism Takes Off: First CDM Project Registered (Nov. 18, 2004), *available at* https://cdm.unfccc.int/press/releases/2004_02.pdf; *see* United Nations Framework Convention on Climate Change, *CDM Insights: Data as of 31 December 2012*, http://cdm.unfccc.int/Statistics/Public/archives/201212/index.html (last visited Nov. 21, 2015) (presenting data showing that by December 31, 2012, 5,511 CDM projects were registered, 546 were requesting registration, 1407 were pending registration, and 44 were requesting review).

80 *See* United Nations Convention on Climate Change, *CDM Insights: Data as of 28 February 2015*, http://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html (last visited Nov. 21, 2015) (presenting data showing that by February 28, 2015, 7,598 CDM projects were registered, creating a potential supply of 4,723,704,757 CERs to the end of 2015).

81 Kyoto Protocol, *supra* note 11, art. 12, ¶¶ 5(a)–(c).

82 Michael Wara, *Measuring the Clean Development Mechanism's Performance and Potential*, 55 UCLA L. REV. 1759, 1778–79 (2008).

83 *See* United Nations Framework Convention on Climate Change, *Joint Implementation (JI)*, http://unfccc.int/kyoto_protocol/mechanisms/joint_implementation/items/1674.php (last visited Nov. 21, 2015) [hereinafter *Joint Implementation*] (stating that "joint implementation" is defined in Article 6 of the Kyoto Protocol and describing JI projects generally); Kyoto Protocol, *supra* note 11, art. 3, ¶ 1, art. 6, ¶ 1 (describing quantified emission limitation and reduction commitments of Annex I parties as inscribed in Annex B, and declaring that such parties may transfer or acquire ERUs from other Annex I parties).

Annex I countries.[84] Unlike a CDM CER, which creates an additional emission credit added to the allocated national cap of GHG emissions, a JI project transfers a credit under the existing cap from one nation to another nation, netting a zero-sum transaction in total allowed global emissions.[85] Thus, the emission cap of any country includes assigned Kyoto credit units plus removal units (RMUs) from forestation projects that remove CO_2 from the atmosphere, plus JI ERUs and CDM CERs.

JI projects are accompanied by less burdensome transaction costs than CDM projects, as the former are approved and administered by the parties involved, rather than the U.N. Kyoto Executive Board, and JI projects are not subject to detailed periodic monitoring.[86] Under the Kyoto Protocol, CDM CERs and JI ERUs can be used in future compliance to satisfy up to 2.5% of a regulated party's emissions, with E.U. compliance penalties of 100 euros per ton for failure to have enough emission credits during the first compliance period between January 2008 and December 2012.[87] CERs are only created for projects that reduce GHGs in excess of the business-as-usual baseline emissions of one of the six regulated GHGs.[88] It is mandatory that there must be "additionality" of carbon reduction resulting from the project.[89]

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84 *See 2006 COP.MOP-1 Report*, *supra* note 77, at dec 9.CMP 1, Annex ¶21 (stating that "a Party included in Annex I with a commitment inscribed in Annex B is eligible to transfer and/or acquire ERUs issued in accordance with the relevant provisions" contingent on compliance with certain eligibility requirements); *Joint Implementation*, *supra* note 83 (stating that the projects occur "in another Annex B Party").

85 *Compare* Kyoto Protocol, *supra* note 11, art. 6, ¶ 1(d) (stating that ERUs are "supplemental to domestic actions" for meeting Article 3 commitments), *with id.* art. 12, ¶ 5(c) (stating that CERs are "additional to any that would occur in the absence of the certified project activity"). Whereas the CDM process creates additional room in the envelope of permissible carbon emissions by developed nations, the JI process transfers a static quantity of existing allocated credits under the cap from one developed nation to another. Thus, the emission cap of any country includes assigned Kyoto credit units plus removal units (RMUs) from forestation projects that remove CO_2 from the atmosphere, plus JI ERUs and CDM CERs.

86 John McMorris, *Running a Carbon Project*, *in* CLIMATE CHANGE: A GUIDE TO CARBON LAW AND PRACTICE 57 (Paul Q. Watchman ed., 2008).

87 Marrakesh Accords, *supra* note 75, at Dec. 19/CP.7, Annex, ¶ 15; *see* Council Directive 2003/87, art 16, ¶¶ 3–4, Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC, 2003 O.J. (L 275) 32 (EC) [hereinafter Council Directive 2003/87], *available at* http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02003L0087-20090625&from=EN (describing penalties of 100 euros every compliance period with increasing penalties beginning January 1, 2013).

88 *See* Kyoto Protocol, *supra* note 11, art. 3, ¶ 1, art. 12, ¶¶ 3(b), 5(c), Annex A (binding Annex I parties to stay below assigned amounts and reduction commitments for the six GHGs in Annex A, and stating that Annex I parties can use CERs to meet Article 3 commitments, as long as such CERs are "additional to any [reductions] that would occur in the absence of the certified project activity").

89 *See id.*, art. 12, ¶ 5(c) (stating that CERs are "additional to any that would occur in the absence of the certified project activity").

B. Europe: European Union Greenhouse Gas Emission Trading System Regulation

The EU ETS carbon regulation was implemented effective 2005 as a parallel CO_2 regulatory system to the Kyoto Protocol, with an earlier start for the now twenty-eight E.U. member countries and three other participating European countries (Norway, Iceland, and Liechtenstein).[90] Every E.U. country must comply with the EU ETS, which includes 85% of world countries subject to binding regulation on carbon emissions under the Kyoto Protocol.[91] The EU ETS covers CO_2 emissions at approximately 5,000 companies at 12,000 industrial sites, unlike the Kyoto Protocol, which covers all GHG emissions.[92] The EU ETS utilizes National Allocation Plans for the initially free distribution of carbon emission allowances.[93] The quantity of allowances a nation can issue is governed by eleven EU ETS criteria, but otherwise the EU does not explicitly proscribe national discretion.[94]

Many of these provisions of the EU ETS are now similar to those of the Regional Greenhouse Gas Initiative (RGGI) Program in the United States, which began in 2009,[95] including EU ETS auction of carbon emission allowances increasing from 20% auction-allocated in 2013 to 70% auction-allocated in 2020, and entirely auction-allocated allowances by 2027.[96] Starting in 2013 in the EU, a renewable energy portfolio requirement requires each country to achieve a certain percentage of renewable power

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90 EUROPEAN COMMISSION, THE EU EMISSIONS TRADING SYSTEM (EU ETS) (2013) [hereinafter EU ETS FACTSHEET], *available at* http://ec.europa.eu/clima/publications/docs/factsheet_ets_en.pdf. The EU ETS directive went into effect on October 13, 2003. *See id.* (describing how the EU ETS is established); Council Directive 2003/87/EC, *supra* note 87, pmbl. (declaring that the directive "identifies climate change as a priority for action and provides for the establishment of a Community-wide emissions trading scheme by 2005").

91 *See* Kyoto Protocol, *supra* note 11, Annex B (identifying 40 countries subject to emissions limitations); EU ETS FACTSHEET, *supra* note 90 (stating that the EU ETS covers emissions sources in the 28 EU member states as well as Iceland, Liechenstein, and Norway).

92 *Compare* OurClimate, *The Emission Trading Scheme: On December 17th 2008, the European Parliament Voted in Favor of the EU ETS Review*, http://www.ourclimate.eu/ourclimate/ourclimate/euets.aspx (last visited Nov. 21, 2015), *with* Kyoto Protocol, *supra* note 11, art. 3.

93 Council Directive 2003/87/EC, *supra* note 87, arts. 9–11.

94 Communication from the Commission on Guidance to Assist Member States in the Implementation of the Criteria Listed in Annex III to Directive 2003/87/EC Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC, and on the Circumstances Under Which Force Majeure is Demonstrated, ¶ 5, COM (2003) 830 final (Jan. 7, 2004), *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0830:FIN: en:PDF.

95 Council Directive 2009/29/EC, Amending Directive 2003/87/EC so as to Improve and Extend the Greenhouse Gas Emission Allowance Trading Scheme of the Community, 2009 O.J. (L140) 63, *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:en:PDF [hereinafter Council Directive 2009/29]; Reg'l Greenhouse Gas Initiative, *About the Regional Greenhouse Gas Initiative (RGGI)*, *available at* https://www.rggi.org/docs/Documents/RGGI_Fact_Sheet.pdf.

96 Council Directive 2009/29, *supra* note 95**,** ¶¶ 13, 15, 21; Reg'l Greenhouse Gas Initiative, *CO2 Auctions*, http://www.rggi.org/market/co2_auctions (last visited Nov. 21, 2015).

production and use, with different renewable target percentages for different countries.[97]

C. International Sustainable Development Financing

There is now a proven regulatory mechanism—demonstrated successfully in several developing countries in which the author has worked—which would arrest rapid increase in carbon emissions in major developing countries.[98] To finance such mechanisms, developed countries have committed to the largest sustained international transfer of wealth in history—a commitment of an additional $100 billion/year of foreign aid continuing indefinitely in perpetuity—for the explicit purpose of dealing with global warming risk.[99] The United Nations Climate Change Conference in Copenhagen set a goal of mobilizing $100 billion per year by 2020 to support mitigation and adaptation activities in developing countries, plus USD $30 billion in "fast start" finance during 2010–2012.[100]

The $100 billion is an unprecedented shift of resources among nations, and it is permanent. By comparison, the total annual U.N. budget is $1.9 billion;[101] added peacekeeping operations raise annual U.N. expenditures to $15 billion.[102] About half of this latter amount comes from mandatory U.N. assessments, and the other half from voluntary donations by member nations.[103] The annual operating budget of the World Bank—excluding loans and grants—is approximately $1.3 billion.[104] The annual budget of the IMF, which has a smaller staff, is approximately $1 billion annually for administration, in addition to its lending.[105]

This fund could be the key mechanism to finance power infrastructure to abate GHG emissions in developing nations. The critical issues in administering this most important financing mechanism are discussed at

97 Council Directive 2009/29, *supra* note 95, ¶¶ 18, 28; Reg'l Greenhouse Gas Initiative, *State Investment Pages*, http://www.rggi.org/rggi_benefits/program_investments (last visited Nov. 21, 2015).

98 *See generally* STEVEN FERREY & ANIL CABRAAL, RENEWABLE POWER IN DEVELOPING COUNTRIES: WINNING THE WAR ON GLOBAL WARMING 67–69 (2006) (discussing five developing nations' renewable energy programs to reduce emission of GHGs).

99 U.N. SECRETARY-GENERAL, SECRETARY-GENERAL'S HIGH-LEVEL ADVISORY GROUP ON CLIMATE CHANGE FINANCING 2, 7 (Nov. 5, 2010), *available at* http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/AGF%20Report.pdf [hereinafter U.N. SECRETARY-GENERAL].

100 *Id.* at 7.

101 Steven Ferrey, *Changing Venue of International Governance and Finance: Exercising Legal Control over the $100 Billion per Year Climate Fund?* 30 WIS. INT'L L.J. 26, 33 (2012).

102 *Id.*; United Nations, *Financing Peacekeeping*, http://www.un.org/en/peacekeeping/operations/financing.shtml (last visited Nov. 21, 2015).

103 Ferrey, *Changing Venue*, *supra* note 101, at 33; United Nations, *Financing Peacekeeping*, http://www.un.org/en/peacekeeping/operations/financing.shtml (last visited Nov. 21, 2015).

104 Ferrey, *Changing Venue*, *supra* note 101, at 35.

105 *Id.*; *see* INT'L MONETARY FUND, ANNUAL REPORT 2014: FROM STABILIZATION TO SUSTAINABLE GROWTH tbl.5.1 (2014), *available at* http://www.imf.org/external/pubs/ft/ar/2014/eng/pdf/ar14_eng.pdf.

length in a separate article written by the author.[106] The fund is currently administered in Songdo, Korea.[107]

Historically, GHG reduction pledges were made by developed countries at the 1997 Kyoto Protocol;[108] at the 2007 Bali COP-13;[109] at the 2009 Copenhagen COP-15;[110] at the 2010 Cancun COP-16,[111] where the "Cancun Agreements" attempt to limit GHG emissions to hold temperature rise to 1.5 degrees Celsius;[112] at the 2011 Durban COP-17 along with a fast-start interim financing pledge,[113] and at the 2012 Doha COP-18, which needed to adopt a second commitment period.[114] However, the 2013 COP-19 held in Warsaw and the 2014 COP-20 in Lima did not advance any progress on the commitments or a new commitment period.[115]

106 Ferrey, *Changing Venue*, *supra* note 101.

107 Gwynne Taraska, *U.S Pledges $3 Billion to Developing Countries in the Global Fight Against Climate Change*, CLIMATE PROGRESS, Nov. 16, 2014, http://thinkprogress.org/climate/2014/11/15/3592756/us-carbon-fund-pledge-developing-countries/ (last visited Nov. 21, 2015); *see also* Carey L. Biron, *Global South Brings United Front to Green Climate Fund*, INTER PRESS SERV., Oct. 24, 2014, http://www.ipsnews.net/2014/10/global-south-brings-united-front-to-green-climate-fund/ (last visited Nov. 21, 2015).

108 *See* U.N. Framework Convention on Climate Change, *Kyoto Protocol*, http://unfccc.int/kyoto_protocol/items/2830.php (last visited Nov. 21, 2015) (discussing the Kyoto Protocol and its adoption).

109 *See* U.N. Framework Convention on Climate Change, Bali, Indon., Dec. 3–15, 2007, *Report of the Conference of the Parties on its Thirteenth Session*, U.N. Doc. FCCC/CP/2007/6/Add.1, at 3 (March 14, 2008), *available at* http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf (establishing the "Bali Action Plan"); *see also Deal Agreed in Bali Climate Talks*, GUARDIAN, Dec. 15, 2007, http://www.theguardian.co.uk/environment/2007/dec/15/bali.climatechange4 (last visited Nov. 21, 2015); Jessica Aldred, *Q&A: Bali Climate Change Conference*, GUARDIAN, Dec. 3, 2007, http://www.theguardian.co.uk/environment/2007/nov/30/bali.climatechange (last visited Nov. 21, 2015).

110 *See* U.N. Framework Convention on Climate Change, Copenhagen, Den., Dec. 7–19, 2009, *Report of the Conference of the Parties its Fifteenth Session*, U.N. Doc. FCCC/CP/2009/11/Add.1, at 4–7 (March 30, 2010), *available at* http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf#page=4 (establishing the "Copenhagen Accord").

111 *See* U.N. Framework Convention on Climate Change, *The Cancun Agreements*, http://cancun.unfccc.int/ (last visited Nov. 21, 2015).

112 U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, REPORT OF THE CONFERENCE OF THE PARTIES ON ITS SIXTEENTH SESSION, HELD IN CANCUN FROM 29 NOVEMBER TO 10 DECEMBER 2010 3 (2011), *available at* http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf.

113 *See* WORLD RES. INSTITUTES, SUMMARY OF DEVELOPED COUNTRY FAST-START CLIMATE FINANCE PLEDGES (2010), *available at* http://pdf.wri.org/climate_finance_pledges_2010-10-27.pdf; United Nations Framework Convention on Climate Change, *Fast-Start Finance*, unfccc.int/cooperation_support/financial_mechanism/fast_start_finance/items/5646.php (last visited Nov. 21, 2015).

114 *Summary of the Doha Climate Change Conference: 26 November–8 December 2012*, EARTH NEGOTIATIONS BULLETIN, Dec. 11, 2012, at 1, *available at* http://www.iisd.ca/download/pdf/enb12567e.pdf.

115 *See*, Elliot Diringer, *COP 20: Why Lima Was So Tough*, THE ENERGY COLLECTIVE, http://www.theenergycollective.com/falwellp/2172131/why-lima-was-so-tough (last visited Nov. 21, 2015); Lucas Schoeppner, *COP-19 in Warsaw Overshadowed by Coal*, TRIPLE PUNDIT, http://www.triplepundit.com/2013/11/cop-19-climate-conference-polish-people-coal/ (last visited Nov. 21, 2015).

D. Carbon Additionality Requirements at Law

The quid pro quo for offsets has been the requirement for additionality.[116] Although it can vary in each program, almost all world carbon reduction certification standards require some form of additionality.[117] Additionality refers to the determination that a proposed offset will produce extra reductions in emissions compared to a projected future scenario without the offset, otherwise known as the baseline.[118]

Programs require that eligible offsets must be "additional" in legal or regulatory additionality, common practice or technological additionality, and financial additionality.[119] Legal or regulatory additionality requires a project to provide GHG emissions reduction beyond that required by law.[120] Financial additionality asks whether or not the project would be financially attractive to the site without offset funding.[121] There are several prongs to the CDM's additionality requirement, including a common practice test, a government incentive test (legal additionality, timing test), that requires a showing that CDM incentive was seriously considered in project decision-making, and an investment or barrier analysis (financial additionality).[122]

A lawsuit in California by advocates for low-income interests attacked the California climate control legislation on the basis that its compliance requirements would be met principally by offsets from out-of-state or even international locations, without any assurance that the offsets would be additional to business-as-usual policies in California.[123] Plaintiffs argued that the regulation was *ultra vires* to the administrative power of the California

116 "Additionality" is the requirement in most carbon control statutes or regulations that only "additional" or non-business-as-usual carbon-reduction projects legally qualify to create carbon "offsets," "which are tradable credits for compliance with these carbon policies. *See* REGIONAL GREENHOUSE GAS INITIATIVE MODEL RULE 106–07 (Jan. 5, 2007) [hereinafter RGGI MODEL RULE], *available at* http://www.rggi.org/docs/model_rule_corrected_1_5_07.pdf; PERVAZE A. SHEIKH & ROSS W. GORTE, CONG. RESEARCH SERV., RL34634, CLIMATE CHANGE AND INTERNATIONAL DEFORESTATION: LEGISLATIVE ANALYSIS CRS-5, tbl.1 (2008).

117 *See* Brian Joseph McFarland, *Carbon Reduction Projects and the Concept of Additionality*, SUSTAINABLE DEV. L. & POL'Y, Winter 2011, at 16 (stating every major offset credit standard requires some form of additionality).

118 *Id.* at 15–16 (explaining the concept of additionality).

119 *Id. See also* Michael Gillenwater, *What is Additionality? Part 1: A Longstanding Problem*, 19–21(GHG Mgmt Inst., Discussion Paper No. 001, 2012), *available at* http://ghginstitute.org/wp-content/uploads/2015/04/AdditionalityPaper_Part-1ver3FINAL.pdf (displaying in table 2 many different kinds of additionality, many of which are very similar to or synonymous with legal, common practice, technological, or financial additionality).

120 Gillenwater, *supra* note 119, at 18 (listing and describing Regulatory Additionality in table 2); *see also* McFarland, *supra* note 117, at 15–16 (explaining legal additionality).

121 *See* Gillenwater, *supra* note 119, at 18–19 (listing and describing financial, investment, and barrier additionality in table 2); McFarland, *supra* note 117, at 16–17 (explaining financial additionality).

122 *See* Mark C. Trexler et al., *A Statistically-Driven Approach to Offset-Based GHG Additionality Determinations: What Can We Learn?*, SUSTAINABLE DEV. L. & POL'Y, Winter 2006, at 31, tbl.1 (describing the multiprong additionality test of the CDM).

123 Statement of Decision Re: Petition for Writ of Mandate, Citizens Climate Lobby v. California Air Res. Bd., No. CGC-12-519554, 2013 WL 861396, at *7 (Cal. Sup. Jan. 25, 2013).

Air Resources Board (CARB).[124] The California trial court rejected both arguments,[125] deferring to CARB's expertise and experience and demurring to CARB's choice of methodology.[126]

IV. UNITED STATES DIRECT AND INDIRECT CARBON REGULATION

Efforts to enact carbon control in the United States at the federal level failed in 2009 and 2010.[127] Nonetheless, without any action by the legislative branch to make new law, U.S. GHG emissions have declined.[128] Some of this is due to the recession in demand for power and decreasing prices of natural gas,[129] an alternative fossil fuel to coal for power generation.

A. Federal Tax Policy

Coal and other fossil fuels which together produce two-thirds of U.S. power, with a recent shift during the Bush Administration in 2008, now receive less than half of the total federal tax subsidy amounts for energy.[130] 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.[131] Of this, approximately one-third ($6.3 billion) was given for tax incentives for the use of renewable fuels.[132] "Another $6.7 billion can be attributed to tax-related incentives supporting various renewable energy technologies,"[133] and targeted tax incentives for the use of fossil energy resources amounted to $2.4 billion.[134] "In 2010, nearly half of the tax incentives for renewables benefitted biofuels,"[135] and "[f]rom 2009 onwards, the increased costs associated with

124 Petition for Writ of Mandate and Complaint for Declaratory and Injunctive Relief at 3–4, Citizens Climate Lobby v. California Air Res. Bd., No. CGC-12-519554 (Cal. Sup. Mar. 28, 2012); Our Children's Earth Found. v. Cal. Air Res. Bd., No. A138830 (Cal. Ct. App. Feb. 23, 2015).

125 The court concluded that plaintiffs had "failed to demonstrate that the Legislature foreclosed the use of standardized additionality mechanisms or demonstrate that [CARB] acted arbitrarily or capriciously in promulgating additionality standards." *Citizens Climate Lobby*, at *20; *see also*, *Our Children's Earth Found*, at 23–24 (finding that the "voluminous" administrative record the California Air Resources Board produced in promulgating the regulations for the program supports the agency's policy decisions).

126 Citizens Climate Lobby, at *18, *20.

127 Ryan Lizza, *As the World Burns*, NEW YORKER, Oct. 11, 2010, http://www.newyorker.com/magazine/2010/10/11/as-the-world-burns (last visited Nov. 21, 2015).

128 U.S. ENVTL. PROT. AGENCY, DRAFT INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS 2-1 (2015), *available at* http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Chapter-2-Trends.pdf.

129 *Id.* at 2-1, 2-3.

130 MOLLY F. SHERLOCK, CONG. RESEARCH SERV., R41953, ENERGY TAX INCENTIVES: MEASURING VALUE ACROSS DIFFERENT TYPES OF ENERGY RESOURCES 11, 14–15, figure 2 (2015).

131 *Id.* at 6–7 tbl.2.

132 *Id.* at 10.

133 *Id.* at 7 tbl.2, 22.

134 *Id.*

135 *Id.* at 10 ("Of the estimated $19.1 billion in energy tax provisions in 2010, an estimated $6.3 billion, or 33.0%, went toward supporting biofuels.").

incentives for renewable electricity are largely attributable to the Section 1603 grants in lieu of tax credit program."[136]

Table 2 compares subsidies for electricity production by fuel type.[137] Again, as of this date, fossil fuels receive a much smaller percentage allocation than their share of electric production. "Although 44.9% of 2010 generation can be attributed to coal . . . coal received an estimated 10% [of direct federal financial support]."[138] Correspondingly, renewable sources receive a much larger portion of electric production than their share.

Table 2: Subsidies to Electricity Production by Fuel Type, 2010
(Dollar values 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%
Natural Gas and Petroleum Liquids	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 and Distribution	(i)	(i)	58	924	8.2%
Total	**4,091**	**100%**	**3,382**	**8,502**	**100%**

B. United States Unilateral Executive Actions Targeting CO_2

A fundamental change is occurring in the United States, in large part through the regulation of pollutants implemented through unilateral executive actions regarding CO_2 emissions. The Obama Administration is moving through unilateral executive action toward 32% reduction of annual

136 *Id.* at 11. The Section 1603 grant option is not available for projects that began construction after December 31, 2011. For additional background, see 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 25 (2011), *available at* http://archives.republicans.energycommerce.house.gov/Media/file/PDFs/110911CRS1603report.pdf.

137 SHERLOCK, *supra* note 130, at 15 tbl.4. The data is taken from the EIA. *Id.*

138 *Id.* at 14. This is similar to the EIA's data for 2007, "where 47.6% of generation was attributable to coal, while coal received 12.7% of the total federal financial support for electricity production."

CO_2 emissions by 2030, compared to a baseline of 2005 emission levels, with a glide path toward this goal to begin in 2022.[139] In the interim, EPA is cutting NOx, PM, and SO_2 emission limits, which with coal power generation are all related to combustion of the fuel.[140] EPA estimates that this will cost private power generators from $5.1 billion to $8.4 billion.[141] EPA has issued a series of regulations, affecting criteria pollutant National Ambient Air Quality Standards (NAAQS) tightening, regulation of interstate air pollution, coal ash and mercury regulation, and CO_2 limitations on new and existing fossil fuel-fired power plants. Coal generation emits more of the regulated and targeted air emissions than other fuels per Mwh of power generated.[142]

1. New Power Generation Sources

President Obama issued a Presidential Memorandum directing the EPA to "work expeditiously to complete 'carbon pollution' standards for both new and existing power plants."[143] In response, the EPA released the Clean Power Plan, which will regulate carbon emissions from new and existing power plants.[144] Section 111(d) regulates existing sources that are not regulated under other sections of the Act.[145] EPA enacted executive branch

139 Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. 64,662, 64,665–66 (Oct. 23, 2015) (to be codified at 40 C.F.R. Pt.60).

140 Wendy Koch, *EPA Seeks 30% Cut in Power Plant Carbon Emissions by 2030*, USA TODAY, June 3, 2014, http://www.usatoday.com/story/money/business/2014/06/02/epa-proposes-sharp-cuts-power-plant-emissions/9859913/ (last visited Nov. 21, 2015); *See Nitrogen Dioxide (NO2) Standards–Table of Historical NO2 NAAQS*, U.S. Envtl. Prot. Agency, http://www.epa.gov/ttn/naaqs/standards/nox/s_nox_history.html (last visited Nov. 21, 2015) (setting forth changing limits on NOx); *Particulate Matter (PM) Standards–Table of Historical PM NAAQS*, U.S. Envtl. Prot. Agency, http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_history.html (last visited Nov. 21, 2015) (setting forth changing limits on PM); *Sulfur Dioxide (SO2) Primary Standards–Table of Historical SO2 NAAQS*, U.S. Envtl. Prot. Agency, http://www.epa.gov/ttn/naaqs/standards/so2/s_so2_history.html (last visited Nov. 21, 2015) (setting forth changing limits on sulfur dioxide).

141 Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,679 (estimating total compliance costs of the final regulations in 2030 at $5.1 billion under mass-based approaches and $8.4 billion under rate-based approaches).

142 *See* MCCARTHY & COPELAND, *supra* note 56, at 6 (noting that fossil-fueled power plants, the vast majority of which are coal-fired, contribute a significant percentage of total U.S. air emissions including 60% of the arsenic, 60% of the SO_2, 13% of the NOX, 30% of the nickel, 20% of the chromium, and 50% of the mercury).

143 Robert Varela, *Obama Directs EPA to Issue Carbon Standards for New and Existing Power Plants as Part of Climate Change Plan*, PUBLIC POWER DAILY, June 26, 2013, http://www.publicpower.org/media/daily/ArticleDetail.cfm?ItemNumber=38218 (last visited Nov. 21, 2015); *see* Presidential Memorandum, White House Office of the Press Secretary, *Power Sector Carbon Pollution Standards*, Jun. 25, 2013, https://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards (last visited Nov. 21, 2015).

144 Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,663; Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources, 80 Fed. Reg. 64,510, 64,511 (Oct. 23, 2015) (to be codified at 40 CFR Parts 60, 70, 71, and 98).

145 *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,711. Section 111(d) has been used only five times because most other categories of

regulations for new CO_2 emitting power plants under section 111(b) of the Clean Air Act, to which Best System of Emission Reduction (BSER) applies, which would effectively make conventional coal-burning power technology impossible for new plants, without new technology.[146]

The U.S. Supreme Court upheld these EPA rules in part, although limiting the scope of discretion afforded EPA to take action.[147] The Supreme Court struck the EPA's resurrection and application of its so-called "tailoring rule" to allow it to not apply air regulation to any sources which had the potential to emit greater than 250 tons per year (tpy), instead arbitrarily increasing the statutory threshold by exempting all facilities less than 100,000 tpy of CO_2.[148] Striking down the tailoring rule prevented EPA from regulating carbon emissions from new sources, as doing so would have vastly expanded EPA's regulatory authority: "When an agency claims to discover in a long-extant statute an unheralded power to regulate a significant portion of the American economy . . . we typically greet its announcement with a measure of skepticism."[149]

In ruling against EPA, the Supreme Court stated that "EPA therefore lacked authority to 'tailor' the Act's unambiguous numerical thresholds to accommodate its greenhouse-gas-inclusive interpretation of the permitting triggers."[150] Further, "[a]gencies . . .must always 'give effect to the unambiguously expressed intent of Congress.'"[151] "The power of executing

sources are addressed in other sections of the Clean Air Act. Jennelle Arthur, *Arguments of the Opposition to EPA's Clean Power Plan*, LAW360, http://www.law360.com/articles/563360/arguments-of-the-opposition-to-epa-s-clean-power-plan (last visited Nov. 21, 2015). Section 111(d) differs from 111(b) as it requires states to create EPA guided "performance standards for existing sources." *Compare* Clean Air Act, 42 U.S.C. § 7411(b)(1)(B) (recognizing "the Administrator shall publish proposed regulations, establishing Federal standards of performance"), *with id.* § 7411(d)(1) (recognizing "[t]he Administrator shall prescribe regulations . . . under which each state shall submit to the Administrator a plan which (A) establishes standards of performance"). Section 111(d) cannot be used to regulate existing sources unless section 111(b) has already established new source performance standards, for new or modified sources. *Id.* § 7411(d)(1)(A)(ii) (2012).

146 *See* Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources, 80 Fed. Reg. at 64,513 (establishing a BSER consistent with a highly efficient supercritical pulverized coal boiler implementing partial carbon capture and sequestration). EPA previously proposed CO_2 emission standards for new power plants in 2012, but withdrew the proposed rule after taking comment. *See* Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units**,** 77 Fed. Reg. 22,392, 22,394 (proposed Apr. 13, 2012); Withdrawal of Proposed Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1352 (Jan. 8, 2014) (withdrawing proposal). *See also* JAMES E. MCCARTHY, CONG. RESEARCH SERV., R43127, EPA STANDARDS FOR GREENHOUSE GAS EMISSIONS FROM POWER PLANTS: MANY QUESTIONS, SOME ANSWERS SUMMARY (2013) (noting that because "[c]oalfired plants would find it impossible to meet the standard" without utilizing carbon capture and storage technology and will likely be powered by low cost natural gas, the standards "can be met without add-on emissions controls").

147 Util. Air Regulatory Group v. U.S. Envtl. Prot. Agency, 134 S. Ct. 2427, 2449 (2014).

148 *Id.* at 2444–45.

149 *Id.* at 2444.

150 *Id.* at 2446.

151 *Id.* at 2445.

the laws . . . does not include a power to revise clear statutory terms that turn out not to work in practice.[152] Essentially, the Court held that EPA cannot unilaterally exercise greater than delegated executive authority to rewrite or refashion parts of congressional environmental statutes: "EPA's interpretation is . . . unreasonable because it would bring about an enormous and transformative expansion in EPA's regulatory authority without clear congressional authorization."[153] The Court concluded that EPA's interpretation of the Clean Air Act was neither compelled nor permissible and invalidated EPA's Tailoring Rule on the grounds that it purported to amend the statute:

> We conclude that EPA's rewriting of the statutory thresholds was impermissible and therefore could not validate the Agency's interpretation of the triggering provisions. An agency has no power to "tailor" legislation to bureaucratic policy goals by rewriting unambiguous statutory terms. Agencies exercise discretion only in the interstices created by statutory silence or ambiguity; they must always "give effect to the unambiguously expressed intent of Congress."[154]

The decision held that the federal government cannot extend regulation to otherwise uncovered sources—including power generation sources—that are not otherwise regulated entities.[155] However, the basic limitation on emissions from new coal-fired plants and other plants was not disturbed by the Court, and remains in place.

2. Existing Power Generation

Under section 111(d) of the Clean Air Act,[156] EPA promulgated rules restricting CO_2 emissions from existing, rather than new, power plants:[157] "[t]he centerpiece of the plan is the announcement that the [EPA] will regulate greenhouse gas emissions from existing power plants."[158] The Center for American Progress indicated that "EPA should spur the

152 *Id.* at 2445–46

153 *Id.* at 2444.

154 *Id.* at 2445 (internal citations omitted).

155 *Id.* at 2449.

156 Clean Air Act, 42 U.S.C. § 7411(d) (2012).

157 Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. 64,662, 64,663 (Oct. 23, 2015) (to be codified at 40 C.F.R. Part 60); EPA also finalized standards for new, modified, and reconstructed sources under section 111(b) of the Clean Air Act. Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources, 80 Fed. Reg. 64,510 (Oct. 23, 2015) (to be codified at 40 C.F.R. Parts 60, 70, 71, and 98).

158 Dana Nuccitelli, *President Obama Acts on Climate Change by Enforcing the Law*, GUARDIAN, June 25, 2013, http://www.theguardian.com/environment/climate-consensus-97-per-cent/2013/jun/25/climate-change-carbon-emissions-president-obama-epa (last visited Nov. 21, 2015); Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,663.

retirement of coal-fired power plants and their replacement with natural gas."[159]

These EPA existing source regulations were proposed in June 2014, with a final rule published in October 2015 and state compliance required by 2018.[160] "The rules could affect 1,600 power plants. About 600 of these operate on coal, including many that are nearly 50 years old and will have the most difficulty meeting the new standards."[161] If states do not comply, EPA can impose federal implementation plans (FIPs) on the states by December 2018.[162] However, lawsuits will likely delay the realization of these deadlines.

There is significant controversy: EPA received multiple millions of comments in preparing the regulation under which each state will be required to develop standards of performance to limit CO_2 emissions from existing generating facilities.[163] Seventeen state attorneys general filed comments highlighting "numerous legal defects" and system reliability issues in the EPA's proposal to regulate power plant emissions under section 111(d) of the Clean Air Act.[164] Environmental justice advocates told EPA that the proposed CO_2 limits for power plants do not emphasize equity, and offer too much flexibility to states.[165]

Under these regulations, in various states this will require up to a 50% cut in carbon emissions from existing generation.[166] States have freedom to use a mass-based or rate-based calculation and can come up with a

159 CENTER FOR AMERICAN PROGRESS, THE POWER OF THE PRESIDENT: RECOMMENDATIONS TO ADVANCE PROGRESSIVE CHANGE 6 (2010), *available at* http://files.eric.ed.gov/fulltext/ED535869.pdf.

160 Carbon Pollution Emission Guidelines for Existing Stationary Sources: Proposed Rule, 79 Fed. Reg. 34,830 (proposed June 18, 2014); Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,669 (explaining that final state plans are due in 2016 but an extension until 2018 is available if the initial submission meets specific criteria).

161 Suzanne Goldenberg, *Obama Unveils Historic Rules to Reduce Coal Pollution by 30%*, GUARDIAN, June 2, 2014, http://www.theguardian.com/environment/2014/jun/02/obama-rules-coal-climate-change (last visited Nov. 21, 2015). The EPA estimated the total affected EGUs at "approximately 3,000." Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,813.

162 Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,828.

163 U.S. ENVTL. PROT. AGENCY, REGULATORY IMPACT ANALYSIS FOR THE PROPOSED STANDARDS OF PERFORMANCE FOR GREENHOUSE GAS EMISSION FOR NEW STATIONARY SOURCES: ELECTRIC UTILITY GENERATING UNITS 1-1 (2013), *available at* http://www2.epa.gov/sites/production/files/2013-09/documents/20130920proposalria.pdf.

164 *Utilities: Comments Show Split in State Support for EPA Proposed Power Plant Rule*, Energy & Climate Rep. (BNA) No. 231, at 24–5 (Dec. 2, 2014). The comments were signed by attorneys general from Alabama, Florida, Georgia, Indiana, Kansas, Louisiana, Michigan, Montana, Nebraska, North Dakota, Ohio, South Carolina, South Dakota, Utah, West Virginia, and Wyoming. *Id.* at 26.

165 *Power Plant Carbon Rule Lacks Equity, Environmental Justice Advocates Tell EPA*, Energy & Climate Rep. (BNA) No. 190, at 19 (Oct. 1, 2014).

166 *See* JONATHAN L. RAMSEUR & JAMES E. MCCARTHY, CONG. RESEARCH SERV., EPA'S CLEAN POWER PLAN: HIGHLIGHTS OF THE FINAL RULE 11–12 (2015), *available at* https://www.fas.org/sgp/crs/misc/R44145.pdf.

multistate plan.[167] This will allow state plans to administer CO_2 controls "beyond the fence line" of the affected project's metes and bounds.[168] So if this regulation is upheld after already commenced litigation, it could affect the frequency of dispatch orders for coal plants, which is key to whether or not and how they will continue to be operated in the future.[169]

Under the House version of section 111(d) of the Clean Air Act, if a source category is regulated under the Clean Air Act's hazardous air pollutant (HAP) provision—embodied in section 112—other pollutants emitted by that source category are excluded from regulation under section 111(d).[170] In contrast, under the Senate-enacted version of section 111(d), it is only the pollutants regulated under section 112 that are exempt from regulation under section 111(d). The 1990 Clean Air Act amendments contained different Senate and House versions of amendments to section

167 Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. at 64,664, 64,666. Rate-based limits for emissions limit the pounds of a pollutant emitted per million British thermal units of energy produced by a power generation facility. David Driesen, *A Mass-Based Cap for Power* Plants, http://www.progressivereform.org/CPRBlog.cfm?idBlog=0B546490-BB93-250F-E248E13707C840D8 (last visited Nov. 21, 2015). Mass-based limits do not deal with emissions from individual sources, but instead limit the mass of regional emissions. *See* Juliet Eilperin & Steven Mufson, *EPA is Readying Climate Rule for Existing Power Plants as Deadline* Approaches, WASH. POST, May 21, 2014, http://www.washingtonpost.com/politics/epa-is-readying-climate-rule-for-existing-power-plants-as-deadline-approaches/2014/05/21/8d1c0b5c-e088-11e3-9743-bb9b59cde7b9_story.html (last visited Nov. 21, 2015) (discussing how under a "'mass-based system' . . . states would have to meet an overall target for greenhouse-gas emissions"). California's cap–and–trade program (Assembly Bill 31), the RGGI, and the EU ETS utilize mass-based limits for GHGs. *See, e.g.*, Ctr. for Climate and Energy Solutions, *California Cap and Trade*, http://www.c2es.org/us-states-regions/key-legislation/california-cap-trade (last visited Nov. 21, 2015) (discussing these three cap–and–trade programs that set limits on GHG emissions from industry on a statewide or regional scale). Mass-based limits can be achieved by using lower-emission forms of generation such as renewable generation, or by reducing the need for power through end-use efficiency, but does not affect the rate of emissions per unit of energy produced by conventional generators even when they operate for fewer hours. Driesen, *supra*.

168 *See* Kyle Aarons, *U.S. Policy: Carbon Pollution Standards for Existing Power Plants: Issues and Options*, http://www.c2es.org/publications/carbon-pollution-standards-existing-power-plants-issues-options (last visited Nov. 21, 2015) (recognizing that when EPA sets GHG performance standards for existing power plants, EPA can take into account reductions beyond the "fence line" of what is achievable at the plant level, including demand-side energy efficiency actions).

169 *See FERC Perspectives: Questions Concerning EPA's Proposed Clean Power Plan and Other Grid Reliability Challenges*, *Hearing Before the Subcomm. on Energy & Power of the House Comm. on Energy & Commerce*, 113th Cong. (2014) (statement of Commissioner Philip Moeller, of the Federal Energy Regulatory Commission (FERC)). More than two dozen states and numerous private petitioners filed lawsuits opposing the Final Rule on the day it was published in the Federal Register. *See* Robin Bravender & Jean Chemnick, *Clean Power Plan: States, Industries Launch Legal Assault*, GREENWIRE, Oct. 23, 2015, http://www.eenews.net/stories/1060026852.

170 *See generally* Robert R. Nordhaus & Ilan W. Gutherz, *Regulation of CO_2 Emissions from Existing Power Plants Under § 111(d) of the Clean Air Act: Program Design and Statutory Authority*, 44 ENVTL. L. REP. 10,366, 10,376 (2014) (recognizing that electric generating units could not be regulated under the House version of section 111(d), because emissions from electric generating units are already regulated under section 112 through EPA's Mercury Air Toxics Standards (MATS) rule).

111(d), which were combined without clear reconciliation in the final enacted version of the amendments.[171] Because power plants as a category—and specifically coal-fired power plants—are regulated under Section 112, it becomes an ongoing question which interpretation controls, and ultimately whether EPA has authority under section 111(d) of the Clean Air Act to issue these proposed regulations.[172]

This creates a case of first impression now that the new regulation is challenged.[173] In provocative Supreme Court dicta 40 years ago, the Court stated that it is never impossible for a coal-fired electric power plant to comply with any environmental requirements, because it *always* has the option to shut down its plant and curtail electric service.[174]

3. Mercury and Air Toxics Standard

Mercury (Hg) is a naturally occurring element. The most significant human-caused way that mercury is released into the environment is through burning coal. Mercury is a pollutant that is regulated as a toxic chemical by the Clean Air Act.[175] In 2000, the EPA determined that mercury emitted by electric generation units (EGUs) was a HAP and therefore regulated EGUs'

171 79 Fed. Reg. 34,830, 34,853 (June 18, 2014). The Senate amendment was a technical amendment regarding NSPS criteria pollutant regulation without substantive change; the House amendment made the same technical change and added that section 111(d) could not be applied to a category of sources regulated under section 112, which regulates hazardous air pollutants unrelated to the criteria pollutants. *See* Nordhaus & Gutherz, *supra* note 170, at 10376 (demonstrating that while the Senate version "would continue the CAA's pre-1990 policy, under which EPA would have authority to regulate any *pollutant* emitted from existing sources that is neither a criteria pollutant listed under § 108 of the CAA nor a HAP listed under § 112," the House version would "bar regulation under § 111(d) of any pollutants emitted by *source categories* that are regulated under § 112 of the CAA").

172 EPA asserts in the preamble and in the legal memorandum supporting the proposed rule that this conflict creates an ambiguity that the agency may resolve, and that it is entitled to deference under *Chevron*. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Proposed Rule, 79 Fed. Reg. 34,830, 34,853, 34,885 (proposed Jun. 18, 2014). In the Final Rule, EPA has taken a different position in regard to the interaction between the House and Senate versions of 111(d). Rather than seeing them as conflicting and thus creating ambiguity, the EPA argues that they can be reconciled. In the final rule, EPA states that the "best, and sole reasonable" interpretation of the House amendment is that it is "reasonable to interpret the House amendment of the Section 112 Exclusion as only excluding the regulation of HAP emissions under CAA section 111(d) and only when that source category is regulated under CAA section 112." Carbon Pollution Emission Guidelines for Existing Stationary Sources, 80 Fed. Reg. 64,662, 64,714 (Oct. 23, 2015) (to be codified at 40 C.F.R. Pt. 60).

173 Industry petitioners challenged the proposed rule in the D.C. Circuit, which denied the petition for review on procedural grounds and did not reach the merits, including the reconciliation of the Senate and House versions. *In re* Murray Energy Corp. v. U.S. Envtl. Prot. Agency, No. 14-1151 (D.C. Cir. 2015) (denying petition for review on grounds that a proposed rule is not final agency action). However, legal experts anticipate that challenges to the rule will reach the U.S. Supreme Court, at which time the Court will have an opportunity to evaluate the merits. Coral Davenport, *Court Gives Obama a Climate Change Win*, N.Y. TIMES, June 9, 2015, http://www.nytimes.com/2015/06/10/us/coal-epa-clean-power-plan.html?_r=0 (last visited Nov. 21, 2015).

174 Union Elec. v. U.S. Envtl. Prot. Agency, 427 U.S. 246, 265 n. 14 (1976).

175 42 U.S.C. § 7412 (2012).

emissions of mercury under section 112 of the Clean Air Act.[176] Four years after this determination, EPA decided it would be more effective to regulate EGUs with a cap–and–trade system under section 111 of the Clean Air Act,[177] and proceeded to remove EGUs from the list of HAPs in Section 112.[178]

New Mercury and Air Toxics Standards (MATS) set limits for all HAPs emitted by coal- and oil-fired electric generating units with a capacity of 25 Mw or greater.[179] MATS is specifically aimed at reducing power plants' emissions of toxic air pollutants—rather than criteria pollutants—including toxic arsenic, chromium, nickel, hydrochloric acid, and hydrofluoric acid, in addition to mercury.[180] The rule provides existing large electricity generation facilities four years to achieve full compliance, with an additional year available to the power plants that the Federal Energy Regulatory Commission (FERC) deems electric "reliability-critical" to maintain adequate voltage in the nation's bulk power system or for emergency start to meet system crises.[181] MATS further provides that if a source cannot come into compliance within the time frame allowed, EPA will determine—on a case-by-case basis—whether and to what extent it will assess individual fines or penalties for noncompliance.[182]

In 2014, the D.C. Court of Appeals upheld EPA's MATS regulation after the U.S. Chamber of Commerce brought suit in *White Stallion Energy Center LLC v. EPA*.[183] What makes this somewhat controversial is that the co-benefits associated with fine particulate matter ($PM_{2.5}$) reductions comprise the overwhelming majority of all benefits attributed to the MATS

176 New Jersey v. U.S. Envtl. Prot. Agency, 517 F.3d 574, 579 (D.C. Cir. 2008).

177 42 U.S.C. § 7411 (2012).

178 *New Jersey*, 517 F.3d at 579–80.

179 U.S. Envtl. Prot. Agency, *MATS–Basic Information*, http://www.epa.gov/mats/basic.html (last visited Nov. 21, 2015).

180 42 U.S.C. § 7412(b) (2012); Reconsideration of Certain New Source Issues, 78 Fed. Reg. 24,073, 24,073 (Apr. 24, 2013); U.S. ENVTL. PROT. AGENCY, FACT SHEET: MERCURY AND AIR TOXICS STANDARDS FOR POWER PLANTS 1, *available at* http://www.epa.gov/mats/pdfs/20111221MATSsummaryfs.pdf. Regarding HAPs, see STEVEN FERREY, ENVIRONMENTAL LAW: EXAMPLES AND EXPLANATIONS 574 (6th ed. 2013). The 1990 amendments to the Clean Air Act included the HAPs and "Good Neighbor" provisions, which provided the statutory authority for EPA to implement MATS. Clean Air Act Amendments of 1990, 101 Pub. L. No., 101– 549, §§ 101, 301, 104 Stat. 2399, 2404, 2535, 2537 (1990); National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9,304, 9,304 (Feb. 16, 2012); Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208, 48,216 (Aug. 8, 2011). The 1999 amendments revised the NSPS provision, which authorized EPA to apply MATS to new coal- and oil-fired power plants. Chemical Safety Information, Site Security and Fuels Regulatory Relief Act of 1999, 106 Pub. L. No. 40, 113 Stat. 207; 42 U.S.C. § 7411 (2012).

181 U.S. ENVTL. PROT. AGENCY, FACT SHEET: MERCURY AND AIR TOXICS STANDARDS FOR POWER PLANTS 2, *available at* http://www.epa.gov/mats/pdfs/20111221MATSsummaryfs.pdf; U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-635, EPA REGULATIONS AND ELECTRICITY: BETTER MONITORING BY AGENCIES COULD STRENGTHEN EFFORTS TO ADDRESS POTENTIAL CHALLENGES (2012).

182 U.S. ENVTL. PROT. AGENCY, FACT SHEET *supra* note 181.

183 748 F.3d 1222, 1246–48 (D.C. Cir. 2014), *overruled*, Michigan v. U.S. Envtl. Prot. Agency, 135 S. Ct. 2699 (2015).

regulations, and $PM_{2.5}$ is already otherwise heavily regulated by the EPA under other regulations.[184] EPA designed the rule, in part, to achieve through executive action $PM_{2.5}$ emissions reductions that it could not lawfully compel using provisions of the CAA authorizing direct regulation of $PM_{2.5}$.[185] The majority at the Court of Appeals deferred to EPA's technical judgment.[186]

The federal appellate court found that the action was not arbitrary and capricious because EPA demonstrated a reasonable connection between its actions and the record of decision and it was accorded *Chevron* deference.[187] Many in the regulated community expressed concern about the environmental regulations' likely impact on electric grid reliability,[188] and the possibility that many electricity generating plants would be forced to shut down in order to avoid individual noncompliance and fines, risking "the reliability of the" larger electric system.[189] Indeed, FERC deemed some of the affected units poised for permanent or temporary shutdowns after promulgation of the rule as reliability-critical to maintain successful grid operation.[190]

The Supreme Court overturned the D.C. Circuit decision in 2015.[191] The Court focused on the agency's failure to consider costs, stating:

> One would not say that it is even rational, never mind "appropriate," to impose billions of dollars in economic costs in return for a few dollars in health or environmental benefits. In addition, "cost" includes more than the expense of complying with regulations; any disadvantage could be termed a cost.[192]

184 Brief of the U.S. Chamber of Commerce as Amicus Curiae in Support of Industry Petitioners at 2, 26, *White Stallion Energy Center*, (2012) (No. 12-1100), (arguing that the majority of the benefits from the rule are derived from $PM_{2.5}$ reductions); *see, e.g.*, 40 C.F.R. § 50.7 (2009) (regulating the concentration of fine particulate matter in the air).

185 Brief of the U.S. Chamber of Commerce as Amicus Curiae in Support of Industry Petitioners at 3–4, *White Stallion Energy Center* (No. 12-1100).

186 *White Stallion*, 748 F.3d at 1251. This included challenges to EPA's determination of what was achievable by the best performing 12% of sources—i.e., the "MACT floor"—and the supporting data. *Id.* at 1250–51.

187 *Id.* at 1252–53.

188 *See, e.g.*, Neela Banerjee, *Obama Faces a Battle on Air Rules*, L.A. TIMES, Dec. 22, 2011, http://articles.latimes.com/2011/dec/22/nation/la-na-epa-mercury-20111222 (last visited Nov. 21, 2015).

189 *Id.*; Dina Cappiello, *EPA Tells Nation's Dirty Power Plants to Clean Up*, ASSOCIATED PRESS, Dec. 21, 2011, https://gma.yahoo.com/epa-tells-nations-dirty-power-plants-clean-183208854.html (last visited Nov. 21, 2015) (voicing the concern of some in the industry who wanted a safety valve to decrease the risk of too many power plants shutting down at once).

190 *See* Kansas City Bd. of Pub. Utils., 149 FERC ¶ 61,138 (2014).

191 Michigan v. U.S. Envtl. Prot. Agency, 135 S. Ct. 2699 (2015). Plaintiffs were a coalition of more than 20 states.

192 *Id.* at 2707. The agency could only quantify $4–$6 million in "benefits" to reductions of hazardous air pollutants, a fraction of one percent of their total claimed 'benefits' of $37–90 billion annually, without providing any statistical basis or medical proof. Stephen Heins, *EPA and the States Square Off Over Mercury*, FORTNIGHTLY'S SPARK, http://spark.fortnightly.com/fortnightly/epa-and-states-square-over-mercury (last visited Nov. 21, 2015).

Because EPA failed to consider costs in its decision to regulate power plants, the Court held that the MATS regulation was unreasonable.[193] MATS mandated massive reductions in both HAPs and $PM_{2.5}$ from power plants over the next several years.[194] Assuming that EPA is able to justify its regulation after the Supreme Court remand and the regulation, once justified in terms of its costs, survives, this will affect larger coal plants—if coal is greater than 10% of fuel input and the unit is greater than 25 Mw capacity, produces electricity for sale, and supplies more than one third of its potential output to any utility power distribution system—unless its annual capacity factor is less than 8% of rating (i.e. only used for peaking purposes).[195] Individually and collectively, these three unilateral executive actions, through the promulgation of much more demanding regulations, will change the use of coal power in the United States. There will be numerous shutdowns of existing coal-fired generation plants in the next three years.

C. State Legal Authority over Power Choice

While the federal government has promulgated Clean Air Act environmental regulations that inhibit use of coal-fired power and tax incentives which subsidize renewable energy, the significant support for renewable energy and greenhouse gas reduction is at the state level. Forty-four of the fifty states have enacted one or more regulatory mechanisms to promote renewable energy substitutes to fossil fuel power generation. Understanding how each operates, and its legal foundation, is the first step.

1. State Regulation of "Anti-Carbon"

Before addressing direct carbon regulation, some states have promoted "anti-carbon" laws and orders through renewable energy policy initiatives in the past two decades and by sculpting sustainable energy initiatives, including primarily use of:

- Net Metering: In 85% of states[196]
- RPS: In 65% of states[197]

193 *Michigan*, 135 S. Ct. at 2712.

194 Kevin Poloncarz & Ben Carrier, *D.C. Circuit Upholds EPA's Mercury and Air Toxics Standards*, PAUL HASTINGS STAY CURRENT, Apr. 2014, *available at* http://www.paulhastings.com/docs/default-source/PDFs/stay-current-dc-circuit-upholds-epas-mercury-and-air-toxics-standards.pdf. Coal plants that elect to continue can employ different methods for control, such as wet flue gas desulfurization, activated carbon injection, low-sulfur coal, and dry sorbent application. *See* F. SANCHEZ ET AL., CHARACTERIZATION OF MERCURY-ENRICHED COAL COMBUSTION RESIDUES FROM ELECTRIC UTILITIES USING ENHANCED SORBENTS FOR MERCURY CONTROL 3–5 (2006).

195 National Emission Standards for Hazardous Air Pollutants From Coal and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial- Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9,304, 9,366•67 (Feb. 16, 2012).

196 Steven Ferrey, *Solving the Multimillion Dollar Constitutional Puzzle Surrounding State "Sustainable" Energy Policy*, 49 WAKE FOREST L. REV. 121, 122 (2014).

- FiTs: Tried in a few states (<10%)[198]

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

a. FiTs

FiTs deliberately set an above-market price to be paid by utilities for renewable power as a way to encourage it.[199] FiTs are unconstitutional when promulgated by a U.S. state as a way to compel regulated private utilities.[200] Administratively-set FiT prices for power have traditionally been too high, obligating utility customers to pay higher rates for the decades of the affected long-term contracts.[201] In 2011, Oregon lowered the price paid under its solar FiT for the third time in its one year of existence, reducing it from its original $0.65/Kwh to $0.374/Kwh.[202] Each of the prior iterations at higher prices was oversubscribed within less than ten minutes of its availability, even though each time the tariff was lowered 10%–20% from the prior available price.[203]

The experience of government not correctly pricing FiT incentives and incurring significant amounts of debt—which is then passed on to utility ratepayers—is duplicated internationally. Germany and Spain are the leading countries using the FiT to achieve solar photovoltaic (PV) development, and are among the most successful in achieving wind project development with FiTs.[204] Spain's FiT was successful in quickly mobilizing significant and dramatic increases in the use of renewable energy: from less than 1% of total energy supply in 1990 to 24.7% in 2009, and 54% in 2013,[205] overrunning the national target for of 400 Mw of PV production by 1000% by 2010.[206] However, the Spanish FiT started in 1980 at €36 cents/Kwh for small solar projects,[207] rose in 1994,[208] and in 2004 had increased to 575% more than the average price of electricity.[209]

The high FiTs proved that their costs to the utility system were unsustainable, and rates were reduced in 2008.[210] In 2010—with a tariff debt

197 *Id.*
198 *Id.*
199 *Id.* at 124.
200 *Id.* at 128.
201 *Id.* at 124.
202 Pam Russell, *Oregon Reduces Solar Feed-In Tariff for Third Time, Looking for "Sweet Spot" Price*, ELECTRIC UTIL. WEEK, Aug. 8, 2011, at 7.
203 *Id.*
204 Lincoln Davies & Kirsten Allen, *Feed-In Tariffs in Turmoil*, 116 W. VA. L. REV. 937, 940 (2014).
205 *Id.* at 979.
206 *Id.* at 980.
207 *Id.* at 968–69.
208 *Id.* at 969.
209 *Id.* at 973–74.
210 *Id.*

from the FiT program of €26 billion—contracts were abrogated by the utility, rates reduced, and the number of hours that the rate applied were reduced *post facto*.[211] Spain's utilities reneged on their existing power purchase contracts when the nation reconfigured its FiT rate by slashing it to €13cents/Kwh, a small fraction of the contractually agreed rate.[212] Additional radical cuts and abrogations of existing contracts occurred in 2013.[213] Spain now pays almost 1% of its gross domestic product (GDP) in subsidies for renewables, which is more than it spends on higher education.[214] When Spain abrogated its FiTs contracts and its power purchase agreements, it resulted in litigation alleging that the retroactive application was unconstitutional.[215] The European Commission criticized Spain's radical change in policy as a threat to foreign investment in the E.U.[216]

In Germany, starting in 1990, the FiT morphed from a modestly designed program for PV power paying €8.57cents/Kwh—modestly above the wholesale value of that power—into a program paying €50.62 cents/Kwh by 2000—more than 1,000% above the value of wholesale power—for a twenty-year period of production of renewable power.[217] Nonetheless, the price for PV power in 2004 was increased to €57.4 cents/Kwh.[218] In 2009, because of concern about excessive payments to renewable energy projects under the FiT, the PV rate was lowered to €43.01 cents/Kwh, and additional retractions for future projects occurred in 2010.[219] By 2011, the rate for rooftop solar was reduced to €28.74 cents/Kwh.[220] By 2012, it had been reduced to €13.5 cents/Kwh for future eligible renewable energy facilities.[221]

Germany slashed its initial FiTs in several states to approximately half their values from seven years ago.[222] Household electricity prices are four times as high in Germany as in the United States.[223] Germany, the world's fourth-largest economy, has experienced average electricity prices for companies jumping 60% over the past five years due to costs passed along as

211 *Id.* at 976–80.

212 *Id.* at 982.

213 *Id.* at 978.

214 Bjorn Lomborg, *The Decline of Renewable Energy*, PROJECT SYNDICATE, Aug. 13, 2013, http://www.project-syndicate.org/commentary/the-falling-share-of-renewables-in-global-energy-production-by-bj-rn-lomborg (last visited Nov. 21, 2015).

215 *See id.* at 979, 983 n.304.

216 *Id.* at 977.

217 *Id.* at 948–49.

218 *Id.* at 951–52.

219 *Id.* at 955–56.

220 *Id.* at 958.

221 *Id.*

222 *See generally* FRAUNHOFER, RECENT FACTS ABOUT PHOTOVOLTAICS IN GERMANY (2015), *available at* http://www.ise.fraunhofer.de/en/publications/veroeffentlichungen-pdf-dateien-en/studien-und-konzeptpapiere/recent-facts-about-photovoltaics-in-germany.pdf (demonstrating a dramatic decrease in FiT funding since 2007).

223 Ker Than, *As Solar Power Grows, Dispute Flares Over U.S. Utility Bills*, NAT'L GEOGRAPHIC, Dec. 24, 2013, http://news.nationalgeographic.com/news/energy/2013/12/131226-utilities-dispute-net-metering-for-solar/ (last visited Nov. 21, 2015) (noting an average 55 cents/Kwhin Germany, compared to 13 cents/Kwh in the United States).

part of the government subsidization of renewable energy producers.[224] Retail prices are now almost triple those in the U.S.[225] The renewable energy surcharge levied on German households and businesses has likewise nearly tripled since 2010 and now accounts for about 18% of a German household's total electric bill, approximately €24 billion a year.[226] German utilities recently increased the surcharge levied on consumers to fund more renewables by 18% to €6.24 cents/Kwh.[227]

b. Renewable Portfolio Standards

RPS require electric utilities and other retail electric providers to include annually in their retail sales a specified percentage of electricity supply from renewable energy sources.[228] Such standards create and account for Renewable Energy Credits (RECs) associated with production of each MwH of generation from an eligible renewable energy facility as a separate commodity to be traded and transferred, if allowed by the state.[229]

As a matter of global policy, fourteen nations mandate RPS programs, and additionally, several nations allow their states to implement RPS.[230] Twenty-nine U.S. states and the District of Columbia have some form of RPS.[231] These mandatory RPS programs cover about half of nationwide retail electricity sales.[232] 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.[233]

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224 Matthew Karnitschnig, *Germany's Expensive Gamble on Renewable Energy*, WALL ST. J., Aug. 26, 2014, http://online.wsj.com/articles/germanys-expensive-gamble-on-renewable-energy-1409106602 (last visited Nov. 21, 2015).

225 *Id.* (noting that about 35% of Europe's electricity is projected to come from renewable sources by 2020, while Germany has goals of 40%–45% of its electricity from renewable sources, rising to at least 80% by 2050).

226 *Id.* Almost 75% of Germany's small- and medium-size industrial businesses say rising energy costs are a major risk, according to a recent survey by PricewaterhouseCoopers and the Federation of German Industry. *Id.*

227 Stefan Nicola, *Germany Power Consumers to Pay Record Green Surcharges*, BLOOMBERG BUS., Oct. 15, 2013, http://www.bloomberg.com/news/articles/2013-10-15/germany-increases-fee-to-fund-renewable-energy-to-record (last visited Nov. 21, 2015).

228 *See* U.S. Envtl. Prot. Agency, *Portfolio Standards*, http://www3.epa.gov/chp/policies/standards.html (last visited Nov. 21, 2015) (providing an overview of RPS).

229 *See* RYAN WISER & GALEN BARBOSE, LAWRENCE BERKELEY NAT'L LABORATORY, RENEWABLE PORTFOLIO STANDARD IN THE UNITED STATES: A STATUS REPORT WITH DATA THROUGH 2007 1 (2008), *available at* http://emp.lbl.gov/sites/all/files/REPORT%20lbnl-154e-revised.pdf.

230 *Id.* at 2 n.2

231 *See* Database for State Incentives for Renewable Energy, *Renewable Portfolio Standard Policies—Mar. 2015*, *available at* http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2015/01/Renewable-Portfolio-Standards-with-Solar-and-DG-Provisions.pdf (estimating 46% of nationwide electricity sales to be covered by mandatory RPS programs by the end of 2007).

232 *See* WISER & BARBOSE, *supra* note 229.

233 *See id.* at 3.

c. Net Metering

Forty-three U.S. states and the District of Columbia have some form of net metering policy.[234] As of 2003, there were just under 7,000 net metering customers in the United States,[235] and by 2010, there were more than 150,000.[236] 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 approximately two-thirds of the retail bill that is attributable to transmission, distribution, and taxes—for transferring just the wholesale energy commodity: the power itself.[237] In essence, it receives for that power an amount that could be above the utility's avoided cost and the wholesale cost of power by as much as approximately three to four times more for this power than paid to any other independent power generators for wholesale power, and much more than the time-dependent value of this power to the purchasing utility.[238] FERC held that state net metering decisions were not preempted by federal law, because it hypothesized that no sale occurs when an individual customer installs distributed generation and accounts for its dealings with the utility through the practice of netting.[239] The Supremacy Clause and Filed Rate Doctrine legal boundaries between state and federal jurisdiction related to net metering are discussed elsewhere.[240]

234 *See* Database for State Incentives for Renewable Energy, *Net Metering—Mar. 2015*, *available at* http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2015/04/Net-Metering-Policies.pdf. Alabama, Idaho, Mississippi, South Dakota, Tennessee, and Texas are the only states without a state net metering program. *Id.*

235 U.S. Energy Info. Admin., *Today in Energy*, http://www.eia.gov/todayinenergy/detail.cfm?id=6270 (last visited Nov. 21, 2015).

236 *Id.*

237 Steven Ferrey, *Net Metering*, *in* 2 ENCYCLOPEDIA OF ENERGY ENG'G AND TECH. 1096 (Barney L. Capehart ed., CRC Press 2007). *See* Database for State Incentives for Renewable Energy, *Glossary*, http://usd.solarelectricpower.org/glossary/ (last visited Nov. 21, 2015) ("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."). *See* STEVEN FERREY, THE NEW RULES: A GUIDE TO ELECTRIC MARKET REGULATION 211–31 (2000) (explaining whether electricity is a "good" or a "service" and how it should be treated under the law).

238 Ferrey, *Net Metering*, *supra* note 237 at 1096. For example, the Eversouce-NSTAR residential retail rate at the time of publication is $0.1497219/Kwh. Renew Boston, *NSTAR Electric: 6-Month Rate Hike*, http://www.renewboston.org/2014/12/12/nstar-electric-files-new-six-month-supply-rate/ (last visited Nov. 21, 2015). The Massachusetts net metering rate is just slightly below the applicable retail rate. Nationalgrid, *Regular Residential (R-1)*, https://www.nationalgridus.com/masselectric/home/rates/4_res.asp (last visited Nov. 21, 2015). Wholesale power has transacted in the Eversource-NSTAR service territory at approximately $0.03497/Kwh. U.S. Energy Info. Admin., *Wholesale Electricity and Natural Gas Market Data*, http://www.eia.gov/electricity/wholesale/ (last visited Nov. 21, 2015).

239 FERREY, THE NEW RULES, *supra* note 237, at 1096–97.

240 *See*, Steven Ferrey, Chad Laurent & Cameron Ferrey, *Fire and Ice: World Renewable Energy and Carbon Control Mechanisms Confront Constitutional Barriers*, 20 DUKE ENVTL. L. & POL'Y. F. 125, 182–84, 195–202 (2010).

2. Economy, Incentives, and Power

The technological improvements and cost declines of technology associated with wind and solar PV distributed generation makes them a more cost-effective alternative to conventional fossil fuel power. The cost to install PV solar panels has fallen dramatically by about 60% in "hard" costs, with PV module prices declining from approximately $1.90 watt in 2009 to $0.70/watt, and lower in some regions of the world.[241] Inverter prices for the equipment necessary to convert PV 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.[242]

Since 2008, the price of the PV panels has fallen by 75% and solar installations have multiplied tenfold.[243] In the United States, there were more than 300,000 "distributed" behind-the-meter solar PV installations in 2012, almost all in the 43 net metering states.[244] One additional rooftop solar system was being installed every four minutes in 2013 in the United States.[245] This has allowed the solar PV market to grow at an average rate of more than 40% each year since 2000.[246] The sheer amount of solar is impressive, though the 8 GW of solar installed in the United States today is still less than 1% of U.S. electricity production.[247]

Solar energy is forecast to be cost competitive with retail electricity prices in 47 U.S. states by 2016 with maintenance of current subsidies, according to Deutsche Bank.[248] With the aid of 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.[249]

With climate change, there is concern about impacted water resources. Roughly 97% of U.S. electricity comes from thermoelectric (90%) or

241 INT'L ENERGY AGENCY—RENEWABLE ENERGY TECH. DEPLOYMENT, RESIDENTIAL PROSUMERS–DRIVERS AND POLICY OPTIONS (RE-PROSUMERS) 9 (Sept. 2014), *available at* http://iea-retd.org/wp-content/uploads/2014/09/RE-PROSUMERS_IEA-RETD_2014.pdf.

242 *Id.*

243 Ker Than, *supra* note 223.

244 *Id.*

245 *Id.*

246 INT'L ENERGY AGENCY–RENEWABLE ENERGY TECH. DEPLOYMENT, *supra* note 241, at 10.

247 U.S. Energy Info. Admin, *Frequently Asked Questions*, http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3 (last visited Nov. 21, 2015) (noting that solar was 0.4% of domestic energy production in 2014).

248 *Solar Energy to Reach "Grid Parity" in Nearly All States by 2016, Deutsche Bank Predicts*, 45 Envt'l. Rep. (BNA) No. 43, at 3144 (Oct. 31, 2014). This is based on the assumption that the total cost of solar systems will decline by about 20% 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% investment tax credit for solar energy, which is scheduled to drop to 10% at the end of 2016. *Id.*

249 *Id.*

hydroelectric power (7%),[250] and coal plants, nuclear plants, and natural gas plants withdraw 41% of water in the U.S.—with coal withdrawing 85 billion gallons of water daily, nuclear 45 billion gallons, and natural gas 7 billion gallons.[251] "While much of the water withdrawn for electricity production is returned (at higher temperatures) to the sources of withdrawal or other natural water bodies, losses to evaporation can be high, depending on the type of cooling system used."[252] Additionally, the water required for extraction and processing of the fossil fuels can be significant, with coal mining using between 70 million and 260 million gallons of water per day.[253] Hydraulic fracturing for natural gas uses between 2 million and 6 million gallons of water per well for injection.[254]

D. The Regional Greenhouse Gas Initiative

Some U.S. states have also recently enacted cap–and–trade regulation focused on regulating climate-warming gas emissions in these states. The Regional Greenhouse Gas Initiative (RGGI)[255] and California's AB 32 carbon regulation program[256] both adopted cap–and–trade regulatory programs. RGGI in originally ten—and now nine—eastern states regulates its cap–and–trade allowances only for CO_2 emissions from power plants larger than 25 Mw.[257] California's AB 32 regulates all major GHGs by requiring mandatory reporting in the state.[258] Both RGGI and California carbon credits are tradable.[259] Figure 10 shows the 10 U.S. states that regulate CO_2, representing almost 30% of U.S. economic activity as well as coordination with some Canadian provinces.

250 MELISSA WHITED, ET AL., SYNAPSE ENERGY ECON., INC., WATER CONSTRAINTS ON ENERGY PRODUCTION 8 (2013), *available at* http://www.civilsocietyinstitute.org/media/pdfs/Synapse-CSI%20Water%20Constraints%20on%20Energy%20Production%20-%20Final%20Report.pdf; *Renewable Energy: Institute Urges Policy Makers to Encourage Water Research, Renewable Energy Use*, Energy & Climate Rep. (BNA) No. 177, at 10 (Sept. 12, 2013).

251 WHITED ET AL., *supra* note 250, at iv; *Renewable Energy: Institute Urges Policy Makers to Encourage Water Research, Renewable Energy Use*, *supra* note 250.

252 WHITED ET AL., *supra* note 250, at 6.

253 *Id.* at iv.

254 *Id.*

255 Memorandum of Understanding on the Regional Greenhouse Gas Initiative, December 20, 2005, *available at* https://www.rggi.org/docs/mou_final_12_20_05.pdf (Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, Vermont).

256 CAL. HEALTH & SAFETY CODE § 38501 (West 2014).

257 Memorandum of Understanding on the Regional Greenhouse Gas Initiative, *supra* note 255, at 2.

258 *See* Cal. Air Res. Bd., *Assembly Bill 32 Overview*, http://www.arb.ca.gov/cc/ab32/ab32.htm (last visited Nov. 21, 2015) (discussing how AB 32 includes the major GHGs and how the ARB adopted "Mandatory Reporting Regulations" for GHGs).

259 *See* Cal. Air Res. Bd., *Cap–and–Trade Program*, http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm (last visited Nov. 21, 2015); *see also* Regional Greenhouse Gas Initiative Model Rule, § XX-1.2(z) (2008), *available at* http://www.rggi.org/docs/Model%20Rule%20Revised%2012.31.08.pdf.

The RGGI carbon compliance requirements commenced in 2009 in ten northeastern states.[260] CO_2 emissions from power plants in the region were capped at then-current levels, and the cap was to remain in place until 2015.[261] RGGI states would then begin the process of incrementally reducing emissions, with the goal of achieving a 10% reduction by 2019,[262] which recently was amended to make it 45% more demanding at an earlier year.[263] For 2014 and beyond, the RGGI elected to impose more significant demands and limits on the amount of SO_2 that can be emitted by large power plants, including a cap declining 2.5% each year from 2015 to 2020. [264]

The northeast RGGI states raised approximately $1 billion of RGGI auction proceeds in 2009–2011.[265] With the newly amended RGGI standards creating a smaller allowed amount of annual emissions allowances, the restricted supply drove up the auction price for acquiring CO_2 allowances by approximately 220% between 2011 and 2015, from $1.89 to $6.02 per ton.[266] Since coal produces twice as many tons of CO_2 as natural gas,[267] this changed executive agency standard places immense pressure on coal unit operation within these nine states.

There was a suit alleging that Massachusetts's renewable energy tradable energy credits under capped incentives violated the Constitution.[268] TransCanada Corporation, the owner of a Maine wind project, successfully settled its constitutional challenge in 2010.[269] The suit alleged that

260 Memorandum of Understanding on the Regional Greenhouse Gas Initiative, *supra* note 255, at 2. The market-based design of the RGGI Memorandum of Understanding (MOU) is a "cap–and–trade" program. *See id.*

261 *Id.* at 3. The regional base annual CO_2 emissions cap will be equal to 121 million short tons. *Id.* at 2.

262 Press Release, Reg'l Greenhouse Gas Initiative, States Reach Agreement on Proposed Rules for the Nation's First Cap–and–Trade Program to Address Climate Change (Aug. 15, 2006), *available at* http://www.rggi.org/docs/model_rule_release_8_15_06.pdf.

263 Gerald Silverman, et al., *Majority of States in Regional Initiative in early Stages of Implementing "Model Rule,"* 44 Env't Rep. (BNA) No. 24 at 1797 (June 14, 2013). The RGGI regional CO_2 cap was reduced from 165 million annual tons allowed to 91 million tons. *Id.*

264 *Id.*

265 As determined individually by each state, 52% of RGGI funds were used for energy efficiency, 11% for renewable energy, 14% to reduce consumer rates, and 1% for other programs. *See* RGGI INC., INVESTMENT OF PROCEEDS FROM RGGI CO2 ALLOWANCES 4 (2011), *available at* http://www.realskeptic.com/wp-content/uploads/2013/03/Investment_of_RGGI_Allowance_Proceeds.pdf.

266 Reg'l. Greenhouse Gas Initiative, *Auction Results*, https://www.rggi.org/market/co2_auctions/results (last visited Nov. 21, 2015) (providing a drop-down chart that displays allowance prices by auction).

267 *See* U.S. ENERGY INFO. ADMIN., EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2 (2009), *available at* http://www.eia.gov/environment/emissions/ghg_report/pdf/0573%282009%29.pdf (describing the carbon intensity of natural gas as being 55% of coal's carbon intensity).

268 Brief for Petitioner at 1, TransCanada Power Mktg., Ltd. v. Bowles, No. 4:10-cv-40070-FDS (D. Mass. 2010), *available at* http://www.ohiogreenstrategies.com/documents/transcanada.pdf; *See* Erin Ailworth, *State Looking to Settle Suit Over Law on Clean Energy*, BOSTON GLOBE, May 27, 2010, *available at* http://www.boston.com/business/articles/2010/05/27/lawsuit_hits_mass_law_promoting_local_energy_providers/.

269 Ailworth, *supra* note 268.

Massachusetts' 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.[270] After stating that it had confidence in its position, Massachusetts immediately settled the litigation so as to avoid a court decision, providing that TransCanada would be eligible for these programs.[271]

E. California Carbon Regulation

California was not the first state to regulate carbon—in fact, it was the last of the ten states which now regulate carbon.[272] However, its scope of regulation is more pervasive as to affected chemicals and the sectors of the economy because California regulates both production of electricity and liquid vehicle fuel carbon content.[273] California's regulation has been challenged on both constitutional and administrative bases.

1. AB 32

California is the twelfth largest GHG producer in the world.[274] California has taken the most aggressive approach of all the states to curb emissions. The California Global Warming Solutions Act of 2006[275]—commonly referred to as Assembly Bill 32 or AB 32—requires the state to reduce its aggregate GHG emissions to 1990 levels by 2020.[276] This equates to an eventual

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270 *Id.*

271 *See* MASS. DEPT. OF ENERGY RES., PARTIAL SETTLEMENT AGREEMENT WITH TRANSCANADA (2010), *available at* http://www.mass.gov/eea/docs/doer/renewables/solar/settlement-agreement.pdf. *see also* Daniel K. Lee & Timothy P. Duane, *Putting the Dormant Commerce Clause Back to Sleep: Adapting the Doctrine to Support State Renewable Portfolio Standards*, 43 ENVTL. L. 295, 315 (2013); Steven Ferrey, *Legal Barriers to Sub-National Governance Techniques by U.S. States for Renewable Energy Promotion and GHG Control*, Paper Prepared for the 2nd UNITAR-Yale Conference on Environmental Governance and Democracy, (Sept. 17–19, 2010), New Haven, USA.

272 *See* Cal. Air Res., *supra* note 258 (noting that "early action" California measures first took effect in January 2010); Ctr. for Climate and Energy Solutions, *Regional Greenhouse Gas Initiative (RGGI)*, http://www.c2es.org/us-states-regions/regional-climate-initiatives/rggi (last visited Nov. 21, 2015) (listing the nine states in the RGGI and noting the program administered its first CO_2 emissions allowance auction in 2008).

273 *See* CAL. CODE REGS. tit. 17, §§ 95801, 95811, 95851 (West 2015) (regulating the carbon output of a wide variety of industries, including electricity producers); *id.* §§ 95482, 95484 (setting out an extensive list of entities subject to the low carbon fuel standard, including gasoline and diesel producers and importers).

274 CAL. ENERGY COMM'N & CAL. PUB. UTIL. COMM'N, PROPOSED FINAL OPINION SUMMARY ON GREENHOUSE GAS REGULATORY STRATEGIES at 2 (2008), [hereinafter 2008 Cal. Final GHG Opinion] *available at* http://www.energy.ca.gov/2008publications/CEC-100-2008-004/CEC-100-2008-004.PDF.

275 California Global Warming Solutions Act of 2006, CAL. HEALTH & SAFETY CODE § 38500 (West 2006).

276 *Id.*

estimated 29% reduction from business-as-usual GHG emission levels.[277] AB 32 establishes a declining limit on approximately 85% of the state's total GHG emissions.[278] Covered sources must surrender "compliance instruments" to CARB that are equal to their GHG emissions.[279] California's comprehensive cap–and–trade program—prior to lawsuits that delayed it[280]—was to commence in 2012.[281] AB 32 charges the California Air Resources Board ("CARB") with implementation.[282]

The state Market Advisory Committee (MAC) concluded that the California cap–and–trade program should eventually incorporate "all major [GHG]-emitting sectors" in the state, with the greatest attention on the electricity, industry, buildings, and transportation sectors.[283] MAC recommended the initial scheme of freely allocating some shares of allowances and auctioning the other shares of allowances, with the percentage of allowances auctioned increasing over time.[284] Electric generators are required to meet a CO_2 emissions level no greater than that achievable by a combined-cycle gas-fired generator.[285] Any new contracts for the procurement of baseload generation for a term of five years or more must comply with a performance standard of emitting no more than 1100 lbs CO_2/Mwh of power generation.[286]

277 2008 Cal. Final GHG Opinion, *supra* note 274, at 1.

278 *See* Cal. Air Res. Bd., Assembly Bill 32 Overview, http://www.arb.ca.gov/cc/ab32/ab32.htm (last visited Nov. 21, 2015) (explaining that AB 32 requires California to reduce its GHG emissions to approximately 15 percent below emissions expected under a "business as usual" scenario).

279 CAL. AIR RES. BD., REGULATORY GUIDANCE DOCUMENT §§ 3.2–3.4 (2012), *available at* http://www.arb.ca.gov/cc/capandtrade/guidance/20130419%20Guidance%20Document%20Ch%203%20posting.pdf

280 *See, e.g.*, Ass'n of Irritated Residents v. Cal. Air Res. Bd., 206 Cal. App. 4th 1487, 1493 (2012).

281 CAL. AIR RES. BD., FACTS ABOUT ASSEMBLY BILL 32: GLOBAL WARMING SOLUTIONS (Dec. 7, 2009), *available at* http://www.arb.ca.gov/cc/factsheets/ab32factsheet.pdf.

282 *Id.*

283 *Id.* at iv.

284 CAL. ENVTL. PROT. AGENCY, PRESS RELEASE: EXPERT ADVISORS RELEASE FINAL CAP-AND-TRADE REPORT: RECOMMENDATIONS INTENDED TO COMPLEMENT CALIFORNIA'S ONGOING EFFORTS TO REDUCE EMISSIONS 2 (June 29, 2007), *available at* http://www.calepa.ca.gov/pressroom/Releases/2007/PR12-062907.pdf.

285 CAL. PUB. UTIL. CODE § 8341(d)(1) (2007). This legislation targets only electric generation. *Id.* §§ 8340–8341 govern all new long term energy commitments and establish a "greenhouse gas emission performance standard." This is specific to the electric power role in meeting AB 32 goals. The GHG emissions standard creates a specific level of permissible emissions and prohibits new construction, new long-term power contracts, and any major plant investment that will not meet the performance standard. This prohibits load serving entities from entering long-term power contracts with out-of-state producers who do not meet California's stringent new emissions standard. California's Public Utilities Commission (PUC) has set the GHG emissions performance standard at the equivalent of the emissions from a combined-cycle natural gas plant. *See* Chadborne Law, *California Plans a Carbon Diet; Still Struggling to Put AB32 Regulatory Framework in Place*, Jan. 2009, http://www.chadbourne.com/CaliforniaPlansCarbonDiet_Jan09_projectfinance/ (last visited Nov. 21, 2015).

286 CAL. PUB. UTIL. CODE §§ 8340(f), 8341(a) (2007); News Release, Cal. Pub. Utils. Comm'n, PUC Sets GHG Emissions Performance Standard to Help Mitigate Climate Change (Jan. 25, 2007), *available at* http://docs.cpuc.ca.gov/word_pdf/NEWS_RELEASE/63997.pdf. This is a level

Approximately 350 businesses with approximately 590 facilities are required to obtain and surrender to the state credits in the first phase of the carbon program.[287] In the first AB 32 compliance period, approximately 90% of allowances are allocated free of charge to regulated entities.[288] As a secondary source to procure allowances, there are CARB allowance auctions and secondary market trades.[289] In the California system, for auctions there are both floor prices[290] and mechanisms to restrain high allowance prices.[291] The cost of California carbon credits advanced in auctions from an initial price of $10.09 in November 2012 to $13.62 in February 2013, and $14.00 in May 2013.[292]

A legal challenge set back the entire implementation of AB 32 for approximately a year from its scheduled implementation to correct discretionary agency deficiencies.[293] The petitioners claimed that CARB violated the California Environmental Quality Act[294] in the preparation of its Functional Equivalent Document.[295] The court held that CARB improperly

that conventional coal-fired electric generation will not be able to meet, generating about 1770 lbs. CO2/MWh. *See* Seth Hilton, *The Impact of California's Global Warming Legislation on the Electric Utility Industry*, 19 ELECTRICITY J. 1, 14 (2006). "Baseload generation" is defined as generation that is designed and intended to operate at an annualized capacity factor of 60% or greater. CAL. PUB. UTIL. CODE § 8340(a) (2007).

287 *State's Greenhouse Gas Allowances Sell for $14 per Ton in Third Auction*, 44 Envt. Rep. (BNA), at 1556 (2013).

288 Cal. Chamber of Commerce v. Cal. Air Res. Bd., No. 34-2012-80001313, at 3 n.1 (Cal. Super. Ct. 2013)

289 Covered Entities may opt to trade allocated allowances by consigning allowances to CARB for sale through auction. *See* CAL. AIR RES. BD., APPENDIX J: ALLOWANCE ALLOCATION at J-11, *available at* http://www.arb.ca.gov/regact/2010/capandtrade10/capv4appj.pdf.

290 To control the floor price, CARB sets a reserve price for each auction below which no allowances may be sold. This reserve price was $10 in the first auction in 2012, then $11.34 in 2014, and will increase annually by five percent plus the rate of inflation. CAL. AIR RES. BD., ADDITIONAL AUCTION 1 SUMMARY STATISTICS (2012), *available at* http://www.arb.ca.gov/cc/capandtrade/auction/november_2012/auction1_summary_statistics_2012q4nov.pdf; CAL. AIR RES. BD., QUARTERLY AUCTION 8 SUMMARY RESULTS REPORT (2014), *available at* http://www.arb.ca.gov/cc/capandtrade/auction/august-2014/results.pdf.

291 To contain prices on the upper end, CARB is setting aside a pool of allowances that will be offered if prices exceed certain thresholds. Thus, of the total allowances available, CARB will reserve one percent of the allowances from budget years 2013–2014, four percent of the allowances from 2015–2017, and seven percent of the allowances from 2018–2020 for purposes of relieving rising prices should they occur. CAL. CODE REGS. tit. 17, § 95870(a) (2011). This reserve will total 121.8 million metric tons of CO_2 equivalent ($MTCO_2e$) over the length of the program. The price of reserve allowance will increase annually at five percent plus the cost of inflation. *Id.* § 95913(d)(3).

292 *State's Greenhouse Gas Allowances Sell for $14 per Ton in Third Auction*, 44 Envt. Rep. (BNA), at 1556 (2013).

293 *See* Ass'n of Irritated Residents v. Cal. Air Res. Bd., 206 Cal. App. 4th 1487 (2012); Lisa Weinzimer & Geoffrey Craig, *Delaying California CHG Cap-and-Trade Regime a Year Draws Support From Stakeholders*, ELECTRIC UTIL. W., July 4, 2011, at 11–12.

294 CAL. PUB. RES. CODE §§ 21000–21181 (West 2007). The California environmental statute is somewhat similar to the National Environmental Policy Act of 1969. 42 U.S.C. §§ 4321–4370h (2012).

295 Ass'n of Irritated Residents v. Cal. Air Res. Bd., No. CPF–09-509562, 2011 WL 991534, at *3 (Cal. Super. Ct. Mar. 17, 2011). Petitioners alleged that CARB violated CEQA by "(1) failing to

approved its Scoping Plan prior to completing the legally required environmental review.[296]

2. The California Low Carbon Fuel Standard

Under AB 32, the purpose of the low carbon fuel standard (LCFS) is "to implement a low carbon fuel standard, which will reduce greenhouse gas emissions by reducing the full fuel-cycle, carbon intensity of the transportation fuel pool used in California."[297] The LCFS rule is to reduce the carbon content of transportation fuels sold in California by 10% by the year 2020 from the year 2010 baseline[298] through a "set of regulations to govern the marketing of gasoline-ethanol blends sold in California."[299] It assesses "the amount of lifecycle greenhouse gas emissions, per unit of energy of fuel delivered, expressed in grams of carbon dioxide per megajoule."[300]

CARB's LCFS rule regulates lifecycle GHG emissions of fuel, including emissions produced during production and transportation of fuels *to* California.[301] For example, corn-derived ethanol produced in the Midwest is assigned a higher carbon intensity score than chemically similar corn-derived ethanol produced anywhere in California, regardless of its transportation within California.[302] Thus, a chemically identical ethanol imported from the Midwest can receive a higher carbon intensity score than ethanol produced anywhere in California, ultimately rendering the Midwest product disadvantaged and more expensive for fuel providers seeking to meet the California fuel standard requirements.

The LCFS rule was challenged in two court cases that alleged the rule violated federal and state law. One case was under California state law,[303] and another was under federal constitutional law in *Rocky Mountain Farmers Union v. Goldstene*,[304] where plaintiffs alleged that CARB discriminated against interstate commerce and fuels produced out of state.[305] In December 2011, the District Court for the Eastern District of California upheld plaintiffs' argument, invalidating certain parts of the LCFS rule and

adequately analyze the impacts of the measures described in the Scoping Plan; (2) failing to adequately analyze alternatives to the Scoping Plan; and (3) impermissibly approving and implementing the Scoping Plan prior to completing its environmental review." *Id.*

296 *Id.* at 32–34. The court held that CARB selected the scoping plan prior to the public hearing on it, rather than after, and that the CEQA review was "approved" without taking public comments received after the hearing into account. *Id.* at 34. The court issued a Writ of Mandate enjoining CARB from any further cap–and–trade rulemaking until it complied with CEQA by analyzing alternatives to cap–and–trade and considering relevant public comments. *Id.* at 35.

297 CAL. CODE REGS. tit. 17, § 95480 (West 2015).

298 *Id.* § 95482.

299 Rocky Mountain Farmers Union v. Goldstene, 719 F. Supp. 2d 1170, 1177 (E.D. Cal. 2010).

300 CAL. CODE REGS. tit. 17 § 95481(a)(16) (2015).

301 *See id.* § 95481(a)(38) (including emissions from distribution and delivery of fuel in the definition of lifecycle GHG emissions).

302 *Id.* § 95486(b).

303 POET, LLC v. California Air Res. Bd., 218 Cal. App. 4th 681, 698 (2013).

304 719 F. Supp. 2d 1170 (E.D. Cal. 2010).

305 *Id.* at 1179.

enjoining the rule's enforcement because it "discriminate[d] against out-of-state corn-derived ethanol while favoring in-state corn ethanol and impermissibly regulate[d] extraterritorial conduct."[306]

The court held that the LCFS "may not impose a barrier to interstate commerce based on the distance that the product must travel in interstate commerce."[307] "'[L]egislation favoring in-state economic interests is facially invalid under the dormant Commerce Clause, even when such legislation also burdens some in-state interests or includes some out-of-state interests in the favored classification.'"[308] "While a State . . . may seek lower prices for its consumers, it may not insist that producers or consumers in other States surrender whatever competitive advantages they may possess."[309]

In 2013, the Ninth Circuit Court of Appeals reversed the federal district court opinion on the unconstitutionality of the California LCFS.[310] The trial court decision was overturned as to the standard of review applied to the regulation, whether the regulation was facially discriminatory and violated the Constitution's dormant Commerce Clause, and whether the California action was impermissibly extraterritorial.[311] With one partially-dissenting judge, the 2–1 majority instructed the district court on remand to determine whether the regulation discriminated as applied and if so to apply strict scrutiny; otherwise, the court was to apply a balancing test pursuant to *Pike v. Bruce Church, Inc*.[312] In contrast, the dissenting judge in the Ninth Circuit decision found facial discrimination.[313]

Two other federal circuit courts rendered decisions contemporaneously with the Ninth Circuit decision on the California LCFS, adjudicating the issue of state versus federal constitutional authority to regulate aspects of sustainable energy. In 2013, the Seventh Circuit unanimously declared that it is a violation of the dormant commerce clause of the Constitution for a state to treat renewable power originating out of state differently than renewable

306 Rocky Mt. Farmers Union v. Goldstene, 843 F. Supp. 2d 1071, 1105 (E.D. Cal. 2011), *vacated sub nom.* Rocky Mt. Farmers Union v. Corey, 730 F.3d 1070 (9th Cir. 2013). CARB attributed the difference in carbon intensity values to multiple scientific factors in addition to geographic location factors such as emissions related to shipping or transportation of fuel. *Id.* at 1087–88. The court relied upon a table of Carbon Intensity values generated by CARB. *Id.* at 1087.

307 *Id.* at 1086.

308 *Id.* at 1089 (quoting Daghlian v. DeVry Univ., 582 F. Supp. 2d 1231, 1243 (C.D. Cal. 2007)).

309 Brown-Forman Distillers Corp. v. N.Y. State Liquor Auth., 476 U.S. 573, 573 (1986), *rev'g* 64 N.Y.2d 479 (N.Y. App. 1985); *see also* Baldwin v. G.A.F. Seelig, Inc., 294 U.S. 511, 521 (1935) (holding that one state "has no power to project its legislation into [another state] by regulating the price to be paid in that state for [products] acquired there").

310 Rocky Mountain Farmers Union. v. Corey 730 F.3d 1070, 1071 (9th Cir. 2013), *vacating* 843 F. Supp. 2d 1071 (E.D. Cal. 2011), *reh'g denied*, 740 F. 3d 507 (9th Cir. 2014), *cert denied*, 134 S. Ct. 2884 (2014).

311 *Id.* at 1107.

312 *Id.* at 1078 (citing Pike v. Bruce Chruch, Inc., 297 U.S. 187 (1970)).

313 *Id.* at 1108 (Murguia, J., dissenting) (relying on *Chem. Waste Mgmt., Inc. v. Hunt*, 504 U.S. 334, 342 (1994), which held that an "additional fee [on imported commerce] facially discriminates."); *see also* Or. Waste Sys., Inc. v. Or. Dep't of Envtl. Quality, 511 U.S. 93, 100 (1994) ("In making [the] geographic distinction, the [regulation] patently discriminates against interstate commerce.").

power originating in state.[314] Also in 2013, the Second Circuit ruled that a question of whether a Vermont statute favoring in-state power customers violated the dormant commerce clause was not yet ripe for review without an actual power purchase agreement before the court—however, the court hinted that it was likely unconstitutional for a state to regulate low-carbon power in a way that affects the ability of energy commerce to freely flow interstate across state lines.[315]

Oregon thereafter patterned its similar program on that of California's LCFS. The program requires importers of transportation fuels to cut average carbon intensity to levels which ramp up to a 10-percent carbon reduction goal by 2025. Plaintiffs asked a federal court judge to enjoin the Oregon low-carbon fuel standard on grounds that it violates the dormant commerce clause of the Constitution and is preempted by federal statutes.[316] It remains to be determined this time around, whether the view of two federal judges who found the California equivalent statute constitutional, or the view of the other two federal judges who found it unconstitutional, will prevail over time.

V. CROSS-PURPOSES: INTERNATIONAL EXPEDITED DEVELOPMENT OF COAL-FIRED POWER

One of the critical distinctions about warming emissions is that unlike most conventional pollutants, the impact of a warming molecule released anywhere on the planet is global.[317] Similarly, solutions must be global. Greenhouse gases constitute a zero-sum game: Anyone's loss is everyone's loss. All countries are in the same climate boat on a somewhat unpredictable and warming sea. And without a consolidated global protocol, the legal vessel has no rudder. Nonetheless, almost two decades after the Kyoto Protocol, many large developing countries have made coal the most added new power generation capacity year after recent year.[318]

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314 Ill. Commerce Comm'n v. Fed. Energy Reg. Comm'n, 721 F.3d 764, 776, (7th Cir. 2013) (noting that Michigan's renewable portfolio standard, which applied only to in-state generation, "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"). Judge Richard Posner—in a unanimous decision—relied on a 2012 law review article on constitutional energy jurisdiction issues authored by Professor Ferrey to come to this conclusion. *Id.*

315 Entergy Nuclear Vermont Yankee v. Shumlin, 733 F.3d 393, 431 (2d Cir. 2013).

316 Am. Fuel & Petrochemical Mfrs. v. O'Keeffe, No. 3:15-cv-00467 (D. Or. Mar. 23, 2015).

317 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT 5 (2015), *available at* http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf (describing increases in greenhouse gas concentrations as "extremely likely" causes of increased global average surface temperatures).

318 John Vidal, *Five G7 Nations Increased Their Coal Use Over a Five-Year Period, Research Shows*, GUARDIAN, June 8, 2015, http://www.theguardian.com/environment/2015/jun/08/five-g7-nations-increased-their-coal-use-over-a-five-year-period-research-shows (last visited Nov. 21, 2015) (describing a 16% increase in coal burning in 2013 as compared to 2009 by Britain, Germany, Italy, Japan, and France).

A. International Dimensions of Coal

The existing power plants already installed across the globe will emit an estimated 300 billion tons of CO_2 before they are retired at the end of their lives; coal-fired plants comprise two-thirds of this total.[319] An average of 89 gigawatts (GW) of new coal-fired generation capacity was added annually from 2010–2012.[320] This is an increase of more than 35% annually from the prior decade of 2000–2009, and an increase of 165% more than was added annually during the decade before that from 1990–1999.[321]

Despite the pressing issue of climate change and the Kyoto Protocol having been in place for a decade, the additional new coal electric generation capacity installed between 2010 and 2012 was almost equal to all other forms of electric generation combined.[322] None of the countries with the largest coal reserves—the United States, China, India, or Indonesia—has a carbon policy in place yet to regulate the release of CO_2 from the deployment of such coal reserves. China plans to build almost 400 traditional coal plants in the next several years.[323]

B. China, India, and Beyond

The battle against unsustainable warming from climate change could be won or lost depending on whether Asia does or does not drastically limit its carbon emissions.[324] A molecule of carbon, wherever in the world released, makes an equally damaging contribution to global warming.[325] In the mid-2000s, each year China was adding fossil-fuel based generating capacity equivalent to the total capacity of Britain—the seat of the coal-fired industrial revolution.[326] Indeed, Asia is the engine where there are the

319 Andrew Childers, *300 Billion Tons of Carbon Dioxide Will Be Emitted by Power Plants Globally, Study Says*, 45 Envt. Rep. (BNA) No. 2536, at 1 (Aug. 28, 2014) (quoting a study by scientists from the University of California, Irvine and Princeton University, STEVEN J DAVIS & ROBERT H SOCOLOW, COMMITMENT ACCOUNTING OF CO_2 EMISSIONS 4 (2014), *available at* http://iopscience.iop.org/1748-9326/9/8/084018/pdf/1748-9326_9_8_084018.pdf).

320 Childers, *supra* note 319, at 1.

321 *See id.* The average amount of coal-fired power added was 66 GW annually between 2000 and 2009 and 33 GW annually between 1990 and 1999. *Id.*

322 See Int'l Energy Agency, *Coal*, http://www.iea.org/topics/coal (last visited Nov. 21, 2015) (stating that coal supplied 46% of the additional global primary energy supply from 2010 to 2012).

323 *See* Damian Carrington, *More Than 1,000 New Coal Plants Planned Worldwide, Figures Show*, GUARDIAN, Nov. 20, 2012, http://www.theguardian.com/environment/2012/nov/20/coal-plants-world-resources-institute (last visited Nov. 21, 2015) (indicating that China plans to build 363 new coal power plants).

324 Steven Ferrey, *Why Electricity Matters, Developing Nations Matter, and Asia Matters Most of All*, 15 N.Y.U. ENVTL. L.J. 113, 147–49 (2007).

325 Bradford Plumer, *Is All CO_2 Created Equal? Maybe Not.*, NEW REPUBLIC, Mar. 16, 2010, http://www.newrepublic.com/blog/the-vine/all-co2-created-equal-maybe-not (last visited Nov. 21, 2015).

326 Keith Bradsher, *China's Green Energy Gap*, NY TIMES, Oct 24, 2007, at C1; Ross Taylor, *Exporting Coal, Importing Pollution: Can the Consumption of Coal be Ignored under NEPA and SEPA Analysis when Burned Overseas?*, 4 WASH. J. ENVTL. L. & POL'Y 212, 220 (2014).

greatest annual continental emissions of carbon, and where national emissions are increasing rather than decreasing—as they are elsewhere in North America and Europe.[327] Projections estimate that by 2020, China's GHG emissions will triple, and that China alone will emit 40% of the world's carbon emissions.[328]

Electricity generation accounted for 44% of China's CO_2 emissions in 2010.[329] As of 2012, China already accounted for 46% of global coal consumption.[330] China is the world's largest producer and consumer of coal, accounting for almost as much coal use as the rest of the world combined.[331] Moreover, China has now surpassed the United States as the largest CO_2 emitter in the world.[332] By 2010, China had the highest CO_2 emissions in the world per unit of gross national product (GNP) by a factor approximately double that of any other major nation.[333] In 2005, China's energy consumption per unit of GDP was more than three times that of the United States, more than five times that of Germany, and eight times that of Japan.[334]

And the pace is not being abated: At the end of 2012, there were 363 coal-fired plants with a combined generating capacity of 557,938 Mw proposed to be built in China.[335] China plans to build almost 400 traditional coal plants in the next few years.[336] China is progressing with the construction of more than 500 new coal-fired plants, having opened more than one new coal plant every week in a recent year.[337] "[T]he intensity of China's growth is unprecedented in any other developing country in the

327 JOS G.J. OLIVIER ET AL., PBL NETH. ENVTL. ASSESSMENT AGENCY, TRENDS IN GLOBAL CO_2 EMISSIONS 10–15 (2013), http://cdiac.ornl.gov/trends/emis/top2010.tot (last visited Nov. 21, 2015).

328 Debora E. Cooper, *The Kyoto Protocol and China: Global Warming's Sleeping Giant*, 11 GEO. INT'L ENVTL. L. REV. 401, 405 (1999).

329 RICHARD BARON ET AL., INTERNATIONAL ENERGY AGENCY, POLICY OPTIONS FOR LOW CARBON POWER GENERATION IN CHINA 5 (2012), *available at* https://www.iea.org/publications/insights/insightpublications/Insight_PolicyOptions_LowCarbon_China.pdf.

330 AILUN YANG & YIYUN CUI, WORLD RESOURCE INSTITUTE, GLOBAL COAL RISK ASSESSMENT: DATA ANALYSIS AND MARKET RESEARCH (2012), *available at* http://pdf.wri.org/global_coal_risk_assessment.pdf.

331 *Id.* at 3–4.

332 John Vidal & David Adam, *China Overtakes U.S. as World's Biggest CO_2 Emitter*, GUARDIAN, June 19, 2007, http://www.theguardian.com/environment/2007/jun/19/china.usnews (last visited Nov. 21, 2015).

333 World Bank, *CO2 Emissions (kg per PPP $ of GDP)*, http://data.worldbank.org/indicator/EN.ATM.CO2E.PP.GD (last visited Nov. 21, 2015).

334 *Energy Consumption per Unit of GDP Continues to Fall*, CHINA DAILY, July 15, 2008, http://www.chinadaily.com.cn/business/2008-07/15/content_6847891.htm (last visited Nov. 21, 2015).

335 YANG & CUI, *supra* note 330, at 5.

336 SourceWatch, *Proposed Coal Plants in China*, http://www.sourcewatch.org/index.php/Category:Proposed_coal_plants_in_China (last visited Nov. 21, 2015)

337 Mark Clayton, *New Coal Plants Bury "Kyoto,"* CHRISTIAN SCI. MONITOR Dec. 23, 2004, http://www.csmonitor.com/2004/1223/p01s04-sten.html (last visited Nov. 21, 2015).

world,"[338] with a growth rate of GDP at more than ten percent for the last three decades.[339]

China and India harbor around one quarter of the world's coal reserves and are deploying them rapidly to fire electric power plants.[340] India has targeted 100,000 MW in new capacity over the next ten years.[341] By the year 2030, coal-fired power in India and China will add 3,000 million extra tons of CO_2 to the atmosphere every year.[342] Therefore just the *additional* CO_2 emissions from China and India's electric power sectors alone will constitute approximately 10% of all world CO_2 emissions from all sources.[343] China alone is projected to account for 42% of future air emissions.[344] The growth in emissions reflects China being the world's largest producer and consumer of coal.[345]

While China is developing some renewable power, it adds yearly 40 times more new coal capacity than new wind power capacity.[346] In China, renewables' share in energy production dropped from 40% in 1971 to 11% today; in 2035, it will likely be just 9%.[347]

C. Required Policy

The failure to include only China presages the difficulty of realizing world climate control objectives in the next handful of years, as required. In 2011, global CO_2 emissions rose at the rate of approximately 3% worldwide and 9% per year in China, the largest GHG emitter in the world.[348] Non-fossil sources of power generation in China are projected to meet only a similarly

338 Meixian Li, *China's Compliance with WTO Requirements*, 18 TEMP. INT'L & COMP. L.J. 155, 155 (2004).

339 Michael Schuman, *The Real Reason to Worry About China*, TIME, Apr. 28, 2013, http://business.time.com/2013/04/28/the-real-reason-to-worry-about-china/ (last visited Nov. 21, 2015).

340 FERREY, UNLOCKING THE GLOBAL WARMING TOOLBOX, *supra* note 45, at 35.

341 *Id.*

342 SCIENCE & TECHNOLOGY COMMITTEE, MEETING UK ENERGY AND CLIMATE NEEDS: THE ROLE OF CARBON CAPTURE AND STORAGE, 2005–6, H.C. 578-1, at 11, *available at* http://www.publications.parliament.uk/pa/cm200506/cmselect/cmsctech/578/578i.pdf, *cited in* Ray Purdy, *The Legal Implications of Carbon Capture and Storage Under the Sea*, SUSTAINABLE DEV. L. & POL'Y, Fall 2006, at 22, 23.

343 *See* Purdy, *supra* note 342, at tbl.11 (showing that the 2030 projected global CO_2 emissions is 36.868 tons).

344 Matt McGrath, *Full Extent of Global Coal "Binge" is Hidden, Say Researchers*, BBC NEWS, Aug. 26, 2014, http://www.bbc.com/news/science-environment-28942403 (last visited Nov. 21, 2015).

345 U.S. Energy Info. Admin., *China*, http://www.eia.gov/countries/cab.cfm?fips=ch (last visited Nov. 21, 2015).

346 FERREY, UNLOCKING THE GLOBAL WARMING TOOLBOX, *supra* note 45, at 37.

347 Bjørn Lomborg, *The Decline of Renewable Energy*, PROJECT SYNDICATE, Aug. 14, 2013, http://www.project-syndicate.org/commentary/the-falling-share-of-renewables-in-global-energy-production-by-bj-rn-lomborg (last visited Nov. 21, 2015).

348 JOS G.J. OLIVIER ET AL., PBL NETHERLANDS ENVTL ASSESSMENT AGENCY, TRENDS IN GLOBAL CO_2 EMISSIONS: 2012 REPORT 6 (2012), *available at* http://edgar.jrc.ec.europa.eu/CO2REPORT2012.pdf.

small percentage of primary energy demand in China by the year 2025.[349] Annual fossil-fuel based carbon emissions in China are projected to increase by 37% by the year 2035.[350] China's carbon emissions already account for 29% of the current world total, and the country is likely to maintain or increase that percentage through 2035.[351]

It will be "almost impossible" to limit global warming to 2 degrees Celsius (3.56 degrees Fahrenheit) unless China puts limits on its coal consumption within the next decade.[352] World countries' recent pledges to fight climate change by cutting their CO_2 emissions are unlikely to affect global increases in coal use and emissions. According to the International Energy Agency, global demand for coal is still the fastest growing demand for fossil fuel and will rise 2.1% annually, driven mainly by China, India, and other expanding Asian economies.[353]

Even if all developed nations succeed in their carbon reduction targets, the increased amounts of carbon emissions projected for China alone could threaten reductions collectively made by other countries.[354] The increase in fossil fuel use in China also will consume an increasing share of world oil production. Unless China deploys energy efficiency measures or shifts to non-fossil fuels, this one country alone could frustrate global carbon and GHG reduction goals.

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349 *See* Goldman Sachs Inst., Inc., *Sustainable Growth in China: Spotlight on Energy*, http://www.goldmansachs.com/our-thinking/archive/archive-pdfs/sustainable-growth-china-cohen.pdf (last visited Nov. 21, 2015) (noting growth in China's renewables sector, but stating that China only intends to fulfill 15% of its energy needs with non-fossil fuels by 2020).

350 World Nuclear Ass'n, *Nuclear Power in China*, http://www.world-nuclear.org/info/country-profiles/countries-a-f/china—nuclear-power/ (last visited Nov. 21, 2015).

351 Matt McGrath, *China's Per Capita Carbon Emissions Overtake EU's*, BBC News, Sept. 21, 2014, http://www.bbc.com/news/science-environment-29239194 (last visited Nov. 21, 2015); World Nuclear Ass'n, *Nuclear Power in China*, *supra* note 350.

352 FERGUS GREEN & NICHOLAS STERN, CENTRE FOR CLIMATE CHANGE ECONOMICS AND POLICY, AN INNOVATIVE AND SUSTAINABLE GROWTH PATH FOR CHINA: A CRITICAL DECADE 23 (2014), *available at* http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/05/An-Innovative-and-Sustainable-Growth-Path-for-China-A-Critical-Decade1.pdf.

353 *IEA Says Climate Pledges Won't Halt Global Growth in Coal Demand to 2019*, 45 Env't Rep. (BNA) No. 50, at 3640 (Dec. 19, 2014). The article further reports that according to the IEA, "India, averaging 5 percent annual coal demand growth, should pass the U.S. as the world's second-biggest coal consumer by 2019, [while] China, the world's biggest producer and importer of coal, should see coal demand grow 2.6 percent, or 100 million tons, per year to 2019, assuming it maintains an annual gross domestic product growth rate of about 7 percent." *Id.*

354 *See* XILIANG ZHANG ET AL., MASS. INST. OF TECH., CARBON EMISSIONS IN CHINA: HOW FAR CAN NEW EFFORTS BEND THE CURVE? 5 (2014), *available at* http://globalchange.mit.edu/CECP/files/document/MITJPSPGC_Rpt267.pdf (stating that without further policy action, China's projected emissions would threaten any global effort to stabilize climate change). China currently produces 0.7 billion tons of carbon annually. By the year 2015 it is projected, on its current pace of development, to emit 2.1 billion tons of carbon, and 3.2 billion tons of carbon by the year 2025. The 1997 level of global emission of carbon was 6.15 billion tons. Thomas Drennen & Jon Erickson, *Who Will Fuel China?*, 279 SCI. MAG. 1483, 1483 (1998).

VI. CONCLUSION: INTERNATIONAL IMPERATIVES

Despite a significant developed country pledge of $100 billion annually by 2020 for developing country carbon reduction and adaptation, there is still a significant expenditure on high-carbon power development in developing countries. Three of the Asian countries in which I have worked as the legal advisor to the World Bank and the United Nations on renewable energy are still, despite reforms that were initiated, at the high end of energy and carbon emissions, exceeding the average country by 600%–6,000% each. The country experiencing the greatest percentage increase in electricity use is Vietnam; the country with the greatest percentage increase in CO_2 emissions in the past 30 years is Thailand; and the country with the greatest percentage increase in coal use is Indonesia.[355] Developed nations are already delivering more than one-third of the $100 billion pledged amount.[356]

By contrast, what has transpired in the United States is a significant and continuing reduction in coal use and development. Coal-fired generation has decreased from more than 50% of total U.S. generation a decade ago, to less than 40% today and falling fast.[357] In the next five years, under increasing competition from shale gas and the EPA's regulations on power plant emissions of CO_2, 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.[358] U.S. policy and basic economic factors are exerting a demonstrable impact.

Contrasted with what is transpiring with coal in developing countries, the U.S. Energy Information Administration "reports that 60 gigawatts of [existing U.S.] coal-fired [power generation] capacity . . . will be shuttered by 2020. Ninety percent of this coal capacity retirements will occur by 2016."[359] At the end of 2012 there were 1,308 coal-fired generating units in the United States, totaling 310 Gw of capacity.[360] In 2012 alone, 10.2 Gw of coal-fired capacity was retired, representing 3.2% of the 2011 total.[361] Units that retired in 2010–2012 were small in size, with an average size of 97 Mw, and inefficient, with an average heat rate of about 10,695 British thermal

355 *Analyst Says Needs of Developing Nations Make Carbon Taxes, Emission Limits Unlikely*, 37 Env't Rep. (BNA) No. 22, at 1481 (Oct. 22, 2014). Indonesia's increased use of electricity resulted in a 442% increase in gross domestic product. *Id.*

356 Reed Landberg, *Climate Finance from Developed Nations Tops $35 Billion a Year, U.S. Envoy Says*, Energy & Climate Rep. (BNA) No. 38, at 14 (Feb. 26, 2015).

357 *See* U.S. Energy Info. Admin., *Electric Power Monthly* http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_01 (last visited Nov. 21, 2015) (reporting net generation by energy source).

358 *IEA Says Climate Pledges Won't Halt Global Growth in Coal Demand to 2019*, 45 Env't Rep. (BNA) at 3640 (Dec. 15, 2014).

359 Michael Bastasch, *Report: EPA Regulations to Accelerate Coal Plant Shutdowns*, THE DAILY CALLER, Feb. 14, 2014, http://dailycaller.com/2014/02/14/report-epa-regulations-to-accelerate-coal-plant-shutdowns (last visited Nov. 21, 2015).

360 U.S. Energy Info. Admin., *AEO2014 Projects More Coal-Fired Power Plant Retirements by 2016*, Feb. 14, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=15031 (last visited Nov. 21, 2015).

361 *Id.*

unit/kWh.[362] So the most inefficient units were retired first, which follows economic logic. In contrast, units scheduled for retirement over the next 10 years are larger and more efficient: at 145 Mw, their average size is 50% larger than recent retirements, with an average tested heat rate of 10,398 Btu/kWh.[363]

U.S. coal-fired generating capacity will fall from 310 Gw in 2012 to 262 Gw in 2040, according to EIA, amounting to a 15% decrease in the country's coal-fired capacity.[364] Standard & Poor's estimated an even more aggressive ramp-down rate of that same 15% reduction of 40–75 Gw of coal-fired power generation units to shut by 2020.[365] Permanent shutdowns of half of this 15%—27 Gw—have already been announced.[366]

There is evidence that countries can exercise power over power.[367] Half of these U.S. shutdowns of coal generation are attributed to an indirect effect of the executive action of the new MATS regulations, with which many coal plants complied before they were remanded by the Supreme Court[368] Whatever the final value of decrease of coal generation, the impact of the EPA regulations and the court orders interpreting them will be significant.[369] The impact of exercise of power on power also can steer the replacement technology. While 18% of the U.S. coal plant closures expected by the end of 2015 will be offset by natural gas-generated power, renewable energy technologies are supplanting much of the decrease: "[s]ince 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] doubl[ing] wind and solar electricity generation in the United States—once again—by 2025."[370]

Electricity is considered the second most important invention in human history.[371] It also is of significant scope, with several hundred billion dollars

362 *Id.*

363 *Id.*

364 U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2014 WITH PROJECTIONS TO 2040 D-26 (2014), *available at* http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf.

365 *Breathing Clean Air Will Come at a Cost as U.S. Utility Bills Are Predicted to Surge*, 45 Env't Rep. (BNA) No. 43, at 3138 (Oct. 31, 2014). 20,000 Mw of coal facilities operated at 38 percent of capacity for the first half of 2014, and will shut permanently by the end of 2015. *Id.*

366 *Id.*

367 *See* Coral Davenport, *Obama to Take Action to Slash Coal Pollution*, June 1, 2014, http://www.nytimes.com/2014/06/02/us/politics/epa-to-seek-30-percent-cut-in-carbon-emissions.html (last visited Nov. 21, 2015) (discussing the Obama administration's regulations to reduce carbon pollution from the nation's over 600 power plants by 30 percent from 2005 levels by 2030 that are "one of the strongest actions ever taken by the United States government to fight climate change").

368 *Breathing Clean Air*, *supra* note 365.

369 *See* Ctr. for Climate and Energy Solutions, *Clean Air Act Cases*, http://www.c2es.org/federal/courts/clean-air-act-cases (last visited Nov. 21, 2015) (detailing all of the implications of the subsequent case law).

370 The White House, Climate Change Plan, *Cutting Carbon Pollution in America*, http://www.whitehouse.gov/energy/climate-change (last visited Nov. 21, 2015).

371 James Fallows, *The Fifty Greatest Breakthroughs Since the Wheel*, ATLANTIC, Oct. 23, 2013, http://www.theatlantic.com/magazine/archive/2013/11/innovations-list/309536/ (last visited Nov. 21, 2015).

of annual transactions.[372] Power will remain and increase. It is not a transient or "bridge" technology. What is clearly demonstrated is that there is power over power: government executive and legislative action—as well as unilateral executive action alone—can fundamentally change how a country generates electric power. How we choose to generate the power of this most important technology fundamentally affects climate, so it becomes imperative that all governments now exercise actions to control expansion of their power technology.

The mechanism is now proven and demonstrated in the United States, and there is also a proven and tested mechanism for developing countries.[373] The opportunity in developing countries is even greater than that in developed countries, because there is a dramatic increase in power demand and construction.[374] Since developing countries do not need to replace existing power generation capacity as in developed countries, it is easier to promote renewable power where it is all additional "greenfield" development of additional capacity. But while some developing countries are doing so, many of the large developing countries are building additional coal plants as fast as possible. Change is not immediate. President Obama's order prohibiting new coal facility financing by the U.S. Export-Import Bank was overturned in a U.S. Senate vote 64–29 in July 2015, barring the U.S. Export-Import Bank from denying an application for financing based on the source of energy used for the project.[375]

With the creation of the new climate change pledges of developed countries to fund an additional $100 billion/year of aid to developing countries to deal with climate change—the largest transfer of wealth in human history—there is no longer any reason why climate-sensitive development should not be required for use of these funds. Developed countries should condition this funding on use of the funds for renewable or other power development that dramatically reduces warming emissions. There is documentation that controls on these expenditures are warranted, to a degree not present in other forms of aid.[376] When one gives this much money, it can and should be devoted to low-carbon power generation.

India, the world's third most significant emitter of carbon, offered to make sharper cuts in emissions only if rich nations pay it to do so.[377] Some

372 *See* ERNST & YOUNG, POWER TRANSACTIONS AND TRENDS: GLOBAL POWER AND UTILITIES TRANSACTION REVIEW, 2014 REVIEW AND 2015 OUTLOOK 1 (2015), *available at* http://www.ey.com/Publication/vwLUAssets/EY-power-transactions-and-trends-2014-review-and-2015-outlook/$FILE/EY-power-transactions-and-trends-2014-review-and-2015-outlook.pdf.

373 *See* Ferrey, *International Alchemy*, *supra* note 3, at 311 (noting that sustainable renewable power technology can be deployed ab initio for the structural backbone of rapid electric power development).

374 *Id.* at 305, 307 (referring specifically to Asia).

375 Dean Scott, *Hurdles seen in Reversing Overseas Coal Ban*, Energy & Climate Rep. (BNA) No. 145, at 22 (July 29, 2015).

376 *See* Ferrey, *Changing Venue*, *supra* note 7, at 104–05.

377 Natalie Obiko & Uni Krishnan, *India Tells Developed World It Will Impose More Cuts in Exchange for Cash*, Technology, Energy & Climate Rep. (BNA) No. 58, at 1 (March 26, 2015) (explaining that India's Environment Minister Prakash Javadekar stated that he may present the world with a choice ahead of the December Kyoto Protocol Conference of the Parties with the

question whether even $100 billion annually will be enough—according to a study by the London School of Economics, richer nations need to provide $400 billion to $2 trillion a year to the developing world by 2050 to help cut greenhouse gases and fight climate change.[378] This level would be four to twenty times the level pledged by developing countries by 2020, and even that amount has yet to be raised.

In addition to the above "how" to get to where the world needs to arrive, the "when" of this transition is now. Now is an opportunity for this technological change abroad. In the last five years, natural gas prices in the U.S. have fallen precipitously to one-third of their prior value.[379] Natural gas is now cost-competitive with the traditionally much cheaper cost of coal for power generation, and natural gas has the added benefit of producing only approximately half as much CO_2 as coal, no PM criteria pollutants, no SO_2 criteria pollutant emissions, and the ability to emit less NOx[380] and greatly reduce global warming.[381] New combined-cycle gas turbines—a spin-off technology from the aviation industry—have transformed the economics of the industry, providing a more efficient means to convert energy inputs to electric output.[382] 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.[383] In the United States gas and coal are changing their positions of fuel dominance. Coal once produced more than 60% of electricity in the United States but now accounts for only 35%, while natural gas generation has increased to 25%.[384] Coal's loss is offset by natural gas's gain.

In both developed and developing countries, there are now proven legal models to take necessary and imperative control of power. These successful models are templates for all countries. It is developing countries that are not, to date, moving robustly to embrace new sustainable power alternatives. Developed countries are the donors to the new $100 billion/year

proposition that "[t]he world has to decide what they want. . . . Every climate action has a cost. I can't make my poor pay for somebody who has polluted the world").

378 Alex Morales, *At Least $400 Billion in Climate Aid Needed for Developing Nations a Year, Study Says*, International Environment Reporter (BNA) No. 6 (March 16, 2015).

379 Gail Teverberg, Our Finite World, *Why U.S. Natural Gas Prices Are So Low: Are Changes Needed*?, http://ourfiniteworld.com/2012/03/23/why-us-natural-gas-prices-are-so-low-are-changes-needed/ (last visited Nov. 21, 2015).

380 American Gas Association, *Environmental Benefits of Natural Gas*, http://www.aga.org/environmental-benefits-natural-gas. (last visited Nov. 21, 2015).

381 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/ (last visited Nov. 21, 2015).

382 *See* STEVEN FERREY, LAW OF INDEPENDENT POWER § 2.9 (35th ed. 2015).

383 Symposium, *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. 245, 245 (2012).

384 Western Energy Alliance, *Natural Gas: Most Significant Solution for Reducing U.S. Greenhouse Gas Emissions*, http://www.westernenergyalliance.org/knowledge-center/air/methane (last visited Nov. 21, 2015).

climate fund, and there are legal mechanisms to tie these funds to the implementation of sustainable power options. Climate change is international, as must be any effective response. International law must now exercise power over power, if there is any reasonable prospect to arrest global warming to manageable levels of change.