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## Electric Power in a Carbon Constrained World

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# ELECTRIC POWER IN A CARBON CONSTRAINED WORLD

ARNOLD W. REITZE, JR.\*

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## I. INTRODUCTION TO ELECTRIC POWER

Electric power plants have been a focus of the Clean Air Act for forty years because they are major sources of conventional air pollutants.<sup>1</sup>

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<sup>1</sup> Coal-fired electric power plants that, in 1996, were more than twenty years old produced

In the past decade, pressure has been building for politicians to respond to the outpouring of the scientific community claiming that greenhouse gases (“GHGs”) released into the atmosphere are negatively changing the climate of the planet.<sup>2</sup> Carbon dioxide (“CO<sub>2</sub>”) is considered the most important GHG released in the United States, and it accounted for 82.69% of U.S. GHG emissions in 2007.<sup>3</sup> Fossil fuel combustion, in 2007, was responsible for nearly all of U.S. CO<sub>2</sub> emissions and 82.27% of U.S. GHG emissions.<sup>4</sup> Electric power plants are the largest source of CO<sub>2</sub> emissions with 39.66% of U.S. CO<sub>2</sub> emissions, followed by the transportation sector with 30.32%.<sup>5</sup> Government mandated GHG controls that will create a carbon-constrained economy are coming. The nature and extent of these developments and the policy options that potential GHG restrictions present are the subject of this article.

In 2008, electric generation nameplate capacity in the United States was more than a million megawatts (“MW”); electric power production capacity by fuel source was: 30.54% coal, 41.16% natural gas, 9.61% nuclear, 7.04% hydroelectric, 5.76% petroleum, 2.97% geothermal, 2.26% wind, and 0.05% solar.<sup>6</sup> Coal-fired plants had a net summer capacity of 313,322 MW.<sup>7</sup> Nameplate capacity for wind energy was 24,980 MW, solar capacity was 539 MW, and geothermal capacity was 3,281 MW.<sup>8</sup> Because power plants utilizing the various fuels operate with differing capacity factors, the net electrical energy generated, in 2008, by fuel was:

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eighty-five percent of the NO<sub>x</sub>, ninety-seven percent of the SO<sub>2</sub>, and ninety-two percent of the CO<sub>2</sub> from the electric utility industry. David Driesen, *Sustainable Development and Air Quality: The Need to Replace Basic Technologies with Cleaner Alternatives*, 32 *Envtl. L. Rep.* 10277, 10286 (2002) (citing NATURAL RES. DEF. COUNCIL & PUB. SERV. ELEC. & GAS CO., BENCHMARKING AIR EMISSIONS OF ELECTRIC UTILITY GENERATORS IN THE U.S. 39 (1998)).

<sup>2</sup> Andrew C. Revkin, *Overview—Global Warming*, N.Y. TIMES, <http://topics.nytimes.com/top/news/science/topics/globalwarming/index.html> (last visited Mar. 8, 2010).

<sup>3</sup> STACY C. DAVIS, SUSAN W. DIEGEL & ROBERT G. BOUNDY, TRANSPORTATION ENERGY DATA BOOK 11-4 tbl.11.3 (28th ed. 2009) (calculated from data).

<sup>4</sup> *Id.* at 11-4 tbl.11.3, 11-6 tbl.11.5 (calculated from data).

<sup>5</sup> U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2008 ES-4 tbl.ES-2 (2010), available at <http://epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010-Full-Docment.pdf> [hereinafter INVENTORY] (public review draft) (calculated from data).

<sup>6</sup> ENERGY INFO. ADMIN., U.S. DEPT OF ENERGY, DOE/EIA-0348 (2008) ELECTRIC POWER ANNUAL 2008 18 tbl.1.2 (2009), available at <http://tonto.eia.doe.gov/FTPROOT/electricity/034808.pdf> [hereinafter 2008 ELECTRIC POWER] (calculated from data).

<sup>7</sup> *Id.*

<sup>8</sup> *Id.*

59.24% coal, 17.14% nuclear, 12.94% natural gas, 1.14% petroleum, and 0.46% from renewable energy sources.<sup>9</sup>

Planned electrical power capacity additions for the following five years total 87,966 MW, which is a five-year growth of 7.96%.<sup>10</sup> Much of this growth may be attributable to America's population growth, which increased about 1.10% annually between 1990 and 1995 and grew by 27 million from 1990 to 1999.<sup>11</sup> From 2000 to July 1, 2008, another 22.638 million were added to the U.S. population.<sup>12</sup>

Almost one ton of CO<sub>2</sub> is produced for each megawatt/hour ("MWh") of electricity generated using coal.<sup>13</sup> But, emissions can vary significantly, depending on factors such as the fuel and technology used and the age of the plant.<sup>14</sup> CO<sub>2</sub> emissions from fossil fuel combustion from 1990 to 2008 increased eighteen percent, which is an average annual increase of one percent.<sup>15</sup> During the same period, overall U.S. CO<sub>2</sub> emissions increased sixteen percent.<sup>16</sup> In 2007, electric power plant CO<sub>2</sub> emissions increased 2.9%, which is the largest one-year increase since 1998.<sup>17</sup> But, in 2008, energy consumption fell 2.2% and CO<sub>2</sub> emissions fell 2.8% as GDP dropped at an annual rate of 6.3% in the fourth quarter.<sup>18</sup> However, in many government reports, CO<sub>2</sub> emissions from electric power generation are attributed on a pro-rated basis to the other end-use sectors: transportation, industrial, commercial, and residential; and electricity use was

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<sup>9</sup> *Id.* at 28 tbl.2.1 (calculated from data for "other renewables").

<sup>10</sup> *Id.* at 18 tbl.1.2, 19 tbl.1.4 (calculated from data).

<sup>11</sup> Jennifer C. Day, U.S. Census Bureau, Population Profile of the United States, <http://www.census.gov/population/www/pop-profile/natproj.html> (last visited Mar. 8, 2010).

<sup>12</sup> U.S. Census Bureau, United States—States GCT-T1.Population Estimates, <http://factfinder.census.gov> (follow "Population Finder" hyperlink; then follow "Population for all States in the United States" hyperlink) (last visited Mar. 8, 2010).

<sup>13</sup> In 2008, the net electricity generated from coal was 1985.8 billion MWh. 2008 ELECTRIC POWER, *supra* note 6, at 28 tbl.2.1. Coal used to generate electricity in 2008 was responsible for the release of 1940.7 million metric tons of carbon dioxide equivalent GHGs, which is 0.98 metric tons per MWh. INVENTORY, *supra* note 5, at 4 tbl.3-5.

<sup>14</sup> See INVENTORY, *supra* note 5, at ES-4 to -8.

<sup>15</sup> *Id.* at 9.

<sup>16</sup> *Id.* at ES-4.

<sup>17</sup> Leora Falk, *Study Finds Rise in Carbon Emissions From Power Plants Largest Since 1998*, 39 ENV'T REP. (BNA) 552 (Mar. 21, 2008). Carbon dioxide emissions from electricity generation went from 2325.7 million metric tons in 2006 to 2391.3 million metric tons in 2007. INVENTORY, *supra* note 5, at ES-4 tbl.ES-2.

<sup>18</sup> ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, U.S. CARBON DIOXIDE EMISSIONS FROM ENERGY SOURCES 2008 FLASH ESTIMATE 2 (May 2009), available at <http://www.eia.doe.gov/oiaf/1605/flash/pdf/flash.pdf>.

respectively responsible for 0.20%, 29.26%, 34.92%, and 35.61% of U.S. CO<sub>2</sub> emissions.<sup>19</sup>

The United States Supreme Court's decision in *Massachusetts v. EPA* held GHGs are pollutants under the Clean Air Act<sup>20</sup> ("CAA").<sup>21</sup> However, before it may regulate GHGs, the Environmental Protection Agency ("EPA") must decide whether they are air pollutants that endanger public health or welfare.<sup>22</sup> The Court held that the "EPA can avoid taking further action only if it determines that greenhouse gases do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do."<sup>23</sup> The Court went on to say that the EPA cannot refuse to regulate because of its concerns over scientific uncertainty or because of the implications concerning foreign affairs.<sup>24</sup> "The statutory question is whether sufficient information exists to make an endangerment finding."<sup>25</sup> The Supreme Court remanded the case to EPA for additional proceedings.<sup>26</sup> The Court did not say whether EPA must make an endangerment finding, and it did not articulate what policy concerns may be considered by the EPA in making its finding.<sup>27</sup>

EPA made an endangerment finding for CO<sub>2</sub> after being pressured to do so after the remand in *Massachusetts v. EPA*.<sup>28</sup> It may "have ramifications beyond the CAA, because other environmental laws have provisions similar to" the "endangerment" language of the CAA.<sup>29</sup> The result could be to make most environmental laws applicable to sources of GHG

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<sup>19</sup> INVENTORY, *supra* note 5, at ES-9 tbl.ES-3 (calculated from 2007 data).

<sup>20</sup> Clean Air Act, 42 U.S.C. §§ 7401-7671q (2006).

<sup>21</sup> *Massachusetts v. EPA*, 549 U.S. 497, 528 (2007).

<sup>22</sup> *Id.* at 532-33.

<sup>23</sup> *Id.* at 533.

<sup>24</sup> *Id.* at 533-34.

<sup>25</sup> *Id.* at 534.

<sup>26</sup> *Id.* at 535.

<sup>27</sup> *Massachusetts v. EPA*, 549 U.S. at 534-35.

<sup>28</sup> See, e.g., Peter Glaser, *Will EPA be Forced to Issue a Climate Change Endangerment Finding?*, ENVTL. PROTECTION, June 30, 2008, <http://eponline.com/articles/2008/06/30/will-epa-be-forced-to-issue-a-climate-change-endangerment-finding.aspx> (explaining that a motion was filed in an effort to compel EPA to make a finding). In December 2009, the EPA released an endangerment finding concerning CO<sub>2</sub> and stated that it posed a risk to public health. U.S. Env'tl. Prot. Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act*, <http://www.epa.gov/climatechange/endangerment.html> (last visited Mar. 8, 2010) [hereinafter *Endangerment and Cause*].

<sup>29</sup> Arnold W. Reitze, Jr., *Federal Control of Carbon Dioxide Emissions: What are the Options?*, 36 B.C. ENVTL. AFF. L. REV. 1, 8 (2009); see also *infra* Part II.C.1 (discussing Safe Water Drinking Act, CERCLA, and RCRA).

emissions. The EPA promulgated an advance notice of proposed rulemaking, "Regulating Greenhouse Gas," on July 30, 2008, in which the EPA effectively decided not to regulate GHGs at that time and commenced a lengthy regulatory process that precluded a decision being made before President Obama occupied the White House.<sup>30</sup> On April 17, 2009, the EPA released a proposed rule declaring that six GHGs endanger health and welfare.<sup>31</sup> On December 7, 2009, these findings were finalized; they went into effect January 14, 2010.<sup>32</sup> These findings pave the way for the EPA to regulate GHGs under the CAA.<sup>33</sup>

In addition to the CAA regulation discussed above, on September 28, 2009, the National Highway Traffic Safety Administration ("NHTSA") and the EPA promulgated a proposed rule to reduce GHGs and improve fuel economy for passenger cars, light-duty trucks, and medium-duty passenger vehicles.<sup>34</sup> Because CO<sub>2</sub> emissions, which are ninety-five percent of the GHG emitted from light-duty vehicles, are essentially constant per gallon for any particular type of fuel,<sup>35</sup> emission limits for CO<sub>2</sub> are basically the same as fuel efficiency standards. This joint rule-making effort by the NHTSA and EPA aims to comply with requirements of the CAA and the Energy Policy and Conservation Act of 1975<sup>36</sup> ("EPCA"), as amended by the Energy Independence and Security Act of 2007<sup>37</sup> ("EISA").<sup>38</sup> By 2030, this proposed rule is projected to reduce GHGs from the U.S. light-duty fleet by approximately twenty-one percent from what would occur without this rule.<sup>39</sup> When these motor vehicle standards are finalized, GHGs will be regulated

<sup>30</sup> Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354 (July 30, 2008) (to be codified at 40 C.F.R. ch. 1). See generally Roger Martella, James Cahan & Chris Bell, *EPA's Greenhouse Gas Proposal: A Blueprint for Federal Regulation*, 39 ENV'T REP. (BNA) 2145 (Oct. 24, 2008) (discussing the implications of the EPA's notice).

<sup>31</sup> Dean Scott, *EPA Proposal Finds Greenhouse Emissions Endanger Health, Lays Groundwork for Action*, 40 ENV'T REP. (BNA) 908 (Apr. 24, 2009).

<sup>32</sup> Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) for the Clean Air Act, 74 Fed. Reg. 66, (Dec. 15, 2009) [hereinafter Endangerment and Cause or Contribute Findings].

<sup>33</sup> See Endangerment and Cause, *supra* note 28.

<sup>34</sup> Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 74 Fed. Reg. 49,454 (Sept. 28, 2009) [hereinafter Proposed Fuel Standards].

<sup>35</sup> *Id.* at 49,458-59.

<sup>36</sup> Energy Policy and Conservation Act of 1975, Pub. L. No. 94-163, 89 Stat. 871 (codified as amended in scattered sections of 15 U.S.C. & 42 U.S.C.).

<sup>37</sup> Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (to be codified at 42 U.S.C. § 17001).

<sup>38</sup> Proposed Fuel Standards, *supra* note 34, at 49,459.

<sup>39</sup> *Id.* at 49,460.

pollutants under the CAA. This will make GHGs emitted from electric power plants and other stationary sources subject to CAA regulation.

Using the existing CAA to deal with climate change is a poor policy. However, many people believe that using a less than ideal tool to address climate is better than doing nothing. For example, the Supreme Court's decision in *Massachusetts v. EPA* is helping to spur Congress to enact climate change and energy policy legislation.<sup>40</sup> At this time, Congress appears to favor a cap-and-trade approach to reduce GHG emissions.<sup>41</sup> Similarly, three regional GHG programs and many states are developing programs to address climate change, and a cap-and-trade program appears to be their tool of choice to deal with this issue.<sup>42</sup> The basic thrust of these programs is to increase the cost of energy.<sup>43</sup> This is expected to reduce fossil fuel consumption and pave the way for the development of alternative ways of providing useful energy.<sup>44</sup> But increasing fossil fuel cost will not assure that either the capital or the technology is available to achieve a transition to a carbon-free economy in time to avoid serious impacts to our biosphere.

To date, international climate efforts have had almost no effect on U.S. producers of GHG emissions.<sup>45</sup> But, the Kyoto Protocol, the leading international GHG reduction program, is being renegotiated.<sup>46</sup> Participating nations may adopt specific mandates to reduce GHG emissions that will lead to restrictions on sources in the United States. However, a viable U.S. GHG reduction program will not guarantee that an effective international reduction effort will develop, as most of the future growth in GHG emissions is expected to come from industrializing nations. For example, from 1980 to 2006, CO<sub>2</sub> emissions increased 23.27% in the United States and 0.28% in Europe.<sup>47</sup> In the same time span, the world's CO<sub>2</sub> emissions

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<sup>40</sup> See *infra* Parts VI.B.1, VI.B.1.a.

<sup>41</sup> See *id.*

<sup>42</sup> See *infra* notes 301–03, 459–70, 479–80 and accompanying text.

<sup>43</sup> See *infra* Part VI.

<sup>44</sup> See *infra* Part VI.A.

<sup>45</sup> For example, the U.S. Senate never ratified the Kyoto Protocol because of concerns that the agreement did not mandate emission reductions for developing nations and could have harmed the U.S. economy. S. REP. NO. 105-54, at 4 (1997).

<sup>46</sup> See U.N. Framework Convention on Climate Change, <http://unfccc.int/2860.php> (last visited Mar. 9, 2010) (providing information regarding ongoing and completed U.N. negotiations on climate change issues).

<sup>47</sup> ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, WORLD CARBON DIOXIDE EMISSIONS FROM CONSUMPTION AND FLARING OF FOSSIL FUELS, 1980–2006, <http://www.eia.doe.gov/pub/international/iealf/tableh1co2.xls> (last visited Mar. 9, 2010) (calculated from data).

increased 57.79%, but China's emissions increased 312.11% (to exceed U.S. emissions), India's increased 341.11%, and Brazil's increased 102.97%.<sup>48</sup>

Most knowledgeable people do not believe that global warming can be prevented, but if we act appropriately, we may be able to reduce some of the adverse consequences.<sup>49</sup> A successful program will require the cooperation of the world's major users of energy, but without a viable program to reduce GHG emissions in the United States, it is unlikely that an effective international effort will materialize. Thus, to make a difference, GHG controls on the fossil-fueled electric power industry are almost certainly going to have to be imposed by domestic and, perhaps, international law.

#### A. *Introduction to Coal-Fired Power Plant Technology*

There were 1,445 coal-fired electric-generating units in the United States in 2008, which constituted 31.02% of the nation's net summer capacity.<sup>50</sup> There are 444 coal-burning power plants that sell electricity as their primary business.<sup>51</sup> For new coal-burning electric power plants, the conventional technology is pulverized coal boilers that combust their fuel at about 3,000 degrees Fahrenheit ("F") to produce high pressure steam that is utilized in a high pressure turbine, although low NO<sub>x</sub> burners may be used to keep flame temperatures at about 2,500° F to limit NO<sub>x</sub> formation.<sup>52</sup> A better technology is circulating fluidized bed ("CFB") boilers, which result in lower emissions of air pollutants.<sup>53</sup> The high-pressure turbine's exhaust steam can subsequently be utilized in a low-pressure turbine to produce additional electricity, or it can be used as

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<sup>48</sup> *Id.* In 2006, Chinese CO<sub>2</sub> emissions exceeded U.S. emissions for the first time. *Id.*

<sup>49</sup> See, e.g., Patrick J. Michaels, *The Devolution of Kyoto Power*, CATO INST., Sept. 19, 2002, [http://www.cato.org/pub\\_display.php?pub\\_id=3599](http://www.cato.org/pub_display.php?pub_id=3599) (arguing that the physics of global warming dictate that the phenomena cannot be prevented without radical changes that are possible but unlikely to occur).

<sup>50</sup> 2008 ELECTRIC POWER, *supra* note 6, at 18 tbl.1.2.

<sup>51</sup> *Id.* at 51 tbl.5.1.

<sup>52</sup> See Nat'l Energy Tech. Lab., U.S. Dep't of Energy, Coal Becomes a "Future Fuel," [http://www.netl.doe.gov/KeyIssues/future\\_fuel.html](http://www.netl.doe.gov/KeyIssues/future_fuel.html) (last visited Mar. 23, 2010). NO<sub>x</sub> typically forms at approximately 2,500° F. U.S. Dep't of Energy, Fluidized Bed Technology—Overview, [http://www.fossil.energy.gov/programs/powersystems/combustion/fluidizedbed\\_overview.html](http://www.fossil.energy.gov/programs/powersystems/combustion/fluidizedbed_overview.html) (last visited Mar. 10, 2010).

<sup>53</sup> Nat'l Energy Tech. Lab., U.S. Dep't of Energy, Clean Coal Demonstrations Coal 101, <http://www.netl.doe.gov/technologies/coalpower/cctc/coal101/coal101-4.html> (last visited Mar. 10, 2010).

process steam, which is usually at temperatures below 400° F.<sup>54</sup> Conventional coal-burning plants that increase their overall efficiency by using heat that would otherwise be wasted to supply process steam to industrial or commercial customers are called cogeneration facilities.<sup>55</sup>

Electric generating plants have differing levels of thermal efficiency depending on the process used. A typical subcritical power plant has an efficiency of about thirty-seven percent.<sup>56</sup> State-of-the-art coal-fired plants, which utilize super critical steam technology without cogeneration, have an efficiency of about forty-two percent regardless of whether they are pulverized coal, pressurized fluidized bed combustion, or integrated gasification combined cycle ("IGCC") facilities.<sup>57</sup> A plant can achieve this efficiency without a combined cycle or cogeneration through high temperature operation (1,085° F) using superheated steam at 3,775 pounds per square inch gage ("psig") with a reheat to 1,085° F.<sup>58</sup> Ultra-supercritical pulverized coal power plants that use a double reheat cycle are expected to reach forty-eight percent efficiency.<sup>59</sup>

In 1971, new source performance standards ("NSPS"), which impose specific emission limits on new or modified facilities, were promulgated for coal-fired power plants.<sup>60</sup> The standards were 0.7 pounds of nitrogen dioxide per million Btu of heat input (lb NO<sub>x</sub>/MBtu), 1.2 lb SO<sub>2</sub>/MBtu, and 0.1 lb particulate/MBtu.<sup>61</sup> In 1979, the regulations were made more stringent with the lb NO<sub>x</sub>/MBtu being set at 0.5 or 0.6 lbs, depending on the type of coal, and the lb SO<sub>2</sub>/MBtu being set at 1.2 to 0.3 lbs,

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<sup>54</sup> *Id.*; Steven Ferrey, *Power Future*, 15 DUKE ENVTL. L. & POL'Y F. 261, 270 (2005).

<sup>55</sup> *See* Ferrey, *supra* note 54, at 270–71. The Carnot Cycle utilizes heat energy in the form of steam to produce mechanical energy to drive a generator to yield marketable and transportable electrical energy. *See id.* at 270–71, 271–72 n.29; Carnot Cycle, <http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/carnot.html> (last visited Mar. 10, 2010). When industrial customers use process steam from a power plant they are utilizing heat energy rather than electrical energy. *See* Ferrey, *supra* note 54, at 270–71. The second law of thermodynamics limits the efficiency of the Carnot Cycle to  $[1 - \text{Temperature of the heat sink} / \text{temperature of the heat source}] \times 100\%$ , where the temperature is measured in degrees Kelvin. Carnot Cycle, *supra*.

<sup>56</sup> ALBERT J. BENNETT, PROGRESS OF THE WESTON UNIT 4 SUPERCRITICAL PROJECT IN WISCONSIN 4 (2006), available at <http://www.babcock.com/library/pdf/br-1790.pdf>.

<sup>57</sup> G.T. BIELAWSKI ET AL., HOW LOW CAN WE GO? CONTROLLING EMISSIONS IN NEW COAL-FIRED POWER PLANTS 1 (2001).

<sup>58</sup> *See, e.g.*, BENNETT, *supra* note 56, at 1 (describing such a reactor).

<sup>59</sup> *See, e.g., id.* at 4.

<sup>60</sup> *See* BIELAWSKI ET AL., *supra* note 57, at 4.

<sup>61</sup> *Id.*

depending on the sulfur content of the coal.<sup>62</sup> The particulate standard was set at 0.03 lb/MBtu.<sup>63</sup> However, over time, the standards have become more stringent for plants subject to construction permit requirements. By 2001, construction permit requirements for NO<sub>x</sub>, SO<sub>2</sub>, and particulates were 0.08, 0.12, and 0.018 lbs per million Btu respectively (“MBtu”),<sup>64</sup> and, since then, permit requirements have become “significantly more stringent.”<sup>65</sup> Emissions control technology has continued to improve, and eastern bituminous coals can achieve 0.016 lb NO<sub>x</sub>/MBtu, 0.04 lb SO<sub>2</sub>/MBtu, and 0.006 lb/MBtu of particulates.<sup>66</sup> Western Powder River Basin (“PRB”) coal can achieve 0.008, 0.04, and 0.006 lb/MBtu for NO<sub>x</sub>, SO<sub>2</sub>, and particulates.<sup>67</sup> Stringent control of these criteria pollutants also results in high levels of mercury removal.<sup>68</sup> NO<sub>x</sub> control for coal-burning plants has become about as stringent as the requirements for gas turbine combined-cycle units.<sup>69</sup>

In a typical plant burning western low-sulfur coal, emissions’ limitations are met using low NO<sub>x</sub> burners, limestone injection into the furnace, particulate collection, a high removal efficiency selective catalytic reduction system, a spray dry absorber flue gas desulfurization system, and a fabric filter, which is usually a reverse air pulse-jet fabric filter.<sup>70</sup> The controls on high-sulfur fuel are somewhat different and use wet scrubber and wet electrostatic precipitator technology.<sup>71</sup> But, these emission controls have no effect on CO<sub>2</sub> emissions.<sup>72</sup>

### B. *The Future of Coal*<sup>73</sup>

Carbon dioxide is created during the chemical transformation of fossil fuels and can only be reduced by increasing combustion efficiency

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<sup>62</sup> *Id.*

<sup>63</sup> *Id.*

<sup>64</sup> *Id.* at 4 tbl.1.

<sup>65</sup> See *Sierra Club v. Franklin County Power of Illinois*, 546 F.3d 919, 927 (7th Cir. 2008).

<sup>66</sup> BIELAWSKI ET AL., *supra* note 57, at 1.

<sup>67</sup> *Id.*

<sup>68</sup> *Id.* at 9.

<sup>69</sup> *Id.* at 1.

<sup>70</sup> *Id.* at 4, 7.

<sup>71</sup> *Id.* at 4.

<sup>72</sup> See BIELAWSKI ET AL., *supra* note 57, at 1.

<sup>73</sup> Portions of the text accompanying notes 85–86 and 93–95 are derived from Reitze, *supra* note 29.

(using less fuel per MWh of electricity produced).<sup>74</sup> Efficiency improvements usually involve increasing the temperature and pressure of the system.<sup>75</sup> This involves building plants with more expensive materials.<sup>76</sup> Convincing utilities to spend money for additional efficiency improvements will necessitate higher prices for electricity and restrictions on carbon emissions. On a capital cost basis, pulverized coal technology has an advantage over other options such as pressurized fluidized bed combustion (“PFBC”) and IGCC. The average capital cost of a pulverized coal plant is \$1,562 per kilowatt (“KW”) while an IGCC plant has a capital cost of \$1,841 per KW.<sup>77</sup> A natural gas combined cycle (“NGCC”) plant has a capital cost of \$554 per KW, but the cost of fuel is much higher.<sup>78</sup> Total cost for generating electricity is about \$0.04 per kilowatt hour (“KWh”) more for NGCC plants than for pulverized coal technology<sup>79</sup> that meets the stringent emission standards for conventional pollutants.<sup>80</sup>

Closing old coal-burning power plants could significantly reduce CO<sub>2</sub> as well as criteria pollutant emissions. But, replacing coal with modern natural gas plants, while a relatively quick way to reduce GHG emissions, is not an appropriate policy. Natural gas should not be used to produce base load electricity.<sup>81</sup> This fuel is far too valuable for this use and should be reserved for applications that can only be met by using natural gas. Moreover, natural gas used to produce electrical power wastes its potential

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<sup>74</sup> See BIELAWSKI ET AL., *supra* note 57, at 1–3; JOHN MARION ET AL., CONTROLLING POWER PLANT CO<sub>2</sub> EMISSIONS: A LONG TERM VIEW 3 [http://www.netl.doe.gov/publications/proceedings/01/carbon\\_seq/1b2.pdf](http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/1b2.pdf) (last visited Mar. 10, 2010).

<sup>75</sup> See, e.g., JOHN MARION ET AL., *supra* note 74, at 4, 8, 9 (describing efficiency improvements).

<sup>76</sup> See NAT'L COAL COUNCIL, ADVANCED COAL TECHNOLOGIES: GREATER EFFICIENCY AND LOWER CO<sub>2</sub> EMISSIONS 4, [http://www.nationalcoalcouncil.org/Documents/Advanced\\_Coal\\_Technologies.pdf](http://www.nationalcoalcouncil.org/Documents/Advanced_Coal_Technologies.pdf) (last visited Mar. 10, 2010).

<sup>77</sup> NAT'L ENERGY TECH. LAB., U.S. DEP'T OF ENERGY, PROGRAM FACTS: THE COST OF CARBON DIOXIDE CAPTURE AND STORAGE IN GEOLOGIC FORMATIONS 4 (2008), <http://www.netl.doe.gov/publications/factsheets/program/Prog065.pdf>.

<sup>78</sup> NAT'L ENERGY TECH. LAB., U.S. DEP'T OF ENERGY, DOE/NETL-2007/1281, COST AND PERFORMANCE BASELINE FOR FOSSIL ENERGY PLANTS 11, 12 tbl.ES-7 (2007), *available at* [http://www.netl.doe.gov/energy-analyses/pubs/Bituminous%20Baseline\\_Final%20Report.pdf](http://www.netl.doe.gov/energy-analyses/pubs/Bituminous%20Baseline_Final%20Report.pdf).

<sup>79</sup> *Id.* at 12 tbl.ES-7.

<sup>80</sup> BIELAWSKI ET AL., *supra* note 57, at 1,4.

<sup>81</sup> “Base load: The minimum amount of electric power delivered or required over a given period of time at a steady rate.” Energy Info. Admin., U.S. Dep't of Energy, Glossary, <http://www.eia.doe.gov/glossary/index.html> (follow link for B) (last visited Mar. 11, 2010) [hereinafter Glossary].

for delivering useful energy at much higher levels of efficiency if used directly as an energy carrier rather than being converted to electricity.<sup>82</sup>

Even if coal-fired plants are replaced by more efficient technologies that produce less GHGs per KWh of electricity, government intervention will be required to prevent old coal plants from being used to provide capacity reserve rather than being retired. More stringent conventional air pollution control requirements could spur their retirement. Emission limitations based on power produced rather than fuel input would be an obvious step in the correct direction. EPA regulations provide for emissions based on heat input not on the amount of electricity generated.<sup>83</sup> This allows inefficient electric power producers to legally have emissions higher than energy efficient plants. An exception is the NO<sub>x</sub> standard for sources whose construction commenced after July 9, 1997, and before March 1, 2005, which have emissions limitations of 1.6 lb/MWh of gross energy output.<sup>84</sup>

Costs of electricity can be expected to continue to rise because many states are requiring reductions in GHG emissions as well as imposing renewable energy and energy efficiency requirements.<sup>85</sup> More stringent controls on conventional air pollutants and the potential regulation of mercury emissions using maximum achievable control technology ("MACT") standards based on section 112 of the CAA will add to electric generating costs.<sup>86</sup> Fly ash, which has not been stringently regulated, when captured in pollution control devices, contains heavy metals and other toxins.<sup>87</sup> This waste remains toxic in perpetuity.<sup>88</sup> It is another potential regulatory target that would add to the cost of electricity generated using fossil fuel. If sequestration of CO<sub>2</sub> emissions is required, the cost of electricity will

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<sup>82</sup> See Union of Concerned Scientists, *How Natural Gas Works*, [http://www.ucsusa.org/clean\\_energy/technology\\_and\\_impacts/energy\\_technologies/how-natural-gas-works.html](http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-natural-gas-works.html) (last visited Mar. 11, 2010).

<sup>83</sup> See 40 C.F.R. § 60.40Da (2009).

<sup>84</sup> 40 C.F.R. § 60.44Da(d)1.

<sup>85</sup> James D. Stivers, *The Mercury's Rising! Can National Health Group Intervention Protect the Public Health from EPA's Clean Air Mercury Rule?*, 27 J. LEGAL MED. 323, 337 (2006).

<sup>86</sup> 42 U.S.C. § 7412 (2006); see also Stivers, *supra* note 85, at 337.

<sup>87</sup> U.S. Env'tl. Protection Agency, *Fossil Fuel Combustion Waste*, <http://www.epa.gov/waste/nonhaz/industrial/special/fossil/index.htm> (last visited Mar. 11, 2010); Federal Highway Admin., U.S. Dep't of Transp., *Fly Ash*, <http://www.fhwa.dot.gov/infrastructure/materialsgrp/flyash.htm> (last visited Mar. 11, 2010).

<sup>88</sup> World Nuclear Ass'n, *Uranium, Electricity and Climate Change*, <http://www.world-nuclear.org/education/ueg.htm> (last visited Mar. 11, 2010).

increase significantly, although the costs and effectiveness of such measures is currently uncertain.<sup>89</sup> Because of the projected costs of dealing with GHG emissions, some state public utility commissions have begun to require the consideration of such costs in the resource plans required to be submitted by electric utilities.<sup>90</sup>

The coal-fired electric power industry not only faces expensive regulatory requirements related to climate change, it also faces increases in construction costs that threaten the economic viability of new coal-burning plants. New coal-fired plants can cost \$2 billion to \$3 billion.<sup>91</sup> They are two to three times more costly than new plants built in the 1970s, even without CO<sub>2</sub> control.<sup>92</sup> States are beginning to impose reductions on GHGs that add to construction costs.<sup>93</sup> Moreover, the worldwide growth in electric power generation is creating competition for the resources and skills necessary to build plants, and that is leading to skyrocketing increases in construction costs.<sup>94</sup> These costs may be difficult to recover from the revenues that can be garnered in a competitive electric power market.

The future role of coal in generating electricity in the United States is an important policy issue that has not yet been resolved. In early 2008, there were twenty-four coal-fired plants under construction involving \$23 billion of new capital investment.<sup>95</sup> These facilities would be far less polluting than older plants, but they would be expected to contribute massive amounts of CO<sub>2</sub> to the atmosphere for a half-century or more.<sup>96</sup> For this

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<sup>89</sup> Stephen Siciliano, *Sequestration Called Best Way to Achieve Short-Term Reductions of Carbon Emission*, 38 ENV'T REP. (BNA) 2286 (Oct. 26, 2007); see *infra* Part II.C.

<sup>90</sup> Alexandra B. Klass & Sara E. Bergan, *Carbon Sequestration and Sustainability*, 44 TULSA L. REV. 237, 238 (2008).

<sup>91</sup> Dean Scott, *House Bill Carbon Incentives Lauded; Energy Industry Calls for Regulation Certainty*, 40 ENV'T REP. (BNA) 1820 (July 31, 2009).

<sup>92</sup> See generally U.S. DEP'T OF ENERGY, MARKET-BASED ADVANCED COAL POWER SYSTEMS FINAL REPORT APP. A (1999), available at <http://fossil.energy.gov/programs/powersystems/publications/MarketBasedPowerSystems/appa.pdf> (discussing and presenting data on the cost increase of coal plants from 1965 to 1995).

<sup>93</sup> SYNAPSE ENERGY ECONOMICS, INC., DON'T GET BURNED: THE RISKS OF INVESTING IN NEW COAL FIRED GENERATING FACILITIES 8 (2008), available at [http://www.iccr.org/news/press\\_releases/pdf%20files/DontGetBurned08.pdf](http://www.iccr.org/news/press_releases/pdf%20files/DontGetBurned08.pdf).

<sup>94</sup> *Id.*

<sup>95</sup> Lynn Garner, *Coal, Electricity Industries Ask White House to Double Funding for Carbon Technologies*, 39 ENV'T REP. (BNA) 157 (Jan. 25, 2008).

<sup>96</sup> See generally *supra* Part I.A (discussing modern plant emissions); see Clean Coal Ctr., Int'l Energy Agency, *Life Extension of Coal-Fired Power Plants*, PROFILES, Dec. 2005, [http://www.iea-coal.org.uk/publishor/system/component\\_view.asp?LogDocId=81405](http://www.iea-coal.org.uk/publishor/system/component_view.asp?LogDocId=81405) (suggesting some plants may be used for fifty years).

reason, environmental groups and state governments caused electric utilities to cancel or delay the construction of 100 coal-fired power plants between 2001 and mid-2009.<sup>97</sup> The coal industry is fighting to survive by lobbying to have the federal government dramatically increase the funding for clean coal-related programs.<sup>98</sup> If they are successful in obtaining funding and the money expended results in technology advances that reduce or eliminate the climate threat to the planet,<sup>99</sup> continued dependence on coal-fired electric power plants will likely continue.

Long-term goals should be to use renewable energy technologies to meet an increasing share of the nation's electric power demand, to continue to encourage conservation measures, and to support state efforts to regulate GHGs. However, for the foreseeable future, the base load demand for electricity is going to be supplied primarily from coal-fired, nuclear, and hydroelectric power plants.

### C. *GHG Emissions Reporting*

Accurate information concerning GHG emissions is a prerequisite for developing an effective control program. "The first step to control CO<sub>2</sub> emissions should be to create an accurate emissions inventory that is publicly disclosed in a useful form such as facility specific, company wide, and source category aggregation of data."<sup>100</sup> In 1992, the Energy Policy Act ("EP Act"), with thirty titles on energy regulation and policy, was enacted as omnibus domestic legislation.<sup>101</sup> Section 1605(b) provides a program to track GHG emissions, but "it has weak reporting standards, no verification, and no penalties for companies that do not report their data."<sup>102</sup> Section 1605(b) requires the Department of Energy ("DOE") to establish guidelines for the voluntary reporting of GHG releases and their annual reduction.<sup>103</sup> The DOE issued guidelines entitled "Voluntary Greenhouse Gas Reporting Program: General Guidelines."<sup>104</sup>

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<sup>97</sup> Steve Cook, *With Coal-Fired Plant in Utah Canceled, Sierra Club Says 100 Facilities Shelved*, 40 ENV'T REP. (BNA) 1711 (July 17, 2009).

<sup>98</sup> Garner, *supra* note 95.

<sup>99</sup> *See id.*

<sup>100</sup> Reitze, *supra* note 29, at 17.

<sup>101</sup> Energy Policy Act of 1992, Pub. L. No. 102-486 (codified in scattered sections of 12 U.S.C., 16 U.S.C., 26 U.S.C., & 42 U.S.C.).

<sup>102</sup> Reitze, *supra* note 29, at 17 (citing 42 U.S.C. § 13385(b) (2006)).

<sup>103</sup> 42 U.S.C. § 13385(b)(2) (2009).

<sup>104</sup> 10 C.F.R. pt. 300 (2009).

The voluntary reporting program provides for three types of reporting:

[1] [p]roject-level reporting, defined as the reporting of the emission reductions or carbon sequestration achieved as a result of a specific action or group of actions[;] [2] [e]ntity-level reporting, defined as the reporting of emissions, emission reductions, and carbon sequestration for an entire organization, usually defined as a corporation[;] [and] [3] [c]ommitment reporting, defined as the reporting of pledges to take action to reduce emissions in the future.<sup>105</sup>

This voluntary program evolved into DOE's Climate Vision program.<sup>106</sup> The EPA administers a similar voluntary Climate Leaders program that collects data on GHG emissions.<sup>107</sup> More than thirty-nine states took part in the first year of the 1992 EP Act's voluntary reporting of GHG emissions.<sup>108</sup> Most of the reporting involved electric power generators and covered nearly 600 projects to reduce emissions or prevent the release of GHGs.<sup>109</sup> The federal voluntary reporting system subsequently began to be supplanted by the Climate Registry, a state developed program that includes forty-one states, eleven Canadian provinces, six Mexican states, the District of Columbia, and four Native American tribes.<sup>110</sup>

EPA has a mandatory reporting program, under CAA section 412, applicable primarily to electric power plants over twenty-five MW, that requires reporting of sulfur dioxide, nitrogen oxides, opacity, and volumetric flow at each unit subject to the CAA's acid rain program.<sup>111</sup> The

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<sup>105</sup> ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, VOLUNTARY REPORTING OF GREENHOUSE GASES 2005: SUMMARY 4 (2006), available at [http://www.eia.doe.gov/oiaf/1605/vrrpt/summary/pdf/0608\(2005-s\).pdf](http://www.eia.doe.gov/oiaf/1605/vrrpt/summary/pdf/0608(2005-s).pdf).

<sup>106</sup> Climate Vision, Program Mission, <http://www.climatevision.gov/mission.html> (last visited Mar. 23, 2010).

<sup>107</sup> Press Release, Env'tl. Prot. Agency, EPA Administrator Launches Climate Leaders Program Charter Members Commit to Greenhouse Gas Inventories and Emissions Reduction Targets (Feb. 20, 2002).

<sup>108</sup> ARNOLD W. REITZE, JR., AIR POLLUTION CONTROL LAW: COMPLIANCE AND ENFORCEMENT 423 (2001) (citing U.S. DEP'T OF STATE, CLIMATE ACTION REPORT (1997)).

<sup>109</sup> *Id.* (citing Pamela Wexler & David Hodas, *Special Committee on Climate Change and Sustainable Development 1995 Annual Report*, in NATURAL RESOURCES, ENERGY AND ENVIRONMENTAL LAW 1995: THE YEAR IN REVIEW 164, 168 (1996)).

<sup>110</sup> The Climate Registry North America's Leaders Solving Climate Change Together, <http://www.theclimateregistry.org> (last visited Mar. 11, 2010).

<sup>111</sup> Clean Air Act, 42 U.S.C. § 7651k (2006).

Consolidated Appropriations Act of 2008 (H.R. 2764), signed into law in December 2007, required the EPA to finalize the rules for an economy-wide GHG registry by June 26, 2009.<sup>112</sup> The EPA released a proposed regulation to implement a mandatory GHG emissions reporting program on March 10, 2009.<sup>113</sup>

On October 30, 2009, the EPA's administrator promulgated a final rule that requires monitoring of emissions of the GHGs covered by the United Nations Framework Convention on Climate Change ("UNFCCC").<sup>114</sup> The rule is effective on December 29, 2009, with the first report due on March 31, 2011.<sup>115</sup> About 10,000 facilities, which are responsible for about eighty-five percent of U.S. GHG emissions, will be subject to the reporting requirements.<sup>116</sup>

The final rule is limited to reporting requirements and applies to fossil fuel suppliers; industrial gas suppliers; manufacturers of heavy trucks, motorcycles, and non-road vehicles and engines; and other facilities that emit 25,000 metric tons or more GHGs per year, expressed as carbon dioxide equivalent ("CO<sub>2</sub>e"),<sup>117</sup> although some facilities in identified categories must report even if emissions are below 25,000 tons of CO<sub>2</sub>e.<sup>118</sup> Facilities within listed categories include electric power plants subject to the Acid Rain Program.<sup>119</sup> The EPA will collect facility data from facilities in "the 50 states, the District of Columbia, [and] the U.S. possessions and

<sup>112</sup> Consolidated Appropriations Act, 2008, Pub. L. No. 110-161, tit. II, 121 Stat. 1844, 2128 (2007).

<sup>113</sup> U.S. Env'tl. Prot. Agency, Proposed Mandatory Greenhouse Gas Reporting Rule: Fact Sheet, <http://www.epa.gov/climatechange/emissions/downloads/ProposedRule-FactSheet.pdf> (last visited Mar. 11, 2010).

<sup>114</sup> Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260 (Oct. 30, 2009).

<sup>115</sup> *Id.* at 56,260, 56,267.

<sup>116</sup> U.S. Env'tl. Prot. Agency, Frequently Asked Questions: Mandatory Reporting of Greenhouse Gases Rule, [http://www.epa.gov/climatechange/emissions/ghg\\_faq.html](http://www.epa.gov/climatechange/emissions/ghg_faq.html) (last visited Mar. 11, 2010) [hereinafter FAQ].

<sup>117</sup> Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. at 56,261, 56,264.

Carbon Dioxide equivalent: The amount of carbon dioxide by weight emitted into the atmosphere that would produce the same estimated radiative forcing as a given weight of another radiatively active gas. Carbon dioxide equivalents are computed by multiplying the weight of the gas being measured (for example, methane) by its estimated global warming potential (which is 21 for methane). "Carbon equivalent units" are defined as carbon dioxide equivalents multiplied by the carbon content of carbon dioxide (i.e., 12/44).

Glossary, *supra* note 81.

<sup>118</sup> Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. at 56,267.

<sup>119</sup> *Id.* at 56,266.

territories.”<sup>120</sup> The 25,000 tons threshold for reporting requires a facility to combust the equivalent of about 58,000 barrels of oil, or 131 railcars of coal a year, to be subject to the rule.<sup>121</sup> The average home emits about eleven metric tons of CO<sub>2</sub>e a year.<sup>122</sup> Stationary sources whose aggregated heat input for their combustion sources does not exceed thirty mmBtu/hr are not required to report.<sup>123</sup> Most commercial building will be below the threshold.<sup>124</sup>

Eighteen states have proposed or adopted GHG reporting rules.<sup>125</sup> The federal GHG reporting rules do not replace state reporting requirements, but the EPA is working with the Climate Registry and Exchange Network to harmonize the reporting requirements of the various data generating programs.<sup>126</sup> The Western Climate Initiative calls for more stringent requirements, and California's Air Resources Board is considering lowering the reporting threshold to 10,000 metric tons of GHGs annually.<sup>127</sup> Washington state, for example, has a 10,000 tons per year (“tpy”) trigger that is applicable to indirect emissions as well as sources not covered by the federal rule.<sup>128</sup>

## II. CONTROLLING FOSSIL-FUELED ELECTRIC POWER PLANT GHG EMISSIONS

### A. *Construction and Operating Permits*<sup>129</sup>

A proposed new or modified major source must obtain a construction permit prior to construction.<sup>130</sup> If the facility is planned for an area that

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<sup>120</sup> FAQ, *supra* note 116.

<sup>121</sup> *Id.*

<sup>122</sup> *Id.*

<sup>123</sup> *Id.*

<sup>124</sup> *Id.*

<sup>125</sup> *States Struggle to Harmonize GHG Reporting Rules with EPA Approach*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 23 (Nov. 5, 2009) [hereinafter *States Struggle*].

<sup>126</sup> *EPA-State Team Works to Craft Central Hub for Disparate GHG Reporting*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 26 (Dec., 30, 2009).

<sup>127</sup> *California Eyes GHG Reporting Rules Stricter than EPA Registry*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 23 (Nov. 5, 2009).

<sup>128</sup> *States Struggle*, *supra* note 125.

<sup>129</sup> Portions of the text accompanying notes 130–41, 144–46, and 184–87 are derived from Reitze, *supra* note 29.

<sup>130</sup> Clean Air Act, 42 U.S.C. § 7475(a) (2006). For an overview of the NSR program, see generally Arnold W. Reitze, Jr., *New Source Review: Should it Survive?*, 34 Env'tl. L. Rep. (Env'tl. Law Inst.) 10,673 (July 2004) [hereinafter Reitze, *New Source Review*].

meets national ambient air quality standards (“NAAQS”), a prevention of significant deterioration (“PSD”) review is required, and the permitting authority may impose limits on all regulated pollutants that the source will emit.<sup>131</sup> If the area does not meet the NAAQS for a pollutant that will be emitted, a project is subject to an even more stringent new source review (“NSR”).<sup>132</sup> Projects must have their environmental impacts assessed as part of a construction permit program.<sup>133</sup> The PSD process includes determining the appropriate technology needed to comply with the CAA section 165(a)(4) requirement to use the best available control technology (“BACT”),<sup>134</sup> which is “defined in [CAA] section 169(3) to require consideration of economic impacts and costs.”<sup>135</sup> In nonattainment areas, CAA section 173(a)(2) requires the lowest achievable emission rate (“LAER”) to be achieved.<sup>136</sup> For determining what is the BACT/LAER, the EPA usually uses a top-down analysis.<sup>137</sup> The primary guidance is the EPA’s 1990 New Source Review Workshop Manual.<sup>138</sup> Determining the appropriate technology requires consideration of process changes, fuel substitution, add-on controls, and any other available methods to obtain the maximum degree of emission reduction.<sup>139</sup>

A new or modified major source must first comply with any applicable NSPS<sup>140</sup> for its industrial category.<sup>141</sup> PSD/NSR requirements are site specific and allow the permitting authority to impose more stringent requirements on a permit applicant than otherwise would be imposed by

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<sup>131</sup> 42 U.S.C. § 7475(a),(d); *see also* Reitze, *New Source Review*, *supra* note 130.

<sup>132</sup> *See* 42 U.S.C. §§ 7502–7503, 7506; *see also* Reitze, *New Source Review*, *supra* note 130. The EPA frequently uses NSR to mean both the PSD and NSR program. Robert A. Greco, Comment, *When is Routine Maintenance Really Routine? A Proposed Modification to the EPA’s New Source Review Program*, 88 MARQ. L. REV. 391, 393 n.13 (2005).

<sup>133</sup> 42 U.S.C. § 7475(a).

<sup>134</sup> 42 U.S.C. § 7475(a)(4).

<sup>135</sup> 42 U.S.C. § 7479(3); *see also* Alaska Dep’t Env’tl. Conservation v. EPA, 540 U.S. 461, 471–73 (2004). In *Entergy Corp. v. Riverkeeper, Inc.*, the U.S. Supreme Court upheld the EPA’s use of a cost-benefit analysis to determine the best technology under the Clean Water Act’s effluent discharge standard. No. 07-588, 2009 U.S. LEXIS 2498, at \*29–30 (Apr. 1, 2009).

<sup>136</sup> 42 U.S.C. § 7503(a)(2).

<sup>137</sup> U.S. ENVTL. PROT. AGENCY, NEW SOURCE REVIEW WORKSHOP MANUAL: PREVENTION OF SIGNIFICANT DETERIORATION AND NONATTAINMENT AREA PERMITTING B.14 (1990), *available at* <http://www.epa.gov/ttn/nsr/gen/wkshpman.pdf> [hereinafter NEW SOURCE REVIEW].

<sup>138</sup> *Id.* at B.14.

<sup>139</sup> *See generally* NEW SOURCE REVIEW, *supra* note 137, at B.10–14; *Sur Contra Contaminacion v. EPA*, 202 F.3d 443 (1st Cir. 2000).

<sup>140</sup> 42 U.S.C. §§ 7411(a)(3)–(4), 7475(a)(3), 7501(3).

<sup>141</sup> 42 U.S.C. § 7411(f).

the CAA.<sup>142</sup> The PSD/NSR program requires technology-based mitigation measures to be imposed for any air pollutant that will be released, and air pollutant is defined broadly in CAA section 302(g).<sup>143</sup> States may impose additional standards pursuant to CAA section 116.<sup>144</sup> All states have been delegated the authority to run their nonattainment NSR programs; most states have been delegated the authority to run their PSD programs.<sup>145</sup>

An issue of concern is whether pollutants that are not regulated, but could be regulated, are subject to PSD/NSR requirements. Are GHG emissions subject to PSD/NSR?<sup>146</sup> The EPA's position, prior to 2009, appeared to be that CO<sub>2</sub> impacts did not have to be considered as part of the NSR permit process because CO<sub>2</sub> was not yet a regulated pollutant.<sup>147</sup> But, challenges to the EPA's pre-2009 position have not been consistently decided. For example, on June 2, 2008, the EPA's Environmental Appeals Board ("EAB") rejected a challenge to a refinery expansion project for tar sands processing in Illinois that did not include GHG controls.<sup>148</sup> The case, however, was a win for the project's opponents because the EAB remanded the permit to the state to review emission limitations for conventional pollutants.<sup>149</sup> Similarly, in *In re: Northern Michigan University Ripley Heating Plant*, the EAB issued an order that it would not consider CO<sub>2</sub> emissions for an air permit.<sup>150</sup> On August 30, 2007, the EPA's Region 8 granted a PSD permit to the Deseret Power Electric Cooperative's proposed new facility near Bonanza, Utah, despite its potential for increasing CO<sub>2</sub> emissions.<sup>151</sup> The granting of the permit was appealed by the Sierra

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<sup>142</sup> See Reitze, *New Source Review*, *supra* note 130; see also U.S. ENVTL. PROT. AGENCY, NSR 90-DAY REVIEW BACKGROUND PAPER 5 (2001), available at <http://www.epa.gov/nsr/documents/nsr-review.pdf>.

<sup>143</sup> 42 U.S.C. §§ 7475(a)(4), 7602(g).

<sup>144</sup> 42 U.S.C. § 7416.

<sup>145</sup> See 40 C.F.R. §§ 51.165–66 (2008); see also *id.* subch. C subpts. B–ZZ (approving or disapproving state policies).

<sup>146</sup> See *Sur Contra la Contaminacion v. EPA*, 202 F.3d 443 (1st Cir. 2000); *Old Dominion Elec. Coop.*, 3 E.A.D. 779 (Envtl. App. Bd. 1992); *Multitrade Ltd. P'ship*, 3 E.A.D. 773 (Envtl. App. Bd. 1992).

<sup>147</sup> *But see* *Steel Dynamics, Inc.*, 9 E.A.D. 165 (Envtl. App. Bd. 2000); *Genesee Power Station*, 4 E.A.D. 832 (Envtl. App. Bd. 1993); *N. County Res. Recovery, Assocs.*, 2 E.A.D. 229 (Envtl. App. Bd. 1986).

<sup>148</sup> *ConocoPhillips Co.*, PSD Appeal No. 07-02, slip op. at 49–50 (Envtl. App. Bd. June 2, 2008).

<sup>149</sup> *Id.* at 51.; *EAB Ruling May Bolster Activists' Bid to Target Tar Sands Refining*, 19 CLEAN AIR REP. (InsideEPA.com) 12 (June 12, 2008).

<sup>150</sup> *In re: Northern Michigan University Ripley Heating Plant*, PSD Appeal No. 08-02 (Envtl. App. Bd. Feb. 18, 2009); see also *Activists Plan Shift to State Suits if EAB Rejects CO<sub>2</sub> Permit Limits*, 25 ENVTL. POL'Y ALERT (InsideEPA.com) 22 (Feb. 18, 2000).

<sup>151</sup> *Deseret Power Elec. Coop.*, PSD Appeal No. 07-03, slip op. at 1 (Envtl. App. Bd. Nov. 13,

Club to the EPA's EAB, which, on November 13, 2008, remanded the permit to the EPA's Region 8 to reconsider whether to impose CO<sub>2</sub> BACT limits and to develop an adequate record for its decision.<sup>152</sup> The EAB found that the Region wrongly believed its discretion was limited by historical EPA interpretation.<sup>153</sup> Moreover, the EAB suggested the Region consider whether the public and the Agency would benefit from having the phrase "subject to regulation under the Act" determined as an interpretation of nationwide scope rather than through this specific permitting proceeding.<sup>154</sup> This decision seemed likely to end the permitting of new coal-fired power plants until the EPA completed its review.<sup>155</sup>

In addition to outside challenges to the EPA's pre-2009 stance, the EPA's internal policies have shifted. For example, in December 2008, EPA Administrator Stephen Johnson issued a memorandum restating the EPA's position that CO<sub>2</sub> is not a pollutant under the CAA; therefore, the Agency is not required to consider CO<sub>2</sub> emissions when it issues permits under the PSD program.<sup>156</sup> On February 17, 2009, EPA Administrator Lisa Jackson said that the Agency would take a new look at whether CO<sub>2</sub> from power plants should be regulated and that the prior administrator's memorandum should not be considered the final word on the appropriate interpretation of the CAA.<sup>157</sup>

This internal decision affected pending permits, such as the Desert Rock coal-fired power plant on Navajo tribal land located in northwest New Mexico.<sup>158</sup> The EPA issued the permit in 2008.<sup>159</sup> On January 22, 2009, EPA's EAB agreed to hear the permit application that was chal-

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2008).

<sup>152</sup> *Id.* at 64.

<sup>153</sup> *Id.* at 1–2.

<sup>154</sup> *Id.* at 9–10. The EAB did not rule on a Sierra Club argument that section 821 of the CAA Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399, 2699 (noted, but not codified, at 42 U.S.C. § 7651k (2006)), which require monitoring and reporting of CO<sub>2</sub> emissions, are regulations under the CAA. *Deseret Power*, PSD Appeal No. 07-03, slip op. at 63.

<sup>155</sup> See Steven D. Cook, *Industry Environmental Groups Dispute Effects of EAB's Deseret Power Decision*, 39 ENV'T REP. CUR. DEV. (BNA) 2298 (Nov. 21, 2008).

<sup>156</sup> Memorandum from Stephen L. Johnson, EPA Administrator, to Regional Administrators (Dec. 18, 2008), available at [http://www.epa.gov/NSR/documents/psd\\_interpretive\\_memo\\_12.18.08.pdf](http://www.epa.gov/NSR/documents/psd_interpretive_memo_12.18.08.pdf).

<sup>157</sup> *Jackson Agrees to Take Fresh Look at Last-Minute CO<sub>2</sub> Permit Memo*, 20 CLEAN AIR REP. (InsideEPA.com) 4 (Feb. 19, 2009); see also Steven D. Cook, *EPA Request to Review Desert Rock Permit Violates Clean Air Act, Plant Owner Says*, 40 ENV'T REP. CUR. DEV. (BNA) 1427 (June 19, 2009) (illustrating the effect the shift in policy is having on the permitting process).

<sup>158</sup> Cook, *supra* note 157.

<sup>159</sup> *Id.*

lenged by states and environmentalists.<sup>160</sup> But, on April 27, 2009, in *In Re: Desert Rock Energy Company*, the EPA asked the EAB to remand the permit for the Agency to review the policy of whether IGCC technology is a BACT.<sup>161</sup> On September 24, 2009, the request for remand was granted.<sup>162</sup> Subsequently, Desert Rock was reported to be willing to accept GHG restrictions, but that may not result in a permit because the EPA still must decide whether IGCC technology is a BACT.<sup>163</sup> In another permit example, on February 18, 2009, the EAB told the Michigan Department of Environmental Quality that it must review a permit for a new power plant at Northern Michigan University to determine whether GHGs should be regulated.<sup>164</sup>

In response to this policy uncertainty, the EPA is moving to regulate GHGs as pollutants under the CAA. On April 24, 2009, the Administrator made a proposed endangerment finding that six GHGs are air pollutants that may be reasonably anticipated to endanger public health and welfare.<sup>165</sup> On September 28, 2009, the NHTSA and the EPA proposed rules to control GHG emissions from passenger cars, light-duty trucks, and medium-duty passenger vehicles.<sup>166</sup> The EPA's light-duty vehicle GHG rule could not be finalized until it made an endangerment finding.<sup>167</sup> On December 7, 2009, the EPA found that GHGs contribute to GHG pollution, which threatens public health and welfare.<sup>168</sup> The endangerment finding allows the EPA to finalize the light-duty vehicle CO<sub>2</sub> rule, which makes GHGs regulated pollutants and triggers the need to comply with other

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<sup>160</sup> Tripp Baltz, *Colorado Officials Ask EPA to Reconsider Permit Decision for New Mexico Power Plant*, 40 ENV'T REP. (BNA) 674 (Mar. 27, 2009).

<sup>161</sup> EPA Region 9's Motion for Voluntary Remand at 1–2, *Desert Rock Energy Co.*, PSD Appeal Nos. 08-03, 08-04, 08-05 & 08-06 (Env'tl. App. Bd. 2009).

<sup>162</sup> *Amid Uncertainty, EPA Fails to Close Doors on Small Source GHG Permits*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 20 (Oct. 7, 2009).

<sup>163</sup> *Id.*; see also Cook, *supra* note 157.

<sup>164</sup> N. Mich. Univ. Ripley Heating Plant, PSD Appeal No. 08-02, slip op. at 66–67 (Env'tl. App. Bd. Feb. 18, 2009).

<sup>165</sup> Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 18,886 (Apr. 24, 2009) (to be codified at 40 C.F.R. ch. 1).

<sup>166</sup> Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 74 Fed. Reg. 55,292 (Sept. 27, 2009) (to be codified at 40 C.F.R. pts. 86, 600).

<sup>167</sup> Endangerment and Cause, *supra* note 28.

<sup>168</sup> Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009) (to be codified at 40 C.F.R. ch. 1).

environmental laws, including the CAA's PSD/NSR requirements.<sup>169</sup> The EPA had already published a proposed rule on October 27, 2009, saying it would reconsider the application of the PSD program to GHG emissions.<sup>170</sup>

While the EPA is moving to regulate GHGs as pollutants under the CAA, the House of Representatives is moving to prevent this from occurring.<sup>171</sup> The American Clean Energy and Security Act of 2009 ("ACES") that was approved by the House on June 26, 2009, would modify the use of the CAA to regulate GHGs.<sup>172</sup> ACES adds a new Title VIII to the CAA.<sup>173</sup> ACES section 331 creates CAA section 831 that prohibits GHGs from being added to the list of criteria pollutants.<sup>174</sup> Proposed CAA section 832 prohibits the application of CAA section 115, which can require states to revise their state implementation plans ("SIPS") when a pollutant is found to endanger public health or welfare in a foreign country, to pollutants based on a contribution to global warming.<sup>175</sup> Proposed CAA section 833 prohibits regulating GHGs as hazardous air pollutants unless the substance meets the criteria for listing, independent of its effects on global climate change.<sup>176</sup> CAA section 834 says that Part C new source review is not triggered by the release of a GHG.<sup>177</sup> CAA section 835 says that there is no need for a Title V operating permit for a source of GHGs that is based solely on the emissions of a GHG.<sup>178</sup>

To control GHG emissions, ACES proposed CAA section 811(a)(2) allows regulation under the CAA's section 111 new source performance standards as well as the regulation of existing sources based on CAA section 111(d) to control GHG emissions.<sup>179</sup> However, sources subject to cap-and-trade will continue to be subject to NSPS for their non-GHG emissions, but will not be subject to NSPS for capped GHG emissions.<sup>180</sup> ACES generally focuses its cap-and-trade program on GHG sources with emissions

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<sup>169</sup> See *id.* at 66,501; Endangerment and Cause, *supra* note 28.

<sup>170</sup> Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 74 Fed. Reg. 55,292 (Oct. 27, 2009) (to be codified at 40 C.F.R. pts. 51, 52, 70, 71).

<sup>171</sup> Steven D. Cook, *Climate Bill Imposes Emissions Trading, Energy-Efficiency, Renewables Requirements*, 40 ENV'T REP. CUR. DEV. (BNA) 1546 (July 3, 2009).

<sup>172</sup> *Id.*

<sup>173</sup> American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. § 331 (2009).

<sup>174</sup> *Id.*

<sup>175</sup> *Id.*; 42 U.S.C. § 7414 (2006).

<sup>176</sup> H.R. 2454 § 331.

<sup>177</sup> *Id.*

<sup>178</sup> *Id.*

<sup>179</sup> *Id.*

<sup>180</sup> *Id.*

greater than 25,000 tpy of CO<sub>2</sub>e,<sup>181</sup> but the ACES NSPS provision targets sources with 10,000 tpy to 25,000 tpy of CO<sub>2</sub>e,<sup>182</sup> which could expose millions of businesses to the need to comply with NSPS. This could lead to GHG emission standards for small sources that are more stringent than the standards applicable to large sources.

To obtain a preconstruction PSD/NSR permit, CAA sections 165(a)(2) and 173(a)(5) require “an analysis of alternative sites, sizes, production processes, and environmental control techniques for [the] proposed source” that demonstrates that the benefits “significantly outweigh the environmental and social costs” that are imposed by construction or modification.<sup>183</sup> The extent to which alternative analysis can be used to require an alternative to be adopted is not clear, and this ambiguity is likely to be the subject of challenges to permit applications.<sup>184</sup> If an alternative analysis is to be used to stop a project, who will have the power to determine the social values that are to be considered, and how will these values be balanced?

Court decisions have held that BACT/LAER requirements cannot be used to force an applicant to redesign a proposed facility. Thus, BACT/LAER cannot be defined to force a proposed coal-burning plant to use alternative energy, natural gas, or nuclear power. On August 24, 2006, the EPA’s EAB ruled that [the] EPA could not require the use of low-sulfur coal at Peabody Energy’s proposed Prairie State facility in Illinois because it would redefine the basic design of the facility, which was planned as a mine-mouth facility that would burn high-sulfur Illinois coal.<sup>185</sup> Subsequently, in *Sierra Club v. EPA*, the Seventh Circuit ruled that the EPA does not have to consider whether the applicant should use low-sulfur coal as a pollution control technology because such a requirement would

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<sup>181</sup> *See id.*

<sup>182</sup> *Climate Bill Would Mandate EPA Air Rules for Small GHG Sources*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 12 (June 17, 2009).

<sup>183</sup> 42 U.S.C. §§ 7503(a)(5), 7475(a)(2) (2006).

<sup>184</sup> *Compare* *Hibbing Taconite Co.*, 2 E.A.D. 838, 843 (Envtl. App. Bd. 1989), *and* *Pennsauken County, N.J. Res. Recovery Facility*, 2 E.A.D. 667, 673 (Envtl. App. Bd. 1988) (finding permit conditions did not “redefine the source”), *with* *Kendall New Century Dev.*, 11 E.A.D. 40, 52 n.14 (Envtl. App. Bd. 2003), *and* *Hillman Power Co.* 10 E.A.D. 691–92 (Envtl. App. Bd. 2002) (finding permit conditions did redefine the source). *See* Gregory B. Foote, *Considering Alternatives: The Case for Limiting CO<sub>2</sub> Emissions From New Power Plants Through New Source Review*, 34 ENVTL. L. REP. (Envtl. L. Inst.) 10,642 (July 2004).

<sup>185</sup> *Prairie State Generating Co.*, PSD Appeal No. 05-05, slip op. at 36–37 (Envtl. App. Bd. Aug. 24, 2006).

require significant modifications of the plant.<sup>186</sup> BACT review cannot be used to require a redesign of a proposed facility.<sup>187</sup>

Older plants produce more pollutants than more modern plants because the legal system allows them to meet standards much weaker than those applicable to newer plants.<sup>188</sup> The extent to which old plants can be forced to comply with current standards remains an ongoing political and legal struggle. On April 2, 2007, the U.S. Supreme Court moved in the direction of supporting the EPA's efforts to control electric power plant emissions when it ruled that, for new source review purposes, an increase in emissions means an annual increase, not an hourly increase.<sup>189</sup> Winning this case was important to those concerned with the effects of power plant emissions, but it is only one step in an effort to control old electric power plants. Another example of efforts to modify existing sources is the EPA and the Department of Justice's August 11, 2009, consent decree which, for the first time, required GHG reductions for an Ohio Edison plant involved in CAA violations.<sup>190</sup> Overall, environmentalists and states have had mixed success at using the PSD/NSR program to force electric utilities to upgrade their facilities.<sup>191</sup>

Environmental organizations are now using the operating permit requirements in Subchapter V of the CAA<sup>192</sup> to challenge state permits and to enforce the provisions of existing operating permits.<sup>193</sup> This includes efforts to require compliance schedules in operating permits. For example, in 2005, the Second Circuit held that a facility's CAA Subchapter V operating permit must include a compliance schedule to address a formal enforcement complaint and enforcement lawsuit filed by the state permit-issuing

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<sup>186</sup> *Sierra Club v. EPA*, 499 F.3d 653, 655–57 (7th Cir. 2007).

<sup>187</sup> *Id.* at 657.

<sup>188</sup> See Robert N. Stavins, *Vintage-Differentiated Environmental Regulation*, 25 STAN. ENVTL. L. J. 29, 49–50 (2006).

<sup>189</sup> See *Env'tl. Def. v. Duke Energy Co.*, 549 U.S. 561, 578 (2007).

<sup>190</sup> *EPA Wins First-Time Mandatory GHG Cuts In Power Plant Settlement*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 17 (Aug. 26, 2009).

<sup>191</sup> See, e.g., *Nat'l Parks Conservation Ass'n v. Tenn. Valley Auth.*, 502 F.3d 1316, 1329–30 (11th Cir. 2007) (dismissing in favor of the utility company because of defective notice). *But see Nat'l Parks Conservation Ass'n v. Tenn. Valley Auth.*, 480 F.3d 410, 418 (6th Cir. 2007) (ruling against the utility company in their effort to rely on a preconstruction permit in the face of post-construction responsibilities).

<sup>192</sup> Clean Air Act, 42 U.S.C. § 7661c (2006).

<sup>193</sup> See, e.g., *N.Y. Pub. Interest Research Group v. Johnson*, 427 F.3d 172, 178–79 (2nd Cir. 2005).

agency.<sup>194</sup> In 2008, the Eleventh Circuit and the Sixth Circuit ruled against the Sierra Club on this issue, creating a split among the circuits.<sup>195</sup> Environmental organizations have had more success at preventing new facilities from being constructed than in controlling existing facilities, but their efforts continue.<sup>196</sup>

While the EPA has yet to require GHG emissions to be subject to emission limits included in construction and operating permits, a September 30, 2009, proposed rule would impose PSD requirements on new sources emitting 25,000 tons or more of CO<sub>2</sub>e and impose PSD permit requirements on existing sources making modifications between 10,000 and 25,000 tons, with the exact emissions levels to be determined after public comment.<sup>197</sup> In addition, the EPA plans to impose operating permit requirements on sources emitting 25,000 tpy or more of CO<sub>2</sub>e.<sup>198</sup>

In addition to the EPA's efforts, states are denying construction permits based on climate change concerns. For example, on October 18, 2007, the Kansas Department of Health and Environment denied an air permit for a proposed new coal-fired power plant, saying it could consider the effect of unregulated pollutants if they present a substantial endangerment to public health or the environment.<sup>199</sup> On March 21, 2008, the governor of Kansas vetoed a bill that would have allowed the construction of two coal-fired generation units by the Sunflower Electric Power Corporation.<sup>200</sup> The bill was designed to overturn the state environmental agency's decision to deny a construction permit because of its CO<sub>2</sub> emissions.<sup>201</sup> On April 13, 2009, a fourth attempt by the legislature to approve the plant failed because of a veto by the governor.<sup>202</sup> However, on May 4,

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<sup>194</sup> *Id.* at 180–82.

<sup>195</sup> *Sierra Club v. Johnson*, 541 F.3d 1257, 1269 (11th Cir. 2008); *Sierra Club v. EPA*, 557 F.3d 401, 411–12 (6th Cir. 2009).

<sup>196</sup> *See supra* notes 91–97 and accompanying text.

<sup>197</sup> U.S. Evtl. Prot. Agency, Fact Sheet—Proposed Rule: Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, <http://www.epa.gov/NSR/fs20090930action.html> (last visited Mar. 12, 2010).

<sup>198</sup> *Id.*

<sup>199</sup> *See* Press Release, Kan. Dep't of Health and Env't, KDHE Denies Sunflower Electric Air Quality Permit (Oct. 18, 2007), available at [http://www.kdheks.gov/news/web\\_archives/2007/10182007a.htm](http://www.kdheks.gov/news/web_archives/2007/10182007a.htm).

<sup>200</sup> Susanne Pagano, *Governor Vetoes Legislation to Allow Expansion of Coal-Fired Power Plant*, 39 ENV'T REP. (BNA) 623 (Mar. 28, 2008).

<sup>201</sup> *Id.*

<sup>202</sup> Christopher Brown, *Governor Vetoes Bill to Allow Construction Of Two Coal-Fired Electric Generators*, 40 ENV'T REP. (BNA) 955 (Apr. 24, 2009).

2009, a new governor agreed to allow one 895 MW plant to be built in place of the two controversial 700 MW units that had been the subject of controversy for two years.<sup>203</sup> In response, on July 1, 2009, the EPA stated that the Sunflower facility would need to reapply for a construction permit because major changes had been made, and it asked Kansas to consider mandating IGCC as the BACT.<sup>204</sup>

To avoid litigation, utilities are making deals with some environmental groups. For example, as part of a TXU Corporation buyout, on February 26, 2007, environmentalists announced a non-binding agreement that eight of eleven proposed coal-fired power plants in Texas would not be built.<sup>205</sup> The company also agreed to expand wind generation and invest \$400 million in energy efficiency measures.<sup>206</sup> On March 19, 2007, a legally binding agreement between the Sierra Club and Kansas City Power and Light allowed a new 600 MW coal-fired electric power plant to be built in return for an agreement to offset its GHG emissions through energy efficiency measures and by building 400 MW of wind generated electric power by 2012.<sup>207</sup> On February 28, 2007, the North Carolina Utility Commission partially approved Duke Energy's proposed 1,600 MW facility, but required the company to invest one percent of its revenues "in energy efficiency and demand side programs."<sup>208</sup>

On April 30, 2008, the Iowa Utilities Board approved a construction permit for a coal-fired power plant to be built by Interstate Power and Light Company.<sup>209</sup> As part of the permit, five percent of the plant's electric generation is to be fueled by biomass within two years, and ten percent of the power is to be fueled by biomass in five years.<sup>210</sup> In addition, ten percent of the company's electric generation in Iowa is to be from renewable sources by 2013 and is to increase to twenty-five percent by 2028.<sup>211</sup>

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<sup>203</sup> Christopher Brown, *Governor, Energy Company Announce Deal To Allow One New Coal-Fired Power Plant*, 40 ENV'T REP. (BNA) 1088 (May 8, 2009).

<sup>204</sup> *EPA Asks Kansas To Redo Utility Air Permit To Consider IGCC Controls*, 20 CLEAN AIR REP. (InsideEPA.com) 14 (July 9, 2009).

<sup>205</sup> *Kansas Pact May Set New Floor For Resolving Coal Plant Disputes*, 18 CLEAN AIR REP. (InsideEPA.com) 7 (April 5, 2007).

<sup>206</sup> *Id.*

<sup>207</sup> *Id.*

<sup>208</sup> *North Carolina Ruling Underscores Hurdles for New Coal Plants*, 18 CLEAN AIR REP. (InsideEPA.com) 5 (Mar. 8, 2007).

<sup>209</sup> Mark Wolski, *State Regulators Approve Power Plant, Tell Utility to Supplement Coal With Biomass*, 39 ENV'T REP. (BNA) 923 (May 9, 2008).

<sup>210</sup> *Id.*

<sup>211</sup> *Id.*

On January 15, 2009, the Minnesota Public Utilities Commission approved a transmission line to receive power from a power plant project in South Dakota that is contingent upon South Dakota "accepting a number of conditions to reduce GHG emissions from the plant."<sup>212</sup> Among the conditions is a requirement that an old coal-fired power plant in Minnesota be closed, and the new plant must be "carbon capture retrofit ready."<sup>213</sup> There are also requirements concerning improving energy efficiency.<sup>214</sup> The applicant is required to report to the commission on the feasibility of using a more advanced ultra-critical technology.<sup>215</sup> On July 9, 2009, Intermountain Power announced it would allow its permit to build a new plant in Utah to expire.<sup>216</sup>

The controversy over building new coal-fired power plants has resulted in major uncertainty concerning the ability to obtain a construction permit and the concessions that will be required to obtain a permit in the present regulatory environment. Industry may be giving up their efforts to obtain permits to build new coal-fired power plants.<sup>217</sup>

### B. *Coal Gasification*<sup>218</sup>

Coal gasification can use high-sulfur, low-quality coal or petroleum coke to produce coal gas (a.k.a. synthetic gas or syngas), which is then processed to remove pollutants.<sup>219</sup> In 1792, coal gasification technology was developed by a Scottish engineer.<sup>220</sup> In 1816, the process was introduced in the United States when coal gas began to be used to light street lamps, which led to the "gaslight era" of the 1890s.<sup>221</sup> In World War II, Nazi Germany used coal gasification to produce chemicals, fertilizer, and armaments.<sup>222</sup> Using coal gasification to produce synthetic natural gas ceased for many years, but on March 24, 2009, Indiana

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<sup>212</sup> *Minnesota Imposes GHG Mitigation on South Dakota Project*, 20 CLEAN AIR REP. (InsideEPA.com) 4 (Feb. 19, 2009).

<sup>213</sup> *Id.*

<sup>214</sup> *Id.*

<sup>215</sup> *Id.*

<sup>216</sup> Steve Cook, *With Coal-Fired Plant in Utah Canceled*, *supra* note 97.

<sup>217</sup> *See id.*

<sup>218</sup> Portions of Part II.B. are derived from Reitze, *supra* note 29.

<sup>219</sup> Walter Mugdan, *Back to the Future: Coal Gasification Comes of Age . . . Again*, 18 ENVTL. L. IN N.Y. 4 (Apr. 1 2007).

<sup>220</sup> *Id.*

<sup>221</sup> *Id.*

<sup>222</sup> *Id.*

legislation authorized a long-term contract to buy synthetic natural gas from a new facility to be developed by Indiana Gasification LLC.<sup>223</sup>

Integrated gasification combined cycle (“IGCC”) technology is, in theory, an improved coal gasification technology for electric power generation. In the IGCC process, coal of any quality is fed to a gasifier where it is partly oxidized by steam under pressure.<sup>224</sup> By reducing the oxygen in the gasifier, the carbon in the fuel is converted to a gas that is eighty-five percent CO<sub>2</sub> and hydrogen.<sup>225</sup> Contaminants, including sulfur compound, particulates, halides, ammonia, and tars, are removed prior to combustion.<sup>226</sup>

When used to produce electricity, in an IGCC facility, coal gas is combusted relatively cleanly in a gas turbine, and the heat from the exhaust gas can be used to produce high temperature and high pressure steam in a heat exchanger, which can then be used in a separate steam turbine.<sup>227</sup> This increases an IGCC plant’s overall efficiency and is known as a combined cycle.<sup>228</sup> Two cycles are utilized: the combustion cycle of a gas turbine and a steam cycle that heats water to drive a steam turbine.<sup>229</sup> Both turbines drive separate generators that produce electricity.<sup>230</sup> Combined cycle facilities increase the efficiency of the plant by using the excess heat from the combustion turbine’s exhaust to generate steam to produce electricity.<sup>231</sup> Combustion turbines have peak performance efficiencies in the thirty to forty percent range.<sup>232</sup> Their exhaust gas temperature of approximately 1000° F can be used to produce electricity from steam at an efficiency in the upper thirty percent range.<sup>233</sup> Thus, the combined efficiency of a

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<sup>223</sup> Thom Wilder, *Governor Signs Legislation to Allow Long-Term Contracts With Gasification Plant*, 40 ENV’T REP. (BNA) 788 (Apr. 3, 2009).

<sup>224</sup> See U.S. Dept. of Energy, *How Coal Gasification Power Plants Work*, <http://fossil.energy.gov/programs/powersystems/gasification/howgasificationworks.html> (last visited Mar. 18, 2009); *supra* note 219 and accompanying text.

<sup>225</sup> See Richard A. Oliver, Global Energy Inc., *Application of BGL Gasification of Solid Hydrocarbons for IGCC Power Generation*, 2000 GASIFICATION TECH. CONFERENCE 4 (Oct. 8–11, 2000), <http://www.gasification.org/Docs/Conferences/2000/Gtc00210.pdf>.

<sup>226</sup> See generally Abbie W. Layne, *Overview of Contaminant Removal from Coal-Derived Syngas*, 6 PROCEEDINGS OF THE ASME INT’L MECH. ENG’G CONG. & EXPOSITION 2007 397–407 (2008).

<sup>227</sup> U.S. Dept. of Energy, *How Coal Gasification Power Plants Work*, *supra* note 224.

<sup>228</sup> *Id.*

<sup>229</sup> *Id.*

<sup>230</sup> *Id.*

<sup>231</sup> *Id.*

<sup>232</sup> *Id.*

<sup>233</sup> See Lee S. Langston, *Efficiency by the Numbers*, MECHANICAL ENG’G MAG., <http://>

combined cycle plant using natural gas would be approximately sixty percent.<sup>234</sup> IGCC plants could achieve this efficiency despite the lower heat value of the gas generated from coal combustion, but the amount of fuel burned must be increased to provide the necessary heat input.<sup>235</sup>

IGCC, when used with stack gas pollution control technology, is claimed to provide the lowest emissions of criteria pollutants from coal-burning electric power plants and to have a superior ability to cost-effectively reduce mercury and CO<sub>2</sub> emissions.<sup>236</sup> IGCC technology can reduce SO<sub>2</sub> by ninety-nine percent and reduce NO<sub>x</sub> to 0.15 lb/mmBtu, a ninety percent reduction, which exceeds NSPS.<sup>237</sup> NSPS, however, are far less stringent than the performance obtained from state-of-the-art facilities.<sup>238</sup> Performance of IGCC in controlling traditional pollutants does not appear to be superior to the best new pulverized coal plants.<sup>239</sup> IGCC technology may be a partial solution to the control of CO<sub>2</sub> emissions because it creates a separate gas stream of CO<sub>2</sub> that makes sequestration easier.<sup>240</sup> A difficult policy issue is whether IGCC technology should be mandated for new electric power plants prior to sequestration being proven to be a cost-effective control technology.

In 2002, there were 160 commercial IGCC plants, built or planned, in twenty-eight countries.<sup>241</sup> At the time, Italy had 1484 MWs and Spain had 1124 MWs of IGCC capacity.<sup>242</sup> The United States has two IGCC plants, the Polk County, Florida, 250 MW facility owned primarily by the Tampa Electric Company and the Wabash River Repowering Project, owned by Cinergy.<sup>243</sup> The Wabash River IGCC project cost, if applied to a green

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memagazine.asme.org/web/Efficiency\_by\_Numbers.cfm (last visited Mar. 13, 2010).

<sup>234</sup> See *id.* If it is assumed that gas turbine efficiency is thirty-five percent and steam turbine efficiency is thirty-seven percent, then, under the First Law of Thermodynamics, the efficiency of the overall combined unit would be fifty-nine percent. See *id.*; U.S. Dept. of Energy, How Coal Gasification Power Plants Work, *supra* note 224.

<sup>235</sup> FRANK J. BROOKS, GE POWER SYS., GE GAS TURBINE PERFORMANCE CHARACTERISTICS 7, 11 (2000), available at <http://www.muellerenvironmental.com/documents/GER3567H.pdf>.

<sup>236</sup> Craig Canine, *How to Clean Coal*, ONEARTH, Fall 2005, at 21, 27.

<sup>237</sup> U.S. DEPT. OF ENERGY, CLEAN COAL TECHNOLOGY DEMONSTRATION PROGRAM: PROGRAM UPDATE 2001, 5–117 (2002) [hereinafter CLEAN COAL TECHNOLOGY].

<sup>238</sup> See *supra* notes 60–69 and accompanying text.

<sup>239</sup> See *supra* notes 60–69 and accompanying text.

<sup>240</sup> See U.S. Dept. of Energy, How Coal Gasification Power Plants Work, *supra* note 224.

<sup>241</sup> Curtis A. Moore, *The 1990 Clean Air Act Amendments: Failing the Acid Test*, 34 ENVTL. L. REP. (Envtl. Law Inst.) 10,366 (Apr. 2004).

<sup>242</sup> Moore, *supra* note 241.

<sup>243</sup> *Id.* Air Products says there is a facility in Plaquemine, Louisiana, built in 1987, that uses IGCC technology. Air Products, Integrated Gasification Combined Cycle (IGCC) Synthetic Natural Gas (SNG), <http://www.airproducts.com/Markets/Gasification/integrated>

field project, was estimated at \$1700/kW.<sup>244</sup> The Tampa Electric Project cost \$1213/kW.<sup>245</sup> Projected costs have dropped, but despite construction costs as low as \$1000 per KW and emissions control of ninety-nine percent for SO<sub>2</sub> and 0.15 lb/MBtu for NO<sub>x</sub>, these plants have not been able to compete with existing coal-burning power plants that are subject to less stringent air pollution controls.<sup>246</sup> Moreover, their IGCC technology is no better at controlling emissions than the new conventional electric power plants.<sup>247</sup> To obtain NO<sub>x</sub> emissions below those of natural gas-fired facilities requires the use of selective catalytic reduction devices that make IGCC technology too expensive to be competitive.<sup>248</sup> Tampa Electric was seeking to build another IGCC plant at the site of its first plant.<sup>249</sup> However, on October 4, 2007, the company announced it was abandoning its plan and giving up \$133.5 million in federal tax credits because of the uncertainty concerning the requirements for carbon capture and sequestration and the associated costs.<sup>250</sup>

Section 1307 of the Energy Policy Act of 2005 modified the Internal Revenue Code ("I.R.C.") to provide a tax credit for IGCC projects.<sup>251</sup> I.R.C. § 48A provides a twenty percent investment tax credit for qualifying advanced coal projects using IGCC technology.<sup>252</sup> On March 13, 2006, the Internal Revenue Service issued Notice 2006-24 to establish the tax credit program.<sup>253</sup> Section 48A defines a "qualified advanced coal project" as one that: (a) uses IGCC; (b) operates at forty percent efficiency; or (c) is a retrofitted or repowered unit that achieves an efficiency of thirty-five percent and meets specified design efficiency improvements.<sup>254</sup> A project

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.htm (last visited Mar. 13, 2010).

<sup>244</sup> CLEAN COAL TECHNOLOGY, *supra* note 237, at 5–127.

<sup>245</sup> *Id.* at 5–119.

<sup>246</sup> Moore, *supra* note 241.

<sup>247</sup> Compare *id.*, with Nat'l Energy Tech. Lab., U.S. Dep't of Energy, Integration of Advanced Emissions Controls to Produce Next-Generation Circulating Fluid Bed Coal Generating Unit (Withdrawn Prior to Award), [www.netl.doe.gov/publications/factsheets/project/Proj218.pdf](http://www.netl.doe.gov/publications/factsheets/project/Proj218.pdf) (last visited Mar. 13, 2010).

<sup>248</sup> EPA, *DOE Eye Study on Benefits of Coal Gasification Power Plants*, 21 ENVTL. POL'Y ALERT 31 (Dec. 22, 2004).

<sup>249</sup> Drew Douglas, *Tampa Electric Scuttles Plan to Build IGCC Generating Plant in Central Florida*, 38 ENV'T REP. (BNA) 2202 (Oct. 12, 2007).

<sup>250</sup> *Id.*

<sup>251</sup> Energy Policy Act of 2005, Pub. L. No. 109-58 § 1307, 119 Stat. 999-1006.

<sup>252</sup> I.R.C. § 48A (2006).

<sup>253</sup> INTERNAL REVENUE SERVICE, NOTICE 2006-24: QUALIFYING ADVANCED COAL PROJECT PROGRAM (2006), available at [http://www.taxalmanac.org/index.php/Notice\\_2006-24](http://www.taxalmanac.org/index.php/Notice_2006-24).

<sup>254</sup> I.R.C. 48A(c), (e–f).

is also required to meet specific performance requirements such as ninety-nine percent SO<sub>2</sub> removal and ninety percent mercury removal.<sup>255</sup>

The term “clean coal” appears to be more of a political buzzword than a standard based on objective criteria.<sup>256</sup> If carbon dioxide emissions are ignored, are emissions from a modern boiler fired with low sulfur western coal and utilizing state of the art exhaust gas treatment to remove conventional criteria pollutants and heavy metals higher than the emissions from IGCC operations? If they are not, then IGCC cannot be justified as BACT. If IGCC actually produces lower emissions than other technology, the actual emissions from IGCC should be imposed as BACT, and the electric power industry should be allowed to meet them with any technology they select.

The IRS definition of a qualified advanced coal project using IGCC does not appear to impose standards that are a significant improvement over conventional pollutant emission limits applicable to pulverized coal plants. If “clean coal” means low or no carbon dioxide emissions, then IGCC without sequestration is not a viable technology, and requiring the installation of IGCC before the ability to properly sequester CO<sub>2</sub> is established makes no sense. The most effective way to quickly reduce CO<sub>2</sub> emissions from power plants is to improve efficiency.<sup>257</sup> Unfortunately, the gains from efficiency improvement are limited, and efficiency improvements do little to reduce emissions of conventional pollutants.<sup>258</sup>

If IGCC technology is to be used to make it easier to control CO<sub>2</sub> emissions, some assurance of an appropriate return on investment will be helpful. Base load facilities typically require large capital investments to construct a plant that has the advantage of low operating costs.<sup>259</sup> Plants that provide peaking power during times of high demand are built to minimize capital investment, and high operating costs are accepted

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<sup>255</sup> I.R.C. § 48A(c)(2), (f)(1).

<sup>256</sup> See James B. Meigs, *The Myth of Clean Coal: Analysis—Will Coal Become the Clean, Green Fuel of the Future? Not So Fast.*, POPULAR MECHS., Dec. 8, 2009, <http://www.popularmechanics.com/science/earth/4339171.html>.

<sup>257</sup> See *supra* Parts I.A–B. See also World Coal Inst., *Coal Use & the Environment*, <http://www.worldcoal.org/coal-the-environment/coal-use-the-environment/> (last visited Mar. 14, 2010) (calling energy efficiency improvements key in reducing coal’s impact on the environment).

<sup>258</sup> See *supra* Part I.A; *infra* Part V.

<sup>259</sup> See Nathan E. Hottle, *Valuation Methods for Capital Investment in Merchant Power Plants* 23 (Sept. 2003) (unpublished Masters thesis, Massachusetts Institute of Technology) (on file with Massachusetts Institute of Technology Libraries).

because these plants have low utilization.<sup>260</sup> To encourage investment in base load facilities, states must provide “rate-of-return” assurances that will allow the utilities to recover their investments and make a profit. If new technologies are to be implemented, states will need to assure investors that the associated higher costs will be included in the rate base. An IGCC facility will cost about twenty percent more to construct than a pulverized coal-burning plant, but the turbines available for IGCC use may not have the reliability needed to produce base load electricity that provides an adequate return on investment.<sup>261</sup>

There has been an effort to get the federal government to provide loan guarantees to encourage IGCC installation.<sup>262</sup> As part of the FutureGen initiative, a site was to be selected in either Texas or Illinois for the construction of a 275 MW prototype plant that would produce electricity and hydrogen while removing and sequestering CO<sub>2</sub> in a coal gasification process.<sup>263</sup> Both Texas and Illinois enacted legislation, in 2006, that prevented tort liability from being imposed on the project operators.<sup>264</sup> However, after selecting the Mattoon, Illinois site, the estimated cost increased about fifty percent, and, in January 2008, the DOE canceled the FutureGen program.<sup>265</sup> Some members of Congress claimed that the FutureGen project was cancelled because an Illinois site, rather than the Texas site, was selected.<sup>266</sup> On March 18, 2009, the Government Accountability Office said it made a \$500 million error in calculating the cost of the FutureGen project during the Bush administration, when the cost was

<sup>260</sup> See *id.* at 22.

<sup>261</sup> U.S. GOV'T ACCOUNTABILITY OFFICE, NO. 08-1080, CLIMATE CHANGE: FEDERAL ACTIONS WILL GREATLY AFFECT THE VIABILITY OF CARBON CAPTURE AND STORAGE AS A KEY MITIGATION OPTION 20–21 (2008).

<sup>262</sup> *Fuel Gasification Plan Expanded in Response To Rising Energy Prices*, 22 ENVTL POL'Y ALERT (InsideEPA.com) 2 (Jan. 19, 2005).

<sup>263</sup> *Lawmakers To Ask GAO To Investigate Futuregen Restructuring*, 25 ENVTL. POL'Y ALERT (BNA) 4 (Feb. 13, 2008); Press Release, FutureGen Alliance, FutureGen Industrial Alliance to Pioneer Development of First Near-Zero Emissions Electricity and Hydrogen Production Facility (Sept. 13, 2005), available at [http://www.futuregenalliance.org/news/releases/pr\\_9-13-05.pdf](http://www.futuregenalliance.org/news/releases/pr_9-13-05.pdf).

<sup>264</sup> See TEX. NAT. RES. CODE. ANN. § 119.004 (Vernon 2009); 20 ILL. COMP. STAT. ANN. 1107/25, /30 (West 2008).

<sup>265</sup> See Jenny Johnson, *EPA Advisors Back CO<sub>2</sub> Storage Fund as Future-Gen Alternative*, 19 CLEAN AIR REP. (InsideEPA.com) 3 (Feb. 7, 2008); Posting of Kate Galbraith to Green Inc. Blog—NYTimes.com, <http://greeninc.blogs.nytimes.com/2009/06/12/clean-coal-project-revived-in-illinois/> (June 12, 2009, 12:27 EST).

<sup>266</sup> *Lawmakers to Ask GAO to Investigate Futuregen Restructuring*, 25 ENVTL. POL'Y ALERT (BNA) 4 (Feb. 13, 2008).

projected to be \$1.8 billion rather than \$1.3 billion.<sup>267</sup> The error now is not important because the cost has increased substantially.<sup>268</sup> FutureGen was the subject of controversy among the Democratic leadership that continued to fight over who would get the “pork.” Majority Whip Richard Durbin (D-IL) worked to get the FutureGen project that is located in his home state funded.<sup>269</sup> The former House Energy and Commerce subcommittee chairman, Representative Rick Boucher (D-VA), wanted multiple projects funded that would benefit his constituents.<sup>270</sup>

The fate of federal funding for FutureGen also is entwined with federal support for carbon sequestration. FutureGen is now supported by the Obama Administration, which worked to develop a new agreement to fund a substantial portion of the project's cost.<sup>271</sup> However, the Southern Company and American Electric Power (“AEP”) pulled out of the FutureGen project.<sup>272</sup> AEP plans to retrofit an existing plant in West Virginia to capture and store CO<sub>2</sub>.<sup>273</sup> Southern Company is seeking a permit to build a IGCC plant in Mississippi.<sup>274</sup> Despite these withdrawals, nine companies remain as partners in the FutureGen project.<sup>275</sup> On July 14, 2009, the DOE announced plans to move forward with financial assistance for the project.<sup>276</sup> Federal funding will be \$1.073 billion with \$1 billion coming from the car-

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<sup>267</sup> Michael Kinsley, *U.S. Shouldn't Give Up On Clean Coal*, SALT LAKE TRIB. Mar. 20, 2009, at A13.

<sup>268</sup> *See id.* (indicating that some estimates of the project put its cost at \$2.3 billion).

<sup>269</sup> Steven Cook, *Senators Press Energy Department to Move Forward with FutureGen Project*, 40 ENV'T REP. (BNA) 272 (Feb. 6, 2009).

<sup>270</sup> *See* Dean Scott & Steven D. Cook, *Emissions Trading: House Will Take Lead on Emissions Caps, Support From Obama Likely, Boucher Says*, 39 ENV'T REP. (BNA) 2116 (Oct. 24, 2008). On March 24, 2009, Rep. Rick Boucher (D-VA) introduced legislation to establish a \$1 billion annual fund to support large-scale projects for commercial CCS technology. Coal Utilization Research Council, *Boucher Re-Introduces CCS Bill—'Carbon Capture and Storage Early Development Act,'* [http://www.coal.org/news/article.asp?ARTICLE\\_ID=174&](http://www.coal.org/news/article.asp?ARTICLE_ID=174&) (last visited Mar. 14, 2009).

<sup>271</sup> Steven D. Cook, *FutureGen Carbon Sequestration Project, Cancelled Last Year, Will Restart, Chu Says*, 40 ENV'T REP. (BNA) 1424 (June 19, 2009).

<sup>272</sup> Mark Chediak & Katarzyna Klimasinska, *AEP, Southern Withdraw From FutureGen Coal Project*, BLOOMBERG.COM, June 24, 2009, <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aBeVHVGtr7KE#>.

<sup>273</sup> Steven D. Cook, *Southern Co., AEP Pull Out of FutureGen; DOE Says More Partners Needed for Funding*, 40 ENV'T REP. (BNA) 1555 (July 3, 2009).

<sup>274</sup> *See id.*

<sup>275</sup> *Id.*

<sup>276</sup> Steven D. Cook, *Energy Department Moves Forward With FutureGen Project in Illinois*, 40 ENV'T REP. (BNA) 1707 (July 17, 2009) [hereinafter *Energy Department Moves Forward*].

bon capture and research funds in the American Recovery and Reinvestment Act.<sup>277</sup> The total cost of the project is estimated at \$2.4 billion.<sup>278</sup>

In June 2007, a CAA construction permit was granted to build a 630 MW IGCC plant in Taylorville, Illinois, but the plant is not designed to sequester carbon.<sup>279</sup> If the plant becomes operational, it will be the first commercial scale IGCC plant in the United States.<sup>280</sup> The Sierra Club subsequently challenged the EPA's permit before the EAB in *In re: Christian County Generation, LLC*,<sup>281</sup> but the EAB denied review of the PSD permit on January 28, 2008.<sup>282</sup> The same company, Tenaska Inc., has started a carbon capture project at its Trailblazer power plant in Texas.<sup>283</sup> On January 12, 2009, Illinois enacted its "clean-coal portfolio standard" that requires Illinois electric utilities to buy up to five percent of their power from clean-coal facilities by 2015 and twenty-five percent by 2025.<sup>284</sup> This law is expected to assist the Taylorville IGCC facility's economic viability.<sup>285</sup>

In Minnesota, Excelsior Energy is attempting to build an IGCC plant, although it will not capture and sequester CO<sub>2</sub> emissions.<sup>286</sup> Because it will be years before there can be large-scale commercial deployment of sequestration technologies,<sup>287</sup> the Sierra Club and other environmental organizations are opposing the project.<sup>288</sup> A coal gasification facility, currently without carbon capture, is being constructed in Indiana.<sup>289</sup> It, also,

<sup>277</sup> American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

<sup>278</sup> *Energy Department Moves Forward*, *supra* note 276.

<sup>279</sup> Michael Bologna, *State Issues Air Permit for Construction Of Power Plant Using Coal Gasification*, 38 ENV'T REP. (BNA) 1297 (June 8, 2007).

<sup>280</sup> *Id.*

<sup>281</sup> Jonathan S. Martel, *Climate Change Law and Litigation in the Aftermath of Massachusetts v. EPA*, 214 DAILY ENV'T REP. (BNA) B-1 (Nov. 6, 2007).

<sup>282</sup> Steven D. Cook, *EPA Permit for Utah Coal-Fired Power Plant Under Challenge at Agency's Appeals Board*, 39 ENV'T REP. (BNA) 344 (Feb. 22, 2008).

<sup>283</sup> Dean Scott, *House Bill Carbon Capture Incentives Lauded; Energy Industry Calls for Regulatory Certainty*, 40 ENV'T REP. (BNA) 1820 (July 31, 2009).

<sup>284</sup> Michael Bologna, *Governor Signs 'Clean-Coal' Legislation to Provide Boost for Gasification Plant*, 40 ENV'T REP. (BNA) 135 (Jan. 16, 2009).

<sup>285</sup> *Id.*

<sup>286</sup> See Press Release, Excelsior Energy, Excelsior Energy Files Permit Application for Mesaba Energy Project with the Minnesota Public Utilities Commission (July 31, 2006) <http://www.excelsiorenergy.com/news/index.html> (follow "July 2006" hyperlink); *Environmentalists Cite Sequestration Concerns in Opposing IGCC Plant*, 18 CLEAN AIR REP. (InsideEPA.com) 2 (Jan. 25, 2007).

<sup>287</sup> *DOE Admits CO<sub>2</sub> Sequestration Years Away in Coal-To-Fuel Plant Study*, 18 CLEAN AIR REP. (InsideEPA.com) 2 (Jan. 25, 2007).

<sup>288</sup> *Environmentalists Cite Sequestration Concerns in Opposing IGCC Plant*, *supra* note 286.

<sup>289</sup> *State Permit Ruling Stands To Boost Coal Gasification Supporters*, 19 CLEAN AIR REP.

was challenged by a citizen group, but on October 16, 2008, the Indiana Court of Appeals upheld the state utility commission's issuance of a Certificate of Public Convenience and Necessity.<sup>290</sup>

C. *Sequestration*<sup>291</sup>

Carbon sequestration may be accomplished through storage in a geologic depository or by using a biologic process in which CO<sub>2</sub> is removed from the atmosphere by plants that store carbon.<sup>292</sup> However, it will be some time in the future before sequestration in geologic formation is proven to be an effective and economical way to reduce CO<sub>2</sub> emissions to the atmosphere.<sup>293</sup> A major benefit from effective sequestration is that America's abundant supply of coal<sup>294</sup> could be utilized without the adverse environmental impacts associated with CO<sub>2</sub> emissions. Risks from sequestration that have been identified include changes in soil chemistry that could harm the ecosystem, effects on water quality due to acidification, effects of geologic stability, and the potential for large releases that could harm or suffocate people and animals.<sup>295</sup>

Carbon dioxide may be captured from fossil-fueled power plants or from industrial processes, including the production of hydrogen and other chemicals, the production of substitute natural gas, and the production of transportation fuel.<sup>296</sup> Carbon capture and storage ("CCS") begins by separating CO<sub>2</sub> from other gases, which may be done before or after fuel is combusted.<sup>297</sup> Post-combustion capture involves concentrating the ex-

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(InsideEPA.com) 22 (Oct. 30, 2008).

<sup>290</sup> *Id.*

<sup>291</sup> Portions of the text accompanying notes 293, 295, 297, 342, and 356, are derived from Reitze, *supra* note 29.

<sup>292</sup> Nat'l Energy Tech. Lab., U.S. Dep't of Energy, Carbon Sequestration FAQ Information Portal, [http://www.netl.doe.gov/technologies/carbon\\_seq/FAQs/carbon-seq.html](http://www.netl.doe.gov/technologies/carbon_seq/FAQs/carbon-seq.html) (last visited Mar. 14, 2009).

<sup>293</sup> See U.S. Dept. of Energy, Geologic Sequestration Research, <http://www.fe.doe.gov/programs/sequestration/geologic/index.html> (last visited Mar. 14, 2010) (explaining that studies are still being conducted to determine effects and efficiency of geologic sequestration).

<sup>294</sup> Trygve Gaalaas, *U.S. Coal Reserves: Still Very Abundant*, 2 AM. COAL (2009), [http://www.americancoalonline.com/Abundant\\_Reserves.php](http://www.americancoalonline.com/Abundant_Reserves.php).

<sup>295</sup> *International Climate Study Examines Feasibility of CO<sub>2</sub> Storage*, CLEAN AIR REP. (Inside Wash. Publishers) (Feb. 24, 2005), available at 2005 WLNR 2764072.

<sup>296</sup> Howard Herzog & Dan Golomb, *Carbon Capture and Storage from Fossil Fuel Use*, in 1 ENCYCLOPEDIA OF ENERGY 277-78 (Cutler J. Cleveland ed., 2004).

<sup>297</sup> *Id.* at 285.

haust gases into a stream of nearly pure CO<sub>2</sub> and then compressing it to convert it from gas to a supercritical fluid before it is transported to the injection site by pipeline.<sup>298</sup> Carbon capture from the flue gas of coal-burning power plants will be more expensive than the carbon capture used in industrial processes that involve more concentrated streams of CO<sub>2</sub>.<sup>299</sup> The concentration of CO<sub>2</sub> in conventional post-combustion gas streams means that large volumes of flue gas must be processed to remove their conventional pollutants.<sup>300</sup> Conventional power plant CO<sub>2</sub> emissions are about three to fifteen percent by volume, which increases the energy requirements needed to remove a given quantity of CO<sub>2</sub> from the gas stream compared to gas streams with higher concentrations of CO<sub>2</sub>.<sup>301</sup> If the nitrogen in air is removed prior to combustion, CO<sub>2</sub> in the exhaust stream is more concentrated, and it is less costly to separate.<sup>302</sup> IGCC plants have lower CO<sub>2</sub> separation costs than conventional power plants because pure oxygen is supplied to the gasification reactor,<sup>303</sup> so the CO<sub>2</sub> concentration is greater and less energy is required to remove CO<sub>2</sub>.<sup>304</sup>

After the CO<sub>2</sub> is removed at either a conventional or an IGCC facility, it must be compressed to liquefy it for transport.<sup>305</sup> This reduces the efficiency of the electric generation process because of the energy required to liquefy CO<sub>2</sub>.<sup>306</sup> It is estimated that carbon capture from a new IGCC plant would increase the cost of electricity production by less than half the cost of carbon capture from a new pulverized coal plant because it would have lower energy requirements for capturing and liquefying the CO<sub>2</sub>.<sup>307</sup> Carbon capture from most conventional power plants that use pulverized coal would require post-combustion capture using technologies, such as chilled ammonia, which could increase the cost of electricity by fifty-nine percent according to a DOE report.<sup>308</sup> However, a report

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<sup>298</sup> See *id.* at 278–79.

<sup>299</sup> *Id.* at 277–79.

<sup>300</sup> See *id.* at 279.

<sup>301</sup> *Id.*

<sup>302</sup> See Herzog & Golomb, *supra* note 296, at 279; Inst. for Clean and Secure Energy, Univ. of Utah, Oxyfuel (2009), [www.cleancoal.utah.edu/files/oxynew.pdf](http://www.cleancoal.utah.edu/files/oxynew.pdf).

<sup>303</sup> GE Energy, IGCC Technology, [http://www.gepower.com/prod\\_serv/products/gas\\_turbines\\_cc/en/igcc/technology.htm](http://www.gepower.com/prod_serv/products/gas_turbines_cc/en/igcc/technology.htm) (last visited Mar. 15, 2010).

<sup>304</sup> Herzog & Golomb, *supra* note 296, at 279, 284.

<sup>305</sup> See *id.* at 278–80, 283–84.

<sup>306</sup> U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 261, at 22–23.

<sup>307</sup> *Id.* at 19.

<sup>308</sup> *Industry Downplays DOE Report Doubting CO<sub>2</sub> Capture Process*, CLEAN AIR REP. (Inside Wash. Publishers) (July 26, 2007), available at 2007 WLNR 14210145.

prepared at the University of Utah found the cost of carbon capture to be about \$40 per ton and the underground storage cost to be \$10 per ton, which would add \$0.075 to the cost of a KWh.<sup>309</sup> This cost would be added to the average delivered cost of \$0.089 per KWh.<sup>310</sup>

The American Coalition for Clean Coal Electricity, a coal-fired electric industry group, estimates that the cost of having carbon sequestration available by 2025 will be \$17 billion.<sup>311</sup> The added cost is projected, by an MIT study, to nearly double the cost of a KWh of electricity.<sup>312</sup> A report by the Intergovernmental Panel on Climate Change ("IPCC") estimated that CCS would increase the cost of a KWh of electricity from a natural gas combined cycle plant by \$0.01–0.03.<sup>313</sup> CCS for CO<sub>2</sub> from a pulverized coal plant would increase costs by \$0.02–0.05 and the cost increase for an IGCC plant would be \$0.01–0.03 per KWh.<sup>314</sup> Thus, CCS, according to the IPCC, would increase the cost of producing electricity by about thirty to sixty percent.<sup>315</sup> The IPCC study also says that, since none of these technologies have used CCS at a full-scale facility, "the costs of these systems cannot be stated with a high degree of confidence."<sup>316</sup> The cost of sequestration will be added to the costs of updating an inadequate transmission system, updating or replacing aging generation assets, investing in advanced metering equipment, expanding the electric power generating capacity to deal with power demand, and investing to meet renewable portfolio requirements. A June 12, 2009 California Public Utilities Commission report, estimates electric power will cost 16.7% more in 2020, without a sequestration requirement.<sup>317</sup>

After CO<sub>2</sub> is captured, it must be transported to a storage site for underground injection.<sup>318</sup> Even with relatively convenient access to storage reservoirs, transportation will be costly because a 1000 MW plant will

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<sup>309</sup> Stephen Siciliano, *Sequestration Called Best Way to Achieve Short-Term Reductions of Carbon Emissions*, 38 ENV'T REP. (BNA) 2286 (Oct. 26, 2007).

<sup>310</sup> *See id.*; U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 261, at 23.

<sup>311</sup> Kinsley, *supra* note 267.

<sup>312</sup> *See* THE FUTURE OF COAL 19 tbl.3.1 (Mass. Inst. Tech. 2007) [hereinafter FUTURE OF COAL].

<sup>313</sup> INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE WORKING GROUP III, CARBON DIOXIDE CAPTURE AND STORAGE 10 tbl.SPM.3 (2005) [hereinafter IPCC WORKING GROUP III].

<sup>314</sup> *Id.*

<sup>315</sup> *Id.* (calculated from data).

<sup>316</sup> *Id.*

<sup>317</sup> *See* Carolyn Whetzel, *Report Says State's Plan to Boost Renewables Portfolio Ambitious, Costly*, 40 ENV'T REP. (BNA) 1463 (June 19, 2009).

<sup>318</sup> IPCC WORKING GROUP III, *supra* note 313, at 3–4.

consume about 12,000 tons of coal each day.<sup>319</sup> The weight of CO<sub>2</sub> that will need to be shipped will be more than double the weight of the coal that was used by the power plant, with the exact weight being dependent on the moisture content and carbon content of the fuel.<sup>320</sup> Thus, a 1000 MW power plant using 13,000 tons a day of Powder River Basin coal would produce about 24,321 tons of CO<sub>2</sub> per day.<sup>321</sup> Carbon dioxide in the super critical state used for injection has a density of 0.03454 cubic feet per pound or about sixty-nine cubic feet per ton.<sup>322</sup> Thus, a modern power plant could be expected to need to transport liquid CO<sub>2</sub> in an amount of over 1.85 million cubic feet each day, which is equivalent to the volume of a football field over 32.13 feet deep.<sup>323</sup> Electrical generation, in 2008, in the United States produced 2342 million metric tons of CO<sub>2</sub>.<sup>324</sup> This will result in the generation of 165,598 million cubic feet a year, which occupies a

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<sup>319</sup> See Interview by Chris Kelly with Turk Storvick, Mo. Univ. Professor Emeritus of Chem. Eng'g, in Jefferson City, Mo., *available at* [http://www.chriskelly24.com/callaway\\_II\\_storvick.htm](http://www.chriskelly24.com/callaway_II_storvick.htm) (last visited Feb. 18, 2010).

<sup>320</sup> Coal is a mixture of carbon, hydrogen, and oxygen molecules with carbon, and carbon itself makes up about sixty to ninety-eight percent of this mixture, depending on coal type. B.D. HONG & E. R. SLATICK, ENERGY INFO. ADMIN., U.S. DEPT OF ENERGY, CARBON DIOXIDE EMISSION FACTORS FOR COAL (1994), [http://www.eia.doe.gov/cneaf/coal/quarterly/co2\\_article/co2.html](http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html); ENERGY INFO. ADMIN., U.S. DEPT OF ENERGY, EIA-0064(93) COAL DATA: A REFERENCE 107 (1995). But, coal also contains impurities, such as in the case of the Powder River Basin coal. See THE BABCOCK & WILCOX CO., STEAM: ITS GENERATION AND USE, 5-11 tbl.16 (38th ed. 1972) (showing the Campbell, Wyoming coal to be 4.8% ash and .55% sulfur). About seventy-four percent of dry Powder River Basin coal is carbon, but the coal consumed is wet with a thirty-one percent moisture content. *Id.* at 5-11 tbl.16, 5-15 tbl.21. The carbon in the coal combines with oxygen in the air to produce CO<sub>2</sub> that weighs 3.667 times the weight of its carbon, based on the atomic weights of oxygen and carbon. HONG & SLATICK, *supra*.

<sup>321</sup> For a Powder River Basin coal, 13,000 tons of coal per day minus its moisture content multiplied by its carbon content is the weight of the carbon, and multiplied by the relative weight of CO<sub>2</sub> will produce 24,321 tons per day of CO<sub>2</sub> (13,000 x .69 x .74 x 3.664). See *supra* note 320 (calculated from data).

<sup>322</sup> See CHEMICAL ENGINEER HANDBOOK 3-162 (Robert H. Perry & Cecil H. Chilton eds., 5th ed. 1953). The IPCC Special Report provides a range of numbers, but says the density is 1032 kg/m<sup>3</sup> at 20°C and 19.7 bar pressure, which converts to 64.8 lb/ft<sup>3</sup>. See Paul Freund et al., *Annex I: Properties of CO<sub>2</sub> and Carbon-based Fuels*, in IPCC WORKING GROUP III, *supra* note 313, at 386 tbl.AI.1.

<sup>323</sup> A NFL football field is 360 by 160 feet, which is 57,600 square feet. See SportsKnowHow.com, Professional (NFL) Football Field Dimension Diagram, <http://www.sportsknowhow.com/pops/football-field-pro.html> (last visited Mar. 16, 2010). A power plant's production of 26,824 tons per day of CO<sub>2</sub> at 69 cubic feet per ton is 1.85 million cubic feet of super critical CO<sub>2</sub>. See *supra* notes 168-69 and accompanying text. Divided by 57,600 gives depth of 32.13 feet.

<sup>324</sup> INVENTORY, *supra* note 5, at ES-4 tbl.ES-2.

space equivalent to a column one square mile at its base and over 1.09 miles high.<sup>325</sup>

In addition to the significant engineering and economic issues concerning transporting CO<sub>2</sub>, carbon sequestration raises legal issues concerning how the CO<sub>2</sub> will be transported and potential liability for transportation mishaps. Carbon dioxide will be compressed into a supercritical fluid and transported to a site where it can be injected far below the ground.<sup>326</sup> It is expected that pipelines will be the primary method of transporting CO<sub>2</sub> to a sequestration site.<sup>327</sup> Safety regulations for these pipelines will be within the jurisdiction of the Department of Transportation's ("DOT") Pipeline and Hazardous Materials Safety Administration ("PHMSA") for pipelines that affect interstate commerce, and it provides minimum standards for states that regulate intrastate pipelines.<sup>328</sup> The PHMSA will need to reevaluate its legal requirements for pipelines if a large-scale sequestration program is to develop, and it will need to deal with cross-jurisdictional issues involving multiple federal agencies as well as state regulatory agencies. At some point, it will be necessary to develop regulations concerning rates and terms of service for interstate pipelines. The Federal Energy Regulatory Commission ("FERC") does not appear to have authority over CO<sub>2</sub> pipelines.<sup>329</sup> It appears that legislation is needed to specify the agency that will regulate pipelines used for CO<sub>2</sub> transportation.<sup>330</sup>

After the liquid CO<sub>2</sub> is transported to an underground storage location, it will be injected into underground geological formations and monitored.<sup>331</sup> There appears to be more than adequate geological formations to use as potential storage reservoirs, although detailed studies will need to be performed prior to using a specific formation as a CO<sub>2</sub> repository.<sup>332</sup> The Energy Independence and Security Act of 2007 requires the U.S. Geological Survey to develop a methodology to determine the capacity for CO<sub>2</sub> sequestration in the United States and to then assess the capacity.<sup>333</sup> On

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<sup>325</sup> 2342 million metric tons of CO<sub>2</sub> multiplied by 69 cubic feet per ton equals 161,598 million cubic feet, and one square mile (5,280 feet x 5,280 feet = 27,878,400 square feet) multiplied by 1.12 miles (5,913.6 feet) equals 1.65 x 10<sup>11</sup> cubic feet. *See supra* notes 319–22 and accompanying text.

<sup>326</sup> U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 261, at 10.

<sup>327</sup> *Id.*

<sup>328</sup> *Id.* at 43–44.

<sup>329</sup> *Id.* at 44.

<sup>330</sup> *See id.* at 43–45.

<sup>331</sup> *Id.* at 9.

<sup>332</sup> FUTURE OF COAL, *supra* note 312, at 44.

<sup>333</sup> Energy Independence and Security Act of 2007, 42 U.S.C. § 17271 (2006).

June 3, 2009, the Department of the Interior issued its report, which recommends a framework for identifying suitable CO<sub>2</sub> storage sites.<sup>334</sup> Issues of concern raised in the report include the effect of sequestration on mineral extraction as well as “surface activities such as grazing, recreation, and community development.”<sup>335</sup> Sites also need to be evaluated for their potential to induce earthquakes.<sup>336</sup> It is expected that the CO<sub>2</sub> will be injected at depths of over 800 meters (2,625 feet) into geological formations that will sequester it for hundreds to thousands of years.<sup>337</sup> The Nuclear Waste Policy Act requires decaying radioactive materials to be isolated from the biosphere for 10,000 years to preclude potentially harmful effects.<sup>338</sup> GHGs are potentially harmful in perpetuity<sup>339</sup> and need similar containment.

Carbon dioxide injection is used to enhance oil recovery and to force methane out of coal beds for recovery and use.<sup>340</sup> We do not have much experience with injection on the scale that will be required for geological storage of CO<sub>2</sub> from electric power plants for time spans in excess of human civilization. Such storage will require dealing with the properties of flue gas from fossil-fuel combustion.<sup>341</sup> That includes the relative buoyancy of CO<sub>2</sub>, its mobility within subsurface formations, the corrosive properties of the gas in water, the impact of the impurities in the flue gas, and the large volume of material that will need to be injected.<sup>342</sup> The supercritical liquid will be injected, using proven technology, at a depth greater

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<sup>334</sup> Steven D. Cook, *Site Selection Criteria Recommended For Geological Storage of Carbon Dioxide*, 40 ENV'T REP (BNA) 1292 (June 5, 2009) [hereinafter *Site Selection Criteria Recommended*]. See also U.S. DEPT. OF THE INTERIOR, FRAMEWORK FOR GEOLOGICAL SEQUESTRATION ON PUBLIC LAND (2009).

<sup>335</sup> *Site Selection Criteria Recommended*, *supra* note 334.

<sup>336</sup> *Id.*

<sup>337</sup> U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 261, at 10.

<sup>338</sup> Nuclear Waste Policy Act of 1982 § 121, 42 U.S.C. § 10141(a) (2006); Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada, 40 C.F.R. § 197.20 (2009). *But see* Nuclear Energy Inst. v. Env'tl. Prot. Agency, 373 F.3d 1251, 1273 (D.C. Cir. 2004) (holding that EPA's 10,000 year mark violated Congress's express provision to follow the recommendation of the National Academy of Sciences).

<sup>339</sup> See Posting of Lisa Moore to Climate 411, [http://blogs.edf.org/climate411/2008/02/26/ghg\\_lifetimes/](http://blogs.edf.org/climate411/2008/02/26/ghg_lifetimes/) (Mar. 17, 2008).

<sup>340</sup> *Site Selection Criteria Recommended*, *supra* note 334.

<sup>341</sup> See U.S. ENVTL. PROT. AGENCY, EPA816-F-08-032, EPA PROPOSES NEW REQUIREMENTS FOR GEOLOGICAL SEQUESTRATION OF CARBON DIOXIDE 1 (2008), available at [http://www.epa.gov/safewater/uic/pdfs/fs\\_uic\\_co2\\_proposedrule.pdf](http://www.epa.gov/safewater/uic/pdfs/fs_uic_co2_proposedrule.pdf) [hereinafter NEW REQUIREMENTS].

<sup>342</sup> *Id.* at 1.

than 800 meters (2,625 feet) in order to keep the CO<sub>2</sub> in a supercritical state where it cannot be distinguished whether it is in a liquid or a gas phase.<sup>343</sup>

It is estimated by the International Energy Agency that “[a]bout 10,000 large-scale [CCS] projects will be needed by 2050 to hold global warming to less than 3 degrees Celsius by the end of this century.”<sup>344</sup> There are now four: Sleipner in the North Sea and Snohvit in the Barents Sea, Norway, operated by Statoil Hydro; the Salah project in Algeria, operated by British Petroleum, Sonatrach, and Statoil Hydro;<sup>345</sup> and the Great Plains Synfuels Plant in North Dakota, owned by the Dakota Gasification Company, a subsidiary of Basin Electric Cooperative, which is the only coal-burning facility in North America that sequesters CO<sub>2</sub>.<sup>346</sup> The Great Plains Synfuels Plant is a synthetic natural gas facility where coal is gasified to make methane, and CO<sub>2</sub>, sulfur dioxide, and mercury are removed from the gas stream.<sup>347</sup> The gas stream, which is ninety-six percent CO<sub>2</sub>, is pressurized until it is in a supercritical state, which results in the gas becoming as dense as a liquid while flowing like a gas.<sup>348</sup> It is then transported 205 miles, by pipeline, to an oil field near Weyburn, Saskatchewan, Canada, where it is injected into one of thirty-seven injection wells and is used to enhance oil recovery.<sup>349</sup> The facility began sequestering CO<sub>2</sub> in 2000.<sup>350</sup> It handles 8,000 metric tons of CO<sub>2</sub> each day, and is expected to

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<sup>343</sup> *Id.* At temperatures above supercritical temperature a material cannot be distinguished between its liquid or gas phase. American Energy Independence, Geothermal Energy, <http://www.americanenergyindependence.com/geothermal.aspx> (last visited Mar. 17, 2010). The critical temperature for CO<sub>2</sub> is 88°F. *Id.*

<sup>344</sup> Rick Mitchell, *IEA Says 10,000 Large-Scale Projects Needed by 2050 to Meet Climate Goals*, 39 ENV'T REP. (BNA) 2222 (Nov. 7, 2008).

<sup>345</sup> *See id.*; see also Pub. L. No. 109-58 §§ 1301, 1307, 119 Stat. 594 (2005); Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change and Carbon Sequestration: Assessing a Liability Regime for Long-Term Storage of Carbon Dioxide*, 58 EMORY L.J. 103, 107 n.7 (2009).

<sup>346</sup> Dakota Gasification Co., About Us, [http://www.dakotagas.com/About\\_Us/index.html](http://www.dakotagas.com/About_Us/index.html) (last visited Mar. 17, 2010); Dakota Gasification Co., Gas Pipeline, [http://www.dakotagas.com/Gas\\_Pipeline/index.html](http://www.dakotagas.com/Gas_Pipeline/index.html) (last visited Mar. 17, 2010).

<sup>347</sup> Dakota Gasification Co., About Us, *supra* note 346; Dakota Gasification Co., Gasification Process, [http://www.dakotagas.com/Gasification/Gasification\\_Process/index.html](http://www.dakotagas.com/Gasification/Gasification_Process/index.html) (last visited Mar. 17, 2010); Dakota Gasification Co., How it Works, [http://www.dakotagas.com/CO2\\_Capture\\_and\\_Storage/How\\_It\\_Works/index.html](http://www.dakotagas.com/CO2_Capture_and_Storage/How_It_Works/index.html) (last visited Mar. 17, 2010).

<sup>348</sup> Dakota Gasification Co., About Us, *supra* note 346; Dakota Gasification Co., How it Works, *supra* note 347.

<sup>349</sup> Basin Elec. Power Coop., CO<sub>2</sub>, <http://www.basinelectric.com/Gasification/CO2/index.html> (last visited Mar. 17, 2010).

<sup>350</sup> Dakota Gasification Co., About Us, *supra* note 346.

eventually store 20 million tons 1,400 meters underground.<sup>351</sup> None of the four existing sequestration projects were designed for long-term storage.<sup>352</sup> They all are used to enhance hydrocarbon recovery.<sup>353</sup>

### 1. Safe Drinking Water Act, CERCLA & RCRA

Carbon sequestration in underground reservoirs requires a permit issued under the Safe Drinking Water Act (“SDWA”).<sup>354</sup> The “EPA administers the [underground injection control (“UIC”)] program in ten states and for all Indian tribes.”<sup>355</sup> Thirty-three states have been given “primacy,” or primary enforcement authority, and seven states have partial authority to administer the UIC program.<sup>356</sup> The Energy Independence and Security Act of 2007<sup>357</sup> gave the EPA the explicit authority, under the SDWA, to regulate injection and geologic sequestration of CO<sub>2</sub>.<sup>358</sup> Governors from oil and gas producing states did not want federal regulation of CO<sub>2</sub> injection because they do not want interference with the use of CO<sub>2</sub> to force natural gas and petroleum to the surface.<sup>359</sup> These operations are small compared to what would be required to sequester CO<sub>2</sub> emissions from fossil-fueled electric power plants.<sup>360</sup>

“The EPA’s proposed rule governing underground injection of carbon dioxide under the [SDWA] was released July 15, 2008.”<sup>361</sup> On July

<sup>351</sup> Basin Power Elec. Coop., *supra* note 349.

<sup>352</sup> *See, e.g.*, Greenhouse Gas R&D Program, Int’l Energy Agency, R, D&D Projects Database: Snohvit (Snow White) LNG Project, [http://www.co2captureandstorage.info/project\\_specific.php?project\\_id=35](http://www.co2captureandstorage.info/project_specific.php?project_id=35) (last visited Mar. 28, 2010) (describing Snohvit as a “demonstration project”).

<sup>353</sup> *See, e.g.*, Basin Power Elec. Coop., *supra* note 349 (describing the use of liquified CO<sub>2</sub> to force oil towards production wells); Statoil, Sleipner Vest, <http://www.statoil.com/en/TechnologyInnovation/ProtectingTheEnvironment/CarboncaptureAndStorage/Pages/CarbonDioxideInjectionSleipnerVest.aspx> (last visited Mar. 28, 2010) (describing how carbon is be separated and then sequestered in a process to bring the natural gas composition to the quality demanded by customers).

<sup>354</sup> *See* 42 U.S.C. § 300(b)(1)(a) (2006). Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-25 (2006).

<sup>355</sup> U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 261, at 15 & n.12.

<sup>356</sup> *Id.* at 15.

<sup>357</sup> 42 U.S.C. app. §§ 17001–17386 (2009).

<sup>358</sup> *Id.* §§ 17254–55.

<sup>359</sup> *See Oil, Natural Gas Producing States Offer Strategy for Carbon Capture*, CLEAN AIR REP. (Inside Wash. Publishers) (Mar. 24, 2005), available at 2005 WLNR 4551374.

<sup>360</sup> *See id.*

<sup>361</sup> Reitze, *supra* note 29, at 41 (citing Federal Requirements Under the Underground

20, 2009, the EPA sent the regulation to the White House Office of Management and Budget for final review.<sup>362</sup> The proposed rule creates a new Class VI category for geologic sequestration wells (“GS wells”) as an addition to the five classes of wells that already require permits.<sup>363</sup> The EPA is also considering the creation of a new Class VII to regulate wells that simultaneously produce oil and sequester CO<sub>2</sub>.<sup>364</sup> However, the industry would prefer that EPA regulate wells as a subclass of Class II, which is applicable to oil and gas recovery operations.<sup>365</sup>

Proposed Class VI regulations include requirements to ensure wells are appropriately sited and are constructed to prevent fluid movement.<sup>366</sup> The confining zone for the injected CO<sub>2</sub> must be free of faults or fractures,<sup>367</sup> and the injection may not be above the lowest formation containing a source of drinking water.<sup>368</sup> Owners and operators of injection wells must delineate an “area of review” within which all potential penetrations of the confining zone must be identified, and it must be demonstrated that movement of fluids that could endanger underground drinking water will not occur.<sup>369</sup> This may lead to battles over the geology of any site selected similar to those that helped prevent Yucca Mountain from being used as a high-level radioactive waste storage facility.<sup>370</sup>

The proposed rule does not resolve the uncertainty concerning whether underground injection of CO<sub>2</sub> will be considered to be a hazardous substance under the Resource Conservation and Recovery Act (“RCRA”)<sup>371</sup>

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Injection Control (UIC) Program for Carbon Dioxide (CO<sub>2</sub>) Geologic Sequestration (GS) Wells Proposed Rule, 73 Fed. Reg. 43,492 (Jul. 25, 2008)); *see also* Press Release, U.S. Evtl. Prot. Agency, EPA Lays Groundwork for Promising Technologies to Help Mitigate Climate Change (July 15, 2008), [http://www.epa.gov/ogwdw000/uic/wells\\_sequestration.html](http://www.epa.gov/ogwdw000/uic/wells_sequestration.html) (follow “July 15, 2008 Press Release:” hyperlink).

<sup>362</sup> *Notice May Open New Comment Period on Sequestration Proposal*, 26 ENVTL POL'Y ALERT (InsideEPA.com) 15 (July 29, 2009).

<sup>363</sup> Kate Winston, *Industry, Activists Poised for Talks on CO<sub>2</sub> Storage in Drilling Wells*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 16 (Aug. 12, 2009).

<sup>364</sup> *Id.*

<sup>365</sup> *Id.*

<sup>366</sup> *See* Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO<sub>2</sub>) Geologic Sequestration (GS) Wells, 73 Fed. Reg. 43,492, 43,536–43,537, (proposed July 25, 2008) (to be codified at 40 C.F.R. pts. 144, 146).

<sup>367</sup> *Id.* at 43,536.

<sup>368</sup> *Id.* at 43,535.

<sup>369</sup> *See id.* at 43,537.

<sup>370</sup> *Cf.* Tom Doggett, *Obama Opposition to Nuclear Waste Site Questioned*, REUTERS, Apr. 30, 2009, <http://www.reuters.com/article/idUSTRE53T7MH20090430>.

<sup>371</sup> Resource Conservation and Recovery Act of 1976, 42 U.S.C. §§ 6901–6992k (2006).

or the Comprehensive Environmental Response, Compensation, and Liability Act (“CERCLA” or “Superfund”).<sup>372</sup> The EPA indicates that the concentration of impurities in the waste is expected to be low, but the Agency will not categorically determine whether CO<sub>2</sub> injection is hazardous under RCRA or CERCLA.<sup>373</sup> Since CO<sub>2</sub> injection streams may contain hazardous constituents, those involved in sequestration could be subject to liability under these federal laws even if there is no contamination of underground water.<sup>374</sup> The proposed UIC rule is unclear as to whether RCRA and CERCLA are applicable to CO<sub>2</sub> that is injected below ground.<sup>375</sup> Ultimately, the SDWA is too limited in its scope to resolve the issues that will arise if a large-scale CCS program is to develop. A more comprehensive statute is needed that deals with the long-term concerns including monitoring and liability issues.

## 2. Clean Air Act

EPA has not yet addressed how the CAA requirements apply to plants that install carbon capture equipment. Because of the energy requirements for compressing captured CO<sub>2</sub> prior to transport and sequestration, a power plant will have to burn more fuel to obtain the same net generating capacity.<sup>376</sup> A retrofitting of an existing facility would, therefore, be expected to result in increased emissions, which could require a modification of an operating permit and could trigger new source review requirements. On September 30, 2008, the EPA’s Region V proposed a settlement agreement applicable to a Merit Energy and Shell natural gas processing facility that was allegedly violating PSD and operating permit requirements of the CAA.<sup>377</sup> The agreement would require the company to obtain an underground injection permit and to sequester CO<sub>2</sub> and hydrogen sulfide beginning September 1, 2009.<sup>378</sup>

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<sup>372</sup> Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9601–9675 (2006).

<sup>373</sup> *EPA Opens Door to Cleanup Liability for Underground CO<sub>2</sub> Contamination*, 19 CLEAN AIR REP. (InsideEPA.com) 15 (July 24, 2008).

<sup>374</sup> *See id.*

<sup>375</sup> *See id.*

<sup>376</sup> *See* Herzog & Golomb, *supra* note 296, at 283–84.

<sup>377</sup> *EPA Enters First-Time Settlement Requiring Carbon Sequestration*, 25 ENVTL. POL’Y ALERT (InsideEPA.com) 23 (Nov. 5, 2008).

<sup>378</sup> *Id.*

The House Committee on Energy and Commerce reported H.R. 2454, ACES, on May 21, 2009.<sup>379</sup> The bill is also known as the Waxman-Markey bill.<sup>380</sup> ACES is divided into five titles each with subtitles.<sup>381</sup> Title I, subtitle B addresses CCS.<sup>382</sup> ACES section 111 gives the Administrator one year after the date of enactment to identify the “key legal, regulatory and other barriers” to CCS and to inform Congress what additional federal legislation is needed.<sup>383</sup> ACES section 112 amends title VIII of the CAA, which is added by ACES section 331, to require the Administrator to “establish a coordinated approach to certifying and permitting geologic sequestration” that takes into account the requirements of the SDWA.<sup>384</sup>

ACES section 112(a) requires the EPA to “promulgate regulations to protect human health and the environment by minimizing the risk” of CO<sub>2</sub> escaping from geologic sequestration within two years of enactment of this title.<sup>385</sup> Within one year after enactment, section 112(b) requires regulations to be promulgated for CO<sub>2</sub> geological sequestration wells.<sup>386</sup> ACES section 116 requires new coal-burning power plants, permitted after 2020, to use CCS when they commence operations.<sup>387</sup> Plants “permitted between 2015 and 2020 lose eligibility for federal financial assistance if they do not use CCS when they commence operations.”<sup>388</sup> Such plants must retrofit for CCS by 2025.<sup>389</sup> “Coal plants permitted between 2009 and 2015 lose eligibility for federal financial assistance if they do not retrofit CCS within five years after commencing operations,” after which they must retrofit by 2025 without federal financial assistance.<sup>390</sup> The 2025 retrofit requirement “is accelerated if four gigawatts of electricity generation” are

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<sup>379</sup> PEW Center on Global Climate Change, The American Clean Energy and Security Act (Waxman-Markey Bill), <http://www.pewclimate.org/acesa> (last visited Feb. 17, 2010).

<sup>380</sup> *See, e.g., id.*

<sup>381</sup> H.R. 2454 § 1(b).

<sup>382</sup> *Id.* §§ 111–116.

<sup>383</sup> *Id.* § 111.

<sup>384</sup> *Id.* § 112(a); *see also* Safe Drinking Water Act of 1974 § 1421, 42 U.S.C. § 300h (2006).

<sup>385</sup> H.R. 2454 § 112(a).

<sup>386</sup> *Id.* § 112(b).

<sup>387</sup> *See id.* § 116 (requiring a CO<sub>2</sub> emissions limit of a sixty-five percent reduction for such plants). *See also* STAFF OF H. COMM. ON ENERGY AND COMMERCE, 111TH CONG., AMERICAN CLEAN ENERGY AND SECURITY ACT (H.R. 2454) 3–4 (June 9, 2009), *available at* [http://energycommerce.house.gov/Press\\_111/20090602/hr2454\\_reported\\_summary.pdf](http://energycommerce.house.gov/Press_111/20090602/hr2454_reported_summary.pdf) [hereinafter ACES COMMITTEE REPORT].

<sup>388</sup> ACES COMMITTEE REPORT, *supra* note 387, at 4.

<sup>389</sup> *Id.*

<sup>390</sup> *Id.*

utilizing CCS before 2025, but, on a case-by-case basis, compliance may be extended by the EPA for up to eighteen months.<sup>391</sup> This is a low threshold for accelerating CCS requirements and will not be sufficient to demonstrate the technology is cost effective.

For the foreseeable future, costs will be the primary barriers to the implementation of CCS. This includes the high retrofit costs for existing pulverized coal-fired plants, the high costs of separating CO<sub>2</sub> from the other gases and liquefying it, the costs of the needed transportation infrastructure, the costs of creating a storage facility and monitoring long-term storage, and the costs of alternative technologies such as IGCC. The absence of any commercial-scale use of CCS at a large power plant is an important constraint of program development because meaningful cost data is difficult to obtain. DOE has focused on IGCC as a promising technology for use with CCS, but it is more costly than conventional technology, does not result in further reductions of conventional emissions, and is not an effective solution to emissions from existing facilities.<sup>392</sup> The projected high cost of CCS will also be affected by whatever develops concerning a CO<sub>2</sub> emissions trading program. If cap-and-trade is enacted and it significantly raises the costs of using fossil-fuel energy in the United States, it could make CCS an attractive option to avoid both the cap on emissions and the cost of allowances.

### III. RENEWABLE ENERGY<sup>393</sup>

Renewable resources can provide a carbon-free source of useable energy, but their use is limited by their cost and, for most renewable energy sources, reliability problems that limit their use for base load applications. A long-term goal should be to use renewable energy technologies to meet an increasing share of the nation's electric power demand, and to continue to encourage conservation measures. But, for the foreseeable future, the base load demand for electricity is going to be supplied primarily from coal-fired, nuclear, and hydroelectric power plants. This could change, however, if the cost of coal-fired electricity increases significantly. Financial penalties, such as those imposed by a cap-and-trade program and mandated CCS requirements, could change the economics of electric power generation.

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<sup>391</sup> *Id.*

<sup>392</sup> *See supra* Part II.B.

<sup>393</sup> Portions of the text accompanying notes 438–88, and 536–47 are derived from Reitze, *supra* note 29.

CCS potentially could increase the cost of electricity by almost fifty percent.<sup>394</sup> More stringent CAA NAAQS; more stringent NSPS that could be imposed on existing sources; additional NSRs;<sup>395</sup> state limits on carbon emissions; more stringent controls on toxic emissions, including mercury; and subjecting coal ash to RCRA requirements for hazardous waste<sup>396</sup> could make coal one of the more expensive options for electric power generation. A strategy to terminate the use of coal as a fuel based on death from a thousand regulations has been adopted by some environmental organizations.<sup>397</sup> Without carbon sequestration the role of coal in the U.S. economy is likely to diminish, but sequestration cannot be viewed in isolation from the many additional costs and constraints being imposed on the industry and the many new subsidies being given to coal's competitors.<sup>398</sup>

Renewable sources of energy for electric power production are a rapidly growing but remain a small segment of the electric power industry. Renewable energy generated 9.23% of electric power produced in the United States in the twelve months ending in February 2009.<sup>399</sup> Conventional hydroelectric power generated 66.59% of this electricity.<sup>400</sup> However, obtaining significant amounts of new electric power capacity from hydro sources is unlikely. Hydroelectric power production has declined significantly since its high point in 1997, and the production decline is equal to 84.20% of the total non-hydroelectric renewable electric power production in 2009.<sup>401</sup> It is estimated that, by 2020, non-hydro renewable energy could produce ten percent of U.S. electric power.<sup>402</sup>

Geothermal power production accounts for four percent of the electricity produced from renewable energy and was used to generate

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<sup>394</sup> See FUTURE OF COAL, *supra* note 312, at 19 tbl.3.1.

<sup>395</sup> See generally Clean Air Act, §§ 109, 111, 165, 173, 42 U.S.C. §§ 7409, 7411, 7475, 7503 (2006).

<sup>396</sup> See generally Resource Conservation and Recovery Act §§ 3001–3011, 42 U.S.C. §§ 6921–6939e (2006).

<sup>397</sup> See *In New Climate Strategy, Activists Move to Shut Existing Coal Plants*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 6 (Mar. 25, 2009).

<sup>398</sup> See *infra* Part VI, notes 599–605 and accompanying text.

<sup>399</sup> ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, EIA-0226(2009/05) ELECTRIC POWER MONTHLY MAY 2009 17 tbl.1.1 (May 2009), available at <http://tonto.eia.doe.gov/ftproot/electricity/epm/02260905.pdf> (calculated from data) [hereinafter ELECTRIC POWER MONTHLY MAY 2009].

<sup>400</sup> *Id.* (calculated from data).

<sup>401</sup> *Id.* (calculated from data).

<sup>402</sup> Ari Natter, *U.S. Can Generate 10 Percent of Electricity from Renewables by 2020, Study Estimates*, 40 ENV'T REP. (BNA) 1426 (June 19, 2009).

14,859 MWh of electricity in 2008.<sup>403</sup> Geothermal electric power development is limited by the need for geologically suitable sites, but the potential exists to develop over 517,800 MWe of geothermal capacity.<sup>404</sup> Geothermal energy is the only renewable energy that is available “24/7,” which allows it to be used for base load electricity.<sup>405</sup> This technology’s ability to function with minimum downtime means that the amount of electricity that can be generated is close to a plant’s design capacity.<sup>406</sup>

Solar power provided 0.22% of the electric power produced from renewable energy sources in the United States in the year ending February 2009.<sup>407</sup> At the end of 2007, there was 3,400 MW of installed solar power in the United States, which included 750 MW of photovoltaic power capacity.<sup>408</sup> For this reason, even if the industry expands its capacity substantially, it will not be an important source of electricity for decades.

Wind is used to produce about 14.51% of the electricity from renewable sources and is the most rapidly growing method of generating electricity.<sup>409</sup> Electric power generated from wind more than tripled from 2004 to 2008.<sup>410</sup> Wind-powered generation capacity in 2008 accounted for 2.26% of U.S. nameplate capacity.<sup>411</sup> Texas and California accounted for 37.77% of the nation’s wind generated electricity,<sup>412</sup> but forty-six states have potential wind power sites.<sup>413</sup> Replacing ten percent of 1993 U.S. elec

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<sup>403</sup> ENERGY INFO. ADMIN., U.S. DEP’T OF ENERGY, RENEWABLE ENERGY CONSUMPTION AND ELECTRICITY PRELIMINARY STATISTICS 2008 7 tbl.3 (2009), available at [http://www.eia.doe.gov/cneaf/alternate/page/renew\\_energy\\_consump/pretrends08.pdf](http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/pretrends08.pdf) (calculated from data) [hereinafter PRELIMINARY STATISTICS 2008].

<sup>404</sup> OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEP’T OF ENERGY, FEDERAL INTERAGENCY GEOTHERMAL ACTIVITIES 2 (2010), available at <http://www1.eere.energy.gov/geothermal/pdfs/ngap.pdf> (draft report).

<sup>405</sup> RASER TECHNOLOGIES, THERMO 1 GEOTHERMAL POWER NETWORK PROFILE 1, <http://www.rasertech.com/media/pdfs/Geothermal%20Site%20Profile%20Flyers%202005.pdf> (last visited Mar. 18, 2010).

<sup>406</sup> See OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEP’T OF ENERGY, *supra* note 404, at 7, 43.

<sup>407</sup> ELECTRIC POWER MONTHLY MAY 2009, *supra* note 399, at 17 tbl.1.1, 18 tbl.1.1.A (calculated from data).

<sup>408</sup> Leora Falk & Carolyn Whetzel, *Pacific Gas & Electric Signs Solar Deals; Contracts Hinge on Extension of Tax Credit*, 39 ENV’T REP. (BNA) 1704 (Aug. 22, 2008).

<sup>409</sup> ELECTRIC POWER MONTHLY MAY 2009, *supra* note 399, at 17 tbl.1.1 (calculated from data).

<sup>410</sup> PRELIMINARY STATISTICS 2008, *supra* note 403, at 7 tbl.3 (calculated from data). See also ENERGY INFO. ADMIN., U.S. DEP’T OF ENERGY, RENEWABLE ENERGY CONSUMPTION AND ELECTRICITY PRELIMINARY 2006 STATISTICS 7–8 (2007) (discussing factors driving wind power growth).

<sup>411</sup> 2008 ELECTRIC POWER, *supra* note 6, at 25 tbl.2.2 (calculated from data).

<sup>412</sup> PRELIMINARY STATISTICS 2008, *supra* note 403, at 10 tbl. 6.

<sup>413</sup> Am. Wind Energy Ass’n, Wind Power Today, <http://www.awea.org/pubs/factsheets/>

tric power production with wind power could be accomplished by developing 1.8% of the wind resources in the forty-eight states.<sup>414</sup> The American Wind Energy Association ("AWEA") reports that over 8,500 MW of wind energy capacity was brought on-line in 2008.<sup>415</sup> This added capacity increased the country's total capacity to 25,369 MW, or roughly 1.25% of the United States electrical energy generation.<sup>416</sup> In 2008, wind energy increases constituted forty-two percent of the nation's new electrical generation capacity.<sup>417</sup>

Wind power is essentially a form of solar energy that takes advantage of the sun's uneven heating of the earth's atmosphere, which results in wind currents.<sup>418</sup> The energy of the wind turns the blades of the wind turbine, which turns a shaft connected to a generator, which transforms the energy into electricity.<sup>419</sup> Wind turbines can be used to power single facilities, or multiple turbines can be used to transmit energy to the power grid.<sup>420</sup>

Modern wind turbines can be designed to use a vertical or horizontal axis,<sup>421</sup> but horizontal axis machines are less costly.<sup>422</sup> Commercially viable wind turbines usually are horizontal axis turbines that have two to three blades.<sup>423</sup> They vary in size, but large turbines may have blades over forty meters long and mounted on towers eighty meters tall.<sup>424</sup> A turbine of this size can cost \$1.5 million and have a capacity of 1.8 MW of electricity, which is enough power for 600 homes.<sup>425</sup> Large wind systems

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WindPowerToday\_2007.pdf (last visited Mar. 18, 2010) [hereinafter Wind Power Today].

<sup>414</sup> Curtis A. Moore, The 1990 Clean Air Act Amendments: Failing the Acid Test, 34 ENVTL. L. REP. (Envtl. Law Inst.) 10,366, 10,376 (Apr. 2004).

<sup>415</sup> AM. WIND ENERGY ASS'N, AMERICAN WIND ENERGY ASSOCIATION ANNUAL WIND INDUSTRY REPORT YEAR ENDING 2008 2 (2009), available at <http://www.awea.org/publications/reports/AWEA-Annual-Wind-Report-2009.pdf>.

<sup>416</sup> *Id.*

<sup>417</sup> *Id.*

<sup>418</sup> U.S. Dep't of Energy, How Wind Turbines Work, [http://www1.eere.energy.gov/windandhydro/wind\\_how.html](http://www1.eere.energy.gov/windandhydro/wind_how.html) (last visited Mar. 18, 2010) [hereinafter How Wind Turbines Work].

<sup>419</sup> *Id.*

<sup>420</sup> *See id.*

<sup>421</sup> *Id.*

<sup>422</sup> *See* Homewind.net, Vertical Wind Turbine, <http://www.homewind.net/verticalwindturbine.html> (last visited Mar. 18, 2010).

<sup>423</sup> Eric Eggleston, Am. Wind Energy Ass'n, Wind Energy FAQ: What Are Vertical-Axis Wind Turbines (VAWTs)?, <http://www.awea.org/faq/vawt.html> (last visited Mar. 18, 2010); How Wind Turbines Work, *supra* note 418.

<sup>424</sup> Wind Power Today, *supra* note 413.

<sup>425</sup> *Id.*

require an average wind speed of six meters per second, or approximately thirteen miles per hour.<sup>426</sup> Smaller farms or home size turbines can have a rotor as small as fifteen meters on a tower thirty-five meters tall and can cost anywhere from a few thousand dollars to \$80,000.<sup>427</sup>

Wind power and geothermal power are nearly economically competitive with fossil fuel generated electricity. The cost of generating electricity using renewable energy has dropped by eighty to ninety percent in the past twenty years and is continuing to drop.<sup>428</sup> The price of wind varies across the United States depending on the average wind speed, size of the turbine, and cost to build the facility.<sup>429</sup> Wind power currently costs about \$0.04–0.06/kWh to generate.<sup>430</sup> A centralized coal-burning electric power plant can produce electricity for \$0.02–0.04/kWh.<sup>431</sup> In comparison to the cost of other renewable power, electricity from a concentrated solar facility typically costs \$0.10–0.14/kWh<sup>432</sup> and biomass, when used as a fuel to produce electrical power, results in costs from \$0.07–0.09/kWh.<sup>433</sup> In addition to increasingly favorable costs of production, wind power facilities can be constructed in eighteen to twenty-four months, which is significantly less time than required to construct traditional fossil fuel or nuclear facilities.<sup>434</sup>

Wind power is an intermittent power source, and in most locations wind speed is significantly reduced at night.<sup>435</sup> It cannot supply baseload

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<sup>426</sup> Am. Wind Energy Ass'n, Top 20 States with Wind Energy Resource Potential, [http://www.awea.org/pubs/factsheets/Top\\_20\\_States.pdf](http://www.awea.org/pubs/factsheets/Top_20_States.pdf) (last visited Mar. 18, 2010).

<sup>427</sup> Wind Power Today, *supra* note 413.

<sup>428</sup> Jeff Deyette, *Easing the Natural Gas Crisis: Renewable Energy and Energy Efficiency Can Help Alleviate Natural Gas Shortages and Bring Consumers' Skyrocketing Heating Bills Back to Earth*, CATALYST, Fall 2003, at 13.

<sup>429</sup> See Am. Wind Energy Ass'n, Wind Energy Costs, [http://www.awea.org/faq/wwt\\_costs.html](http://www.awea.org/faq/wwt_costs.html) (last visited Mar. 18, 2010).

<sup>430</sup> U.S. Dep't of Energy, Wind and Hydropower Technologies Program: Advantages and Disadvantages of Wind Power, [http://www1.eere.energy.gov/windandhydro/wind\\_ad.html](http://www1.eere.energy.gov/windandhydro/wind_ad.html) (last visited Mar. 18, 2010).

<sup>431</sup> Megan Sever, *Changing the World One Kilowatt at a Time*, GEOTIMES, Apr. 2008, [www.geotimes.org/apr08/article.html?id=feature\\_kilowatt.html](http://www.geotimes.org/apr08/article.html?id=feature_kilowatt.html). See also Steven Ferrey, *Corporate Governance and Rational Energy Choices*, 31 WM. & MARY ENVTL. L. & POL'Y REV. 113, 123 (2007).

<sup>432</sup> Natural Resources Defense Council, Wind, Solar and Biomass Energy Today: Solar, <http://nrdc.org/air/energy/renewables/solar.asp> (last visited Mar. 18, 2010).

<sup>433</sup> Natural Resources Defense Council, Wind, Solar and Biomass Energy Today: Biomass, <http://www.nrdc.org/air/energy/renewables/biomass.asp> (last visited Mar. 18, 2010).

<sup>434</sup> See Natural Resources Defense Council, Wind, Solar and Biomass Energy Today: Wind, <http://nrdc.org/air/energy/renewables/wind.asp> (last visited Mar. 18, 2010).

<sup>435</sup> See Cristina L. Archer & Mark Z. Jacobson, *Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms*, 46 J. APPLIED METEOROLOGY

power needs, and it is difficult to use wind power as peak power because the source is not reliable.<sup>436</sup> Providing back-up power to intermittent sources is costly and limits the value of intermittent sources.<sup>437</sup> Renewable electric power facilities, in 2008, had an average capacity factor of 37.3%.<sup>438</sup> The average capacity of coal-fired plants was 72.2%, and nuclear electric power plants had an average capacity of 91.1%.<sup>439</sup> Therefore, to be economically viable, renewable sources need to sell surplus electricity to the power grid and to have the right to purchase power from the grid when needed.<sup>440</sup> This is known as net metering<sup>441</sup> or net billing<sup>442</sup> and is encouraged by law in many states.<sup>443</sup> Another way to utilize intermittent power is to use the power to produce hydrogen from water, which allows the energy potential to be stored until needed.<sup>444</sup> But, the infrastructure needed to utilize significant amounts of hydrogen does not exist,<sup>445</sup> and the storage of energy as chemical energy adds to the cost of using these technologies.<sup>446</sup>

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& CLIMATOLOGY 1701, 1713–14 (2007).

<sup>436</sup> *Cf. id.* at 1716 (stating that common wisdom is flawed and, on average, interconnected wind farms can work as baseload electric supply thirty-three percent of the time).

<sup>437</sup> See Geoffrey Heal, *Can Renewable Energy Save the World?*, VOX, Oct. 29, 2009, <http://voxeu.org/index.php?q=node/4138>.

<sup>438</sup> 2008 ELECTRIC POWER, *supra* note 6, at 52 tbl.5.2.

<sup>439</sup> *Id.*

<sup>440</sup> See, e.g., Tripp Baltz, *Governor Signs Legislation Allowing Renewable Energy to Offset Consumption*, 39 ENV'T REP. (BNA) 677 (Apr. 4, 2008) (explaining that Colorado requires electric utilities to offer credit for renewable energy that customers produce).

<sup>441</sup> *Id.*

<sup>442</sup> Jonathan Hibshman, *Utilizing Wind Power to Offset Agribusiness Utility Costs*, 12 DRAKE J. AGRIC. L. 475, 486 (2007).

<sup>443</sup> See, e.g., Baltz, *supra* note 440. An issue that helps determine whether investments in alternative energy will be made concerns the price small generators receive for delivering electricity to the grid. In Colorado on March 26, 2008, legislation was enacted that allows customers to sell power back to the grid at the retail price that they pay as consumers. *Id.* This is an attractive incentive.

<sup>444</sup> See Jon Luoma, *The Challenge for Green Energy: How to Store Excess Electricity*, YALE ENV'T 360, July 13, 2009, <http://e360.yale.edu/content/feature.msp?id=2170>; Elec. Storage Ass'n, *Technologies*, <http://www.electricitystorage.org/ESA/technologies/> (last visited Mar. 21, 2010). Other storage systems that have yet to be commercially proven include batteries, compressed air storage, pumped hydroelectricity, fly wheels, and molten salts. See Elec. Storage Ass'n, *supra*.

<sup>445</sup> Chris Nelder, *Hydrogen Hype*, RENEWABLEENERGYWORLD.COM, Aug. 6, 2007, <http://www.renewableenergyworld.com/rea/news/article/2007/08/hydrogen-hype-49540>.

<sup>446</sup> See Jeff St. John, *Grid Energy Storage: Big Market, Tough to Tackle*, GREENTECHGRID, Sept. 14, 2009, <http://www.greentechmedia.com/articles/read/grid-energy-storage-big-market-tough-to-tackle/>.

Wind powered electricity production results in no direct carbon emissions.<sup>447</sup> The DOE explains that the life cycle, manufacturing, construction, and operations of a wind turbine emit about two percent of the carbon of a natural gas plant and one percent of the carbon of a coal fired plant, thereby, further reducing the carbon-footprint of wind power.<sup>448</sup> Its use does have land-use impacts; though, the impact is less harmful than other methods of generating electricity because wind power does not cause surface disruption, habitat destruction, or involve the creation of toxic material.<sup>449</sup> The DOE estimates that to use wind for twenty percent of the nation's electricity will require 50,000 square kilometers of land and more than 11,000 square kilometers of offshore space.<sup>450</sup> However, the land actually used by the wind infrastructure will only be two to five percent of this land.<sup>451</sup> Usually, wind generation can be compatible with existing agricultural and grazing uses.<sup>452</sup> Habitat destruction will most likely be limited to temporary construction impacts; permanent impacts will be limited to the small area required for the turbine, related infrastructure, and service roads necessary for wind farms.<sup>453</sup> Most of these impacts will disproportionately occur in the country's grasslands because these areas are most suited for wind development.<sup>454</sup>

Wind turbines are associated with indirect environmental impacts. Bird and bat deaths can occur from wind turbines,<sup>455</sup> about one in 10,000 bird deaths from human activities is attributed to wind turbines.<sup>456</sup> Noise

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<sup>447</sup> U.S. DEPT OF ENERGY, 20% WIND ENERGY BY 2030: INCREASING WIND ENERGY'S CONTRIBUTION TO U.S. ELECTRICITY SUPPLY 107 (2008), *available at* [http://www.20percentwind.org/20percent\\_wind\\_energy\\_report\\_revOct08.pdf](http://www.20percentwind.org/20percent_wind_energy_report_revOct08.pdf) [hereinafter 20% WIND BY 2030].

<sup>448</sup> *Id.* at 108.

<sup>449</sup> *See generally id.* at 13, 105–12 (discussing the relative environmental benefits and costs of wind energy); *see also* James R. Drabick, *Why U.S. States Should Take the Power Back: Avoiding Paralysis in the Siting of Wind Energy Systems*, 36 ENVTL. L. REP. (Envtl. Law Inst.) 10125 (Feb. 2006) (addressing common local concerns to wind siting).

<sup>450</sup> 20% WIND BY 2030, *supra* note 447, at 110.

<sup>451</sup> *Id.* at 110–11.

<sup>452</sup> *Id.* at 111.

<sup>453</sup> *Id.*

<sup>454</sup> *See id.*

<sup>455</sup> *Id.* at 111–13.

<sup>456</sup> *See* 20% WIND BY 2030, *supra* note 447, at 112 fig.5-2. However, siting of wind power facilities off the U.S. east coast is an ongoing alternative to terrestrial locations. *See* Kathy Lundy Springuel, *Delaware, Maryland, Virginia Agree To Collaborate on Offshore Wind Power*, 40 ENV'T REP. (BNA) 2662 (Nov. 20, 2009). On Nov. 10, 2009, Delaware, Maryland, and Virginia signed a pact calling for collaboration in developing offshore energy, and Bluewater Wind LLC is moving forward with plans to develop a wind energy

is another concern for some opponents of wind generation; however, modern technology and the location of the turbine significantly decrease noise levels.<sup>457</sup> It is generally not considered a significant problem.<sup>458</sup> In 2009, the U.S. Fish and Wildlife Service posted several draft recommendations to protect birds and bats from wind turbines.<sup>459</sup> A concern in the West is that the Department of the Interior will list the greater sage grouse as endangered in eleven Western states, which could limit wind energy development in large areas of these states.<sup>460</sup>

Obtaining a large increase in the use of wind power will require a more robust electrical transmission system that is expanded to include areas with conditions favorable to wind powered electrical generation.<sup>461</sup> This will be costly and will take years to complete.<sup>462</sup> Some costs of using alternative energy sources may be offset if the facilities can be sited locally.<sup>463</sup> This reduces the need for long-distance transport of electricity, the accompanying stress on the power grid, and the danger of disruption

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facility thirteen miles off the shore of Rehobeth Beach, Del. *Id.* Efforts to place wind power facilities off the coast of Massachusetts have been well-covered in the literature. *See, e.g.*, Victoria Sutton & Nicole Tomich, *Harnessing Wind is Not (by Nature) Environmentally Friendly*, 22 PACE ENVTL. L. REV. 91, 100–03 (2005); Jeremy Firestone, et al., *Regulating Offshore Wind Power and Aquaculture: Messages From Land and Sea*, 35 ENVTL. L. REP. (Envtl. Law Inst.) 10289, 10291 (May 2005); Thomas Arthur Utzinger, *Federal Permitting Issues Related to Offshore Wind Energy, Using the Cape Wind Project in Massachusetts as an Illustration*, 34 ENVTL. L. REP. (Envtl. Law Inst.) 10794 (Sept. 2004).<sup>457</sup> Drabick, *supra* note 449. *See also* Am. Wind Energy Ass'n, *Utility Scale Wind Energy and Sound*, [http://www.awea.org/pubs/factsheets/Utility\\_Scale\\_Wind\\_Energy\\_Sound.pdf](http://www.awea.org/pubs/factsheets/Utility_Scale_Wind_Energy_Sound.pdf) (last visited Mar. 21, 2010).

<sup>458</sup> *See* *Utility Scale Wind Energy and Sound*, *supra* note 457.

<sup>459</sup> *See* U.S. FISH AND WILDLIFE SER., USFWS WIND TURBINE FAC RECOMMENDATIONS, (2009), *available at* [http://www.fws.gov/habitatconservation/windpower/Second\\_Release\\_Draft\\_One\\_Text\\_FAC\\_Briefing\\_3\\_13\\_09.pdf](http://www.fws.gov/habitatconservation/windpower/Second_Release_Draft_One_Text_FAC_Briefing_3_13_09.pdf).

<sup>460</sup> *See, e.g.*, Tripp Baltz, *Wind Power Industry Seeks Review Of Policy on Sage Grouse in Wyoming*, 40 ENV'T REP. (BNA) 1728 (July 17, 2009).

<sup>461</sup> *See* Jessica B. Wilkinson & Robert Bendick, *The Next Generation of Mitigation: Advancing Conservation Through Landscape-Level Mitigation Planning*, 40 ENVTL. L. REP. (Envtl. Law Inst.) 10,023, 10,042 (Jan. 2010). *See also* U.S. DEPT. OF ENERGY, THE SMART GRID: AN INTRODUCTION 9, 21, *available at* [http://www.oe.energy.gov/Documents andMedia/DOE\\_SG\\_Book\\_Single\\_Pages\(1\).pdf](http://www.oe.energy.gov/Documents andMedia/DOE_SG_Book_Single_Pages(1).pdf).

<sup>462</sup> *See* THE SMART GRID: AN INTRODUCTION, *supra* note 461, at 17.

<sup>463</sup> *See* ANDREW MILLS, RYAN WISER & KEVIN PORTER, LBNL-1471E THE COST OF TRANSMISSION FOR WIND ENERGY: A REVIEW OF TRANSMISSION PLANNING STUDIES xii (Berkeley National Laboratory) (2009), *available at* <http://eetd.lbl.gov/ea/emp/reports/lbnl-1471e.pdf> (indicating that, in certain situations, long transmission distances can result in higher unit costs of transmission).

of the electricity supply from mistakes, natural forces, or terrorism.<sup>464</sup> As the number of independent generating units grows so does the overall reliability of the system.<sup>465</sup> But, system reliability does not increase by increasing the number of units in a system unless the level of maintenance and the quality of the associated equipment is comparable. For example, replacing an existing large coal-fired power plant with thousands of small generators maintained by individual owners who generally lack the skill to maintain rotating equipment such as windmills would not result in a more reliable system. Passive energy sources, such as photovoltaic units, would provide greater reliability than rotating equipment including windmills. But, an electrical generating transmission and distribution system supplied by thousands of potential small producers would be unreliable absent an enforceable system with severe economic consequences for non-conformance with its requirements concerning reliability standards by such producers. This, however, may be an unwarranted concern because wind generation farms are likely to be built and maintained by corporations with the resources to run them properly.

The U.S. Department of Interior's Bureau of Land Management ("BLM"), on June 21, 2005, published its programmatic environmental impact statement ("EIS") that is part of the BLM's Wind Energy Development Program.<sup>466</sup> The BLM hopes that in twenty years electricity generated using wind power on public lands will increase from 500 to 3,200 MW of capacity.<sup>467</sup> While the plan covers the Western states, most of the development is expected to occur in Utah, California, Nevada, and Wyoming, which produce most of the current wind-generated electric power.<sup>468</sup> The BLM considers 160,000 acres of public land to be capable of wind-powered electricity generation, based on both technical and economic suitability criteria.<sup>469</sup> On April 22, 2009, the Mineral Management Service of the Department of Interior finalized a rule to cover leasing, easements, and right-of-way for the development of offshore renewable energy.<sup>470</sup> As

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<sup>464</sup> See ANDREW GOETT & RICHARD FARMER, CONGRESSIONAL BUDGET OFFICE, PROSPECTS FOR DISTRIBUTED ELECTRICITY GENERATION xii (Christine Bogusz, Leah Mazade & Joseph Foote eds.) (2003), available at <http://www.cbo.gov/ftpdocs/45xx/doc4552/09-16-Electricity.pdf>.

<sup>465</sup> See *id.*

<sup>466</sup> Mike Ferullo, *Interior Completes Environmental Review Aimed at Boosting Wind Power Production*, 36 ENV'T REP. (BNA) 1335 (July 1, 2005).

<sup>467</sup> *Id.*

<sup>468</sup> See *id.*

<sup>469</sup> *Id.*

<sup>470</sup> Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638 (Apr. 29, 2009) (to be codified 30 C.F.R. pts. 250, 285, 290). See

programs begin to evolve for large-scale renewable energy development on public lands, concern is being voiced that greater attention needs to be given to protecting public lands.<sup>471</sup> By 2010, the BLM expects to complete evaluating more than 670,000 acres of public land in six Western states for their suitability for solar energy projects.<sup>472</sup> The results will be added to the Solar Programmatic Environmental Impact Statement.<sup>473</sup> The BLM is also going to perform environmental reviews of two solar electric projects in Nevada that will have a combined capacity of more than 400 MW.<sup>474</sup> The BLM, in mid-2009, had 199 pending permit applications for solar energy projects, but it has not approved any permits.<sup>475</sup>

In addition to the efforts to discourage the use of fossil fuels, Congress has created financial incentives to encourage development of wind-generated electricity. Subchapter IV of the 1990 CAA Amendments provides 300,000 bonus allowances for utilities that implement renewable energy and conservation programs.<sup>476</sup>

The 1992 Energy Policy Act<sup>477</sup> established a \$0.015 tax credit for every KWh of electricity produced using “qualified energy resources,” a term that included, by definition, only wind and closed-loop biomass at a “qualified facility.”<sup>478</sup> Closed-loop biomass is defined as “any organic material from a plant which [sic] is planted exclusively for purposes of being used at a qualified facility to produce electricity.”<sup>479</sup> This credit may be earned by a qualified facility, which is “any facility owned by the taxpayer which is originally placed in service after December 31, 1993.”<sup>480</sup>

The American Job Creation Act of 2004 expanded the qualifying methods to include solar, landfill gas, trash combustion, and certain

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also Alan Kovski, *Final Rule Finished on Leasing Projects for Offshore Renewable Energy Production*, 40 Env't Rep. (BNA) 911 (Apr. 24, 2009); Alan Kovski, *Interior Officials Provide Details on Plan for Offshore Renewable Energy Leasing*, 40 Env't Rep. (BNA) 1363 (June 12, 2009).

<sup>471</sup> Alan Kovski, *Interior Secretary Cautioned to Consider Renewable Energy Project Impacts, Funding*, 40 Env't Rep. (BNA) 1317 (June 5, 2009).

<sup>472</sup> Ari Natter, *Interior to Establish 'Solar Energy Zones' On Public Land to Boost Renewable Energy*, 40 Env't Rep. (BNA) No. 1559 (July 3, 2009).

<sup>473</sup> *Id.*

<sup>474</sup> *Id.*

<sup>475</sup> *Id.*

<sup>476</sup> 42 U.S.C. § 7651c(g) (2006).

<sup>477</sup> Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2776 (1992).

<sup>478</sup> *Id.* § 1914 (codified as amended at I.R.C. § 45(a) (2006)).

<sup>479</sup> I.R.C. § 45(c)(2); see also 10 C.F.R. § 451.2 (2008).

<sup>480</sup> I.R.C. § 45(d)(2)(i).

hydropower facilities in addition to wind and biomass.<sup>481</sup> The Energy Tax Incentives Act of 2005 extended the five or ten year tax credit of between \$0.0075 and \$0.015 per KWh of electricity generated using qualified energy resources.<sup>482</sup> The larger Energy Policy Act of 2005, of which the Energy Tax Incentives Act of 2005 is a part, set modest renewable energy purchase goals for the federal government, subject to economic feasibility.<sup>483</sup> Though not pertinent to large-scale wind infrastructure, the Energy Policy Act of 2005 also extended a federal rebate of twenty-five percent or \$3,000 to consumers who placed renewable energy systems in their home or business.<sup>484</sup> The tax benefits for renewable energy were to be extended by the bill that became the 2007 energy act.<sup>485</sup> However, the bill's renewable tax provisions were removed at the last minute because of opposition from the Bush administration and the electric power industry.<sup>486</sup> It was also opposed by the petroleum industry because Democrats wanted to fund the renewable program by removing \$16 billion in tax benefits from the oil and gas industry.<sup>487</sup>

The current tax benefits provided for renewables are governed primarily by the I.R.C. Sections 48 and 45.<sup>488</sup> These sections have been amended many times, including modifications and an extension of the benefits by the Emergency Economic Stabilization Act of 2008, division B, which is known as the Energy Improvement and Extension Act of 2008.<sup>489</sup> I.R.C. Section 48(a) provides an energy credit.<sup>490</sup> After 2005, there is a thirty percent tax credit for investments in fuel cell property, with limitations based on electrical capacity.<sup>491</sup> Solar investments that are used to generate electricity, to heat or cool a structure, to provide process heat,

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<sup>481</sup> American Job Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1418, 1552–1555 (2004) (codified as amended at I.R.C. § 45).

<sup>482</sup> Energy Tax Incentives Act of 2005, Pub. L. No. 109-58, tit. XIII § 1301(c), 119 Stat. 956, 987 (codified as amended at I.R.C. § 45(c)).

<sup>483</sup> Energy Policy Act of 2005 § 203, 42 U.S.C. § 15852(a) (2006). The goals are 3% until 2009, 5% until 2012, and 7.5% for 2013 and thereafter. *Id.*

<sup>484</sup> Pub. L. No. 109-58 § 206(c) (codified at 42 U.S.C. § 15853). Renewable energy systems include wind for non-commercial use. *Id.* § 6865(c)(6)(a)(i)(II).

<sup>485</sup> Lynn Garner, *Congress to Tie Up Loose Ends, Plans Early Action on Renewable Energy in 2008*, 39 ENV'T REP. (BNA) 198 (Jan. 18, 2008).

<sup>486</sup> *Id.*

<sup>487</sup> *See id.*

<sup>488</sup> *See* I.R.C. §§ 45, 48 (2006).

<sup>489</sup> Emergency Economic Stabilization Act of 2008, Div. B, Energy Improvement and Extension Act of 2008, Pub. L. No. 110-343, 122 Stat. 3765, 3807 (2008).

<sup>490</sup> I.R.C. § 48(a).

<sup>491</sup> *Id.* § 48(a)(2)–(3).

or for illumination using fiber optic technology receive a thirty percent credit until January 1, 2017, unless the investment is to heat a swimming pool.<sup>492</sup> Wind energy property receives a thirty percent tax credit, too.<sup>493</sup>

Geothermal property, including ground water heat pump systems, microturbine property, and combined heat and power system property receive a ten percent tax credit.<sup>494</sup> I.R.C. Section 48(a)(3) imposes requirements that must be met for the property to qualify for the tax credit.<sup>495</sup>

I.R.C. Section 45 provides a tax credit for electricity produced and sold using specified renewable resources.<sup>496</sup> The credit is \$0.015 for each qualified KWh multiplied by an inflation adjustment factor for the calendar year of the sale.<sup>497</sup> For 2008, the inflation adjustment factor was 1.3854, which resulted in a credit of \$0.021 per KWh.<sup>498</sup> Qualified energy resources are defined in I.R.C. Section 45(c) and include wind, closed-loop and open-loop biomass, geothermal energy, small irrigation power, municipal solid waste power production, and qualified hydropower.<sup>499</sup> The 2008 Energy Improvement and Extension Act added marine and hydrokinetic renewable energy for tax years after 2008.<sup>500</sup> Wind power is not specifically defined in I.R.C. Section 45(c),<sup>501</sup> but some wind-generated electricity, as defined in I.R.C. Section 45(e)(7)(A), is not allowed a tax credit.<sup>502</sup> The 2008 Energy Act extended the wind-generated electric tax credit to January 1, 2010,<sup>503</sup> and the geothermal tax was extended until January 1, 2011.<sup>504</sup> I.R.C. Section 45(d)(4) also denies production tax credit for geo-

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<sup>492</sup> *Id.* § 48(a)(3)(A) (2006) (defining solar energy property).

<sup>493</sup> American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, § 1102, 123 Stat. 115, 320 (2009) (to be codified at I.R.C. § 48(a)).

<sup>494</sup> I.R.C. § 48(a)(2)–(3).

<sup>495</sup> *Id.* § 48(a)(3).

<sup>496</sup> *Id.* § 45.

<sup>497</sup> *Id.* §§ 45(a), 45(b)(2).

<sup>498</sup> See Publication of Inflation Factors and Reference Prices for Calendar Year 2008, 2008-21 I.R.B. 1008.

<sup>499</sup> 26 U.S.C. § 45(c)(1).

<sup>500</sup> Pub. L. No. 110-343, div. B, § 102, 122 Stat. 3765, 3810 (2008) (codified as amended in scattered sections of 26 U.S.C.).

<sup>501</sup> See 26 U.S.C. § 45(c).

<sup>502</sup> *Id.* § 45(e)(7)(A).

<sup>503</sup> See *id.* § 45(d)(1) (noting qualified wind facilities under the Act must be in service before January 1, 2009); see also The Energy Improvement and Extension Act of 2008, div. A, tit. II, subtitle A, § 101(a)(1) (extending the credit to January 1, 2010).

<sup>504</sup> See 26 U.S.C. § 45(d)(4) (noting qualified geothermal facilities must be in service before January 1, 2009 to receive credit); see also The Energy Improvement and Extension Act of 2008, div. A, tit. II, subtitle A, § 101(a)(2) (extending the deadline to January 1, 2011).

thermal and solar electricity if the I.R.C. Section 48 investment credit is claimed.<sup>505</sup>

On February 17, 2009, the American Recovery and Reinvestment Act of 2009 became law.<sup>506</sup> It provides \$4.5 billion to modernize the electric power delivery system including smart grid technologies.<sup>507</sup> It also amends the Energy Policy Act of 2005 to allow fifty percent participation in projects involving renewable energy systems that generate electricity.<sup>508</sup> It provides \$16.8 billion in incentives for development of renewable energy and increased energy efficiency over the next ten years,<sup>509</sup> and provides \$6 billion in federal loan guarantees for renewable energy systems and electricity transmission.<sup>510</sup> The loan guarantees will cost the DOE up to \$750 million.<sup>511</sup> It extends the wind power tax production credit of \$0.015 per KWh of wind energy produced through 2012 and provides extended tax benefits for other renewable energy sources through 2013.<sup>512</sup>

A new program allows companies that are eligible for a production tax credit or an investment tax credit for renewable electric power generation to receive a federal grant in lieu of tax credits.<sup>513</sup> The Treasury will issue “grants of up to 30 percent of the cost of building

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<sup>505</sup> 26 U.S.C. § 45(d)(4).

<sup>506</sup> American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009). This act is often referred to as the “Stimulus Bill” in this article. See Michael A. Fletcher, *Obama Leaves D.C. to Sign Stimulus Bill*, WASH. POST, Feb. 17, 2009, available at <http://www.washingtonpost.com/wp-dyn/content/article/2009/02/17/AR2009021700221.html>.

<sup>507</sup> Steven Snarr, *United States: Enactment Of Stimulus Bill Promotes Development Of Renewable Resources—Incentives Provided For Development Of Transmission Facilities And Wind, Solar, And Geothermal Projects*, HOLLAND & HART LLP, Mar. 9, 2009, <http://www.hollandhart.com/newsitem.cfm?ID=1348>.

<sup>508</sup> *Id.*

<sup>509</sup> Energy Efficiency and Renewable Energy, *American Recovery and Reinvestment Act Allots \$16.8 Billion for EERE*, Feb. 17, 2009, [http://apps1.eere.energy.gov/news/daily.cfm/hp\\_news\\_id=156](http://apps1.eere.energy.gov/news/daily.cfm/hp_news_id=156).

<sup>510</sup> Lynn Garner, *Stimulus Provides \$40 Billion in Spending, \$20 Billion in Tax Credits for Energy Projects*, 40 ENV'T REP. (BNA) 368 (Feb. 20, 2009) [hereinafter *Stimulus Provides \$40 Billion*].

<sup>511</sup> Ari Natter, *Administration Turns to Business Leaders in Push for Senate Climate Change Measure*, 40 ENV'T REP. (BNA) 2396 (Oct. 16, 2009).

<sup>512</sup> American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, § 1102(c), 123 Stat. 115, 320 (2009) (amending 26 U.S.C. § 45(d) (2006)); see *supra* notes 504–05 for discussion of § 45(d) and previous amendments.

<sup>513</sup> Union of Concerned Scientists: Production Tax Credit for Renewable Energy, [http://www.ucsusa.org/clean\\_energy/solutions/big\\_picture\\_solutions/production-tax-credit-for.html](http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/production-tax-credit-for.html) (last visited Mar. 28, 2010).

a new renewable energy facility.”<sup>514</sup> This program is estimated to cost \$5 million over ten years,<sup>515</sup> which is a trivial amount of money. Grants are to be “approved by the treasury secretary in consultation with the energy secretary through a ‘competitive bidding process.’”<sup>516</sup>

On May 27, 2009, President Obama announced that \$350 million from Stimulus Bill funds would go to geothermal projects and \$117.6 million would go to solar energy projects.<sup>517</sup> On July 9, 2009, the Treasury Department and DOE issued guidelines for obtaining “an estimated \$3 billion in grants for renewable energy projects.”<sup>518</sup> The first project received final approval on September 4, 2009, when Solyndra, Inc., a solar panel manufacturer, received a \$535 million loan guarantee from DOE.<sup>519</sup> On September 1, 2009, \$502 million was awarded for renewable energy projects, and on September 22, 2009, another \$550 million of stimulus funding was announced.<sup>520</sup>

The Stimulus Bill also provides loans for the construction of transmission lines,<sup>521</sup> including \$3.25 billion dollars that is to be loaned to the Western Power Administration for “constructing, financing, facilitating, planning, operating, maintaining, or studying construction of new or upgraded electric power transmission lines and related facilities” and “delivering or facilitating the delivery of power generated by renewable energy resources constructed or reasonably expected to be constructed after the date of enactment of this section.”<sup>522</sup> The Stimulus Bill also

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<sup>514</sup> Pub. L. No. 111-5 § 1103(a) (amending I.R.C. § 48(c) (2000)); Snarr, *supra* note 507.

<sup>515</sup> Garner, *supra* note 510.

<sup>516</sup> *Id.*

<sup>517</sup> Charlotte E. Tucker, *Geothermal, Solar Projects to Receive \$467 Million in Federal Recovery Act Funds*, 40 ENV'T REP. (BNA) 1243 (May 29, 2009).

<sup>518</sup> Alan Kovski, *Obama Administration Issues Regulations Covering Renewable Energy Project Grants*, 40 ENV'T REP. (BNA) 1705 (July 17, 2009).

<sup>519</sup> Ari Natter, *DOE Approves \$535 Million Loan Guarantee for California Solar Panel Manufacturer*, 40 ENV'T REP. (BNA) 2107 (Sept. 11, 2009).

<sup>520</sup> Ari Natter, *Obama Administration to Award \$550 Million in Stimulus Money for Renewables Projects*, 40 ENV'T REP. (BNA) 2238 (Sept. 25, 2009).

<sup>521</sup> See American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, § 402, 123 Stat. 115, 141–43 (2009). The Stimulus Bill also provides \$3.25 billion in loans to the Bonneville Power Authority, which governs the hydropower produced in the Northwest, for energy transmission infrastructure. American Recovery and Reinvestment Act of 2009 § 401. Bonneville Power is also seeking to expand their energy profile by investing in more wind projects. See Bonneville Power Administration: Wind Projects, <http://www.transmission.bpa.gov/planproj/wind/> (last visited Feb. 18, 2010).

<sup>522</sup> American Recovery and Reinvestment Act § 402 (amending Hoover Power Plant Act of 1984, 43 U.S.C. § 619 (1984)).

updates the Energy Policy Act of 2005 by increasing the funds available for the Renewable Energy and Electric Power Transmission Loan Guarantee Program to \$500 million for projects commenced no later than September 30, 2011.<sup>523</sup> The Stimulus Bill also provides for studies, analysis, and suggestions for renewable energy transmission.<sup>524</sup>

Despite the environmental benefits and the success in reducing the cost of using renewable energy, coal-burning electric power plants continue to enjoy a cost advantage.<sup>525</sup> Many Americans would rather have air pollution than pay more for electricity.<sup>526</sup> Rocky Mountain Power offers its customers the option of having wind-generated electricity for about \$20 a month.<sup>527</sup> After eight years of effort to market the program in its Utah-Idaho-Wyoming service area, it has 25,000 customers.<sup>528</sup> The federal effort reflects the public's support. The federal research and development budget for wind power, for example, was \$50 million in fiscal year 2008, and in fiscal year 2009 it was increased to \$53 million.<sup>529</sup> This may be changing. The Obama administration proposed funding for clean energy and energy efficiency programs at \$150 billion over ten years.<sup>530</sup>

The federal government is working to increase the cost of electricity generated by fossil fuel. Legislation to achieve this goal is found in ACES.<sup>531</sup> The bill aims to decrease green house gas emissions by implementing a cap-and-trade program.<sup>532</sup> Its cap-and-trade program will require electric utilities to either reduce the use of fossil fuel or buy allowances to meet the cap, which will significantly increase the price of production of electricity from fossil fuel.<sup>533</sup> This will make the cost of renewable energy more competitive in the energy market.<sup>534</sup>

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<sup>523</sup> *Id.* § 406 (amending Energy Policy Act of 2005, 42 U.S.C. §§ 16511–16514 (2005)).

<sup>524</sup> *Id.* § 409.

<sup>525</sup> See Rebecca Walsh, *Green Isn't Utah's Color for Power*, SALT LAKE TRIB., Sept. 30, 2008.

<sup>526</sup> *See id.*

<sup>527</sup> *Id.*

<sup>528</sup> *Id.*

<sup>529</sup> Dean Scott, *Budget Boosts Clean Coal, Nuclear Research, But solar, Other Renewables Would See Cuts*, 39 ENV'T REP. (BNA) 247 (Feb. 8, 2008).

<sup>530</sup> Ari Natter, *Obama Says Energy Provisions in Budget Will Spur Job Creation, Economic Growth*, 40 ENV'T REP. (BNA) 678 (Mar. 27, 2009).

<sup>531</sup> See H.R. COMM. ON ENERGY AND COMMERCE, 111TH CONG., THE AMERICAN CLEAN ENERGY AND SECURITY ACT (H.R. 2454) SUMMARY 2 (Comm. Print 2009), available at [http://energycommerce.house.gov/Press\\_111/20090602/hr2454\\_reported\\_summary.pdf](http://energycommerce.house.gov/Press_111/20090602/hr2454_reported_summary.pdf).

<sup>532</sup> *See id.* at 3.

<sup>533</sup> *See id.* at 3–4.

<sup>534</sup> *See id.* at 3.

States and regions have also moved to use cap-and-trade systems that will increase the price of carbon heavy fuels and make wind more affordable. Ten Northeastern and Mid-Atlantic states that are part of the Regional Greenhouse Gas Initiative<sup>535</sup> (“RGGI”) seek to reduce carbon emissions through a cap-and-trade “CO<sub>2</sub> Budget Trading Program” imposed on the region’s fossil fueled electricity generating facilities that have the capacity to produce 25 MW or more of energy.<sup>536</sup> The program seeks to stabilize CO<sub>2</sub> emissions at 2009 levels until 2014 and then gradually reduce emissions 2.5% a year to reach a 10% reduction by 2018.<sup>537</sup> The Western states are also moving to use cap-and-trade programs to discourage the use of fossil fuels to generate electricity.<sup>538</sup>

An important development is the spread of state renewable portfolio standards (“RPS”) that require a minimum percentage of the power sold in a state to come from renewable energy.<sup>539</sup> Iowa, in 1991, was the first state to enact an RPS,<sup>540</sup> requiring a specific amount of renewable electricity to be sold in the state.<sup>541</sup> Most states that subsequently enacted RPSs specified a percentage of electricity that had to be generated from renewable sources.<sup>542</sup> The percentage of renewable electricity that is required to be sold has ranged from 0.2% to 33%.<sup>543</sup>

By 2009, twenty-seven states and the District of Columbia had RPSs.<sup>544</sup> New York, for example, requires thirty percent of the state’s power to be generated from renewable sources by 2015;<sup>545</sup> California requires at

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<sup>535</sup> Regional Greenhouse Gas Initiative (RGGI): About RGGI, <http://rggi.org/about> (last visited Feb. 23, 2010).

<sup>536</sup> REGIONAL GREENHOUSE GAS INITIATIVE, OVERVIEW OF RGGI CO<sub>2</sub> BUDGET TRADING PROGRAM 1–2 (Oct. 2007), [http://rggi.org/docs/program\\_summary\\_10\\_07.pdf](http://rggi.org/docs/program_summary_10_07.pdf).

<sup>537</sup> *Id.* at 2.

<sup>538</sup> Press Release, Union of Concerned Scientists, Western States Regional Partnership to Issue Cap and Trade Plan (July 23, 2008), [http://www.ucsusa.org/news/press\\_release/western-states-regional-0136.html](http://www.ucsusa.org/news/press_release/western-states-regional-0136.html).

<sup>539</sup> BARRY G. RABE, PEW CENTER ON GLOBAL CLIMATE CHANGE, RACE TO THE TOP: THE EXPANDING ROLE OF U.S. STATE RENEWABLE PORTFOLIO STANDARDS 3 (2006), <http://www.pewclimate.org/docUploads/RPSReportFinal.pdf>.

<sup>540</sup> *Id.* at 3.

<sup>541</sup> *Id.* at 5.

<sup>542</sup> *Id.*

<sup>543</sup> *Id.* at 4 tbl.1.

<sup>544</sup> Ari Natter, *Coalition Urges Rapid Enactment of Bill to Establish Renewable Electricity Standard*, 40 ENV'T REP. (BNA) 688 (Mar. 3, 2009); *cf.* Ferrey, *supra* note 431, at 131 (noting that twelve states had RPSs in 2006).

<sup>545</sup> NYSERDA: New York Renewable Portfolio Standard, <http://www.nyserdera.org/rps/index.asp> (last visited Mar. 28, 2010).

least twenty percent by 2010;<sup>546</sup> the District of Columbia requires twenty percent by 2020.<sup>547</sup> Some states with renewable portfolio requirements, however, are discovering the construction of facilities needed to meet the RPS will not be completed.<sup>548</sup>

Moreover, RPS may not produce carbon reductions beyond those that could be achieved with a cap-and-trade system.<sup>549</sup> It has been argued that cap-and-trade will achieve the same objective as RPS at a lower cost and will preserve the freedom of the regulated entities to decide how to best comply.<sup>550</sup> President Obama has called for twenty-five percent of the nation's electric power to be generated from renewables by 2025.<sup>551</sup> ACES includes a federal renewable portfolio and electricity savings standard starting at six percent in 2012 and increasing to twenty percent in 2020, but the use of energy efficiency measures to meet the mandate is limited to forty percent of the combined renewable electricity and electricity savings requirement.<sup>552</sup> It is worth noting that renewables reduce carbon emissions only to the extent that fossil fuels are displaced. Because renewables are intermittent, spinning reserves from thermal power plants are needed as backup to renewable sources of electricity, which can negate some of the benefits of wind and solar generated power.<sup>553</sup>

#### IV. NUCLEAR ENERGY<sup>554</sup>

If federal legislation to control carbon emissions that is similar to the pending cap-and-trade program in ACES is enacted, a big winner

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<sup>546</sup> California Public Utilities Commission, California Renewables Portfolio Standard, <http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm> (last visited Mar. 10, 2010).

<sup>547</sup> Mary Cheh, *Greening the Capital City With a Sustainable Energy Utility*, TRENDS, Jan.–Feb. 2009, at 10, 10.

<sup>548</sup> See Carolyn Whetzel, *State's Utilities Face Variety of Hurdles In Drive to Meet Renewable Energy Standard*, 39 ENV'T REP. (BNA) 1610 (Aug. 8, 2008).

<sup>549</sup> Neal J. Cabral, *The Role of Renewable Portfolio Standards in the Context of a National Carbon Cap-and-Trade Program*, 8 SUSTAINABLE DEV. L. & POL'Y 13, 13 (2007).

<sup>550</sup> See *id.* at 15.

<sup>551</sup> Christopher Martin & Mario Parker, *Wind Promises Blackouts as Obama Strains Grid with Renewables*, BLOOMBERG.COM, Aug. 7, 2009, [http://www.bloomberg.com/apps/news?pid=20601072&sid=arbHczOryM\\_E](http://www.bloomberg.com/apps/news?pid=20601072&sid=arbHczOryM_E).

<sup>552</sup> CONG. BUDGET OFFICE, CONG. BUDGET OFFICE COST ESTIMATE, H.R. 2454, AMERICAN CLEAN ENERGY AND SECURITY ACT OF 2009 8 (2009), available at <http://www.cbo.gov/ftpdocs/102xx/doc10262/hr2454.pdf> (last visited Feb. 18, 2010) [hereinafter COST ESTIMATE].

<sup>553</sup> See Andrew Ratzkin, *When the Wind Don't Blow, When the Sun Don't Shine: The Risks of Intermittency*, 41 TRENDS, Sept.–Oct. 2009, at 12.

<sup>554</sup> Portions of Part IV are derived from Reitze, *supra* note 29.

will be the nuclear electric power industry.<sup>555</sup> The benefits to the nuclear industry can be calculated in various ways. Regardless of the approach, the benefits are in the billions, and they do not appear in any government budget. They are direct payments by electricity users to the nuclear power utilities. For example, bituminous coal from Virginia has a 68.5% carbon content<sup>556</sup> and an average heat value of 14,000 Btu/lb.<sup>557</sup> By definition, one KWh of electricity is 3412.14 Btu.<sup>558</sup> At a conversion efficiency of approximately forty-two percent, which is found in state-of-the-art facilities, about 8,200 Btu of coal is needed to produce a KWh of electricity.<sup>559</sup> This is produced by 0.585 pounds of coal, which is 585 pounds per MWh.<sup>560</sup> Thus, a MWh of electricity results in the release of about 0.7 tons of CO<sub>2</sub>.<sup>561</sup> The estimated cost of an allowance to release a ton of CO<sub>2</sub> at the start of a cap-and-trade program is \$15,<sup>562</sup> which would cost fossil-fueled electric power generators approximately \$10.50 per MWh.<sup>563</sup> This could be cut in half if Congress decides to give a fifty percent credit to coal burning facilities to place them at approximate parity with natural gas-fueled plants.<sup>564</sup>

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<sup>555</sup> See *infra* Part VI.B.1 for further discussion.

<sup>556</sup> BABCOCK & WILCOX, *supra* note 320, at 2-4.

<sup>557</sup> DAVID GEORGE BRIGGS, FOREST PRODUCTS MEASUREMENTS AND CONVERSION FACTORS: WITH SPECIAL EMPHASIS ON THE U.S. PACIFIC NORTHWEST 110 tbl.9-3 (1994).

<sup>558</sup> American Physical Society: Energy Units, <http://www.aps.org/policy/reports/popa-reports/energy/units.cfm> (last visited Mar. 8, 2010).

<sup>559</sup> BIELAWSKI ET AL., *supra* note 57, at 1.

<sup>560</sup> This number was derived using numbers already discussed *supra* notes 556–58. Coal produces 14,000 Btu/lb. See BRIGGS, *supra* note 557, at 110 tbl.9-3 and accompanying text. There is 8200 Btu/KWh for plants with state-of-the-art conditions. See BIELAWSKI ET AL., *supra* note 57, at 1. To find out how many pounds of coal is necessary to produce one KWh of electricity in these plants, calculate 8200/14000 to reach .585 lb/KWh or 585 lb/MWh.

<sup>561</sup> Carbon has a molecular weight of twelve and Oxygen has a molecular weight of sixteen. See Periodic Table of the Elements, [http://old.iupac.org/reports/periodic\\_table/index.html](http://old.iupac.org/reports/periodic_table/index.html) (last visited Feb. 21, 2010). Thus, the weight of CO<sub>2</sub> is 44. See *id.* Using the carbon content from coal of 68.5% to find the amount of carbon that is released from one MWh, multiply the weight of CO<sub>2</sub>, the carbon content, and 585 lb/MWh; 44/12 x .685 x 585. See *supra* note 560 and accompanying text. This is 1469.32 lbs or 0.7 tons of carbon, which means the CO<sub>2</sub> produced by coal combustion is much heavier than the coal.

<sup>562</sup> U.S. CONG., CONG. BUDGET OFFICE, THE ECONOMIC EFFECTS OF LEGISLATION TO REDUCE GREENHOUSE-GAS EMISSION 10 (Sept., 2009), <http://www.cbo.gov/ftpdocs/105xx/doc10573/09-17-Greenhouse-Gas.pdf>.

<sup>563</sup> This number is calculated by amount of carbon released from one MWh and the cost of releasing one ton of CO<sub>2</sub>; 0.7 ton x \$15 = \$10.50. See *supra* notes 560–61 and accompanying text.

<sup>564</sup> Richard Schlesinger, *Fortunes in Cap-and-Trade*, Nov. 25, 2009, available at <http://www.michigangreen.org/article-678-thread-0-0.html>. Natural gas releases carbon at

In states with a deregulated market, nuclear generated power would sell for the highest price paid for electricity needed to meet the demand.<sup>565</sup> The federal government's effort to increase the price of energy from fossil fuel would result in a comparable increase in the cost of nuclear power although there would be no increase in the cost of producing such power.<sup>566</sup> For Exelon, the largest nuclear electric generator, its 132 million MWh of electricity per year could produce additional revenue in the neighborhood of \$1 billion a year.<sup>567</sup> Other utilities with nuclear generation capacity, such as Florida Power and Light and Energy, would also benefit from increases in fossil-fueled power prices.<sup>568</sup>

"Nuclear energy has no conventional air pollution emissions and no GHG emissions. While its use as a substitute for coal provides obvious environmental benefits, there are tradeoffs involving safety, radioactive waste disposal, and the centralization of energy generation (an issue not limited to nuclear power)."<sup>569</sup> The safety concerns are highlighted by the Chernobyl disaster, which involved a specific nuclear reactor design, RMBK, and was limited in its employment to the then-existing Soviet Union.<sup>570</sup> The RMBK design utilized a water-cooled, graphite-moderated low enrichment reactor, which included numerous technical elements that precluded its satisfaction of licensing requirements associated with fundamental safety features in the United States and Western Europe.<sup>571</sup> After the Chernobyl disaster in Ukraine, its neighbor Belarus spent \$13 billion to deal with the aftermath.<sup>572</sup> The International Atomic Energy Agency estimates that the accident caused 4,000 deaths, but other estimates are much

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14.47 Btu, and commercial coal releases carbon at 26.04 Btu. DAVIS, DIEGEL & BOUNDY, *supra* note 3, at B-14 tbl.B-16.

<sup>565</sup> Schlesinger, *supra* note 564. There are 14 states with deregulated energy markets including Illinois, Ohio, and the states north and east of Virginia and West Virginia. U.S. Dept. of Energy, Energy Info. Admin., Status of Electricity Restructuring by State, [http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure\\_elect.html](http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html) (last visited Feb. 22, 2010).

<sup>566</sup> See Schlesinger, *supra* note 564.

<sup>567</sup> *Id.*

<sup>568</sup> *Id.*

<sup>569</sup> Reitze, *supra* note 29, at 44; see Fred Bosselman, *The Ecological Advantages of Nuclear Power*, 15 N.Y.U. ENVTL. L.J. 1, 40-42 (2007).

<sup>570</sup> INT'L ATOMIC ENERGY AGENCY, THE CHERNOBYL ACCIDENT: UPDATING OF INSAG-1 13-14 (1992), available at [http://www-pub.iaea.org/MTCD/publications/PDF/Pub913e\\_web.pdf](http://www-pub.iaea.org/MTCD/publications/PDF/Pub913e_web.pdf).

<sup>571</sup> *Id.* at foreword, 3-9, 17-20.

<sup>572</sup> Steven Mufson, *Warming Up to Nuclear Power*, WASH. POST, Apr. 27, 2006, at D1, D12.

higher.<sup>573</sup> Nuclear power facilities also present targets for terrorists,<sup>574</sup> although the industry is a “harder” target than many other potential targets, including electric power distribution facilities,<sup>575</sup> and their use by countries that do not have nuclear weapons makes it more difficult to deal with global nuclear proliferation.<sup>576</sup>

The United States generates nineteen percent of its electric power from 104 nuclear reactors<sup>577</sup> located in thirty-one states, mainly in the eastern half of the United States.<sup>578</sup> The nuclear power industry is dominated by ten companies, which operate 76 reactors.<sup>579</sup> Exelon is the largest with seventeen reactors.<sup>580</sup>

For more than thirty years, beginning in 1974, there were no new nuclear plants ordered in the United States.<sup>581</sup> After the 1979 meltdown of half of Pennsylvania’s Three Mile Island No. 2 (“TMI2”) plant reactor core, the nuclear industry was crippled.<sup>582</sup> It took fourteen years and \$1 billion for the cleanup, which was not completed until December 1993.<sup>583</sup> TMI2 was partly dismantled and the fuel, reactor vessel, and other components were removed from the site for disposal.<sup>584</sup>

In the 1980s, Duke Power abandoned its partially built reactor in Cherokee County, South Carolina, at a loss of \$2.7 billion.<sup>585</sup> But, the

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<sup>573</sup> *Id.* at D12.

<sup>574</sup> See Cat Lazaroff, *Nuclear Plants Called Vulnerable to Terrorist Attack*, ENV’T NEWS SERVICE, Sept. 26, 2001, available at <http://www.commondreams.org/headlines01/0926-01.htm>.

<sup>575</sup> See Galvin Electricity Initiative, *Electric Power System is Insecure*, <http://www.galvinpower.org/case-transformation/power-system-insecure> (last visited Mar. 10, 2010) (noting the extreme vulnerability of these facilities and how a relatively minor attack could cause a “catastrophic failure.”).

<sup>576</sup> See Global Issues.org, *The Right to Have Nuclear Weapons?*, <http://www.globalissues.org/issue/67/nuclear-weapons#IranandNuclearWeapons> (last visited Feb. 21, 2010).

<sup>577</sup> World Nuclear Association: *Nuclear Power in the USA*, <http://www.world-nuclear.org/info/inf41.html> (last visited Mar. 28, 2010).

<sup>578</sup> *See id.*

<sup>579</sup> See U.S. NRS: *List of Power Reactor Units* <http://www.nrc.gov/reactors/operating/list-power-reactor-units.html> (last visited Mar. 28, 2010).

<sup>580</sup> *See id.*

<sup>581</sup> BERNARD L. COHEN, *THE NUCLEAR ENERGY OPTION* ch.9 (Plenum Press 1990), available at <http://www.phyast.pitt.edu/~blc/book/index.html>.

<sup>582</sup> *Id.* at ch. 6.

<sup>583</sup> Lynn Garner, *NRC Officials Call Nuclear Plants Safe, 30 Years After Accident at Three Mile Island*, 40 ENV’T REP. (BNA) 696 (Mar. 27, 2009).

<sup>584</sup> U.S. NUCLEAR REGULATORY COMM’N, *BACKGROUND: THREE MILE ISLAND ACCIDENT 4* (Aug. 2009), <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.pdf> [hereinafter *THREE MILE ISLAND ACCIDENT*].

<sup>585</sup> Steven Mufson, *Nuclear Power Primed for Comeback*, WASH. POST, Oct. 8, 2007, available

climate for the nuclear industry may be changing. In 2007, the Tennessee Valley Authority opened a reactor it closed in 1985 and sought to build two new reactors in Alabama.<sup>586</sup> Constellation Energy Group is seeking a partial license to add a nuclear unit to its Calvert Cliffs, Maryland, facility.<sup>587</sup> In November 2009, there were “13 applications for 22 new reactors under review by the Nuclear Regulatory Commission.”<sup>588</sup> Final action on the first new nuclear plant to be constructed in thirty years is expected in 2011.<sup>589</sup> Most of the proposed units are planned for existing sites located in southern states.<sup>590</sup> Each application is expected to take forty-two months to process at a cost to the applicant of approximately \$100 million.<sup>591</sup>

One of the reasons for the interest in nuclear plants is that the cost of producing electricity is lower than producing electricity from natural gas, its primary rival energy.<sup>592</sup> The nuclear industry’s average production cost for electricity in 2007 was \$0.0168/KWh.<sup>593</sup> However, this does not include the cost of most waste disposal and decommissioning, which is paid by the electric power consumer as an additional charge for electricity.<sup>594</sup> Waste disposal costs are \$0.001/KWh as set by the Nuclear Waste Policy Act, and decommissioning costs are approximately \$0.001–\$0.002/KWh.<sup>595</sup>

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at <http://www.washingtonpost.com/wp-dyn/content/article/2007/10/07/AR2007100701324.html>.

<sup>586</sup> *Id.*

<sup>587</sup> *Id.*

<sup>588</sup> Dean Scott, *Vote Against Emissions Caps Aside, Baucus Says He Is Committed to Passage*, 40 ENV’T REP. (BNA) 2601 (Nov. 13, 2009).

<sup>589</sup> Lynn Garner, *Alexander Pushes for 100 Nuclear Plants As Alternative to House Cap-And-Trade Bill*, 40 ENV’T REP. (BNA) 1704 (July 17, 2009).

<sup>590</sup> See U.S. NRC: Location of Projected New Nuclear Power Reactors, <http://www.nrc.gov/reactors/new-reactors/col/new-reactor-map.html> (last visited Mar. 28, 2010).

<sup>591</sup> Mike Ferullo, *More Nuclear Plant Applications Expected; Climate Debate Could Spur More Incentives*, 39 ENV’T REP. (BNA) 199 (Jan. 18, 2008).

<sup>592</sup> See Press Release, Nuclear Energy Inst., U.S. Nuclear Power Plants Set Record Highs for Electricity Production, Efficiency in 2007 (Feb. 6, 2008), <http://www.nei.org/newsandevents/newsreleases/setrecordhighs>.

<sup>593</sup> *Id.*

<sup>594</sup> See NAT’L RURAL ELECTRIC COOPERATIVE ASS’N, FAST FACTS: NUCLEAR WASTE DISPOSAL (June 2007), available at <http://www.nreca.org/Documents/PublicPolicy/FFNuclearWaste.pdf>; see also WORLD NUCLEAR ASS’N, THE ECONOMICS OF NUCLEAR POWER (Jan. 2010), <http://www.world-nuclear.org/info/inf02.html>.

<sup>595</sup> See 42 U.S.C. § 10222 (2006); see also WORLD NUCLEAR ASS’N, *supra* note 594. Waste disposal charges are established by the Nuclear Waste Fund. See *id.*

The decommissioning costs are an estimate based on the \$508 million in 2005 dollars to decommission Maine Yankee. At \$0.002/KWh a 1100 MW facility operated at ninety percent capacity would generate about \$17.3 million a year or \$6.94 over forty years.

Although it is inexpensive to produce electricity using nuclear power, a nuclear power plant is a capital-intensive method of generating electricity, and the issue of costs of construction is always present. A new nuclear reactor costs \$6 to \$8 billion according to the electric power industry's Energy Institute.<sup>596</sup> The cost of twin reactor facilities that most nuclear applicants propose cost \$12 to \$18 billion.<sup>597</sup> Florida Power and Light claims its proposed twin advanced-design reactors near Miami could cost as much as \$24 billion.<sup>598</sup> The high cost estimates arise from the nuclear industry's experience during the construction of the current fleet of operating reactors, wherein changing regulatory requirements including delays chiefly associated with increased opposition following the Accident at TMI2 resulted in unanticipated costs and included large carrying costs of capital during the associated delays and modifications to address modified regulatory requirements.<sup>599</sup> While the new applications are for facilities that are similar to currently operating facilities, the designs for the new reactors included in the new applications represent a new matter from a regulatory review and approval perspective.<sup>600</sup> The discussion of billions of dollars regarding the cost of each facility seems enormous, but such a facility is expected to produce an average of twelve billion KWh/year<sup>601</sup> for forty to sixty years.<sup>602</sup>

An important element in revival of the nuclear energy industry is the amount of public subsidies and loan guarantees Congress is willing to provide. Title VI of the Energy Policy Act of 2005<sup>603</sup> provides \$1.25 billion for research and infrastructure and includes a number of provisions intended to jumpstart the construction of new nuclear power plants.<sup>604</sup>

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This is a conservative estimate because nuclear power plants are likely to operate sixty plus years with no appreciable increase in decommissioning costs measured in constant dollars.

<sup>596</sup> Ari Natter, *Alexander Calls Nuclear Power Preferable To Poorly Planned Renewable Energy Sprawl*, 40 ENV'T REP. (BNA) 2339 (Oct. 9, 2009).

<sup>597</sup> Ferullo, *supra* note 591.

<sup>598</sup> Lynn Garner, *Nuclear Power Advocates Tell Congress Federal Subsidies Are Critical to Renewal*, 39 ENV'T REP. (BNA) 816 (Apr. 25, 2008).

<sup>599</sup> THREE MILE ISLAND ACCIDENT, *supra* note 584, at 1–4.

<sup>600</sup> COHEN, *supra* note 581, at ch. 9.

<sup>601</sup> See U.S. Energy Information Administration Electricity FAQs, [http://tonto.eia.doe.gov/ask/electricity\\_faqs.asp](http://tonto.eia.doe.gov/ask/electricity_faqs.asp) (last visited Mar. 28, 2010).

<sup>602</sup> This is the average lifetime of a nuclear plant. See WORLD NUCLEAR ASS'N, NUCLEAR POWER REACTORS (Apr. 2009), <http://www.world-nuclear.org/info/inf32.html>.

<sup>603</sup> Energy Policy Act of 2005, 42 U.S.C. §§ 16011–16042 (2006).

<sup>604</sup> See *id.* §§ 16021–16025.

Foremost among these are the approval of a production tax credit of 1.8 cents per KWh for the first eight years of operation in section 1306<sup>605</sup> and the authorization of the Department of Energy to provide loan guarantees of up to eighty percent of project cost for advanced nuclear energy facilities in section 1702.<sup>606</sup> Section 638 provides standby support for delays beyond 180 days in the commencement of full operation for up to six new facilities due to litigation or delayed Nuclear Regulatory Commission approval,<sup>607</sup> and section 602 extends liability protection for NRC licensees and DOE contractors to 2025 through amendments to the Price-Anderson Act.<sup>608</sup>

The 2008 Omnibus Appropriations Bill extends the loan guarantee program to fiscal year 2010 and provides \$18.5 billion for nuclear reactors and \$2 billion for uranium enrichment.<sup>609</sup> In early 2008 it had not been resolved how the loan guarantee program was to going to be financed.<sup>610</sup> Loan guarantees require an accurate assessment of the risk involved and an appropriate premium or an economic meltdown can occur if the risk that is insured occurs.<sup>611</sup> Project applicants may have to pay fees to cover the risk of default on the loans that are federally guaranteed to avoid another AIG-type financial disaster.<sup>612</sup> The industry would prefer the risk and costs to be placed on the taxpayer, but AIG has shown that if a default occurs, even if the industry has paid insurance type premiums, the taxpayers are still likely to be stuck with the bill.<sup>613</sup> It also is not clear whether the size of the loan guarantee program is large enough to move the industry to a new construction phase because of the high cost of construction.<sup>614</sup>

The fiscal year 2009 budget request “would more than double funding for nuclear research and development” from \$259 million in fiscal year 2008 to \$630 million in fiscal year 2009.<sup>615</sup> This is more than ten times the budget for wind power development.<sup>616</sup> The budget request also would

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<sup>605</sup> I.R.C. § 45j(a) (2006).

<sup>606</sup> 42 U.S.C. § 16512.

<sup>607</sup> *Id.* § 16014.

<sup>608</sup> 42 U.S.C. § 2010 (2006).

<sup>609</sup> Ferullo, *supra* note 591 (referring to Consolidated Appropriations Act of 2008, H.R. 2764, 110<sup>th</sup> Cong. (2008)).

<sup>610</sup> *See id.*

<sup>611</sup> *See id.*

<sup>612</sup> *See id.*

<sup>613</sup> *See* Gretchen Morgenson, *A.I.G., Where Taxpayers' Money Goes to Die*, N.Y. TIMES, Mar. 8, 2009, at BU1.

<sup>614</sup> Ferullo, *supra* note 591.

<sup>615</sup> Scott, *supra* note 529.

<sup>616</sup> *Id.*

extend the loan guarantee fund for nuclear projects through fiscal year 2011.<sup>617</sup> Legislation introduced in the Senate on November 16, 2009, would increase DOE's loan guarantee program for carbon-free electricity production, including nuclear energy, to \$100 billion.<sup>618</sup>

Another consideration is the limitations of the entire nuclear cycle. Uranium conversion is mainly carried out in a plant operated by ConverDyn in Illinois.<sup>619</sup> Uranium enrichment is primarily done at a USEC operated plant in Paducah, Kentucky.<sup>620</sup> Two new plants are being constructed, one at Piketon, Ohio and another at Eunice, New Mexico.<sup>621</sup> They may become operational this year.<sup>622</sup> Both of the new uranium enrichment plants utilize gas centrifuges rather than WWII technology of the gaseous diffusion previously relied upon by the United States.<sup>623</sup> The gas centrifuges require substantially less energy to accomplish the enrichment of uranium<sup>624</sup> thus reducing the potential carbon footprint if it is assumed that the enrichment process is powered by coal-fired generation.

The uranium oxide ("UO") fuel assemblies are produced at four plants in Lynchburg, Virginia; Columbia, South Carolina; Richland, Washington; and Wilmington, North Carolina.<sup>625</sup> After the fuel is used

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<sup>617</sup> Lynn Garner, *President Requests \$1.1 Billion Increase In Funds for Energy Department in FY 2009*, 39 ENV'T REP. (BNA) 246 (Feb. 8, 2008).

<sup>618</sup> Lynn Garner, *Senators Introduce Legislation to Expand Nuclear Power Capacity, Boost Clean Energy*, 40 ENV'T REP. (BNA) 2658 (Nov. 20, 2009).

<sup>619</sup> U.S. NRC: Uranium Conversion, <http://www.nrc.gov/materials/fuel-cycle-fac/ur-conversion.html> (last visited Mar. 29, 2010); ConverDyn: Honeywell's Metropolis Works, <http://www.converdynam.com/metropolis/index.html> (last visited Mar. 11, 2010).

<sup>620</sup> U.S. NUCLEAR REGULATORY COMM'N, FACT SHEET ON URANIUM ENRICHMENT 1-2 (May 15, 2009), <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/enrichment.html> [hereinafter FACT SHEET ON URANIUM ENRICHMENT].

<sup>621</sup> *Id.*

<sup>622</sup> U.S. Enrichment Corp., *The American Centrifuge*, <http://www.usec.com/american-centrifuge.htm> (last visited Feb. 22, 2010) (noting the Ohio plant's opening has been delayed and hopes to open sometime this year); *NRC: Planned NM Uranium Plant Moving Ahead*, KCBDCOM, Feb. 25, 2010, <http://www.kcbd.com/Global/story.asp?S=12044603> (noting that the New Mexico plant has reached a "critical milestone" but was not open as of February 2010).

<sup>623</sup> See John. J. Fialka, *A "Robust" New Fuel Supply for Nuclear Power Plants is Emerging*, WALL ST. J., May 4, 2009, <http://www.nytimes.com/cwire/2009/05/04/04climatewire-a-robust-new-fuel-supply-for-nuclear-power-p-12208.html?pagewanted=1>; see also FACT SHEET ON URANIUM ENRICHMENT, *supra* note 620, at 2.

<sup>624</sup> See U.S. NRC: Gas Centrifuge Enrichment Facility Licensing, <http://www.nrc.gov/materials/fuel-cycle-fac/gas-centrifuge.html> (last visited Mar. 29, 2010).

<sup>625</sup> See WISE Uranium Project, *World Nuclear Fuel Facilities*, <http://www.wise-uranium.org/efac.html#FUELFABLWUOX> (last visited Mar. 29, 2010).

in the reactor and removed, it must be recycled and/or stored.<sup>626</sup> Since 1977 there has been no recycling of spent nuclear fuel in the United States.<sup>627</sup> Until recently, it was expected that spent fuel would be stored at Yucca Mountain, Nevada.<sup>628</sup> However construction delays and political opposition has resulted in spent fuel being stored in fuel storage pools or in dry casks at the reactor site.<sup>629</sup> There are approximately 121 existing on-site storage facilities in thirty-nine states that have a combined volume of nuclear fuel that would cover “a football field to a depth of five-yards.”<sup>630</sup> As discussed in the sequestration material, this is less than the daily CO<sub>2</sub> storage requirement for one coal-burning power plant.<sup>631</sup> Since 1998, DOE has been responsible for storing this waste, with the costs covered by a tax on the production of electricity from nuclear plants.<sup>632</sup> Yucca Mountain’s capacity is now too small to store the reactor waste produced to date.<sup>633</sup> After spending \$13.5 billion to develop the Yucca Mountain site, the Obama administration is ending most funding for the project in fiscal year 2010.<sup>634</sup> Much of the need for long-term storage could be removed by recycling spent fuel, but there is no prospect of that occurring soon.<sup>635</sup>

In many European nations, nuclear power is an important source of electricity. Five nations generate more than half their electricity from

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<sup>626</sup> U.S. DEP’T OF ENERGY, OFFICE OF CIVILIAN RADIOACTIVE WASTE MGMT., FACT SHEET: WHAT ARE SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE? (2007), <http://www.ocrwm.doe.gov/factsheets/doeymp0338.shtml> [hereinafter FACT SHEET: SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE].

<sup>627</sup> U.S. DEP’T OF ENERGY, REPORT TO CONGRESS: SPENT NUCLEAR FUEL RECYCLING PROGRAM PLAN 9 (2006), <http://www.ne.doe.gov/pdfFiles/snfRecyclingProgramPlanMay2006.pdf>.

<sup>628</sup> See U.S. Energy Information Administration, Introduction to Nuclear Power, <http://www.eia.doe.gov/cneaf/nuclear/page/intro.html> (last visited Jan. 17, 2010).

<sup>629</sup> See Miguel Llanos, *Nuclear Waste: No Way Out?*, MSNBC, June 6, 2002, <http://www.msnbc.msn.com/id/3072031/>; see also U.S. NRC: Storage of Spent Nuclear Fuel, <http://www.nrc.gov/waste/spent-fuel-storage.html> (last visited Mar. 29, 2010).

<sup>630</sup> FACT SHEET: SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE, *supra* note 626.

<sup>631</sup> See *supra* notes 321–24 and accompanying text.

<sup>632</sup> See Phoebe Sweet, *Two Decades Later, How We Got Here*, LAS VEGAS SUN, Oct. 12, 2008, <http://www.lasvegassun.com/news/2008/oct/12/two-decades-later-how-we-got-here/>; see also notes 594–95 and accompanying text for discussion of waste disposal tax.

<sup>633</sup> See Steve Tetreault, *Nuclear Waste: Abraham Says Yucca Mountain Might Be Too Small*, GLOBAL SECURITY NEWSWIRE, May 17, 2002, available at [http://www.nti.org/d\\_newswire/issues/thisweek/2002\\_5\\_17\\_othr.html](http://www.nti.org/d_newswire/issues/thisweek/2002_5_17_othr.html).

<sup>634</sup> *Official: No Nuke Waste at Yucca Mountain*, CBS NEWS, Mar. 5, 2009, [http://www.cbsnews.com/stories/2009/03/05/national/main4847330.shtml?source=RSSattr=Politics\\_4847330](http://www.cbsnews.com/stories/2009/03/05/national/main4847330.shtml?source=RSSattr=Politics_4847330).

<sup>635</sup> Janice Valverde, *More Options to Be Examined under Chu, But Commercial Fuel Recycling Decades Away*, 40 ENV’T REP. (BNA) 634 (Mar. 20, 2009).

nuclear sources: France (78.1%), Lithuania (72.1%), Slovakia (55.2%), Belgium (55.1%), and Sweden (51.8%).<sup>636</sup> Germany, Finland, and the other Eastern European nations are also heavily dependent on nuclear power, and the Eastern European nations are building a new generation of nuclear power plants.<sup>637</sup> China has nine plants and may build up to thirty more by 2021.<sup>638</sup>

## V. ENERGY EFFICIENCY

Energy efficiency is concerned with achieving a result by using less energy,<sup>639</sup> in contrast to energy conservation, which uses less energy by sacrificing some benefits associated with energy utilization.<sup>640</sup> Some measures involve both: for example, driving a fuel-efficient vehicle may require tradeoffs in comfort or carrying capacity, but for most people using a fuel-efficient hybrid is not a sacrifice.<sup>641</sup> It is generally considered significantly less expensive to reduce demand through efficiency than to increase supply, and energy that is not used produces neither GHGs nor conventional pollutants.<sup>642</sup> Stringent national efficiency standards could eliminate the need for 450 power plants by 2020, according to the American Council for an Energy Efficient Economy.<sup>643</sup> According to a report by the consulting firm McKinsey and Co. released July 29, 2009, an investment of \$520 billion in energy efficiency measures by the non-transportation industries could reduce energy consumption twenty-three percent by 2020, a saving of \$1.2 trillion.<sup>644</sup>

Energy efficiency programs should be a major part of a national energy policy, but until recently they have been largely ignored. For example, the DOE is required by the National Appliance Energy Conservation Act of 1987 to issue efficiency standards for consumer and industrial

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<sup>636</sup> INT'L ATOMIC ENERGY AGENCY, NUCLEAR POWER AND SUSTAINABLE DEVELOPMENT 9 (2006), [http://www.iaea.org/OurWork/ST/NE/Pess/assets/06-13891\\_NP&SDbrochure.pdf](http://www.iaea.org/OurWork/ST/NE/Pess/assets/06-13891_NP&SDbrochure.pdf).

<sup>637</sup> Nina Sovich, *Europe's New Nuclear Standoff*, WALL ST. J., June 29, 2005, at A13.

<sup>638</sup> Mufson, *supra* note 572.

<sup>639</sup> See Michael Schirber, *Whatever Happened to Energy Conservation?*, LIVESCIENCE, Jan. 2, 2008, <http://www.livescience.com/environment/080102-energy-conservation.html>.

<sup>640</sup> *Id.*

<sup>641</sup> See Ed Hunt, *Why Hybrid Cars Are Here to Stay*, CHRISTIAN SCI. MONITOR, Apr. 4, 2002, <http://www.csmonitor.com/2002/0404/p13s02-coop.html>.

<sup>642</sup> Michael Grunwald, *Wasting Our Watts*, TIME, Jan. 12, 2009, at 32, 33–34.

<sup>643</sup> *Id.* at 36.

<sup>644</sup> Andrew Childers, *Report Finds Potential Energy Savings, Highlights Obstacles to Greater Efficiency*, 40 ENV'T REP. (BNA) 1833 (July 31, 2009).

equipment categories.<sup>645</sup> The Energy Policy Act of 1992 and 2005 expanded the requirements for energy efficiency rulemaking.<sup>646</sup> Despite the statutory mandate, DOE missed every deadline.<sup>647</sup> However, making energy efficiency a low priority in energy policy development may be changing.

In the American Recovery and Reinvestment Act of 2009,<sup>648</sup> Congress provided significant resources for energy conservation efforts.<sup>649</sup> The act provides for \$4.5 billion to repair and increase the energy efficiency of federal buildings; \$6.3 billion for energy efficiency and conservation grants; \$5 billion for home weatherization; and \$2.5 billion for energy efficiency and renewable energy research.<sup>650</sup> In addition, the law provides funding in the form of block grants to states to use for energy efficiency and conservation projects.<sup>651</sup> On March 26, 2009, it was announced that \$3.2 billion would be made available to spur the local economy and cut energy use.<sup>652</sup> On April 27, 2009, the DOE announced the Advanced Research Projects Agency—Energy Program, which is designed to decrease reliance on fuel imports and improve energy efficiency.<sup>653</sup> The program would receive \$400 million from the economic stimulus legislation.<sup>654</sup> This program was created by the 2007 America Competes Act<sup>655</sup> but it had not previously been funded.<sup>656</sup> On June 26, 2009, the House passed ACES, which would authorize at least \$1.8 billion to provide bonus payments to manufacturers, retailers, and other distributors of appliances and electronics that are the most efficient products in their class.<sup>657</sup>

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<sup>645</sup> See National Appliance Energy Conservation Act of 1987, Pub. L. No. 100-12, 101 Stat. 103 (codified as amended at 42 U.S.C. §§ 6294–6295 (2006)).

<sup>646</sup> See generally Pub. L. No. 102-486, 106 Stat. 2776 (codified at 42 U.S.C. § 13254 (2006)); Pub. L. No. 109-58, § 135, 119 Stat. 594 (codified at 42 U.S.C. §§ 15811–15842 (2006)).

<sup>647</sup> U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-42, ENERGY EFFICIENCY: LONG-STANDING PROBLEMS WITH DOE'S PROGRAM FOR SETTING EFFICIENCY STANDARDS CONTINUE TO RESULT IN FORGONE ENERGY SAVINGS 5 (2007), <http://www.gao.gov/new.items/d0742.pdf>.

<sup>648</sup> American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

<sup>649</sup> See *id.*

<sup>650</sup> *Stimulus Provides \$40 Billion*, *supra* note 510.

<sup>651</sup> Andrew Childers, *State, Local Governments to Receive \$3.2 Billion for Energy Efficiency Programs*, 40 ENV'T REP. (BNA) 761 (Apr. 3, 2009).

<sup>652</sup> *Id.*

<sup>653</sup> *DOE Launches the Advanced Research Projects Agency—Energy, or ARPA-E*, EERE NETWORK NEWS, Apr. 29, 2009, [http://apps1.eere.energy.gov/news/news\\_detail.cfm/news\\_id=12478](http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=12478).

<sup>654</sup> *Id.*

<sup>655</sup> America Competes Act, Pub. L. No. 110-69, § 5012, 121 Stat. 572, 621–25 (2007).

<sup>656</sup> *DOE Launches the Advanced Research Projects Agency—Energy, or ARPA-E*, *supra* note 653.

<sup>657</sup> Ari Natter, *General Electric Urges Senate to Pass Bill With Provision on Energy-Efficient Appliances*, 40 ENV'T REP. (BNA) 1835 (July 31, 2009).

Energy efficiency improvements are hampered by business practices and public attitudes that are difficult to change, even when the existing system is irrational.<sup>658</sup> In addition, consumer consumption of energy is driven by a desire to have energy-intensive electronic devices such as plasma TVs, cell phones, and computers.<sup>659</sup> A major problem in making energy efficiency improvements is the disconnect between the buyers of appliances and the consumers who pay for the power to operate them. Thirty-two percent of American households live in rented property.<sup>660</sup> Eight percent of the tenants pay their own utilities, but the landlords select many of the appliances, and they are concerned with obtaining the lowest initial cost.<sup>661</sup> Similar conditions exist in the new and reconditioned housing market where the developer makes the decisions that affect the energy consumption of those who will live in the home and pay the energy costs.<sup>662</sup> Even if consumers and businesses have accurate information about energy consumption and are in a position to make decisions that will lower energy use, they usually will make decisions that favor lower initial cost and will expect a return on energy efficiency investments that are far higher than market interest rates.<sup>663</sup> Thus, the implicit use of high discount rates for present investment is a significant barrier to the adoption of energy-efficient technologies.<sup>664</sup>

Efficiency improvements in the electric power sector are also hampered by a regulatory environment in which utilities are rewarded for selling more power, but receive nothing for investments in efficiency improvements.<sup>665</sup> Many states do not promote efficiency in the electric power sector, but this appears to be changing. In California, Washington, Oregon and about sixteen other states, there are governmental efforts to reduce electric power demand.<sup>666</sup> Twelve states are giving electric utilities

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<sup>658</sup> See Douglas A. Kysar & Michael P. Vandenbergh, *Introduction: Climate Change and Consumption*, 38 ENVTL. L. REP. (Envtl. Law Inst.) 10825 (2008); see also Michael P. Vandenbergh, *From Smokestack to SUV: The Individual as a Regulated Entity in the New Era of Environmental Law*, 57 VAND. L. REV. 515, 591–94 (2004).

<sup>659</sup> Noah M. Sachs, *Greening Demand: Energy Consumption and U.S. Climate Policy*, 19 DUKE ENVTL. L. & POL'Y F. 295, 305–06 (2009).

<sup>660</sup> *Id.* at 307 (citing AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., QUANTIFYING THE EFFECTS OF MARKET FAILURES IN THE END-USE OF ENERGY 13 fig.1 (2007), available at <http://www.aceee.org/Energy/IEAmarketbarriers.pdf>).

<sup>661</sup> *See id.* at 307–08.

<sup>662</sup> *See id.*

<sup>663</sup> *See id.* at 309.

<sup>664</sup> *Id.*

<sup>665</sup> See Sachs, *supra* note 659, at 310–11.

<sup>666</sup> See AM. COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY, STATE ENERGY EFFICIENCY

the opportunity to profit from investments in efficiency,<sup>667</sup> and three more are considering creating efficiency incentives.<sup>668</sup> Another promising approach is real time pricing for electricity, which uses “smart-meters” that allows consumers to see their electric consumption at any time as well as its cost.<sup>669</sup>

Energy efficiency programs offer the least costly and quickest way to reduce GHG emissions, but they require many approaches targeted at the myriad ways energy is consumed in our society.<sup>670</sup>

## VI. CONTROLLING GHGS BY INCREASING THE COST OF ENERGY<sup>671</sup>

The costs of reducing the world’s GHG emissions will depend on future population size, economic growth, technology development and use, and the mix and quantity of fossil fuels combusted.<sup>672</sup> These factors are not subject to control by the United States.<sup>673</sup> The costs to respond effectively to climate change probably will not be incurred by the same nations or groups that are most adversely affected by climate change.<sup>674</sup> Since the most important GHG is CO<sub>2</sub><sup>675</sup> and it remains in the atmosphere for a century or more, expenditures to control CO<sub>2</sub> emissions will benefit generations not yet born.<sup>676</sup> Because benefits from control will occur in the future, but costs will be incurred in the near term, a benefit/cost analysis

RESOURCE STANDARD (EERS) ACTIVITY 1–4 (2009), <http://www.aceee.org/energy/state/policies/4pgStateEERSsummary.pdf>.

<sup>667</sup> See THE EDISON FOUNDATION, INST. FOR ELECTRIC EFFICIENCY, LOST REVENUE ADJUSTMENT & REVENUE DECOUPLING MECHANISMS FOR ELECTRIC UTILITIES BY STATE 1–4 (2009), [http://www.edisonfoundation.net/iee/issueBriefs/LRAM\\_Decoupling\\_Map0509.pdf](http://www.edisonfoundation.net/iee/issueBriefs/LRAM_Decoupling_Map0509.pdf).

<sup>668</sup> See *id.*

<sup>669</sup> See David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765, 814 (2008); see also Stephen Cunningham, *Thinking Smart on Energy Savings*, BBCNEWS, May 19, 2009, <http://news.bbc.co.uk/2/hi/science/nature/8055344.stm>.

<sup>670</sup> See U.S. ENVTL. PROT. AGENCY & DEP’T OF ENERGY, NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY ES-1 to ES-4 (2006), available at [http://www.epa.gov/RDEE/documents/napee/napee\\_exsum.pdf](http://www.epa.gov/RDEE/documents/napee/napee_exsum.pdf).

<sup>671</sup> Portions of Part VI are derived from Reitze, *supra* note 29.

<sup>672</sup> See John P. Weyant, *Costs of Reducing Global Carbon Emissions*, 7 J. ECON. PERSP. 27, 29–30 (1993).

<sup>673</sup> See *id.* at 27–28.

<sup>674</sup> See Gerard Wynn, *Everyone to Pay for Climate Change*, REUTERS, Oct. 4, 2007, <http://www.reuters.com/article/idUSL0138945720071004>.

<sup>675</sup> See Andrea Thompson, *Charge: Carbon Dioxide Hogs Global Warming Stage*, LIVESCIENCE, Mar. 29, 2007, [http://www.livescience.com/environment/070329\\_non\\_co2.html](http://www.livescience.com/environment/070329_non_co2.html).

<sup>676</sup> See Deborah Zabarenko, *New Technologies May Grab Carbon Right Out of Air*, REUTERS, Oct. 1, 2009, <http://www.reuters.com/article/idUSN01290245>.

will be extremely sensitive to the discount rate selected.<sup>677</sup> Put another way, using traditional economic analysis, it is difficult to justify present expenditures that require a long time to achieve benefits.<sup>678</sup> A transition to a low-carbon economy could take half a century and will be expensive.<sup>679</sup> However, a low-carbon society would be healthier and may be more economically competitive.<sup>680</sup> More than 2,500 economists, including eight Nobel Prize winners, have stated “[GHG] emissions can be cut without harming American living standards.”<sup>681</sup>

The costs of responding effectively to reduce GHG emissions will be high, but the costs of not responding could be even higher.<sup>682</sup> The costs increase if a sudden, catastrophic, large-scale, irreversible change in the planet is considered a threat that requires an immediate response, such as the shutdown of the oceanic heat conveyor or the collapse of the West Antarctic ice sheet.<sup>683</sup> Most of the cataclysmic disasters identified by scientists are predictions based on computer analysis.<sup>684</sup> But, when real world evidence is available it may be too late to effectively respond.<sup>685</sup> If uncertainties exist, who should bear the burden of proof, those who advocate business as usual or those who advocate GHG reductions?<sup>686</sup> A noted

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<sup>677</sup> See Daniel A. Farber, *From Here to Eternity: Environmental Law and Future Generations*, 2003 U. of ILL. L. REV. 289 (2003).

<sup>678</sup> See U.S. CONGRESS, CONG. BUDGET OFFICE, UNCERTAINTY IN ANALYZING CLIMATE CHANGE: POLICY IMPLICATIONS vii (2005), available at <http://www.cbo.gov/ftpdocs/60xx/doc6061/01-24-ClimateChange.pdf> [hereinafter UNCERTAINTY IN ANALYZING CLIMATE CHANGE].

<sup>679</sup> See Carl Pope, *Moving the U.S. Off Carbon With Less Pain, More Gain*, YALE ENV'T 360, Jan. 22, 2009, <http://e360.yale.edu/content/feature.msp?id=2111>; see also John M. Volkman, *Making Change in a New Currency: Incentives and the Carbon Economy*, 29 PUB. LAND & RESOURCES L. REV. 1, 3 (2008).

<sup>680</sup> See Gregg Easterbrook & Brian Palmer, *Greenhouse Common Sense: Why Global-Warming Economics Matters More than Science*, U.S. NEWS & WORLD REP., Dec. 1, 1997, <http://www.uwmc.uwc.edu/geography/globcat/globwarm/easter-common.htm>.

<sup>681</sup> See *id.*

<sup>682</sup> See Laurie Goering, *Global Warming Can be Reduced, But at What Cost?*, SEATTLE TIMES, June 13, 2008, [http://seattletimes.nwsources.com/html/nationworld/2003715537\\_warmingcosts21.html](http://seattletimes.nwsources.com/html/nationworld/2003715537_warmingcosts21.html).

<sup>683</sup> See WILLIAM STEVENS, THE CHANGE IN THE WEATHER 285 (1999); see also UNCERTAINTY IN ANALYZING CLIMATE CHANGE, *supra* note 678, at 7–10.

<sup>684</sup> See STEVENS, *supra* note 683, at 206–15 (discussing computer analysis and modeling).

<sup>685</sup> See UNCERTAINTY IN ANALYZING CLIMATE CHANGE, *supra* note 678, at 10 (discussing abrupt climate change); Elizabeth Burleson, *Climate Change Consensus: Emerging International Law*, 34 WM. & MARY ENVTL. L. & POL'Y REV. 543, 554–55 (2010).

<sup>686</sup> See Mort D. Webster & David M. Reiner, *Beyond Emissions Paths: Rethinking the Climate Impacts of Emissions Protocols in an Uncertain World*, MIT JOINT PROGRAM ON THE SCI. AND POL'Y OF GLOBAL CHANGE 15–16 (1997), available at <http://dspace.mit>

scholar has written “catastrophic risks deserve some kind of precautionary principle.”<sup>687</sup> But efforts to avert catastrophic harm should not be used if they give rise to other risks of catastrophic harm.<sup>688</sup> Even for the Catastrophic Harm Precautionary Principle, the cost matters.<sup>689</sup> This advice is worth pondering because climate change involves high risks and high response costs.<sup>690</sup>

Because CO<sub>2</sub> emissions from fossil fuel combustion are the dominant source of U.S. GHG emissions,<sup>691</sup> a program to deal with climate change needs to focus on fossil fuel use and be tailored to the various sectors of the economy. Electric power plants, for example, depend heavily on coal for fuel.<sup>692</sup> Coal combustion is responsible for CO<sub>2</sub> emissions and conventional air pollution that have adverse health and ecosystem effects.<sup>693</sup> Nearly all motor vehicles are petroleum fueled.<sup>694</sup> The use of petroleum leads to substantial conventional air pollution releases as well as adverse economic, political, and military impacts.<sup>695</sup>

Stabilizing atmospheric concentrations of CO<sub>2</sub> will be very difficult in the context of a growing world population and a growing demand for useable energy. Under a business as usual scenario, global CO<sub>2</sub> emissions could more than double, and emissions from coal combustion could more than triple by 2050.<sup>696</sup> Whether the world’s emissions of GHGs can be cut to the extent necessary to stabilize atmospheric concentrations of GHGs in half a century while population and consumption increases is unknown.<sup>697</sup>

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.edu/bitstream/handle/1721.1/3616/MITJPSPGC\_Rpt31.pdf?sequence=1 (discussing the ‘precautionary principle’ and who should bear the burden of proof).

<sup>687</sup> Cass R. Sunstein, *Irreversible and Catastrophic: Global Warming, Terrorism, and Other Problems*, 23 PACE ENVTL. L. REV. 3, 16–17 (2005–2006).

<sup>688</sup> *Id.* at 15–17.

<sup>689</sup> *Id.* at 17.

<sup>690</sup> See *Billions Face Climate Change Risk*, BBC NEWS, Apr. 6, 2007, <http://news.bbc.co.uk/2/hi/6532323.stm> (discussing the predicted impacts of climate change).

<sup>691</sup> INVENTORY, *supra* note 5, at ES-6.

<sup>692</sup> *Id.* at ES-9.

<sup>693</sup> See FUTURE OF COAL, *supra* note 312, at 5.

<sup>694</sup> See INVENTORY, *supra* note 5, at ES-9.

<sup>695</sup> See Jeffrey Chow et al., *Energy Resources and Global Development*, 302 SCI. 1528, 1528–30 (2003), available at <http://www.haddonfield.k12.nj.us/hmhs/academics/science/John/energy%20resources.pdf>; see also William D. Nordhaus, *Iraq: The Economic Consequences of War*, N.Y. REV. OF BOOKS, Dec. 5, 2002, <http://www.nybooks.com/articles/15850> (discussing political, military, and economic impacts from a disruption in oil supplies).

<sup>696</sup> See FUTURE OF COAL, *supra* note 312, at xi.

<sup>697</sup> See Janet Raloff, *Climate Might be Right for a Deal*, SCI. NEWS, Dec. 5, 2009, [http://www.sciencenews.org/view/feature/id/49761/title/Climate\\_might\\_be\\_right\\_for\\_a\\_deal](http://www.sciencenews.org/view/feature/id/49761/title/Climate_might_be_right_for_a_deal).

“Achieving stabilization will require that growth in primary power consumption come from non-CO<sub>2</sub> emitting sources.”<sup>698</sup> These include renewable sources such as solar, wind, hydroelectric, and biofuels,<sup>699</sup> as well as nuclear<sup>700</sup> and fossil fuel combustion which includes carbon capture and sequestration.<sup>701</sup> No one technology will provide a “silver bullet” solution to global warming.<sup>702</sup> Rather, a long-term strategy needs to evolve using many approaches.<sup>703</sup> In the short term, energy conservation measures may provide the best opportunity for meaningful reductions in CO<sub>2</sub> emissions.<sup>704</sup> To develop alternative energy sources and to encourage energy conservation requires that energy costs remain high. If energy costs are allowed to drop, those who invest in a low-carbon energy future may lose their investment, and attracting capital for a post-carbon economy will be difficult.<sup>705</sup> Even if investing in low-carbon energy is made attractive, the size of the capital investment required will be a challenge for the capital markets.<sup>706</sup>

#### A. *Taxing Fossil Fuels*<sup>707</sup>

The Congressional Budget Office has evaluated the uncertainty concerning both the risks from climate change and the costs and effectiveness of the three options for limiting climate change effects: develop new or improved technologies, mitigate the adverse effects of GHGs, and adapt to a warmer climate.<sup>708</sup> Because of the uncertainty concerning both the

<sup>698</sup> Reitze, *supra* note 29, at 18.

<sup>699</sup> See *supra* Part III (discussing renewable energy sources).

<sup>700</sup> See *supra* Part IV (further discussing nuclear options).

<sup>701</sup> See *supra* Part II.C (discussing sequestration and carbon capture).

<sup>702</sup> See AM. SOC'Y OF MECHANICAL ENGINEERS, TECHNOLOGY AND POLICY RECOMMENDATIONS AND GOALS FOR REDUCING CARBON DIOXIDE EMISSIONS IN THE ENERGY SECTOR ii (2009), available at <http://files.asme.org/asmeorg/NewsPublicPolicy/GovRelations/PositionStatements/17971.pdf> (recommending the utilization of several technologies).

<sup>703</sup> See *id.* at ii–iii (recommending research, incentives, technology, and emissions targets as part of its strategy).

<sup>704</sup> See Claire Fulenwider, *Focus on Energy Efficiency to Reduce Emissions*, SEATTLE TIMES, Jan. 21, 2009, [http://seattletimes.nwsourc.com/html/opinion/2008655904\\_opinc22fulenwider.html](http://seattletimes.nwsourc.com/html/opinion/2008655904_opinc22fulenwider.html).

<sup>705</sup> See generally Panel, *ERA Climate Change Primer: Financing a Renewable Project*, 29 ENERGY L.J. 195, 195–216 (2008) (discussing the financing of various energy efficiency projects).

<sup>706</sup> See Richard L. Ottinger & Rebecca Williams, *Renewable Energy Sources for Development*, 32 ENVTL. L. 331, 359–367 (2002) (discussing the scale of necessary investment as well as potential sources).

<sup>707</sup> Portions of Part VI.A. are derived from Reitze, *supra* note 29.

<sup>708</sup> UNCERTAINTY IN ANALYZING CLIMATE CHANGE, *supra* note 678, at preface.

benefits and costs of responses, the best policy is to select responses likely to minimize the costs of choosing an inappropriate level of control.<sup>709</sup> Imposing caps on emissions is a questionable policy choice when there is no known threshold for significant damage.<sup>710</sup> The Congressional Budget Office (“CBO”) advocates pricing controls rather than emission caps in order to control costs.<sup>711</sup>

If prices are set at a level close to the projected benefits of a measure, the risk to the economy is minimized.<sup>712</sup> It is difficult, however, to determine the appropriate policy concerning the level of costs that should be incurred today to obtain benefits many years in the future.<sup>713</sup> If standard economic evaluation approaches to discounting are used, benefits that are obtained fifty to one hundred years from now have almost no present value.<sup>714</sup> Benefits are also influenced by the values assigned to ecosystem protection.<sup>715</sup> An advantage of a tax-based approach is that any tax imposed may be increased over time, if necessary, when better information concerning costs and benefits is obtained.<sup>716</sup>

Various types of energy taxes have been proposed to discourage the use of fossil fuel including taxes on gasoline, oil imports, carbon, or the energy content of a fuel (Btu tax).<sup>717</sup> A carbon tax is a tax on each unit of fuel based on its carbon content, which determines the amount of CO<sub>2</sub> that will be emitted when the fuel is burned.<sup>718</sup> Not all fossil fuels produce the same quantity of CO<sub>2</sub> per molecule of fuel combusted.<sup>719</sup> The heat value comes from the formation of CO<sub>2</sub> and H<sub>2</sub>O after breaking the hydrogen bonds of the fuel.<sup>720</sup> Thus, the more hydrogen atoms for each carbon atom

<sup>709</sup> *Id.* at xi.

<sup>710</sup> *See id.*

<sup>711</sup> *Id.* at xi–xii.

<sup>712</sup> *See id.* at xii.

<sup>713</sup> *See id.* at 19–21.

<sup>714</sup> *See* UNCERTAINTY IN ANALYZING CLIMATE CHANGE, *supra* note 678, at 20 fig.1 (noting the present discount values of \$1000).

<sup>715</sup> *Id.* at 20.

<sup>716</sup> *Id.* at 27–30.

<sup>717</sup> *See* DOUGLAS COGAN, THE GREENHOUSE GAMBIT: BUSINESS AND INVESTMENT RESOURCES TO CLIMATE CHANGE (1992) (discussing techniques to use market-based pricing and trading schemes to reduce carbon emissions); *see also* James Hartnett, *National Energy Policy: Its History and the Need for an Increased Gasoline Tax*, 28 CAL. WES. L. REV. 81, 84–85 (1991).

<sup>718</sup> Amy C. Christian, *Designing a Carbon Tax: The Introduction of the Carbon-Burned Tax (CBT)*, 10 UCLA J. ENVTL. L. & POL'Y 221, 232 (1992).

<sup>719</sup> *Id.* at 222.

<sup>720</sup> *See* Western Oregon University, Energy From Fossil Fuels, [http://www.wou.edu/las/physci/GS361/Energy\\_From\\_Fossil\\_Fuels.htm](http://www.wou.edu/las/physci/GS361/Energy_From_Fossil_Fuels.htm) (last visited Mar. 15, 2010).

the greater the value of energy that can be extracted from the fuel per molecule of CO<sub>2</sub> created.<sup>721</sup> When hydrogen and oxygen combine to form gaseous water, heat is given off in an exothermic reaction.<sup>722</sup> The total heat, or enthalpy, given off or absorbed by a reaction is the difference between total heat content of the reactants and the heat content of the products.<sup>723</sup>

Coal, gasoline, and natural gas are all mixtures of various chemicals. The energy value of coal varies from about 6,500 Btu per pound of lignite to about 14,000 Btu per pound for the highest quality bituminous or anthracite coals.<sup>724</sup> A typical coal molecule is C<sub>13</sub>H<sub>10</sub>O.<sup>725</sup> Gasoline also is a mixture of hydrocarbons.<sup>726</sup> Indolene is a common fuel and is expressed as C<sub>7</sub>H<sub>13</sub>N.<sup>727</sup> Natural gas is a mixture that may contain ethane (CH<sub>3</sub>CH<sub>3</sub>), propane (CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub>), butane (CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>), or other similar gases.<sup>728</sup> The ratio of carbon to hydrogen bonds is about 13 to 10 for coal, 18 to 25 for gasoline, and 2 to 5 for butane.<sup>729</sup> Coal has fewer hydrogen atoms per carbon atom than oil or natural gas; therefore, it produces more CO<sub>2</sub> per Btu than the other fossil fuels.<sup>730</sup> Because the carbon to hydrogen ratio varies among fuels, a carbon tax should be imposed on the Btu value of natural gas, petroleum, and coal.<sup>731</sup>

Alternatively, a tax could be based on the carbon emissions from technologies using various fossil fuels.<sup>732</sup> To produce a KWh of electricity results, on average, in emission of 955 grams of carbon from coal, 893 grams of carbon from petroleum, and 599 grams of carbon from natural

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<sup>721</sup> Hong & Slatick, *supra* note 320.

<sup>722</sup> H<sub>2</sub>O—The Mystery, Art, and Science of Water, <http://witcombe.sbc.edu/water/chemistry/electrolysis.html> (last visited Mar. 15, 2010).

<sup>723</sup> CHARLES E. MORTIMER, CHEMISTRY A CONCEPTUAL APPROACH 169, 175 (4th ed. 1979).

<sup>724</sup> Leslie F. Ruppert et al., *The US Geological Survey's National Coal Resource Assessment: The Results*, 50 INT'L J. COAL GEOLOGY 247, 265 (2002); BRIGGS, *supra* note 557, at 110 fig.9-3.

<sup>725</sup> Reitze, *supra* note 29, at 20.

<sup>726</sup> See U.S. DEP'T OF HEALTH & HUMAN SERVS., TOXICOLOGICAL PROFILE FOR GASOLINE 10 (1995).

<sup>727</sup> D.J. PATTERSON & N.A. HENEIN, EMISSIONS FROM COMBUSTION ENGINES AND THEIR CONTROL 97 (1972).

<sup>728</sup> See NaturalGas.org, Background, <http://www.naturalgas.org/overview/background.asp> (last visited March 3, 2010).

<sup>729</sup> See *supra* notes 724–28 and accompanying text.

<sup>730</sup> See Department of Energy, Voluntary Reporting of Greenhouse Gases Program, [www.eia.doe.gov/oiaf/1605/coefficients.html](http://www.eia.doe.gov/oiaf/1605/coefficients.html) (last visited Mar. 16, 2010).

<sup>731</sup> See David Hage & Sara Collins, *Pointing to Tax Increases*, U.S. NEWS & WORLD REP., Jan. 31, 1993, [http://www.usnews.com/usnews/biztech/articles/930208/archiv\\_014635.htm](http://www.usnews.com/usnews/biztech/articles/930208/archiv_014635.htm).

<sup>732</sup> See *The Carbon Tax: The Pros and Cons of a Tax on Fossil Fuels*, CBC NEWS, June 16, 2006, <http://www.cbc.ca/news/background/kyoto/carbon-tax.html>.

gas.<sup>733</sup> This means that a carbon tax would impact those who use coal more than users of petroleum or natural gas. Carbon from any fuel reacts with oxygen in a 3 to 8 ratio by weight.<sup>734</sup> Thus, for example, burning a gallon of gasoline weighing 6.3 pounds will release 5.55 pounds of carbon, which will combine to create a little over twenty pounds of CO<sub>2</sub>.<sup>735</sup>

The impact that carbon taxes would have on the national economy depends primarily on how the revenues from the tax are spent and what other taxes are affected. In the United States, we impose taxes on labor and savings, which are activities that should be encouraged. Taxes should be imposed on activities we wish to discourage, such as pollution and fossil energy use. Taxes on GHGs could be developed that were revenue neutral.<sup>736</sup> Another approach would be to use GHG tax receipts to cover the projected deficit in the social security and medicare programs.<sup>737</sup> A better approach would be to return the money collected equally to every citizen.<sup>738</sup> Those that purchase less than the average amount of energy would benefit financially.<sup>739</sup>

Ultimately, the economic and environmental benefits of a pollution tax are determined by how well it is designed and implemented.<sup>740</sup> It also has to be set at a level that modifies behavior but does not have an

<sup>733</sup> See INGVAR B. FRIDLEIFSSON ET AL., THE POSSIBLE ROLE AND CONTRIBUTION OF GEOTHERMAL ENERGY TO THE MITIGATION OF CLIMATE CHANGE 20 fig.14 (2008). These figures are calculated from g/CO<sub>2</sub> and converted into carbon by dividing the figures by the weight of CO<sub>2</sub>, 44. See *supra* note 562 for similar calculations.

<sup>734</sup> See Periodic Table of the Elements, *supra* note 561 (noting that oxygen has a molecular weight of 16 and carbon has a weight of 12). The carbon reacts with two atoms of oxygen resulting in a carbon to oxygen ratio of 12 to 32.

<sup>735</sup> See fueleconomy.gov, How Can 6 pounds of Gasoline Produce 20 Pounds of Carbon Dioxide?, <http://www.fueleconomy.gov/Feg/co2.shtml> (last visited Mar. 16, 2010).

<sup>736</sup> See Monica Prasad, *On Carbon, Tax and Don't Spend*, N.Y. TIMES, Mar. 25, 2009, <http://www.nytimes.com/2008/03/25/opinion/25prasad.html> (discussing putting the revenue back into the industry for research).

<sup>737</sup> See Congressman John D. Dingell, Summary of Draft Carbon Tax Legislation, Representative John D. Dingell, <http://www.house.gov/dingell/carbonTaxSummary.shtml> [hereinafter Draft Carbon Tax of Representative John D. Dingell].

<sup>738</sup> See Cap and Dividend, <http://www.capanddividend.org/> (advocating this program); see also James K. Boyce & Matthew Riddle, *Cap and Dividend: How to Curb Global Warming While Protecting the Incomes of American Families I* (Political Econ. Research Inst., Working Paper No. 150 2007), available at [http://www.peri.umass.edu/fileadmin/pdf/working\\_papers/working\\_papers\\_101-150/WP150.pdf](http://www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_101-150/WP150.pdf).

<sup>739</sup> Boyce & Riddle, *supra* note 738, at I.

<sup>740</sup> See U.S. GEN. ACCOUNTING OFFICE, GAO/RCED-93-13, IMPLICATIONS OF USING POLLUTION TAXES TO SUPPLEMENT REGULATIONS 3 (1993) [hereinafter IMPLICATIONS OF USING POLLUTION TAXES TO SUPPLEMENT REGULATIONS]; see also Christian, *supra* note 718, at 278.

unacceptable adverse impact on those subject to the tax.<sup>741</sup> This may not be possible to accomplish because each interest group seeks to tax others to pay for benefits that they consider important.

A carbon tax has advantages and disadvantages, but its advantages make this approach a useful policy choice.<sup>742</sup> It would promote fuel efficiency, provide a wide variety of opportunities for energy conservation, and be “resilient and equitable” because its impacts would be diffuse, thus easing the burdens on sensitive sectors of the economy such as the automobile and farming industries.<sup>743</sup> A carbon tax would also be less regressive than other energy taxes, such as a gasoline tax, because the “wealthy consume a greater share of electricity and ‘intermediate energy’ from manufactured goods.”<sup>744</sup> Since coal, petroleum, and natural gas provide ninety percent of U.S. energy—five times more than gasoline alone—a tax on these energy sources would be shared more equally and generate the same revenue as a much larger gasoline tax.<sup>745</sup> The disadvantage of a carbon tax would be a disproportionate effect on the coal industry and their customers because coal contains more carbon than other fossil fuels based on equal heat values.<sup>746</sup> Coal is produced domestically and reducing its use would adversely affect this sector of the economy.<sup>747</sup> It would also adversely affect energy intensive industries, especially those that compete in a world market, unless imports were subject to similar controls.<sup>748</sup> Even then, U.S. exports could be adversely affected.<sup>749</sup>

A gasoline tax imposes a direct tax on each gallon of this fuel.<sup>750</sup> Each additional one-cent in taxes would generate about one billion dollars

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<sup>741</sup> See IMPLICATIONS OF USING POLLUTION TAXES TO SUPPLEMENT REGULATIONS, *supra* note 740, at 24–27; see also Christian, *supra* note 718, at 278–79.

<sup>742</sup> See Roberta Mann, *Waiting to Exhale?: Global Warming and Tax Policy*, 51 AM. U. L. REV. 1135, 1220–21 (2002); see also Zhong Xiang Ziang & Andrea Baranzini, *What Do We Know About Carbon Taxes?: An Inquiry into their Impacts on Competitiveness and Distribution of Income*, 32 ENERGY POL'Y 507, 509–18 (2004).

<sup>743</sup> Charles Komanoff, *Instead of a Gas Tax, How About a Carbon Tax?*, WASH. POST, MAR. 6, 1989.

<sup>744</sup> *Id.*

<sup>745</sup> *Id.*

<sup>746</sup> See Robert Inglis et al., *The Triple Win: Energy Security, the Economy and Climate Change, H.R. 2380, the “Raise Wages, Cut Carbon” Act of 2009*, available at [http://inglis.house.gov/sections/issues/current/rnct/The%20Triple%20Win%20\(2\).pdf](http://inglis.house.gov/sections/issues/current/rnct/The%20Triple%20Win%20(2).pdf).

<sup>747</sup> See Ziang & Baranzini, *supra* note 742, at 514–15.

<sup>748</sup> See *id.* at 512–14; see also Christian, *supra* note 718, at 256–59.

<sup>749</sup> See Ziang & Baranzini, *supra* note 742, at 514–15; see also Christian, *supra* note 718, at 256–59.

<sup>750</sup> See Komanoff, *supra* note 743; see also AM. PETROLEUM INST., JANUARY 2010 SUMMARY

per year in revenue.<sup>751</sup> Such a tax would aim to reduce vehicle miles traveled (“VMT”) and raise revenue by making automobile travel more expensive.<sup>752</sup> The revenue could be used to fund the research and development needed to move to the post-petroleum age, or it could be returned to consumers to keep the tax revenue neutral.<sup>753</sup> However, if VMT decrease, so will the revenue raised by a gasoline tax.<sup>754</sup> To the extent that VMT is reduced, CO<sub>2</sub> and other vehicle emissions would be lowered, and such a tax would help reduce U.S. dependency on foreign oil.<sup>755</sup> A high gasoline tax also would help compensate for costs that the energy market currently does reflect concerning the indirect costs of petroleum use, including the costs associated with pollution, congestion, and the national security costs incurred to assure our petroleum supply.<sup>756</sup> One estimate is that the direct costs of military protection for petroleum being shipped from the Middle East from 1993 to 2003 was \$49 billion a year, and this does not include the cost of two wars in Iraq.<sup>757</sup>

A gasoline tax has several disadvantages: the tax could be regressive and would impact certain elements of the economy and regions of the country more than others.<sup>758</sup> It has the potential to cripple sensitive industries like auto manufacturers that already have serious financial problems, and it ignores other energy sources,<sup>759</sup> such as coal, which contributes more CO<sub>2</sub>,<sup>760</sup> as well as other pollutants, on a Btu basis. Moreover, because of

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REPORT (2010), available at <http://www.api.org/statistics/fueltaxes/> [hereinafter JANUARY 2010 SUMMARY REPORT].

<sup>751</sup> See Komanoff, *supra* note 743.

<sup>752</sup> See Draft Carbon Tax of Representative John D. Dingell, *supra* note 737.

<sup>753</sup> Richard G. Lugar, *Raise the Gas Tax: A Revenue Neutral Way to Treat Our Oil Addiction*, WASH. POST, Feb. 1, 2009, available at <http://www.washingtonpost.com/wp-dyn/content/article/2009/01/30/AR2009013002728.html> (discussing a revenue neutral gas tax increase).

<sup>754</sup> Some are already advocating an increased gas tax to compensate for the lost revenue caused by lower fuel consumption. David J. Phillip, *Raise Gasoline Tax by 10 Cents, Congress Urged*, MSNBC, Jan. 2, 2009, <http://www.msnbc.msn.com/id/28467755/>; see Kate Galbraith, *Some States in a Pinch May Raise Gasoline Tax*, N.Y. TIMES, Jan. 14, 2009, <http://www.nytimes.com/2009/01/14/business/economy/14gastax.html>.

<sup>755</sup> See Lugar, *supra* note 753.

<sup>756</sup> See *id.*; see also Robert J. Samuelson, *Conserve Energy—Tax It*, WASH. POST, Jan. 24, 1991.

<sup>757</sup> Thomas Prugh et al., *Changing the Oil Economy*, in STATE OF THE WORLD 2005 100, 109 (WORLD WATCH INSTITUTE 2005).

<sup>758</sup> See Komanoff, *supra* note 743.

<sup>759</sup> See *id.*; U.S. CONGRESS, CONG. BUDGET OFFICE, THE ECONOMIC COSTS OF FUEL ECONOMY STANDARD VERSUS A GASOLINE TAX 3 (2003), available at [http://www.cbo.gov/ftpdocs/49xx/doc4917/12-24-03\\_CAFE.pdf](http://www.cbo.gov/ftpdocs/49xx/doc4917/12-24-03_CAFE.pdf).

<sup>760</sup> See Department of Energy, Voluntary Reporting of Greenhouse Gases Program, *supra* note 730 (noting coal contributes the most CO<sub>2</sub>).

the relative inelasticity of gasoline demand, the size of the price increase needed to significantly reduce gasoline consumption may have a damaging effect on the economy.<sup>761</sup>

Gasoline or other liquid fuel taxes obviously would affect the petroleum industry and transportation sector. Carbon taxes would impact all fossil-fuel energy sources but would affect the coal industry and its customers more than industries that use other fuels.<sup>762</sup> Industries most affected by such a broad energy-based tax include steel, petrochemical, and some aluminum producers.<sup>763</sup> The electric power industry would also be adversely affected by a carbon or a Btu tax.<sup>764</sup>

Industry opposition to energy taxes in the 1990s included the American Gas Association, American Iron and Steel Institute, American Petroleum Institute, National Association of Manufacturers, the U.S. Chamber of Commerce, and the American Trucking Association.<sup>765</sup> Some members of the automobile industry, however, advocated a gasoline tax as a substitute for regulatory controls based on Corporate Average Fuel Economy ("CAFÉ") standards.<sup>766</sup> Some business groups in an effort to avoid a carbon tax have argued that since the majority of future GHG emissions will come from developing countries, the efforts of industrialized nations should be focused on providing modern technology and assistance to these countries.<sup>767</sup>

On February 17, 1993, President Clinton proposed a tax "on the energy content of fuel, measured in British thermal units ["Btu"] that

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<sup>761</sup> BRENT D. YACOBUCCI & ROBERT BAMBERGER, CONG. RESEARCH SERV., AUTOMOBILE AND LIGHT TRUCK FUEL ECONOMY: THE CAFÉ STANDARDS CRS-12 (Jan. 19, 2007), available at <http://fpc.state.gov/documents/organization/82504.pdf>.

<sup>762</sup> See Inglis et al., *supra* note 746.

<sup>763</sup> Andrea M. Bassi et al., *Climate Policy Impacts on the Competitiveness of Energy-Intensive Manufacturing Sectors*, 37 ENERGY POL'Y 3052, 3057 (2009).

<sup>764</sup> See Boyce & Riddle, *supra* note 738, at 10 (noting the effect on electricity generated from coal).

<sup>765</sup> *Key House Ways & Means Member Re-offers Bill for Taxing Carbon Emissions*, 4 CLEAN AIR REP. (InsideEPA.com) 8 (Feb. 11, 1993); Mary McElveen, *Business Helps Sink BTU tax—Opposition to Clinton's Energy Tax Proposal*, NATION'S BUS., July 1993, [http://findarticles.com/p/articles/mi\\_m1154/is\\_n7\\_v81/ai\\_14017856/](http://findarticles.com/p/articles/mi_m1154/is_n7_v81/ai_14017856/); see Michael Wines, *Tax's Demise Illustrates First Rule of Lobbying: Work, Work, Work*, N.Y. TIMES, June 14, 1993, available at <http://www.nytimes.com/1993/06/14/us/tax-s-demise-illustrates-first-rule-of-lobbying-work-work-work.html>.

<sup>766</sup> *Foreign Auto Manufacturers Criticize CAFÉ, Propose Gas Tax to Clinton Team*, 4 CLEAN AIR REP. (InsideEPA.com) 8 (Feb. 11, 1993).

<sup>767</sup> *Reduce Developing Countries' CO<sub>2</sub> First Before Imposing U.S. Carbon Tax*, 4 CLEAN AIR REP. (InsideEPA.com) 7 (Feb. 11, 1993).

would be] collected at the source.”<sup>768</sup> All fuels, however, were not treated equally. Coal and natural gas would have been taxed at a rate of \$0.257 per million Btu, but oil would have been taxed at a rate of \$0.599 per million Btu.<sup>769</sup> The proposal also would have extended the \$0.025 per gallon gasoline tax that was to expire in 1995.<sup>770</sup> The tax would have encouraged the use of natural gas and alternative energy sources.<sup>771</sup> The petroleum industry claimed a Btu tax would increase gasoline prices by \$0.10 to \$ 0.15 per gallon.<sup>772</sup>

Administration figures showed that both the impacts and the benefits of the proposed energy tax would be modest.<sup>773</sup> The overall cost to consumers was expected to result in a five percent increase for gasoline, or \$0.075/gallon, three percent for electricity, four percent for residential natural gas, and eight percent for home heating oil.<sup>774</sup> Energy consumption in the United States was projected to increase fifteen percent in the 1990s which might have been reduced about two percent by the tax.<sup>775</sup>

Claims of significant environmental benefits and business claims of significant economic harm, however, were overstated.<sup>776</sup> Energy costs account for four to six percent of manufacturing costs.<sup>777</sup> The proposed energy tax would have increased costs by about one-half percent.<sup>778</sup>

While the Clinton tax proposal had merit, it immediately was attacked by energy intensive industrial sectors—steel, petrochemical, and aluminum.<sup>779</sup> The Edison Electric Institute, American Public Power Association, and the National Rural Electric Cooperative Association on behalf of electric energy producers opposed such a tax.<sup>780</sup> The National

<sup>768</sup> *Environmentalists, Industry Spar over Effects of Clinton Energy Tax Proposal*, 4 CLEAN AIR REP. (InsideEPA.com) 29 (Feb. 25, 1993).

<sup>769</sup> *Id.*

<sup>770</sup> *Id.*

<sup>771</sup> *See id.*

<sup>772</sup> *Id.*

<sup>773</sup> See Steven Greenhouse, *Clinton's Economic Plan: The Energy Plan; Fuels Tax: Spreading the Burden*, N.Y. TIMES, Feb. 18, 1993, <http://www.nytimes.com/1993/02/18/us/clinton-s-economic-plan-the-energy-plan-fuels-tax-spreading-the-burden.html>; see also Robert J. Samuelson, *Energy Tax: A Good Idea? Probably*, WASH. POST, Mar. 25, 1993.

<sup>774</sup> Samuelson, *supra* note 773.

<sup>775</sup> *Id.*

<sup>776</sup> *Id.*

<sup>777</sup> *Id.*

<sup>778</sup> *Id.*

<sup>779</sup> *Industry, Citizen Groups Warn Against Energy Tax for Deficit Reduction*, 4 CLEAN AIR REP. (InsideEPA.com) 5 (Feb. 11, 1993) [hereinafter *Energy Tax for Deficit Reduction*].

<sup>780</sup> *Utility Sector Warns Against Carbon Taxes, offers Suggestions on Electricity*, 4 Clean AIR REP. (InsideEPA.com) 29 (Jan. 14, 1993).

Consumers League and the League of United Latin American Citizens also opposed the tax because of its alleged regressive impact.<sup>781</sup> The proposal passed the House, but because of opposition in the Senate, the bill was dropped in favor of a \$0.043 per gallon increase in the excise fuel tax.<sup>782</sup>

The interest in using taxes to control CO<sub>2</sub> in the 1990s waned as politicians regarded supporting any energy tax to being akin to grabbing a political “third rail.”<sup>783</sup> For years, most people believed there was no realistic prospect that an energy tax could be enacted unless a catastrophic event occurred.<sup>784</sup> But, this view may be changing. The House Energy and Commerce Committee Chairman John Dingell (D-Mich.) proposed a carbon tax on September 27, 2007,<sup>785</sup> but he has been replaced as chairman by a supporter of cap-and-trade legislation.<sup>786</sup> H.R. 1337 that was introduced on March 5, 2009,<sup>787</sup> would impose a tax of \$15 per ton of carbon in fuel, about \$0.015 per KWh, and would increase each year,<sup>788</sup> but the House voted to impose a cap-and-trade program.<sup>789</sup>

The United States collects a gasoline tax on a per-gallon basis, and the money collected plays an important role in highway funding.<sup>790</sup> A one-cent per gallon tax on gasoline was first enacted in 1932.<sup>791</sup> The tax

<sup>781</sup> *Energy Tax for Deficit Reduction*, *supra* note 779, at 313.

<sup>782</sup> See Lawrence O'Donnell, *Will Hillary Repeal Clinton Gas Tax?*, HUFFINGTON POST, May 5, 2008, [http://www.huffingtonpost.com/lawrence-odonnell/will-hillary-repeal-the-c\\_b\\_100261.html](http://www.huffingtonpost.com/lawrence-odonnell/will-hillary-repeal-the-c_b_100261.html).

<sup>783</sup> See Mona L. Hymel, *Globalization, Environmental Justice, and Sustainable Development: The Case of Oil* 31 (Ariz. Legal Studies, Discussion Paper No. 06-38, 2006) available at <http://ssrn.com/abstract=934467>; see also Posting of Phil Levy to Shadow Government, *The Carbon Tax/Cap-and-Trade Royal Rumble*, [http://shadow.foreignpolicy.com/posts/2009/05/13/the\\_carbon\\_taxcap\\_and\\_trade\\_royal\\_rumble](http://shadow.foreignpolicy.com/posts/2009/05/13/the_carbon_taxcap_and_trade_royal_rumble) (May 13, 2009, 15:51 EST).

<sup>784</sup> See Levy, *supra* note 783.

<sup>785</sup> Lynn Garner, *Chamber's Donohue Endorses User Fees, Carbon Tax for Modernizing Infrastructure*, 39 ENV'T REP. (BNA) 70 (Jan. 11, 2008); Draft Carbon Tax of Representative John D. Dingell, *supra* note 737.

<sup>786</sup> See Edward Felker, *Waxman Outlines Modified Climate Bill*, WASH. TIMES, <http://www.washingtontimes.com/news/2009/may/13/waxman-outlines-modified-climate-bill/>.

<sup>787</sup> H.R. 1337, 111th Cong. (2009).

<sup>788</sup> Leora Falk, *Rep. Larson Introduces Carbon Tax Bill Focusing on Coal, Petroleum, Natural Gas*, 40 DAILY ENV'T REP. (BNA) A-6 (Mar. 13, 2009).

<sup>789</sup> See *infra* Part VI.B.1 for further discussion of ACES; see also Greg Hitt & Stephen Power, *House Passes Climate Bill*, WALL ST. J., June 28, 2009, <http://online.wsj.com/article/SB124610499176664899.html>.

<sup>790</sup> See JANUARY 2010 SUMMARY REPORT, *supra* note 750; see PAMELA J. JACKSON, CONG. RESEARCH SERV., *THE FEDERAL EXCISE TAX ON GASOLINE AND THE HIGHWAY TRUST FUND: A SHORT HISTORY* CRS-4 to CRS-6 (Apr. 4, 2006), available at <http://ncseonline.org/NLE/CRSreports/06May/RL30304.pdf>.

<sup>791</sup> JACKSON, *supra* note 790, at CRS-1 to CRS-2.

gradually increased to four cents,<sup>792</sup> when President Jimmy Carter proposed a fifty-cent increase that quickly was abandoned.<sup>793</sup> On January 6, 1983, President Reagan approved an increase to \$0.09 per gallon.<sup>794</sup> President George H.W. Bush approved raising the federal gas tax by five cents on November 5, 1990.<sup>795</sup> The Clinton Administration sought a \$0.50 per gallon increase, but settled for a \$0.043 per gallon increase on October 1, 1993.<sup>796</sup> Average state and federal gasoline taxes are \$0.47 per gallon, which includes the federal tax of \$0.184 per gallon; diesel highway fuel averages \$0.536 per gallon, which includes the federal tax of \$0.244 per gallon.<sup>797</sup>

There are no emissions taxes in the United States, but the lack of political support in the United States for energy taxes is not shared by other developed nations. Energy taxes are used in the Netherlands, Sweden, Denmark, Norway, and Finland.<sup>798</sup>

Even if a viable energy tax is enacted, it may or may not reduce petroleum consumption. The public may over time accept a higher price for fuel. Alternatively, a very high price for fuel may reduce consumption but adversely affect the economy.<sup>799</sup> Petroleum prices in the 1990s were about \$20 a barrel.<sup>800</sup> The price dipped to a low of \$9.31 a barrel in 1999 and then rose to \$32.38 a barrel in 2000.<sup>801</sup> In January 2002, petroleum was \$18.68 a barrel,<sup>802</sup> and it increased to over \$130 a barrel in the summer of 2008.<sup>803</sup> Despite a 600% increase in the cost of petroleum in six years, U.S. petroleum consumption increased at an annual average of 1.1% from

<sup>792</sup> *Id.* at CRS-4 to CRS-5.

<sup>793</sup> See Martin A. Sullivan, *Gas Tax Politics, Part I*, TAXANALYSTS, Sept. 22, 2008, <http://www.taxhistory.org/thp/readings.nsf/ArtWeb/5DDB79194769C2BF852574D5003C28D5?OpenDocument>.

<sup>794</sup> See *id.*; see JACKSON, *supra* note 790, at CRS-5.

<sup>795</sup> See Sullivan, *supra* note 793.

<sup>796</sup> Steven Mufson, *Talk of Raising Gas Tax is Just That*, WASH. POST, Oct. 18, 2006, <http://www.washingtonpost.com/wp-dyn/content/article/2006/10/17/AR2006101701327.html>.

<sup>797</sup> JANUARY 2010 SUMMARY REPORT, *supra* note 750.

<sup>798</sup> LARRY PARKER, CONGR. RESEARCH SERV., GLOBAL CLIMATE CHANGE: MARKET-BASED STRATEGIES TO REDUCE GREENHOUSE GASES CRS-8 (2004).

<sup>799</sup> See *supra* notes 759–66 and accompanying text for further discussion.

<sup>800</sup> See Michael Ye et al., *A Short-Run Crude Oil Price Forecast Model with Ratchet Effect*, 37 ATLANTIC ECON. J. 37, 38 (2009), <http://www.springerlink.com/content/k204216787945667/fulltext.pdf>.

<sup>801</sup> See U.S. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, PETROLEUM NAVIGATOR, *available at* <http://tonto.eia.doe.gov/dnav/pet/hist/wtotworldw.htm>.

<sup>802</sup> *Id.*

<sup>803</sup> *Id.*

1997–2007,<sup>804</sup> but the high costs of petroleum-based fuel resulted in consumption falling 6% in 2008.<sup>805</sup>

*B. Cap and Trade*<sup>806</sup>

Market-based mechanisms usually focus on limiting emissions or limiting compliance costs.<sup>807</sup> Tradable permits set emission limits using an industry-wide or geographical cap.<sup>808</sup> The cap's emissions reduction target can be met by those with the lowest compliance costs, and the trading mechanism allows the costs of over-compliance by specific sources to be recouped through the sale of carbon credits to those who choose not to reduce emissions because their compliance costs are higher than the cost of carbon credits.<sup>809</sup> This allows the cap to be met at the lowest total cost.<sup>810</sup> Tradable permits have predictable emission reductions but unknown costs.<sup>811</sup> Emission taxes, however, impose a predictable cost, but the marketplace determines the extent to which emissions are reduced.<sup>812</sup>

In the United States, emissions trading programs have been used since the 1970s when EPA recognized the use of netting, offsets, bubbles, and banking as appropriate tools for stationary sources to meet CAA requirements.<sup>813</sup> Subsequently, modifications to the CAA used emissions trading as part of the program to control lead in gasoline.<sup>814</sup> The most important emissions trading program is the acid rain program enacted in 1990 that limits SO<sub>2</sub> emissions.<sup>815</sup> However, tradable permits are a more

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<sup>804</sup> See DAVIS ET AL., *supra* note 3, at 1-5 tbl.1.4.

<sup>805</sup> See *id.*

<sup>806</sup> Portions of Part VI.B are derived from Reitze, *supra* note 29.

<sup>807</sup> LARRY PARKER, CONG. RESEARCH SERV., GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS—COST-LIMITING SAFETY VALVES CRS-2 (2004), available at [https://www.policyarchive.org/bitstream/handle/10207/3534/RS21067\\_20041222.pdf?sequence=1](https://www.policyarchive.org/bitstream/handle/10207/3534/RS21067_20041222.pdf?sequence=1) [hereinafter GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS].

<sup>808</sup> See *id.*

<sup>809</sup> See David Harrison Jr., et al., *Using Emissions Trading to Combat Climate Change: Programs and Key Issues*, 38 ENVTL. L. REP. (Envtl. Law Inst.) 10367, 10368 (June 2008).

<sup>810</sup> See *id.*

<sup>811</sup> See *id.*; GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS, *supra* note 807, at CRS-2 to CRS-3.

<sup>812</sup> GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS, *supra* note 807, at CRS-3.

<sup>813</sup> See A. DENNY ELLERMAN & DAVID HARRISON, JR., PEW CENTER ON GLOBAL CLIMATE CHANGE, EMISSIONS TRADING IN THE U.S. 8 (2003).

<sup>814</sup> See, e.g., Regulation of Fuels and Fuel Additives; Banking of Lead Rights, 50 Fed. Reg. 13,116 (1985) (codified at 40 C.F.R. pt. 80).

<sup>815</sup> See 42 U.S.C. §§ 7651(b) (2006); see also Harrison et al., *supra* note 809, at 10370.

rational approach for SO<sub>2</sub> control, where costs and benefits can be more accurately estimated than for CO<sub>2</sub> control, where costs and benefits are often unknown and are heavily influenced by modeling assumptions.<sup>816</sup>

It is unlikely that the EPA could legally implement a tax-based program to control GHGs using its existing statutory authority.<sup>817</sup> It probably would have to use cap-and-trade if it seeks to utilize an economic approach. Cap-and-trade programs, however, are also a suspect class since the U.S. Court of Appeals for the D.C. Circuit, on July 11, 2008, vacated EPA's Clean Interstate ("CAIR") rule that included a cap-and-trade program for nitrogen oxides.<sup>818</sup> On December 23, 2008, the court modified vacatur to a remand to the EPA to cure the fundamental flaws identified by the court in its July 11th opinion without imposing a schedule for revising the rule.<sup>819</sup> If a cap-and-trade program for controlling carbon emissions could be promulgated that would withstand judicial scrutiny, presumably it would be "similar to the program used to control sulfur dioxide under the CAA's Subchapter IV."<sup>820</sup> This program is a closed system that imposes an emissions limit on a group of sources, primarily fossil-fueled electric power plants, and each source is allocated a portion of the overall emissions cap, called allowances, that it can use to cover its emissions, or it may sell its excess allowances.<sup>821</sup>

In the United States, a cap-and-trade program probably could work for a limited number of stationary CO<sub>2</sub> sources, but it would be impractical to try to include all stationary sources in a program.<sup>822</sup> A cap-and-trade program could be imposed downstream on major emission sources, or it could be imposed upstream on fuels at the source of the supply.<sup>823</sup> Because

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<sup>816</sup> See GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS, *supra* note 807, at CRS-3; see also Harrison et al., *supra* note 809, at 10370.

<sup>817</sup> Arnold W. Reitze, Jr., *Controlling Greenhouse Gas Emissions From Mobile Sources—Massachusetts v. EPA*, 37 ENVTL. L. REP. (Envtl. Law Inst.) 10535, 10538 (July 2007); see also Karen Campbell & David Kreutzer, *CO<sub>2</sub>-Emission Cuts: The Economic Costs of the EPA's ANPR Regulations*, HERITAGE FOUND., Oct. 29, 2008, <http://www.heritage.org/Research/Reports/2008/10/CO2-Emission-Cuts-The-Economic-Costs-of-the-EPAs-ANPR-Regulations>.

<sup>818</sup> See *North Carolina v. EPA*, 531 F.3d 896, 929–30 (D.C. Cir. 2008).

<sup>819</sup> *North Carolina v. EPA*, 550 F.3d 1176, 1178–79 (D.C. Cir. 2008).

<sup>820</sup> See generally CAA §§ 401–406, 42 U.S.C. §§ 7651–7651e (2006); Reitze, *supra* note 817, at 10538; see also GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS, *supra* note 807, at CRS-3.

<sup>821</sup> See CAA §§ 401–402.

<sup>822</sup> See Robert R. Nordhaus, *New Wine in Old Bottles: The Feasibility of Greenhouse Gas Regulation Under the Clean Air Act*, 15 N.Y.U. ENVTL. L.J. 53, 70–71 (2007).

<sup>823</sup> See *id.* at 71.

of the large number of mobile sources, an emissions cap for motor vehicle carbon emissions would most likely be imposed upstream at the refinery in order to be manageable.<sup>824</sup> Natural gas also could be controlled at the point of distribution. When there are few sources, such as fossil-fueled electric power plants, a downstream approach is effective.<sup>825</sup>

Alternatively, a nationwide cap on gasoline consumption could be imposed where individuals would be given the right to buy a specified amount of gasoline,<sup>826</sup> which they could use or sell to anyone seeking to obtain more gasoline than they were authorized to purchase. This would be similar to the rationing of gasoline used during World War II.<sup>827</sup> In Europe, a cap-and-trade system is used that appears to be “ineffective, unwieldy, and prone to gaming and cheating.”<sup>828</sup> Nevertheless, the European Union is committed to cap-and-trade.<sup>829</sup> One important change that is being proposed in Europe is to have all allowances auctioned by 2020 because of the windfall profits garnered by electric generators in the first phase of the Emissions Trading Scheme (“ETS”) from 2005 to 2007.<sup>830</sup> In 2006, the price of “carbon dioxide allowances in the European Union’s [ETS] fell to nearly zero . . . [and is] expected to remain depressed until 2010 . . . .”<sup>831</sup>

Many of the proposed cap-and-trade programs include a safety valve provision that is designed to deal with unacceptable prices for allowances.<sup>832</sup> When a trigger value is reached, additional allowances become available, or some other mechanism is used to lower the cost of allowances.<sup>833</sup> The effect of the safety valve is to make a cap-and-trade

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<sup>824</sup> See *id.* at 70.

<sup>825</sup> See *id.* at 65–66, 71.

<sup>826</sup> See *Energy: Rationing, Tax—or White Market?*, TIME, Dec. 3, 1973, <http://www.time.com/time/printout/0,8816,908220,00.html> (discussing possible gas rationing in the 1970s).

<sup>827</sup> See *id.*

<sup>828</sup> Fareed Zakaria, *In Search of a Better Kyoto*, WASH. POST, Apr. 9, 2007, at A13.

<sup>829</sup> See generally Directive 275/32, Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community, 2003 O.J. (L275) 87 (2003), available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:EN:PDF> (noting the 2003 EU legislation establishing a cap-and-trade program); see Stephen Gardner, *EU Parliament, Council Making Progress on Post-2012 Emissions Trading Scheme*, 38 ENV'T REP. (BNA) 1417 (July 11, 2008) (detailing the EU's commitment to the program).

<sup>830</sup> See Gardner, *supra* note 829.

<sup>831</sup> Andrew Childers, *Trading of Carbon Credits Called Preferable to Carbon Tax Despite Economic Downturn*, 40 ENV'T REP. (BNA) No. 614 (Mar. 20, 2009).

<sup>832</sup> See GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS, *supra* note 807, at CRS-3.

<sup>833</sup> See Leora Falk, *With Limits, Cap-and-Trade Is Feasible Economically, Environmentally, Authors Say*, 39 ENV'T REP. (BNA) 1733 (Sept. 5, 2008).

system similar to a carbon tax without having the program designated as a tax.<sup>834</sup>

For many years, cap-and-trade bills have been introduced in Congress, but legislation has not yet been enacted.<sup>835</sup> However, even without legislation, the Chicago Climate Exchange is selling carbon credits.<sup>836</sup> In January 2009, they were selling for \$6.30–\$7.00 per ton.<sup>837</sup> The major effort to implement emissions trading for GHGs has been at the state level, particularly in the states that are part of the regional organizations in the Northeast’s RGGI and the West’s Western Climate Initiative (“WCI”).<sup>838</sup>

In the United States, more than 600 companies “develop, market, or sell carbon offsets,” and more than 200 projects qualified for the awarding of offsets in 2007.<sup>839</sup> However, the federal government plays only a limited role in supervising this market, and consumer protection is limited or nonexistent.<sup>840</sup> A major beneficiary of a nationally mandated cap-and-trade program would be the financial services industry. Allowing that industry access to handle the sale of allowances needed to use fossil fuel in what could be a trillion dollar market<sup>841</sup> could lead to the next market manipulation disaster. It is highly probable that traders will learn to game the system to yield maximum benefits for the traders who are likely to be many of the same players that sold mortgage-backed derivatives.<sup>842</sup>

<sup>834</sup> See *id.*; see GLOBAL CLIMATE CHANGE: CONTROLLING CO<sub>2</sub> EMISSIONS, *supra* note 807, at CRS-3.

<sup>835</sup> See generally Climate Action in Congress, 111th Congress, [http://www.pewclimate.org/what\\_s\\_being\\_done/in\\_the\\_congress](http://www.pewclimate.org/what_s_being_done/in_the_congress) (last visited January 24, 2010). See generally *Economy-wide Cap-and-Trade Proposals in the 110th Congress*, PEW CENTER FOR GLOBAL CLIMATE CHANGE (2008), <http://www.pewclimate.org/docUploads/Chart-and-Graph-120108.pdf>.

<sup>836</sup> See Marlon B. Allen, *Voluntary Emissions Trading Program to Begin by Mid-2001, Program Official Says*, 32 ENV’T REP. (BNA) 1032 (May, 25, 2001).

<sup>837</sup> See Kristen Moulton, *Landfills Bring ‘Green’ Cash in N. Utah*, THE SALT LAKE TRIB., Jan. 20, 2009.

<sup>838</sup> See Regional Greenhouse Gas Initiative, <http://www.rggi.org> (last visited Jan. 12, 2010); Western Climate Initiative, <http://www.westernclimateinitiative.org/organization> (last visited Jan. 12, 2010).

<sup>839</sup> U.S. GOV’T ACCOUNTABILITY OFFICE, GA0-08-1048, CARBON OFFSETS: THE U.S. VOLUNTARY MARKET IS GROWING, BUT QUALITY ASSURANCE POSES CHALLENGES FOR MARKET PARTICIPANTS 7, 14 fig.4 (2008), available at <http://www.gao.gov/new.items/d081048.pdf>.

<sup>840</sup> See *id.*

<sup>841</sup> See Matt Taibbi, *The Great American Bubble Machine*, ROLLING STONE, July 2009, [http://www.rollingstone.com/politics/story/29127316/the\\_great\\_american\\_bubble\\_machine](http://www.rollingstone.com/politics/story/29127316/the_great_american_bubble_machine).

<sup>842</sup> See William O’Keefe, *Cap and Trade is a License to Steal and Cheat*, S.F. EXAMINER, May 19, 2009, [http://www.sfexaminer.com/opinion/columns/oped\\_contributors/Cap-and-trade-is-a-license-to-cheat-and-steal-45371937.htm](http://www.sfexaminer.com/opinion/columns/oped_contributors/Cap-and-trade-is-a-license-to-cheat-and-steal-45371937.htm).

A cap-and-trade program appears to be more politically acceptable than a revenue neutral carbon tax, but it will have high transaction costs, be more complex, and is unlikely to be revenue neutral.<sup>843</sup> Such a program could lead to a massive transfer of wealth if Congress imposes what is effectively a high tax on energy by using CO<sub>2</sub> allowances to fund programs to benefit those with the political clout.<sup>844</sup> A cap-and-trade program also involves the creation of a cap that, if inadequate to protect the environment, will delay the imposition of an effective program, which in the case of climate change could have catastrophic consequences.<sup>845</sup>

1. H.R. 2454

On March 31, 2009, the new House Energy and Commerce Committee Chairman Henry Waxman (D-CA) and the subcommittee chairman Edward Markey (D-MA) released a draft energy and climate change bill.<sup>846</sup> It called for a twenty percent reduction in GHG emissions from 2005 levels by 2020, compared to the fourteen percent reduction called for by President Obama.<sup>847</sup> The Waxman-Markey draft provided for a cap-and-trade program, but did not specify how allowances would be distributed or how the revenues raised would be utilized.<sup>848</sup> Because the fuel used to generate electricity varies throughout the nation, a cap-and-trade program would have the most impact on areas of the country using coal.<sup>849</sup>

The decision to make Rep. Henry Waxman (D-CA) the chairman of the Energy and Commerce Committee put a strong advocate for climate change legislation on an important committee.<sup>850</sup> But, several important

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<sup>843</sup> See Daniel C. Matisoff, *Making Cap-and-Trade Work: Lessons From the European Union Experience*, ENV'T, Jan.–Feb. 2010, available at <http://www.environmentmagazine.org/Archives/Back%20Issues/January-February%202010/making-cap-full.html>.

<sup>844</sup> See J.R. DeShazo & Jody Freeman, *Timing and Form of Federal Regulation: The Case of Climate Change*, 155 U. PA. L. REV. 1499, 1550–52 (2007).

<sup>845</sup> See Harrison et al., *supra* note 809, at 10376–77.

<sup>846</sup> H.R. Committee on Energy and Commerce, *Chairmen Waxman, Markey Release Discussion Draft of New Clean Energy Legislation* (Mar. 31, 2009), [http://energycommerce.house.gov/index.php?option=com\\_content&task=view&id=1560](http://energycommerce.house.gov/index.php?option=com_content&task=view&id=1560); H.R. 2454, 111th Cong. (2009), available at [http://energycommerce.house.gov/Press\\_111/20090331/acesa\\_discussion\\_draft.pdf](http://energycommerce.house.gov/Press_111/20090331/acesa_discussion_draft.pdf).

<sup>847</sup> Dean Scott, *Waxman Draft Offers Steep Emissions Cuts; Markey Panel to Begin in Late April*, 40 ENV'T REP. (BNA) 745 (Apr. 3, 2009).

<sup>848</sup> *Id.*

<sup>849</sup> *See id.*

<sup>850</sup> *Waxman Win May Upend Industry Climate Legislation Strategy*, 19 CLEAN AIR REP. (InsideEPA.com) 24 (Nov. 28, 2008).

obstacles to enacting a GHG control program have materialized because of the 2008 economic meltdown. First, a cap-and-trade program being advocated by the Democratic majority will have the effect of a massive tax increase at a time when the stimulus package is cutting taxes in the hope that this action will expand the economy.<sup>851</sup> Second, a cap-and-trade program will involve the financial services industry playing an important role in the trading of allowances,<sup>852</sup> and it creates the possibility of another expensive manipulation of the energy market such as what occurred in the Enron fiasco.<sup>853</sup> James Hansen, NASA's chief climate scientist, has said cap-and-trade "generates special interests, lobbyists, and trading schemes, yielding non productive millionaires, all at the public expense."<sup>854</sup> Moreover, according to Hansen, the cap can be expected to be relaxed when an electric utility claims a blackout is forthcoming.<sup>855</sup> Third, increasing the cost of using carbon-based fuels is a desirable policy, but the increase should not be used to enrich the energy industry by giving away allowances or to create large semi-permanent subsidies for the energy industry. Climate change legislation should not be a vehicle for raising money for wealth transfer programs.

The House Committee on Energy and Commerce reported ACES on June 5, 2009.<sup>856</sup> The bill, also known as the Waxman-Markey bill, was introduced May 15, 2009, "to create clean energy jobs, achieve energy independence, reduce global warming pollution and transition to a clean energy economy."<sup>857</sup> During the Committee's consideration, ninety-four amendments were offered, and thirty-six were adopted.<sup>858</sup> On June 26, 2009,

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<sup>851</sup> See Richard J. Pierce, Jr., *Energy Independence and Global Warming*, 37 ENVTL. L. 595, 601 (2007).

<sup>852</sup> See Harrison et al., *supra* note 809, at 10377–378; see HARRISON & ELLERMAN, *supra* note 813, at 37.

<sup>853</sup> William O'Keefe, *Next Bernie Madoff? Emissions Cap-and-Trade Aids the Corrupt, Hurts the Little Guy*, U.S. NEWS & WORLD REP., Apr. 13, 2009, <http://www.usnews.com/articles/opinion/2009/04/13/next-bernie-madoff-emissions-cap-and-trade-aids-the-corrupt-hurts-the-little-guy.html>.

<sup>854</sup> Letter from James Hansen, Dir., NASA Goddard Inst. for Space Studies, to Barack Obama, U.S. President, and Michelle Obama, U.S. First Lady (Dec. 29, 2008), available at [http://www.columbia.edu/~jeh1/mailings/2008/20081229\\_DearMichelleAndBarack.pdf](http://www.columbia.edu/~jeh1/mailings/2008/20081229_DearMichelleAndBarack.pdf).

<sup>855</sup> Leora Falk, *NASA Scientist Says Obama Should Consider Tax on Fuels, Derides Cap-and-Trade Plan*, 40 ENV'T REP. (BNA) 56 (Jan. 9, 2009).

<sup>856</sup> American Clean Energy and Security Act of 2009, H.R. REP. NO. 111–137 (2009). See generally Richard D. Stoll, *House Climate Bill Mandates Many EPA Rulemakings With Tight Deadlines*, 40 ENV'T REP. (BNA) 1672 (July 10, 2009) (discussing the H.R. 2454 proposals and impacts).

<sup>857</sup> *Id.* at 1.

<sup>858</sup> *Id.* at 426.

the House approved the bill by a vote of 219 to 212.<sup>859</sup> Eight Republicans voted for ACES, but forty-four Democrats did not.<sup>860</sup> The debate then moved to the Senate.

This legislation creates a new CAA title seven.<sup>861</sup> Section 702 of the proposed amendment to the CAA would provide for reduction goals of 3% below 2005 emissions of GHGs by 2012; 20% by 2020; 42% by 2030; and 83% by 2050.<sup>862</sup> Section 703 would provide almost the same goal for sources subject to the cap-and-trade program, but the 2020 goal is a 17% reduction.<sup>863</sup> These goals, however, are compromised by other sections of the bill providing for emissions offsets and cost containment mechanisms.<sup>864</sup> In addition, section 721 allocates allowances in a manner that appears to be inconsistent with the goals of sections 701 and 702.<sup>865</sup>

ACES has five titles containing subtitles.<sup>866</sup> Title I focuses on clean energy.<sup>867</sup> Subtitle A of Title I provides a combined efficiency and renewable electricity standard for electric power generators that imposes a six percent requirement in 2012 and gradually rises to twenty percent in 2020.<sup>868</sup> At least seventy-five percent of the requirement is to be met using renewable energy, but the Federal Energy Regulatory Commission can increase the percentage from energy savings and decrease the percentage required to be generated from renewable energy.<sup>869</sup> A governor also may petition to adjust the percentage requirement.<sup>870</sup> Subtitle B includes the carbon capture and sequestration program that is discussed in Section 2(c) below.<sup>871</sup> ACES Section 335 includes a new CAA Section 861 that preempts state cap-and-trade programs from 2012 to 2017, but it does not preempt

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<sup>859</sup> 155 CONG. REC. H7686 (daily ed. June 26, 2009).

<sup>860</sup> U.S. House of Representatives, Clerk of the House, *Final Vote Results for Roll Call 477*, June 16, 2009, available at <http://clerk.house.gov/evs/2009/roll477.xml>.

<sup>861</sup> H.R. 2454 § 311.

<sup>862</sup> *Id.* (proposed CAA § 702).

<sup>863</sup> *Id.* (proposed CAA § 703).

<sup>864</sup> *See, e.g., id.* § 311 (proposed CAA § 726 on the Strategic Reserve Auctions); *see also Cost-Containment and Offset Use in the American Clean Energy and Security Act (Waxman-Markey)* (Pew Center on Global Climate Change, Climate Policy Memo No. 6, 2009), available at <http://www.pewclimate.org/docUploads/policymemo6-cost-containment-offsets-sept2009.pdf>.

<sup>865</sup> *See* H.R. 2454 § 311 (proposed CAA § 721).

<sup>866</sup> *See id.* § 1.

<sup>867</sup> *See id.* § 101.

<sup>868</sup> *Id.*

<sup>869</sup> *Id.*

<sup>870</sup> *Id.* § 101.

<sup>871</sup> *See* H.R. 2454 §§ 111–116.

state GHG caps that do not involve the use of tradeable instruments.<sup>872</sup> ACES Section 116 creates a new CAA Section 812 that imposes CO<sub>2</sub> emission requirements on new electric generating units initially permitted after January 1, 2009.<sup>873</sup> Subtitle C programs address clean transportation, including assistance for electric vehicle development.<sup>874</sup> Section 128 initially included a program that would give vouchers to subsidize the purchase of more fuel-efficient vehicles.<sup>875</sup> A vehicle would qualify if it provided very modest improvement in gas mileage. For example, a buyer would be able to receive a voucher worth \$3,500 for buying a vehicle that gets four miles to the gallon better mileage than the trade-in vehicle.<sup>876</sup> The program was eventually taken out of ACES, however, because the Car Allowance Rebate System, or Cash-for-Clunkers, was signed into law in June 2009 with \$1 billion authorized for the program.<sup>877</sup>

Subtitle E aims to improve the nation's electric power transmission grid,<sup>878</sup> and subtitle F provides for electric transmission planning.<sup>879</sup> Other Title I provisions provide for incentives for the nuclear energy industry,<sup>880</sup> advanced energy technologies support,<sup>881</sup> and various programs to develop new sources of useful energy.<sup>882</sup>

Title II provides support for energy efficiency programs that will impose standards on buildings, lighting efficiency, and appliance efficiency.<sup>883</sup> Subtitle C addresses transportation efficiency.<sup>884</sup> ACES Section 221 amends Title VIII of the CAA by inserting a new Part B—Mobile Sources Section.<sup>885</sup> CAA Section 821 would require the EPA to promulgate GHG emission standards for heavy-duty vehicles.<sup>886</sup> It would also continue the authority of the Secretary of Transportation to regulate the fuel efficiency of “the

<sup>872</sup> *See id.* § 335 (proposed CAA § 861).

<sup>873</sup> *Id.* § 116 (proposed CAA § 816).

<sup>874</sup> *See id.* §§ 121–130A.

<sup>875</sup> *See* H.R. Rep. No. 111-137, pt. 1, at 124–140 (2009).

<sup>876</sup> *Id.*

<sup>877</sup> *See* Consumer Assistance to Recycle and Save Act of 2009, Pub. L. No. 111-32, §§ 1301–1302, 123 Stat. 1859, 1909–1915 (2009) (to be codified at 49 U.S.C. 32901).

<sup>878</sup> *See* H.R. 2454 §§ 141–146.

<sup>879</sup> *See id.* §§ 147–153.

<sup>880</sup> *See id.* §§ 181–191.

<sup>881</sup> *See id.* §§ 111–116.

<sup>882</sup> *See* §§ 171–175, 195–196 (sections encouraging research and innovation).

<sup>883</sup> H.R. 2454 §§ 201–219.

<sup>884</sup> *See id.* §§ 221–224.

<sup>885</sup> *Id.* § 221.

<sup>886</sup> *Id.* (proposed CAA § 821).

commercial goods movement system.”<sup>887</sup> It also directs the Administrator of the EPA to regulate GHG emissions from non-road vehicles if they contribute significantly to the total GHG emissions from non-road engines, and emissions can be cost-effectively reduced.<sup>888</sup> CAA Section 841 imposes transportation planning requirements on the states to reduce GHG emissions.<sup>889</sup> The legislation does not deal in any detail with mobile source carbon emissions. It merely directs the EPA to regulate them, which is something the Agency has been working on for several years.<sup>890</sup> Subtitle D provides for industrial energy efficiency programs.<sup>891</sup>

Title III—Reducing Global Warming Pollution<sup>892</sup>—includes the cap-and-trade program discussed below.<sup>893</sup> Title IV focuses on transitioning to a clean energy economy by providing tax benefits, worker training and adjustment assistance, and other financial assistance to ease the impact of climate change.<sup>894</sup> It includes support for various programs aimed at adapting to climate change.<sup>895</sup> Title V includes discussion of agricultural and forestry offsets.<sup>896</sup>

#### a. Cap-and-Trade

The major GHG emissions reduction program is the cap-and-trade program. Title III amends the CAA to create a new Title VII—Global Warming Pollution Reduction Program.<sup>897</sup> It provides a cap-and-trade program that uses allowances to cap GHG emissions.<sup>898</sup> An allowance is an intangible asset issued by the EPA that allows the emission of one metric ton of CO<sub>2</sub> or its equivalent in other GHGs (mtCO<sub>2</sub>e).<sup>899</sup> By specifying the number of allowances and reducing the number over time,<sup>900</sup> the number of tons of GHG emissions that are allowed can be limited. GHGs

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<sup>887</sup> *Id.* (proposed CAA § 821(a)(4)).

<sup>888</sup> *Id.* (proposed CAA § 821(b)(1)).

<sup>889</sup> H.R. 2454 § 222(a) (proposed CAA § 841).

<sup>890</sup> *Id.* § 223 (proposed CAA § 822).

<sup>891</sup> *Id.* §§ 241–248.

<sup>892</sup> *See id.* §§ 301, 311–312.

<sup>893</sup> *Id.* § 311 (proposed Title VII of the CCA).

<sup>894</sup> *See id.* §§ 421–431; *see also* COST ESTIMATE, *supra* note 552, at 24.

<sup>895</sup> *See* H.R. 2454 §§ 421–495.

<sup>896</sup> *See id.* §§ 502–553.

<sup>897</sup> *Id.* § 311 (proposed CAA Title VII, §§ 721–743).

<sup>898</sup> *Id.* (proposed CAA § 701(b)).

<sup>899</sup> *See id.* § 312 (proposed CAA § 700(5)).

<sup>900</sup> *See id.* § 311 (proposed CAA § 721(e)(1)).

are defined as carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, perfluorocarbons, nitrogen trifluoride, and hydrofluorocarbons (“HFCs”) from a chemical manufacturing process at an industrial stationary source.<sup>901</sup> HFCs, however, are regulated in a different manner than the other GHGs based on a new CAA Section 619.<sup>902</sup>

Cap-and-trade applies to about 7,400 covered entities.<sup>903</sup> Covered entities are defined to include: most electric generators; stationary sources that produce or import petroleum, coal-based liquids, petroleum coke, or natural gas liquid that when combusted will emit more than 25,000 mtCO<sub>2</sub>e; geologic sequestration sites; industrial facilities; and natural gas distributors.<sup>904</sup> The first three categories must submit allowances by 2012,<sup>905</sup> industrial facilities are given until 2014,<sup>906</sup> and natural gas distributors are subject to the need for allowances beginning in 2016.<sup>907</sup> It is expected that the allowance programs will cover about 72% of U.S. GHG emissions in 2012, 78% in 2015, and 86% in 2020.<sup>908</sup> The cap-and-trade requirements for stationary sources are to be implemented using permits issued under CAA Subchapter V.<sup>909</sup>

The allowance program begins in 2012 with 4,627 million mtCO<sub>2</sub>e of allowances,<sup>910</sup> which the CBO says is about 97% of the 2005 emissions from covered entities.<sup>911</sup> Allowances increase until 2016 to account for increases in the number of covered entities and then decrease until 2050 when allowances are 22.4% of the number allocated in 2012.<sup>912</sup> Until the year 2023, however, the allowances do not drop below the number provided in 2012, and it will be 2029 before emission reductions are to exceed a 20% reduction of the 2012 allowable emissions.<sup>913</sup>

An extensive program is provided to allow the use of offset credits to meet GHG reduction requirements. Another program is provided to

<sup>901</sup> H.R. 2454 § 312 (proposed CAA § 700(13)(C)).

<sup>902</sup> *See id.* § 332 (proposed CAA § 619); *see also* COST ESTIMATE, *supra* note 552, at 4.

<sup>903</sup> COST ESTIMATE, *supra* note 552, at 4.

<sup>904</sup> *See* H.R. 2454 § 312 (proposed CAA § 700(13)).

<sup>905</sup> *Id.* § 311 (proposed CAA § 722(a)–(b)).

<sup>906</sup> *Id.* (proposed CAA § 722(a),(c)).

<sup>907</sup> *Id.* (proposed CAA § 722(a),(c)).

<sup>908</sup> COST ESTIMATE, *supra* note 552, at 5.

<sup>909</sup> H.R. 2454 § 311 (proposed CAA § 727).

<sup>910</sup> *See id.* § 311 (proposed CAA § 721(e)).

<sup>911</sup> COST ESTIMATE, *supra* note 552, at 5. In 2007, the U.S. emissions from fossil fuel combustion were 5735.8 million metric tons. INVENTORY, *supra* note 5, at ES-5.

<sup>912</sup> *See* H.R. 2454 § 311 (proposed CAA § 721(e)).

<sup>913</sup> *See id.* § 311 (proposed CAA § 721(e)) (calculated from data).

provide supplemental emissions reduction from reduced deforestation.<sup>914</sup> This agriculture and forestry offsets program is being criticized by environmental organizations because it gives the Department of Agriculture the lead role and appears to lack the accountability provision needed to ensure the program's integrity.<sup>915</sup>

The separate cap-and-trade program applicable to HFC producers and importers is to commence in 2012,<sup>916</sup> and the allowances would "decline from 90% of the baseline" of the 2004–2006 consumption and imports "to 15% of that baseline after 2032."<sup>917</sup> However, unlike the GHG cap-and-trade program, all allowances would be auctioned or offered at a fixed price.<sup>918</sup>

b. Funding Energy Programs<sup>919</sup>

ACES would allow GHG emitters to avoid emission reductions if they hold enough allowances.<sup>920</sup> Emissions in excess of the covered entities emissions allowances are prohibited, and penalties for violation are provided.<sup>921</sup> Once an allowance is received it can be used, traded, or banked, which makes it a valuable asset that the federal government is giving away or selling in order to fund a shift to new forms of useable energy.<sup>922</sup> The size of the projected expenditures to accomplish the goals of ACES is estimated by the CBO to be \$821 billion over 2010–2019.<sup>923</sup> The ultimate costs can be expected to be much more because the program runs until at least 2050.<sup>924</sup> In addition, the cost to state and local governments and the private sector to meet unfunded mandates is estimated at \$69 million and \$139 million a year, respectively, and is expected to increase over time due to inflation.<sup>925</sup> This estimate appears to be unrealistically low.

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<sup>914</sup> See *id.* § 311 (proposed CAA §§ 751–756).

<sup>915</sup> Doug Obey, *EDF Seeks Air Act-Caliber Safeguards for GHG Offset Program*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 27 (July 29, 2009).

<sup>916</sup> H.R. 2454 § 332 (proposed CAA § 619(b)(1)(a)).

<sup>917</sup> COST ESTIMATE, *supra* note 552, at 7; see also H.R. 2454 § 332 (proposed CAA § 619(b)(2)).

<sup>918</sup> COST ESTIMATE, *supra* note 552, at 7; see also H.R. 2454 § 332 (proposed CAA § 619(b)(4)).

<sup>919</sup> Portions of this section are derived from Arnold Reitze, Jr., *Clean Energy and Security Act Shifts Wealth*, SALT LAKE TRIB., July 31, 2009, available at [http://www.sltrib.com/ci\\_12969172](http://www.sltrib.com/ci_12969172).

<sup>920</sup> COST ESTIMATE, *supra* note 552, at 14.

<sup>921</sup> H.R. 2454 § 311 (proposed CAA § 723).

<sup>922</sup> See *id.* § 311 (proposed CAA §§ 724–725).

<sup>923</sup> COST ESTIMATE, *supra* note 552, at 2.

<sup>924</sup> See H.R. 2454 § 311 (proposed CAA § 721(e)).

<sup>925</sup> COST ESTIMATE, *supra* note 552, at 2.

The legislation provides for 70.4% of the allowances to be freely allocated in 2012, and this will increase to 82.5% in 2019.<sup>926</sup> The remaining 29.6% to 17.5% of the allowances are to be auctioned.<sup>927</sup> The money generated for the government from auction proceeds is estimated to be an average of \$21 billion per year over ten years.<sup>928</sup> On June 2, 2009, “[t]he House Committee on Energy and Commerce estimate[d] the total value of allowances [from] 2010 [through] 2019 at approximately \$825 billion”<sup>929</sup> and would range from \$60 billion in 2012 to \$113 billion in 2025.<sup>930</sup> The CBO estimates that the secondary market for allowances distributed for free will exceed \$60 billion in 2012, and the value should increase over time.<sup>931</sup>

The bill specifies the percentage of the allowances to be freely distributed to various classes of recipients.<sup>932</sup> About 75% of the allowances are to be distributed in a manner that will have no direct effect in reducing GHG emissions.<sup>933</sup> Electric utilities are to receive 43.7% of the allowances in 2012 and 2013, which declines to 35% in 2016 to 2025.<sup>934</sup> The natural gas industry receives 9% of the allowances from 2016 to 2025.<sup>935</sup> Some or most of the value of these allowances is to be returned to consumers as specified in regulations that are to be promulgated by the states.<sup>936</sup> These rebates will not necessarily go to those that pay higher energy costs. Energy intensive industries receive 2% to 15% of the allowances through

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<sup>926</sup> *Id.* at 6 tbl.1; see H.R. 2454 § 311 (proposed CAA § 726) (discussing strategic reserve auctions).

<sup>927</sup> COST ESTIMATE, *supra* note 552, at 6 tbl.1.1; see H.R. 2454 § 311 (proposed CAA § 726).

<sup>928</sup> COST ESTIMATE, *supra* note 552, at 26 tbl.4 (noting the net revenues from auctioned allowances).

<sup>929</sup> Reitze, *supra* note 919.

<sup>930</sup> H.R. COMMITTEE ON ENERGY AND COMMERCE, THE AMERICAN ENERGY AND SECURITY ACT (H.R. 2454) 4 (June 2, 2009), available at [http://energycommerce.house.gov/Press\\_111/20090602/hr2454\\_reported\\_summary.pdf](http://energycommerce.house.gov/Press_111/20090602/hr2454_reported_summary.pdf) [hereinafter COMMITTEE ON ENERGY AND COMMERCE].

<sup>931</sup> COST ESTIMATE, *supra* note 552, at 11.

<sup>932</sup> See American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. H.R. 2454 § 321 (2009) (proposed be CAA § 782).

<sup>933</sup> *Distribution of Allowances under the American Clean Energy and Security Act (Waxman-Markey)* 1 (Pew Center on Global Climate Change, Climate Policy Memo No. 4, 2009), available at <http://www.pewclimate.org/docUploads/policy-memo-allowance-distribution-under-waxman-markey.pdf> [hereinafter *Distributions of Allowances*].

<sup>934</sup> H.R. 2454 § 321 (2009) (proposed CAA § 782(a)).

<sup>935</sup> *Id.* § 321 (proposed CAA § 782(b)).

<sup>936</sup> See *id.* § 321 (proposed CAA § 782, 789); see also *Distributions of Allowances*, *supra* note 933, at 2.

2014.<sup>937</sup> Consumers of home heating oil or propane are to receive 1.875% to 1.5% of the allowances.<sup>938</sup> Oil refineries receive 2% of the allowances.<sup>939</sup>

Tax credits funded by 15% of the allowances are to be provided to approximately 20% of the people with the lowest incomes.<sup>940</sup> Federal payments are to be made to a single person with an income of \$23,000 or less; for a family with two or more children, benefits are available if their income is \$42,000 or less.<sup>941</sup> “The Joint Committee on Taxation estimates the credit will cost \$83 billion over the 2009–2019 period.”<sup>942</sup>

About \$600 billion in allowances constitutes wealth redistribution without meaningful environmental benefits.<sup>943</sup> Only about 20% of the money from the sale of allowances is for programs to reduce CO<sub>2</sub> emissions.<sup>944</sup> Energy efficiency and renewable energy programs receive 9.5% to 6.5% of the allowances.<sup>945</sup> Carbon sequestration and storage programs receive 1.75% to 4.75% of the allowances.<sup>946</sup> International programs, including programs to prevent deforestation, receive 2% of the allowances.<sup>947</sup> Advanced automobile technologies receive 3% to 1% allowances.<sup>948</sup> Approximately 2.7% of the allowances are for domestic adaptation measures, wildlife and natural resource mitigation efforts, and energy innovation.<sup>949</sup> This legislation does not impose obligations on the recipients of the free allowances.

Other than identifying categories for allowances, the legislation provides little information concerning the details of the programs to be subsidized.<sup>950</sup> Americans are to pay billions of dollars without knowing what they are getting. This costly wealth transfer program will produce winners and losers, but the majority of Americans will be losers. Among the winners will be Exelon, which expects to net nearly \$1 billion a year

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<sup>937</sup> H.R. 2454 § 321 (proposed CAA § 782(e)).

<sup>938</sup> *Id.* § 321 (proposed CAA § 782(c)).

<sup>939</sup> *Id.* § 321 (proposed CAA § 782(j)).

<sup>940</sup> *Id.* § 321 (proposed CAA § 782(d)), § 431 (proposed § 2201 of the Social Security Act, 42 U.S.C. 201).

<sup>941</sup> COST ESTIMATE, *supra* note 552, at 20–21; *see* H.R. 2454 § 431 (proposed § 2201 of the Social Security Act, 42 U.S.C. 201); *see* Annual Update of the HHS Poverty Guidelines, 74 Fed. Reg. 4199, 4199–4201 (Jan. 23, 2009).

<sup>942</sup> COST ESTIMATE, *supra* note 552, at 21.

<sup>943</sup> *Id.* at 26.

<sup>944</sup> *See* H.R. § 321 (proposed CAA § 782(f)–(i), (l)–(o), (u)).

<sup>945</sup> *Id.* § 321 (proposed CAA § 782(g)) (through 2016).

<sup>946</sup> *Id.* § 321 (proposed CAA § 782(f)) (through 2019).

<sup>947</sup> *Id.* § 321 (proposed CAA § 782(n)–(o)).

<sup>948</sup> *Id.* § 321 (proposed CAA § 782(i)) (through 2025).

<sup>949</sup> *Id.* § 321 (proposed CAA § 782(l)–(m), (u)).

<sup>950</sup> *See generally* H.R. 2454 § 321 (proposed CAA § 782).

from emissions trading.<sup>951</sup> Unfortunately, the sacrifice of most Americans will not produce proportional environmental improvement.

## 2. S. 1462

The Senate, until 2009, has been more receptive to enacting climate change legislation than the House, but that appears to have changed. The Lieberman-Warner Climate Security Act, S. 2191,<sup>952</sup> was the first cap-and-trade bill to survive the committee process and make it to the Senate floor,<sup>953</sup> but it died in a procedural motion in 2008 by a vote of forty-eight to thirty-six.<sup>954</sup> ACES is more stringent than the Lieberman-Warner Climate Security Act that was defeated in 2008.<sup>955</sup>

On April 1, 2009, Senator Reid announced he would take up the climate change legislation being developed in the House rather than developing a separate bill because it was taking too long to get a bill out of committee.<sup>956</sup> Senator Byron Dorgan (D-ND), the chairman of the Senate Democratic Policy Committee, however, is leading the effort to separate cap-and-trade from energy legislation and wants to advance S. 1462, the American Clean Energy Leadership Act.<sup>957</sup> Six Senate committees have jurisdiction over climate change legislation: Finance, Commerce, Agriculture, Foreign Relations, Environment and Public Works, and Energy and Natural Resources.<sup>958</sup>

Among the areas of concern for the Senate is Section 767 of ACES, which provides for possible penalties for imports after 2018 for nations that do not have controls on GHGs that meet U.S. standards.<sup>959</sup> This raises

<sup>951</sup> Charles Davis, *Companies Form New Group To Lobby for Quick Action on Climate Bill*, 20 CLEAN AIR REP. (InsideEPA.com) 21 (Oct. 15, 2009).

<sup>952</sup> S. 2191, 110th Cong. (2008).

<sup>953</sup> PEW CENTER FOR GLOBAL CLIMATE CHANGE, STATUS OF SENATE BILL 2191, THE LIEBERMAN-WARNER CLIMATE SECURITY ACT 1 (2007), available at [http://www.pewclimate.org/docUploads/l-w\\_markup\\_final.pdf](http://www.pewclimate.org/docUploads/l-w_markup_final.pdf).

<sup>954</sup> Charles Davis, *Short-Lived Senate Climate Debate Sets Stage for Future Talks*, 25 ENVTL. POL'Y ALERT (InsideEPA.com) 13 (June 18, 2008).

<sup>955</sup> Compare S. 2191 § 1201 (capping allowances to 1,732 by 2050), with H.R. 2454 § 311 (proposed CAA § 702(4)) (capping allowances to 1,035 by 2050).

<sup>956</sup> Siobhan Hughes, *Senate to Take Up Climate Bill*, WALL ST. J., Apr. 1, 2009, <http://online.wsj.com/article/SB123861206944979213.html>.

<sup>957</sup> Lynn Garner, *Dorgan Wants Separate Energy, Climate Bills, Says Carbon Trading Markets Ripe for Abuse*, 40 ENV'T REP. (BNA) 1754 (July 24, 2009); S. 1462, 111th Cong. (2009).

<sup>958</sup> See Alexander Bolton & Ben Geman, *Chairmen Split Over Climate Bill*, THE HILL, Nov. 17, 2009, <http://thehill.com/homenews/senate/68265-chairmen-split-over-climate-bill>.

<sup>959</sup> H.R. 2454 § 767 (proposed CAA § 767).

concern that other countries will retaliate under World Trade Organization rules.<sup>960</sup> Other Senators, however, are concerned that cap-and-trade will lead to the exporting of American jobs to countries without GHG controls.<sup>961</sup>

Another issue of concern is the agency that will supervise the allowance and offset market. The House Bill makes the Federal Energy Regulatory Commission ("FERC") the primary regulator, and the Commodity Futures Trading Commission ("CFTC") would regulate the derivatives market.<sup>962</sup> S. 1399,<sup>963</sup> introduced July 6, 2009, would make the CFTC the agency with primary oversight over the climate change market.<sup>964</sup> The tax consequence of receiving free allowances under the cap-and-trade program is not found in the House Bill and should be clarified by the Senate if cap-and-trade legislation moves forward.<sup>965</sup> Presumably, they would be intangible, non-depreciable assets with a zero basis.<sup>966</sup> Another concern is that cap-and-trade will "create a massive market in carbon allowances and derivatives [that would lead to] market manipulation and speculation [and result in] severe volatility in electricity prices."<sup>967</sup> Some Senators are concerned that ACES allows older and dirtier plants to continue to operate with even less regulation than now exists.<sup>968</sup>

The Senate Committee of Energy and Natural Resources ("ENR Committee") focused on S. 1462, the American Clean Energy Leadership Act of 2009 ("ACELA"), sponsored by Senator Jeff Bingaman (D-NM).<sup>969</sup> On June 17, 2009, the committee voted fifteen to eight to report ACELA,

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<sup>960</sup> For discussion of this problem see Vincent Paolo Yu, *New Climate Protectionism: Analysis of the Trade Measures in the U.S. Climate Bill*, 40 S. BULLETIN (Sept. 10, 2009), available at [http://www.southcentre.org/index.php?option=com\\_content&task=view&id=1084&Itemid=279](http://www.southcentre.org/index.php?option=com_content&task=view&id=1084&Itemid=279).

<sup>961</sup> See Posting of John M. Broder to Green Inc. Senators Issue Warning on Climate Bill, <http://greeninc.blogs.nytimes.com/2009/08/06/senators-issue-warning-on-climate-bill/> (Aug. 6, 2009 15:02 EST).

<sup>962</sup> Leora Falk, *Feinstein, Snowe Offer Plan to Regulate Carbon Markets Ahead of Senate Climate Bill*, 40 ENV'T REP. (BNA) 1627 (July 10, 2009) [hereinafter *Feinstein, Snowe Offer Plan to Regulate*].

<sup>963</sup> Carbon Market Oversight Act of 2009, S. 1399, 111th Cong. (2009).

<sup>964</sup> See *Feinstein, Snowe Offer Plan to Regulate*, *supra* note 962.

<sup>965</sup> See Christine Grimaldi, *Emission Allowances Distributed for Free Could Be Taxed, Hearing Witnesses Say*, 40 ENV'T REP. (BNA) 1627 (July 10, 2009).

<sup>966</sup> See *id.* (discussing the ways the allowances could be treated as assets).

<sup>967</sup> Charles Davis, *Bingaman Hearings May Open Door to Cap-and-Trade Alternatives*, 26 ENVTL. POL'Y ALERT (InsideEPA.com) 20 (Oct. 7, 2009); see Dean Scott, *Senators Warn of Market Manipulation; CFTC Head Urges Registry, Daily Reporting*, 40 ENV'T REP. (BNA) 2105 (Sept. 11, 2009).

<sup>968</sup> Dean Scott, *Senate Should Close Power Plant Loopholes in House Climate Bill, Attorneys General Say*, 40 ENV'T REP. (BNA) 2104 (Sept. 11, 2009).

<sup>969</sup> S. 1462, 111th Cong. (2009).

which was placed on the Senate's legislative calendar on July 16, 2009.<sup>970</sup> It indirectly reduces GHG emissions by encouraging efficient, alternative, and low carbon energy production and use.<sup>971</sup> ACELA achieves these goals by amending and supplementing previous energy bills. As synthesized in the Committee report, the purpose of ACELA is to:

promote the energy security of the United States by: promoting the development and deployment of clean energy technologies; improving the energy efficiency of appliances, equipment, buildings, manufacturing, and the electric grid; securing the electric grid against cyber attacks; securing petroleum product markets against supply disruptions; promoting the development of domestic sources of oil and natural gas; demonstrating the large-scale geologic storage of industrial sources of carbon dioxide; promoting energy innovation and workforce development; and improving the regulation of energy markets.<sup>972</sup>

To accomplish this, ACELA creates a "Clean Energy Deployment Administration to facilitate tens of billions of dollars of new financing to [achieve] breakthroughs [in the deployment of] clean energy technologies."<sup>973</sup> It also requires electric utilities to meet fifteen percent of their electricity sales by 2021 using renewable energy.<sup>974</sup> It requires the establishment of a national electrical energy transmission grid.<sup>975</sup> FERC is required to establish national interconnection standards for power production facilities of 15KW or less to encourage residential-sized distributed generation.<sup>976</sup> It calls for improving protection for the grid including from cyber attacks.<sup>977</sup> It also calls for the federal government to improve the efficiency of homes, equipment, and appliances to reduce energy use.<sup>978</sup> It calls for opening the Eastern Gulf of Mexico to expanded oil and gas

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<sup>970</sup> AMERICAN CLEAN ENERGY LEADERSHIP ACT OF 2009, S. REP. NO. 111-48, at 9 (2009), available at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111\\_cong\\_reports&docid=f:sr048.111.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_reports&docid=f:sr048.111.pdf).

<sup>971</sup> *Id.* at 2–3.

<sup>972</sup> *Id.* at 1–2.

<sup>973</sup> *Id.* at 5; see S. 1462 § 105(a).

<sup>974</sup> S. 1462 § 132 (proposed § 610(b) of the Public Utility Regulatory Policies Act of 1978, 16 U.S.C. 2601); see S. REP. NO. 111-048, at 2.

<sup>975</sup> See S. 1462 § 121 (proposed § 216 of the Federal Power Act, 16 U.S.C. 824(p)).

<sup>976</sup> *Id.* § 296(b) (proposed § 118 of the Public Utility Regulatory Policies Act of 1978 (16 U.S.C. 2621)).

<sup>977</sup> *Id.* § 301 (proposed § 224 of the Federal Power Act, 16 U.S.C. 824).

<sup>978</sup> See *id.* §§ 221–233, 241–243.

production.<sup>979</sup> It seeks to reform the energy planning process by requiring a comprehensive federal energy plan to be produced every four years.<sup>980</sup>

ACELA in Title I establishes a Clean Energy Development Administration (“the Administration”) that:

may issue direct loans, letters of credit, loan guarantees, insurance products, or such other credit enhancements (including through participation as a co-lender or a lending member of a syndication) as the Administrator considers appropriate to deploy clean energy technologies if the Administrator has determined that deployment of the technologies would benefit or be accelerated by the support.<sup>981</sup>

Clean energy is defined as any technology related to the:

production, use, transmission, storage, control, or conservation of energy that will:

(A) reduce the need for additional energy supplies by using existing energy supplies with greater efficiency or by transmitting, distributing, or transporting energy with greater effectiveness through the infrastructure of the United States;

(B) diversify the sources of energy supply of the United States to strengthen energy security and to increase supplies with a favorable balance of environmental effects if the entire technology system is considered; or

(C) contribute to a stabilization of atmospheric greenhouse gas concentrations through reduction, avoidance, or sequestration of energy-related emissions.<sup>982</sup>

Within one year from the date of enactment, the bill requires that the Administration must assess and publish for comment short, mid, and

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<sup>979</sup> *See id.* § 343.

<sup>980</sup> *See* S. 1462 § 603.

<sup>981</sup> *Id.* § 106(a)(1)(A) (2009); *see also id.* § 106(a)(2)(A) (regarding Congressional mandate to provide “indirect support” to help develop and mobilize private financial support and investment for developing and aggregating small clean energy products).

<sup>982</sup> *Id.* § 102(5).

long-term goals for the deployment of these clean technologies.<sup>983</sup> These goals must include numerical targets and intervals to reach the goals.<sup>984</sup>

ACELA establishes the Clean Energy Investment Fund (“Fund”), a revolving fund created to carry out the administrative functions of Subchapter XV of Title XVII, Incentives for Innovative Technologies, of the Energy Policy Act of 2005 (“2005 Act”).<sup>985</sup> Under Subchapter XV of the 2005 Act, the Secretary may make loan guarantees for up to eighty percent of the cost of projects<sup>986</sup> that “avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases and employ new or significantly imported technologies as compared to commercial technologies in service in the United States at the time in the guarantee is issued.”<sup>987</sup> The money for the ACELA Fund is the amount authorized in the Energy Policy Act of 2005,<sup>988</sup> plus new funds provided for under ACELA, and any other funds appropriated to supplement the fund.<sup>989</sup>

ACELA includes a carbon capture program that incorporates the existing provisions found in the Energy Policy Act of 2005.<sup>990</sup> The goal of Section 963 of the 2005 Act is to create:

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<sup>983</sup> *Id.* § 104(a).

<sup>984</sup> *Id.*; *see also id.* § 104(a)(1)–(11) (specific goals).

<sup>985</sup> *Id.* § 103(a) (proposed Energy Policy Act of 2005, 42 U.S.C. § 16511 et seq. (2005)).

<sup>986</sup> 42 U.S.C. § 16512(c); *see also* S. 1462 § 103(b) (proposed § 701 of the 2005 Act, 42 U.S.C. § 16512(b)).

<sup>987</sup> 42 U.S.C. § 16513(a). Eligible projects are:

- 1) Renewable energy systems.
- 2) Advanced fossil energy technology (including coal gasification meeting the criteria in subsection (d) [of this section]).
- 3) Hydrogen fuel cell technology for residential, industrial, or transportation applications.
- 4) Advanced nuclear energy facilities.
- 5) Carbon capture and sequestration practices and technologies, including agricultural and forestry practices that store and sequester carbon.
- 6) Efficient electrical generation, transmission, and distribution technologies.
- 7) Efficient end-use energy technologies.
- 8) Production facilities for the manufacture of fuel efficient vehicles or parts of those vehicles, including electric drive vehicles and advanced diesel vehicles.
- 9) Pollution control equipment [and]
- 10) Refineries, meaning facilities at which crude oil is refined into gasoline.

42 U.S.C. § 16513(b).

<sup>988</sup> S. 1462 § 103(a)(1)(A).

<sup>989</sup> *Id.* § 103(a)(1)(A)–(C).

<sup>990</sup> S. 1462 § 371(a) (proposed § 963A of 2005 Act, 42 U.S.C. 16291).

a 10-year carbon capture and sequestration research, development, and demonstration program to develop carbon dioxide capture and sequestration technologies related to industrial sources of carbon dioxide for use in new coal utilization facilities and on the fleet of coal-based units in existence on the date of enactment of this act.<sup>991</sup>

ACELA is one of the few bills introduced in the past several years to control GHGs that has progressed through the federal legislative process that does not utilize a cap-and-trade approach.<sup>992</sup>

### 3. S. 1733

On September 30, 2009, the Senate Environment and Public Works Committee Chairmen, Senator Barbara Boxer (D-CA), and Senator John Kerry (D-MA), introduced the Clean Energy Jobs and American Power Act, S. 1733 (“CEJAPA”).<sup>993</sup> On November 5, 2009, S. 1733 was reported out of the Environment and Public Works Committee by a vote of eleven to one, with only Senator Max Baucus (D-MT) voting against the bill.<sup>994</sup> None of the seven Republicans on the committee voted on the bill.<sup>995</sup> The bill must be approved by the other Senate committees with jurisdiction over the subject matter of the legislation before it goes to a Senate floor vote.<sup>996</sup> CEJAPA is opposed by most Republicans and by many Democrats

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<sup>991</sup> See AMERICAN CLEAN ENERGY LEADERSHIP ACT OF 2009, S. REP. NO. 111-48, at 180 (2009), available at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111\\_cong\\_reports&docid=f:sr048.111.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_reports&docid=f:sr048.111.pdf).

<sup>992</sup> See Darren Samuelsohn, *Obama Says Senate May Drop Cap and Trade, Pass Energy-Only Bill*, N.Y. TIMES, Feb. 3, 2010, <http://www.nytimes.com/cwire/2010/02/03/03climatewire-obama-says-senate-may-drop-cap-and-trade-pas-21189.html> (discussing the possibility of adopting ACELA over ACES, because it may be favorable to drop cap-and-trade).

<sup>993</sup> Clean Energy Jobs and American Power Act, S. 1733, 111th Cong. (2009).

<sup>994</sup> Dean Scott, *Senate Environment Committee Passes Bill to Cap Emissions; Republicans Boycott Vote*, 40 ENV'T REP. (BNA) 2552 (Nov. 6, 2009) [hereinafter *Republicans Boycott Vote*].

<sup>995</sup> Press Release, Senate Env't and Public Works Comm., Boxer Statement on Committee Passage of S. 1733—The Clean Energy Jobs and American Power Act (Nov. 5, 2009), [http://www.epw.senate.gov/public/index.cfm?FuseAction=Majority.PressReleases&ContentRecord\\_id=c512ac4d-802a-23ad-4884-2b95a8405efe](http://www.epw.senate.gov/public/index.cfm?FuseAction=Majority.PressReleases&ContentRecord_id=c512ac4d-802a-23ad-4884-2b95a8405efe).

<sup>996</sup> *Republicans Boycott Vote*, *supra* note 994. The committees are: Finance, Commerce, Environment and Public Works, Foreign Relations, Natural Resources, and Agriculture. See Bolton & Geman, *supra* note 958.

because of its cost, its cap-and-trade program, and its failure to provide a major impetus for nuclear power development.<sup>997</sup>

CEJAPA differs from H.R. 2454 by calling for a GHG reduction of 20% from 2005 levels by 2020, whereas the House bill calls for a 17% reduction.<sup>998</sup> Both bills limit offsets to 2 billion tons annually, but the Senate bill requires more offsets to be from domestic sources.<sup>999</sup> The Senate bill gives FERC carbon market oversight,<sup>1000</sup> whereas the House bill gives FERC primary responsibility, but the Commodity Commission is given regulatory authority over derivatives.<sup>1001</sup> Oversight in the Senate bill would be the responsibility of the Department of Justice and the House bill has the EPA responsible for oversight.<sup>1002</sup> Both bills provide relief when the cost of an allowance reaches a trigger point, but there are differences in the details.<sup>1003</sup> CEJAPA is silent on the continuing role of the CAA, but ACES exempts new sources of GHG emissions from new source review.<sup>1004</sup>

The heart of both H.R. 2454 and S. 1733 is the cap-and-trade program. H.R. 2454 allocates the allowances as described *supra* in Part VI.A. The House bill includes a very specific distribution for allowances, but the Senate bill initially did not specify how allowances are to be distributed.<sup>1005</sup> This changed on October 23, 2009, when a new draft of S. 1733 detailed how allowances will be allocated.<sup>1006</sup> The new version of the Senate bill is closer to H.R. 2454,<sup>1007</sup> which means that most of the allocations are politically driven payoffs to pressure groups whose support is needed to have the legislation enacted. Only about 13% of the value of allowances will be

<sup>997</sup> *Republicans Boycott Vote*, *supra* note 994; Dean Scott, *Bill Maintains Emissions Cuts, EPA Authority, Leaves Negotiating Room for Senate Debate*, 40 ENV'T REP. (BNA) 2282 (Oct. 2, 2009) [hereinafter *Bill Maintains Emissions Cuts*].

<sup>998</sup> *Bill Maintains Emissions Cuts*, *supra* note 997; S. 1733 § 3(3).

<sup>999</sup> *Bill Maintains Emissions Cuts*, *supra* note 997.

<sup>1000</sup> Leora Falk, *Senate, House Bills Differ on Key Provisions; Details on Senate Legislation Still to Come*, 40 ENV'T REP. (BNA) 2284 (Oct. 2, 2009) [hereinafter *Bills Differ on Key Provisions*].

<sup>1001</sup> *Feinstein, Snowe Offer Plan to Regulate*, *supra* note 962.

<sup>1002</sup> *Bills Differ on Key Provisions*, *supra* note 1000.

<sup>1003</sup> *Id.*

<sup>1004</sup> *Bill Maintains Emissions Cuts*, *supra* note 997.

<sup>1005</sup> Jesse Jenkins, *Kerry-Boxer Climate Bill Allowance Allocation on Breakdown*, BREAKTHROUGH INST. BLOG (Oct. 26, 2009, 23:08 EST), [http://thebreakthrough.org/blog/2009/10/kerryboxer\\_climate\\_bill\\_allowa.shtml](http://thebreakthrough.org/blog/2009/10/kerryboxer_climate_bill_allowa.shtml); see Amendment to S. 1733, 111th Cong. (Oct. 23, 2009), available at [http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore\\_id=ee5c67bb-a5a7-453d-a4e0-4c8f2908c0cf](http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=ee5c67bb-a5a7-453d-a4e0-4c8f2908c0cf).

<sup>1006</sup> Jenkins, *supra* note 1005; see Amendment to S. 1733 § 111 (proposed § 771 of the CAA).

<sup>1007</sup> Jenkins, *supra* note 1005.

used to develop clean energy technologies,<sup>1008</sup> including the development of carbon sequestration technology, which will receive 1.75% of the value of the allowances.<sup>1009</sup> An additional 3.25% of the allowances will be used to fund clean energy research and development efforts,<sup>1010</sup> but 1% will be given to foreign countries to slow deforestation.<sup>1011</sup> About 64% of the value of the allowances will be used for direct rebates to consumers, low-income energy assistance, and for electric and gas utilities for use on behalf of their customers.<sup>1012</sup> About 10% of the allowances' value will be used for deficit reduction<sup>1013</sup> in contrast to H.R. 2454 that dedicates 3.1% over the first ten years, 2012–2022.<sup>1014</sup>

To date, much of the controversy over the cap-and-trade program has focused on who gets the value of the allowances.<sup>1015</sup> Energy consumers will pay most of the costs of the program, but Congress determines who gets the money; and it is unlikely that those who pay will receive the benefits. For example, H.R. 2454 allocates allowances for electric utilities using a formula based 50% on historic emissions and 50% on retail sales of electricity, which requires customers of coal-burning power plants to subsidize nuclear or renewable power users.<sup>1016</sup> Regardless of what the final bill contains, Congress can change the allocation at any time. New York, for example, has a cap-and-trade program based on the RGGI that was to fund energy conservation and clean energy programs.<sup>1017</sup> On October 15, 2009, Governor Paterson proposed to use the funds to reduce New York's budget deficit.<sup>1018</sup> Potentially, the allowances provided by H.R. 2454, or S. 1733, could have a value exceeding one trillion dollars in net revenue over ten years; this amount of money may create a continuous effort by potential beneficiaries to have it diverted to them.

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<sup>1008</sup> *Id.*

<sup>1009</sup> Amendment to S. 1733 § 111 (proposed § 771(a)(6) of the CAA) (beginning in 2014).

<sup>1010</sup> *Id.* § 111 (proposed § 771(a)(12) of the CAA) (beginning in 2012).

<sup>1011</sup> *Id.* § 111 (proposed § 771(a)(13) of the CAA) (beginning in 2012).

<sup>1012</sup> Jenkins, *supra* note 1005.

<sup>1013</sup> Amendment to S. 1733 § 111 (proposed § 771(d)(2) of the CAA) (beginning in 2012).

<sup>1014</sup> Jenkins, *supra* note 1005.

<sup>1015</sup> Posting of James Kwak to The Hearing, Wash. Post Blog, Dividing the Loot from Cap and Trade, [http://voices.washingtonpost.com/hearing/2009/08/dividing\\_the\\_loot\\_from\\_cap\\_and.html](http://voices.washingtonpost.com/hearing/2009/08/dividing_the_loot_from_cap_and.html) (Aug. 4, 2009, 14:00 EST).

<sup>1016</sup> See Dean Scott, *Senators Call for Shifting Free Allowances to Safeguard Coal-Reliant Electric Utilities*, 40 ENV'T REP. (BNA) 2659 (Nov. 20, 2009).

<sup>1017</sup> See Regional Greenhouse Gas Initiative: Participating States, <http://www.rggi.org/states> (last visited Feb. 22, 2010).

<sup>1018</sup> Gerald B. Silverman, *Governor Proposes Diverting \$90 Million in RGGI Funding to Close Budget Deficit*, 40 ENV'T REP. (BNA) 2482 (Oct. 23, 2009).

Because S. 1733 will increase the cost of energy, an issue that should be addressed is the treatment of imported goods from countries with less stringent GHG requirements. The Lieberman-Warner bill, which was reported out of committee but was defeated in a procedural vote by the Senate in 2008, would have required importers of products produced by carbon-intensive industries to buy carbon credits from a carbon market for importers.<sup>1019</sup> The EPA's small engine rule of October 8, 2008 allows the Agency to enforce air emissions regulations against foreign importers and domestic distributors and retailers.<sup>1020</sup> If cap-and-trade requirements are to avoid adversely affecting the economy, an appropriate treatment of foreign produced products in countries without such requirements will be needed that does not violate international trade agreements. Both H.R. 2454 and S. 1733 provide free allowances for trade-vulnerable industries that are valued at over a billion dollars during 2012–2021.<sup>1021</sup> It was expected that the international trade issues would be a part of the Copenhagen international climate negotiations in December 2009.<sup>1022</sup>

After climate change legislation is enacted it will be years before it is implemented. H.R. 2454, for example, requires the EPA to promulgate thirty-one new regulations—most in eighteen to thirty-six months.<sup>1023</sup> The EPA's average time for promulgating regulations is 5.5 years.<sup>1024</sup> But, the EPA in the spring of 2009 was working on fifty-nine CAA proposed rules and forty-seven CAA rules it expected to finalize within a year.<sup>1025</sup> After the rule is promulgated, it is likely to be the target of litigation that may limit its applicability for years—especially if a court remands or vacates the regulation.<sup>1026</sup> Nevertheless, the pending legislation will significantly increase the EPA's power;<sup>1027</sup> it will make the Agency a major regulator of energy and will give it the ability to significantly affect the nation's economy.

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<sup>1019</sup> Lieberman-Warner Climate Security Act of 2007, S. 2191, 110th Cong. § 6006 (2007).

<sup>1020</sup> Control of Emissions From Nonroad Spark-Ignition Engines and Equipment, 73 Fed. Reg. 59,034 (Oct. 8, 2008) (to be codified at 40 C.F.R. pts. 9, 60, 80).

<sup>1021</sup> Jenkins, *supra* note 1005.

<sup>1022</sup> Dean Scott, *Border Tariffs Should Be Negotiated Under Global Climate Deal*, *Cardin Says*, 40 ENV'T REP. (BNA) 2450 (Oct. 23, 2009).

<sup>1023</sup> Richard G. Stoll, *House Global Climate Bill Mandates Many EPA Rulemakings with Tight Deadlines*, 40 ENV'T REP. (BNA) 1672 (July 10, 2009).

<sup>1024</sup> *Id.*

<sup>1025</sup> *Id.*

<sup>1026</sup> *Id.*

<sup>1027</sup> *Id.*

CONCLUSION<sup>1028</sup>

Environmental degradation usually results from “combined effect[s] of population, increase in per capita consumption, and [the amount] of pollution per unit of consumption.”<sup>1029</sup> However, there is little, if any, widespread support for controlling either population or consumption. Because CO<sub>2</sub> emissions are produced even during ideal combustion, there is little hope of controlling carbon emissions through traditional pollution control efforts. Reducing CO<sub>2</sub> emissions requires increasing the thermal efficiency of production,<sup>1030</sup> substituting nuclear or renewable energy for fossil fuel,<sup>1031</sup> and sequestering CO<sub>2</sub> produced from fossil fuel combustion.<sup>1032</sup> Utilizing these approaches will be costly and will require the use of technology that is not yet commercially available. Thus, worldwide emissions of CO<sub>2</sub> are expected to grow fifty percent from 2005 to 2030 according to the U.S. Energy Information Administration.<sup>1033</sup>

The United States is the world's third largest nation, after China and India, with a population of over 307 million people.<sup>1034</sup> The primary contributor to GHG emissions from U.S. sources is CO<sub>2</sub> created by our large population directly and indirectly utilizing fossil fuels.<sup>1035</sup> The nation's CO<sub>2</sub> emissions for many years increased at about the same rate as the population increase that averaged 1.1% from 1990–2000, which is the highest rate of population increase of any developed nation.<sup>1036</sup> In the span of thirty-nine years, from 1967 to 2006, the U.S. population rose by 100 million.<sup>1037</sup> Three million people are added to the U.S. population each

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<sup>1028</sup> Portions of this section are derived from Reitze, *supra* note 29.

<sup>1029</sup> Arnold W. Reitze, Jr., *Population, Consumption and Environmental Law*, 12 NAT. RESOURCES & ENV'T 89, 89 (1997).

<sup>1030</sup> See *supra* notes 56–72 (discussing the thermal efficiency of coal-based power plants).

<sup>1031</sup> See *supra* Parts III & IV for further discussion.

<sup>1032</sup> See *supra* Part II.C.

<sup>1033</sup> Steven D. Cook, *EIA Forecasts 50% Percent Increase in Carbon Dioxide Between 2005–2030*, 39 ENV'T REP. (BNA) 1271 (June 27, 2008).

<sup>1034</sup> U.S. Central Intelligence Agency, *The World Factbook: United States*, <https://www.cia.gov/library/publications/the-world-factbook/geos/us.html> (last visited Feb. 22, 2010).

<sup>1035</sup> INVENTORY, *supra* note 5.

<sup>1036</sup> Compare Day, *supra* note 11, with ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, CO<sub>2</sub>—HISTORY FROM 1949, [http://www.eia.doe.gov/oiaf/1605/ggrpt/excel/historical\\_co2.xls](http://www.eia.doe.gov/oiaf/1605/ggrpt/excel/historical_co2.xls) (showing an average increase of 2.6% calculated from data).

<sup>1037</sup> PEW HISPANIC CENTER, FROM 200 MILLION TO 300 MILLION: THE NUMBERS BEHIND POPULATION GROWTH 1 (Oct. 10, 2006), available at <http://pewhispanic.org/files/factsheets/25.pdf>.

year.<sup>1038</sup> If present trends in birthrate and immigration continue, the country is projected to have another 100 million people by 2043.<sup>1039</sup>

To stabilize domestic CO<sub>2</sub> emissions, Americans will have to reduce their fossil fuel energy consumption by about one percent annually to overcome the emissions that appear to be attributable to the annual U.S. population increase.<sup>1040</sup> Reaching the 1990 emission level that is the target of the Kyoto Protocol requires additional reductions to offset the effects of the production necessary to sustain the approximately sixty million people added to the population since 1990, as well as increases attributable to increased consumption.<sup>1041</sup> Stabilizing our population would make the control of GHG emissions easier for the United States to achieve. But, in EPA's publication, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2005*, the Agency's discussion of the factors contributing to climate change in its executive summary makes no mention of population growth as a factor in the U.S. CO<sub>2</sub> emissions.<sup>1042</sup>

Because population stabilization appears to be an issue that is off-the-table, then use of fossil fuels needs to be reduced at a rate that exceeds the effect of an expanding population. The most important stationary source of CO<sub>2</sub> emissions is the electric power industry. Cleaner and more efficient coal burning plants could be built if we are willing to pay for them, but for thirty-six years, the CAA and the political process have protected the electric utilities from being required to upgrade many of their facilities.<sup>1043</sup> Although new facilities can be designed to produce significantly less conventional pollution, fossil fuel plants at this time can reduce carbon emissions by only about fifteen percent because CO<sub>2</sub> emissions are a function of energy conversion efficiency, not pollution controls.<sup>1044</sup>

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<sup>1038</sup> Fred Elbel, *U.S. Birth Rates and Population Growth*, SUSPS, <http://www.susps.org/overview/birthrates.html>.

<sup>1039</sup> Erin Texeira, *U.S. Expected to Hit 400 Million by 2043*, USA TODAY, Oct. 22, 2006, [http://www.usatoday.com/news/nation/2006-10-22-400-million-mark\\_x.htm](http://www.usatoday.com/news/nation/2006-10-22-400-million-mark_x.htm).

<sup>1040</sup> See *supra* note 1036 and accompanying text (comparing the increase in U.S. population to the rate emissions).

<sup>1041</sup> Compare BUREAU OF THE CENSUS, 1990 CENSUS OF POPULATION: GENERAL POPULATION CHARACTERISTICS 34 (1992) (listing the 1990 population as 248,709,873 people), with Census.gov, U.S. POPClock Projection, <http://www.census.gov/population/www/popclockus.html> (last visited Mar 5, 2010) (listing the current U.S. estimated population as 308,805,756).

<sup>1042</sup> U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2005 Exec. Summary (2007), available at [http://www.epa.gov/climatechange/emissions/usgginv\\_archive.html](http://www.epa.gov/climatechange/emissions/usgginv_archive.html).

<sup>1043</sup> See *supra* notes 190–98 for further discussion.

<sup>1044</sup> See BIELAWSKI ET AL., *supra* 57, at 2.

Moreover, the new coal-burning plants under construction, and the up to 150 new plants projected by the DOE to be constructed by 2030, make the probability of significant CO<sub>2</sub> reductions small, although the efforts to prevent the construction of new coal-burning power plants may limit the number of plants actually constructed.<sup>1045</sup>

An alternative approach would be to utilize more non-fossil-fueled electric power generation. Nuclear energy is an obvious choice, but its use presents issues of capital costs, subsidies, safety, and radioactive waste disposal.<sup>1046</sup> New hydroelectric plants are almost impossible to build because of opposition from environmentalists.<sup>1047</sup> Wind power often is opposed by environmentalists and by citizens living near proposed facilities.<sup>1048</sup> Moreover, wind power usually is not capable of being used for base load power.<sup>1049</sup> This could change if wind power generation was spread over a large area, but such an effort would require costly additions to the transmission grid.<sup>1050</sup> Reduction of CO<sub>2</sub> emissions from the transportation sector will require the use of more fuel efficient motor vehicles and driving fewer miles, but if we move to the use of electricity for a significant part of our transportation's energy requirements, the demand for electric power could increase. Getting Americans to reduce their energy consumptive lifestyle in order to reduce GHG emissions is the major challenge.

The sooner we face the multifaceted problems created by the use of carbon-based fuels, the more likely a political consensus will emerge that may lead to solutions. While most efforts to date have failed,<sup>1051</sup> it is more alarming that even if the major international and domestic proposals were implemented they would have only a modest positive effect. Only reductions in fossil fuel use significantly larger than those proposed to

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<sup>1045</sup> Steven Mufson, *Midwest Has 'Coal Rush,' Seeing No Alternative*, WASH. POST, Mar. 10, 2007, <http://www.washingtonpost.com/wp-dyn/content/article/2007/03/09/AR2007030902302.html>; see *supra* notes 97–99 and accompanying text discussing environmental groups attempts to prevent construction.

<sup>1046</sup> See generally Harold P. Green, *Safety Determinations in Nuclear Power Licensing: A Critical View*, 43 NOTRE DAME L. REV. 633 (1969). See also *supra* Part IV for further discussion.

<sup>1047</sup> See Kim Murphy, *A Hydroelectric Future Faces a Fish Predicament*, L.A. TIMES, July 27, 2009, <http://articles.latimes.com/2009/jul/27/nation/na-hydro-power27>.

<sup>1048</sup> See Utzinger, *supra* note 456, at 10797–10799; see Jeremy Firestone et al., *Regulating Offshore Wind Power and Aquaculture: Messages From Land and Sea*, 35 ENVTL. L. REP. (ELI) No. 10289, 10289–10290 (May 2005).

<sup>1049</sup> See *supra* notes 435–44 and accompanying text for further discussion.

<sup>1050</sup> See *supra* notes 461–65 and accompanying text for further discussion.

<sup>1051</sup> See *supra* Part V for discussion of proposed legislation that has not yet been enacted.

date will have any chance for ultimately stabilizing atmospheric CO<sub>2</sub> concentrations.<sup>1052</sup> Whether the costs necessary to control CO<sub>2</sub> emissions should be incurred will be a major political issue in the coming decade. Since CO<sub>2</sub> released into the atmosphere has a residency time of perhaps 100 years,<sup>1053</sup> the costs that would be incurred today to prevent CO<sub>2</sub> releases mostly will benefit future generations that have little or no present political clout.

The challenge is to do what needs to be done without unjustified adverse effects on the economy and without creating an intrusive bureaucracy that determines who can use energy and the amount that can be used. The legal system works best when it tweaks the system but allows the free market to work. GHGs as the primary causative factor in climate change<sup>1054</sup> need continued investigation, and any programs to control GHGs will need the flexibility to respond appropriately to new information. The science of climate change is still based to a great extent on mathematical models that require continued verification and refinement.<sup>1055</sup>

The changes needed to stabilize the atmosphere's GHG concentrations will take many years to accomplish and require profound changes in how energy is utilized. It is important, however, to begin to make serious, but prudent, efforts to control GHG emissions. Many states, local governments, trade associations, and corporations are not waiting for a federal response but have taken the lead in responding to climate change.<sup>1056</sup> This should be encouraged. Addressing climate change will involve many small steps that in aggregate could help reduce our dependence on fossil fuels. Progress can be achieved by focusing on the fact that energy efficiency saves money.<sup>1057</sup>

Congress needs to take a more responsible position concerning climate change and enact comprehensive legislation aimed at lowering carbon emissions. A carbon tax that was revenue neutral would be the best approach.<sup>1058</sup> Efforts to enact new legislation to deal with climate

<sup>1052</sup> *Id.* at xvi.

<sup>1053</sup> Pushker A. Kharecha & James E. Hansen, *Implications of "Peak Oil" for Atmospheric CO<sub>2</sub> and Climate*, 22 GLOBAL BIOGEOCHEMICAL CYCLES 3 (2008).

<sup>1054</sup> See UNFCCC, *The Greenhouse Effect and the Carbon Cycle: Too Much of a Good Thing*, [http://unfccc.int/essential\\_background/feeling\\_the\\_heat/items/2903.php](http://unfccc.int/essential_background/feeling_the_heat/items/2903.php) (last visited Feb. 25, 2010).

<sup>1055</sup> *See id.*

<sup>1056</sup> See *supra* notes 535–48 and accompanying text for discussion of regional cap-and-trade programs and state RPSs.

<sup>1057</sup> See Childers, *supra* note 644.

<sup>1058</sup> See *supra* Part VI.A for further discussion.

change, however, have focused primarily on a cap-and-trade approach.<sup>1059</sup> The trading part is likely to be inflationary.<sup>1060</sup> It also could result in a massive transfer of wealth.<sup>1061</sup> The various legislative proposals differ in who would be the primary beneficiaries, but the legislation approved by the House of Representatives is a tax on energy that will be used to finance the Democratic Party's political agenda.

The cap could have unintended consequences. It could lead to electric power brownouts and artificial gasoline shortage;<sup>1062</sup> it would give a boost to nuclear energy.<sup>1063</sup> It also could encourage what manufacturing is left in the United States to move to foreign countries<sup>1064</sup> and could lead to more importation of electricity from Canada and perhaps Mexico. A potential problem with cap-and-trade is Congress could raise the cap when its limit is approached, which would cause the cap to fail to limit CO<sub>2</sub> emissions.

An undesirable response would be to rely on the CAA because it is not a tool designed to deal with GHG emissions, or more specifically, CO<sub>2</sub>. The five Justices in the majority in *Massachusetts v. EPA* promulgated a decision that pressures EPA to limit the use of fossil fuel.<sup>1065</sup> It is difficult to believe that Congress intended the EPA to be the czar of fossil energy use based on the CAA. Modest reductions in CO<sub>2</sub> emission could be achieved through improvement in combustion efficiency, but the CAA does not provide the EPA with the power or the ability to make this happen. The EPA could encourage the use of nuclear power, the expanded use of hydroelectric power, or seek to expand the use of alternative energy.<sup>1066</sup> Such efforts are unlikely to be effective and would carry the EPA well

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<sup>1059</sup> See *supra* Part VI.B (discussing cap-and-trade legislation). *But cf.* Samuelsohn, *supra* note 992 (noting that Obama may drop cap-and-trade).

<sup>1060</sup> D'Angelo Gore, *Cap-and-Trade Cost Inflation*, FACTCHECK.ORG, May 28, 2009, <http://www.factcheck.org/2009/05/cap-and-trade-cost-inflation/>.

<sup>1061</sup> See *supra* notes 943–949 and accompanying text for further discussion of how H.R. 2454 leads to wealth redistribution.

<sup>1062</sup> See Mark P. Mills, *Brownout*, FORBES, June 30, 2008, <http://www.forbes.com/forbes/2008/0630/038.html>.

<sup>1063</sup> See *id.*

<sup>1064</sup> Christa Marshall, *Cap and Trade Won't Push Heavy Industries Overseas—Study*, N.Y. TIMES, May 6, 2009, <http://www.nytimes.com/cwire/2009/05/06/06climatewire-cap-and-trade-wont-push-heavy-industries-ove-12208.html>; Broder, *supra* note 961.

<sup>1065</sup> *Massachusetts v. EPA*, 594 U.S. 497, 525–26 (2007).

<sup>1066</sup> See David Kerley & Huma Khan, *EPA's Greenhouse Gas Mandate Causes Both Joy and Concern*, ABCNEWS.COM, Apr. 17, 2009, <http://abcnews.go.com/Politics/GlobalWarming/story?id=7364713&page=1> (noting it is “unclear how the EPA will use its authority to regulate greenhouse gas emissions”).

beyond what most people would consider the authority granted by the CAA and perhaps beyond what many people would consider the appropriate role of the Agency.<sup>1067</sup> The EPA could achieve some of the goals of reduced fossil fuel combustion by making the CAA so onerous and expensive that the regulated community would be forced to seek alternatives to the use of fossil fuel. The EPA, however, lacks both the resources and the expertise to function effectively as the arbiter of energy use, and the potential for it to devastate the economy in the attempt to control GHG emissions is substantial.<sup>1068</sup>

“The best hope for a viable program is that Congress will nullify *Massachusetts v. EPA* by creating an effective new program to reduce our dependence on carbon-based fuels without harming the economy.”<sup>1069</sup> This will require the price of energy to be increased to represent an approximation of its real cost. We will also need to pursue the development of the technology needed to avoid carbon releases to the atmosphere. Finally, we are going to need to use a lot less energy without reducing our standard of living. This is a difficult challenge, but if we are successful, we can protect the planet, provide jobs, and expand our economy. Unfortunately, the legislation pending in 2009 is unlikely to accomplish what needs to be done.<sup>1070</sup>

Convincing U.S. voters to spend large amounts of money or accept hardship over decades to deal effectively with climate change will be politically difficult.<sup>1071</sup> Obtaining voter support to provide costly subsidies for the developing world in order to limit their carbon emissions will be even more difficult. From a political perspective, it is easier to allow a Katrina or a subprime mortgage crisis to occur and then achieve political benefits from giving away federal money<sup>1072</sup> than it is to develop, fund, and implement a long-term preventive program.<sup>1073</sup> If climate change efforts are to be supported by a majority of American voters, GHG controls will be more

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<sup>1067</sup> See *id.*

<sup>1068</sup> See *id.*

<sup>1069</sup> Reitze, *supra* note 29, at 77.

<sup>1070</sup> See Part VI.B for further discussion.

<sup>1071</sup> See Levy, *supra* note 783 (arguing that both cap-and-trade and carbon taxes will raise the cost of energy); see also *Climate Change Bill Gets Mixed Reviews*, RASMUSSEN REPS., Aug. 31, 2009, [http://www.rasmussenreports.com/public\\_content/politics/current\\_events/environment\\_energy/climate\\_change\\_bill\\_gets\\_mixed\\_reviews](http://www.rasmussenreports.com/public_content/politics/current_events/environment_energy/climate_change_bill_gets_mixed_reviews).

<sup>1072</sup> See Daniel Nasaw, *U.S. Election: Attacks on 'Pork Barrel' Funds Turn Focus to Congressional Spending*, THE GUARDIAN, Sept. 10, 2008, available at <http://www.guardian.co.uk/world/2008/sep/10/uselections2008.johnmccain>.

<sup>1073</sup> See, e.g., Levy, *supra* note 783 (discussing carbon taxes as a political “third rail”).

likely to be accepted if justified on the basis of issues of immediate concern to voters, such as the concern for conventional air pollution control, energy security, reducing the trade deficit, national energy security, and the need to stimulate the economy. A program to save the world that involves the United States incurring a substantial portion of the costs and receiving a disproportionately small share of the benefits will be difficult to sell to American voters. Concern for biosphere protection is unlikely to motivate the American public to modify their behavior or pay higher costs for energy, but other national economic or security concerns may help obtain public support.