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Greenhouse Gas Mitigation Measures in the United States Electric Power Industry

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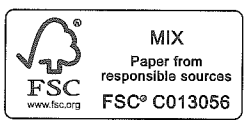

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3. Greenhouse gas mitigation measures in the US electric power industry

Joel B. Eisen

CHAPTER OVERVIEW

This chapter addresses greenhouse gas (GHG) mitigation measures in the US energy sector, and, specifically, those applying to the US electric power industry. The focus is on the systems of federal, state, regional, and local regulation of GHG emissions associated with electricity generation, transmission and distribution, concentrating on the regulatory trends likely to have the largest impacts on mitigating GHG emissions. In addition, this section will discuss the extent to which these systems of regulating GHG emissions have evolved over the past decade.

INTRODUCTION

Regulation of GHG emissions in the US includes direct measures aimed at curbing emissions, such as federal rules that require electric power plants to meet specific limits on their emissions, and state and regional 'cap-and-trade' systems that impose emissions limits and create market-based trading schemes designed to spur emissions reductions. This chapter analyzes two other types of measures that impact GHG emissions:

1. measures aimed at reducing emissions of non-GHG pollutants from power plants, thus also decreasing GHG emissions because those plants must meet air quality requirements by adopting technology-based controls; and
2. measures designed to lead to reduced consumption of electricity (such as energy efficiency measures) or increased use of alternative sources of electricity generation other than fossil fuels (such as renewable portfolio standards mandating that utilities obtain a specified percentage of their electricity generation from renewable sources).

Both of the latter can reduce demand for electricity generated from fossil fuels, and thereby help curb GHG emissions.

This section's focus is on electric power generation in the US from fossil fuel sources (principally coal, although burning of natural gas to generate electric power also produces GHG emissions). Electricity generation from fossil fuels has a greater impact on GHG emissions than any other single industry in the US. In 2011, according to data from the US Environmental Protection Agency (EPA), electricity production accounted for 33 percent of national GHG emissions.[1] Therefore, regulation of emissions from power plants can have a significant impact on emissions and serve as a cornerstone of US climate change mitigation policy. At the same time, promoting alternatives to burning fossil fuels and encouraging demand reduction can help meet other renewable energy and energy efficiency goals.

The focus of this section is on US domestic initiatives. In general, in the absence of a national comprehensive scheme of climate change mitigation, different approaches have supplanted and complemented each other in domestic laws and policies addressing climate change mitigation, including federal legislation, federal regulatory efforts, and regional, state and local initiatives. The move toward comprehensive national climate change legislation has stalled for now with the failure in 2010 of the American Clean Energy and Security Act (ACESA), popularly known as the 'Waxman-Markey' bill for its two principal co-sponsors in the US House of Representatives. However, federal administrative agencies, principally the EPA, have been active in promulgating and proposing regulations designed to curb GHG emissions. President Barack Obama's 'Climate Action Plan,' issued in June 2013,[2] has spurred further regulatory activity. For example, it directed the EPA to 'work expeditiously to complete carbon pollution standards for both new and existing power plants,'[3] and the EPA issued emissions standards in 2014 for both sources.

US states have also been active in GHG emissions regulation in recent years. The most notable and comprehensive regulatory scheme is California's system of laws and regulations designed to limit GHG emissions, known as 'AB 32' after the legislation that created it. This includes an ambitious cap-and-trade scheme for power plants and other industrial facilities, described briefly here and in more detail in Chapter 21 together with the 'Regional Greenhouse Gas Initiative' (RGGI), the cap-and-trade

[1] United States Environmental Protection Agency, 'Sources of Greenhouse Gas Emissions' <http://www.epa.gov/climatechange/ghgemissions/sources.html> accessed 11 September 2013.

[2] Executive Office of the President, The President's Climate Action Plan (2013).

[3] Ibid.

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[4] American Clean Energy an
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scheme in the northeastern and mid-Atlantic US. Other states' laws and programs regulating CO_2 emissions from power plants feature action plans, targets and reporting requirements. States have also taken the lead in developing policies such as net metering, energy efficiency standards and programs, and renewable portfolio standards that do not directly regulate GHG emissions, but have impacts on reducing them (often as one of multiple goals). This section discusses these types of laws and policies, providing examples from individual states.

I. LEGAL AND REGULATORY INSTRUMENTS—REGULATION OF GHG EMISSIONS FROM THE ELECTRIC POWER GENERATION SECTOR

Starting at the national level, although the legislative front has gone relatively quiescent after ACESA's failure, there are still high-profile attempts to move bills providing for a carbon tax and establishing national clean energy standards. The prospects for passage of this legislation are doubtful, given an adverse political climate in the US Congress. In the meantime, a federal regulatory effort to curb GHG emissions is ongoing. After the Supreme Court's landmark decision in *Massachusetts v EPA*, the EPA has promulgated a number of rules designed to reduce emissions from motor vehicles and from power plants and other industrial facilities.

A. Federal Statutory Proposals

1. Comprehensive climate legislation—Waxman-Markey (ACESA)

Comprehensive legislative proposals to address climate change were advocated in the US Congress throughout the 2000s, and one bill reached the floor of the US Senate for a vote in 2003, although it did not succeed. By 2009, prospects for a comprehensive bill looked more promising, as new President Barack Obama and leaders in the US House of Representatives pledged to reduce US GHG emissions through an economy-wide cap-and-trade scheme. In the spring of 2009, Representatives Edward Markey of Massachusetts and Henry Waxman of California, the leaders of the Democratic majority of the powerful House Energy and Commerce Committee, introduced a comprehensive climate bill, the American Clean Energy and Security Act of 2009 (ACESA).[4]

[4] American Clean Energy and Security Act of 2009, HR 2454, 111th Cong. (2009).

The ACESA's cap-and-trade provisions were designed to cover 85 percent of the overall US economy, including electric power plants, oil refineries, natural gas suppliers, and other energy-intensive industries. The cap was designed to begin in 2012 and be completely phased in by 2016. As in other cap-and-trade schemes, regulated industries would need to reduce emissions or acquire allowances to cover their emissions. Total US emission reductions would decline 3 percent by 2012 below a 2005 baseline, 17 percent by 2020, 42 percent by 2030, and 80 percent by 2050.[5] ACESA also would have set a federal renewable electricity and efficiency standard, encouraged carbon capture and storage technology and research and development of a wide range of energy technologies, and authorized the EPA to set performance standards for new coal-fired power plants.

The ACESA passed the US House of Representatives in June 2009 by 219 to 212, becoming the first climate legislation to pass a chamber of the US Congress. Later that year, Senators John Kerry and Barbara Boxer introduced a similar bill, the Clean Energy Jobs and American Power Act. For various reasons, however, the 2010 Congressional term ended without the Senate approving any other comprehensive climate bill, and so the chances for passage of a bill ended. The reasons advanced for failure of climate legislation in the Senate are numerous, including mounting political opposition and changes in the Senate's composition.[6]

2. Carbon tax legislative proposals

A carbon tax imposes a fee, typically expressed in dollars per ton, on fossil fuels (coal, oil and natural gas) according to their carbon content. An example is Australia's carbon price of $23 per ton applying to the nation's largest emitters, although in 2013, Australia shifted the nation's system of carbon regulation from a tax to a cap-and-trade scheme.[7] A carbon tax aims to decrease GHG emissions by prompting regulated entities to reduce their fossil fuel use, or switch to alternatives such as generating electricity from renewable sources. Proponents claim this is the most economically efficient means of internalizing the externalities of fossil fuel combustion.[8] In the US, federal regulators use a figure of about $36 per

[5] Ibid. s 311 n. 4.

[6] For a comprehensive analysis of the failure of climate legislation, *see* Ryan Lizza, 'As The World Burns' *The New Yorker* (11 October 2010).

[7] Matt Siegel, 'Australian Leader Scraps Tax on Carbon Emissions' *New York Times* (16 July 2013).

[8] A recent argument in favor of a carbon tax by a former advisor to President George W. Bush is N. Gregory Mankiw, 'A Carbon Tax That America Could Live With' *New York Times* (31 August 2013).

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[10] Mankiw (n. 8).

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[12] Ibid.

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Proponents argue that a tax's relative simplicity makes it less bureaucratic and more effective than governmental regulation.[10] A relatively modest carbon tax could also provide a substantial amount of revenue. According to a recent analysis by the US Congressional Budget Office, a US carbon tax of $20 per metric ton on GHG emissions in 2012 that increased over time at 5.6 percent per year would yield $1.2 trillion in revenues through 2021.[11] This revenue could fund social purposes, including development and deployment of clean energy technologies for GHG emission reductions.[12] It could also lessen the impacts on households of changes in the cost of electricity. For example, some revenue could be returned to households as dividends or reductions in income taxes. Critical design issues involve the precise breakdown of the uses of the revenue and allocation to specific purposes.

The idea of a carbon tax in the US is not new.[13] In 1993, the Clinton administration proposed a carbon tax based on the heat content of specific fuels. This proposal was fiercely opposed and then withdrawn. In 2013, Senators Barbara Boxer (Democrat of California) and Bernie Sanders (Independent of Vermont) introduced high-profile carbon tax legislation,[14] and discussions continued on adopting a carbon tax as part of a comprehensive legislative proposal to reform the US tax system. As part of a broader tax bill, a carbon tax could be designed to be revenue-neutral, for instance by offsetting reductions in payroll or other taxes. The prospects for any carbon tax, however, seem doubtful in the current adverse environment in the US Congress.

3. Clean energy standard proposals

As described more fully below, nearly three-fourths of US states and the District of Columbia have 'portfolio standards' (or 'clean energy standards,' or CES) that require electric utilities to supply specified percentages

[9] Brad Plumer, 'An obscure new rule on microwaves can tell us a lot about Obama's climate policies' *Washington Post* (5 June 2013).

[10] Mankiw (n. 8).

[11] United States Congressional Budget Office, Effects of a Carbon Tax on the Economy and the Environment 3 (2013) (*citing* United States Congressional Budget Office, Reducing the Deficit: Spending and Revenue Options 205 (2011)).

[12] Ibid.

[13] United States Congressional Budget Office, Carbon Charges as a Response to Global Warming: the Effects of Taxing Fossil Fuels (1990).

[14] Climate Protection Act of 2013, s 332, 113rd Cong. (2013).

of their electricity sales from wind, solar, or other qualifying renewable energy sources, while typically allowing utilities to demonstrate compliance by acquiring tradable 'renewable energy certificates.'[15] Several climate and energy bills throughout the 2000s, including the unsuccessful ACESA, featured proposals for national CES systems. After the ACESA failed to become law, the concept of a federal CES attracted renewed attention when, in his January 2011 State of the Union address, US President Barack Obama articulated a national CES goal, stating that it should be national policy that 'by 2035 [the US] will generate 80 percent of our electricity from a diverse set of clean energy sources—including renewable energy sources like wind, solar, biomass and hydropower, nuclear power, efficient natural gas and clean coal.'[16] In 2012, Senator Jeff Bingaman (Democrat from New Mexico), the Chair of the Energy Committee, introduced a federal Clean Energy Standard Act, which failed to make it to a vote in the Senate.[17]

In the House of Representatives, the near-term political climate is not favorable toward passage of CES legislation, even though some Democrats support the idea.

B. EPA Regulations—GHG Emissions Reductions

In the absence of national legislation providing for comprehensive climate change mitigation through a cap-and-trade scheme, carbon tax, or clean energy standard, federal regulators, notably the US federal Environmental Protection Agency (EPA), have acted through administrative regulations to address GHG mitigation. Prior to the US Supreme Court's landmark decision in 2007 in *Massachusetts v EPA*,[18] the EPA had refused to regulate GHG emissions, but it has been active on the regulatory front since that decision.

The EPA has used a variety of regulatory tools for controlling GHG emissions. Its primary authority for regulating power plants comes from Title I of the federal Clean Air Act (CAA), which provides for regulation of stationary sources (larger industrial and manufacturing facilities that do not move, like utility power plants).[19] The central regulatory mecha-

[15] Database of State Incentives for Renewables and Efficiency, 'Renewable Portfolio Standards Policies' <http://www.dsireusa.org/documents/summarymaps/RPS_map.pdf> accessed 13 September 2013.

[16] The White House, Blueprint for a Secure Energy Future (2011).

[17] Clean Energy Standard Act of 2012, s 2146, 112th Cong. (2012).

[18] *Massachusetts v EPA* 549 US 497 (2007).

[19] Clean Air Act, 42 USC ss 7401–31 (2012).

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[20] Clean Air Act, 42 USC s 740

[21] Clean Air Act, 42 USC s 741

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nism of Title I of the CAA is the development and attainment of National Ambient Air Quality Standards (NAAQS). A NAAQS is a single numerical air quality standard for each regulated 'criteria pollutant' (one for which scientific criteria documents exist and which the EPA has listed as a pollutant that poses a danger to public health and welfare) that is set for the entire US.[20]

NAAQS regulatory responsibilities are divided between the EPA and state governments. Under the CAA, the EPA lists criteria pollutants and sets the NAAQS, but states bear primary responsibility for attaining, maintaining, and enforcing them through developing 'state implementation plans' (SIPs) that contain mechanisms for direct regulation of emitters to comply with the NAAQS.[21] The EPA retains significant oversight, through approval authority over state SIPs.

The EPA has set the NAAQS for only six pollutants: sulfur dioxide (SO_2), tropospheric ozone, nitrous oxides (NOx), particulate matter (PM; two particles sizes are regulated separately), lead, and carbon monoxide. There is no NAAQS for carbon dioxide or any other GHG. However, the EPA has used the NAAQS system for GHG emissions control, when GHG regulation is required as part of the approach to controlling emissions of existing criteria pollutants from power plants. That complex regulatory scheme is described below. In another regulatory approach to controlling GHG emissions, the EPA has also used its separate authority to set 'new source performance standards' under a different section of Title I.

The CAA's use for GHG emissions control began with a different part of the CAA: Title II, which regulates mobile sources (cars, trucks and other sources of air pollution that move), and which was addressed in the landmark US Supreme Court decision in *Massachusetts v EPA*.

1. *Massachusetts v EPA*/Endangerment finding

The *Massachusetts v EPA* decision, discussed in Chapter 27, paved the way for regulation by recognizing the importance of addressing climate change (thereby making it a priority of the highest court in the US).

Responding to the decision, the EPA made two regulatory findings in 2009 that were necessary to control GHG emissions from vehicles under CAA section 202(a): an 'endangerment finding' that GHGs in the atmosphere endanger the public health and welfare, and a 'cause and contribute' finding that GHG emissions from new motor vehicles and new motor vehicle engines contribute to the atmospheric concentrations of GHGs

[20] Clean Air Act, 42 USC s 7409 (2012).
[21] Clean Air Act, 42 USC s 7410 (2012).

and hence to the threat of climate change.[22] Following those decisions, the EPA and the federal National Highway Traffic and Safety Administration issued new combined fuel economy and GHG emissions standards, as discussed in Chapter 27.

Massachusetts v EPA applied only to motor vehicles and mobile sources of air pollution that CAA Title II regulates. However, the decision's holding that carbon dioxide is an 'air pollutant' under the CAA meant that CAA provisions in Title I that regulate stationary sources would apply to carbon dioxide emissions. The CAA's definition of 'air pollutant' triggers regulatory requirements for stationary sources that meet other criteria, such as a threshold quantity of annual emissions.

This prompted the EPA to issue regulations to control GHG emissions from stationary sources, which affected the two principal permitting programs for emissions from stationary sources. The first is 'New Source Review,' one part of which is Title I's Prevention of Significant Deterioration (PSD) program.[23] PSD requires pre-construction permitting for new or modified major stationary sources—like power plants—that have the potential to emit more than a specific amount of certain criteria pollutants in attainment areas (those currently meeting the NAAQS). It applies to an entity constructing a 'major emitting facility' (emitting criteria pollutants above specific thresholds, measured in tons per year, or TPY) or making a 'major modification' of an existing major stationary source in an area EPA has classified as either in attainment of a NAAQS or 'unclassifiable' for attainment. Before the construction or modification, that entity must obtain a PSD permit from the EPA or from a state environmental agency, if the air pollution program has been delegated to it.

As one condition of receiving the PSD permit, the CAA requires the applicant to use the 'best available control technology' (BACT) to control emissions of 'each pollutant subject to regulation' under the CAA.[24] After the EPA's endangerment finding, carbon dioxide was 'subject to regulation,' and by extension, new power plants subject to PSD were as well. New or modified facilities triggering PSD permitting requirements would need to implement BACT and other measures to minimize GHG emissions, as determined on a case-by-case basis during the PSD process. This did not subject all new power plants to PSD regulation and carbon dioxide controls; for example, a new plant that will not emit more than the statu-

[22] Endangerment and Cause of Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed Reg 66,496 (15 December 2009).
[23] Clean Air Act, 42 USC ss 7470–7479 (2012).
[24] Clean Air Act, 42 USC s 7475(a)(4) (2012).

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[25] Clean Air Act, 42 USC ss 76
[26] Portia Mills & Mark Mil
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[28] Clean Air Act, 42 USC ss 76
[29] United States Environmenta
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tory threshold in TPY for any criteria pollutant is not required to obtain a PSD permit. However, most new larger-sized power plants would be subject to regulation.

In addition, the endangerment and cause and contribute findings prompted the CAA Title V[25] operating permits program to apply to existing power plants and other industrial facilities emitting GHGs. Under this program, all large sources ('major' sources) and a limited number of smaller sources ('area' sources, 'minor' sources, or 'non-major' sources) must obtain permits from state or local agencies. These permits are designed to improve air quality and facilities' compliance with the law by clarifying the pollution control requirements from federal or state regulations that apply to a covered source. Sources are required to report emissions to their permitting authorities and must periodically renew their operating permits, typically every five years. Because the CAA defines the 'major source' threshold for any 'air pollutant' as 100 TPY, any power plant or other facility with this level of GHG emissions would need a Title V permit. By some estimates, applying the Title V requirements of more than 100 TPY of GHGs would force millions of new, previously unregulated entities into the Title V program.[26]

2. GHG reporting rule

In October 2009, the EPA issued a final rule on 'Mandatory Reporting of Greenhouse Gases'[27] (MRR) that took effect in January 2010. Under the MRR, covered major stationary sources submit annual GHG emissions reports to the EPA. These facilities include electricity generating units (EGUs) already reporting GHG emissions under the EPA's Acid Rain Program,[28] other stationary sources that emit 25,000 metric tons or more of GHGs per year (expressed as carbon dioxide equivalents) from fossil fuel combustion, and other sources meeting specific thresholds for emissions and rated heat input. The EPA now has a 'Greenhouse Gas Reporting Program,' with a website that makes data available on GHG emissions reported from stationary sources.[29] In reporting year 2011, for

[25] Clean Air Act, 42 USC ss 7661(f) (2012); 40 CFR pt 70 (2012).

[26] Portia Mills & Mark Mills, United States Chamber of Commerce, A Regulatory Burden: The Compliance Dimension of Regulating CO_2 as a Pollutant 3 (2008).

[27] Mandatory Reporting of Greenhouse Gases, 74 Fed Reg 56,260 (30 October 2009) (codified at 40 CFR ss 98.1–98.9).

[28] Clean Air Act, 42 USC ss 7651(o) (2012); 40 CFR pt 75 (2012).

[29] United States Environmental Protection Agency, 'Greenhouse Gas Reporting Program' <http://www.epa.gov/ghgreporting/> accessed 30 August 2013.

example, 1,594 power plants reported emissions of 2,221 metric tons of CO_2 equivalent, the vast majority of which was carbon dioxide.[30] The website also contains other useful information such as EPA's summaries and analyses of the data.

Even with the higher threshold for reporting (25,000 TPY of GHG emissions as opposed to much lower 100 or 250 TPY requirements for other pollutants), the EPA estimates that total reported emissions from the major stationary sources subject to the MRR make up approximately 85 to 90 percent of total US GHG emissions.[31]

3. GHG timing and tailoring rules/*Utility Air Regulatory Group*

In March 2010, the EPA interpreted the term 'subject to regulation,' determining that CAA permitting requirements for GHG emissions from stationary sources would apply when the regulatory requirement to control GHG emissions 'takes effect.' Under this 'Timing Rule,'[32] the EPA determined that stationary sources would face GHG permitting requirements in January 2011.

Two months later, the EPA issued a 'Tailoring Rule,' designed to narrow the number of stationary sources requiring air pollution permits for GHG emissions to the largest sources of GHGs (including electric power plants), responsible for 70 percent of stationary source GHG emissions.[33] The Tailoring Rule addressed the potential problem of millions of new sources being regulated by raising ('tailoring') the thresholds for GHG emissions that define when sources require permits under the PSD and Title V programs.

The EPA established higher thresholds because GHGs are emitted in much greater quantities than most other pollutants. If lower thresholds had applied, many more entities would have been required to obtain permits and state and local permitting authorities would have been overwhelmed with the amount of work involved. Moreover, the EPA did not intend for minor

[30] United States Environmental Protection Agency, 'Greenhouse Gas Reporting Program, Power Plants' <http://www.epa.gov/ghgreporting/ghgdata/reported/powerplants.html> accessed 30 August 2013.

[31] United States Environmental Protection Agency, 'GHG Data Frequent Questions' <http://www.ccdsupport.com/confluence/pages/viewpage.action?pageId=141983792> accessed 11 September 2013.

[32] Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs, 75 Fed Reg 17,004 (2 April 2010) (codified at 40 CFR pts 50, 51, 70 & 71).

[33] Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed Reg 31,514 (3 June 2010) (codified at 40 CFR pts 51, 52, 70 & 71) [hereinafter 'Tailoring Rule'].

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4. GHG new source performan plants (CAA 111(b) and (d))

In April 2012, the EPA propose
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[34] Tailoring Rule (n. 33), at 31,

[35] Standards of Performance
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[36] 'Settlement Agreements to
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emitters like small retailers, farms, restaurants, or churches that otherwise were not subject to any air pollution controls to face GHG regulation.

The Tailoring Rule phased in its regulatory controls, giving time for sources subject to regulation to comply, and for state and local permitting authorities to develop the capacity to issue permits. Starting in January 2011, the Tailoring Rule required new power plants already subject to PSD to include GHG controls in their PSD permits if they have the potential to emit 75,000 TPY of carbon dioxide equivalent (CO_2e) or more, or if they make changes at the power plants that increase GHG emissions by that amount.[34] Six months later, all new power plants emitting more than 100,000 TPY CO_2e and plants making changes that would increase GHG emissions by at least 75,000 TPY CO_2e, were required to obtain permits that address GHG emissions. Existing power plants that emit 100,000 TPY CO_2e were also required as of July 2011 to obtain Title V operating permits. Finally, the Tailoring Rule provided that sources emitting less than 50,000 TPY of GHGs would *not* be required to obtain permits for GHGs before 2016.

The EPA's opponents, including regulated industries, private sector companies and advocacy organizations, and states and individuals (including members of Congress) challenged all of the EPA's GHG regulations (Endangerment Finding, Timing and Tailoring Rules, and the Tailpipe Rule promulgated under Title II) in multiple lawsuits brought before the US Court of Appeals for the DC Circuit. These challenges were consolidated in the *Coalition for Responsible Regulation v EPA* case, discussed further in Chapter 27, in which the DC Circuit upheld the EPA's rules. In the 2014 *Utility Air Regulatory Group v. EPA* decision, however, the US Supreme Court struck down the Tailoring Rule, but left intact the EPA's ability to regulate GHG emissions from power plants already required to obtain PSD permits.

4. GHG new source performance standards for new and existing power plants (CAA 111(b) and (d))

In April 2012, the EPA proposed new limits on GHG emissions from new EGUs under CAA Section 111,[35] after settling a lawsuit aimed at forcing it to set the standards sooner.[36] The EPA then withdrew the standards

[34] Tailoring Rule (n. 33), at 31,516.

[35] Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed Reg 22,392-01 (proposed 13 April 2012) (to be codified at 40 CFR pt 60).

[36] 'Settlement Agreements to Address Greenhouse Gas Emissions From Electric Generating Units and Refineries, Fact Sheet' (EPA) <http://www.epa.gov/airquality/cps/pdfs/settlementfactsheet.pdf> accessed 3 February 2014.

and reissued them in different form in 2014. These standards are known as 'new source performance standards' (NSPS), because they apply only to new or modified sources under CAA section 111.[37] Section 111(b) requires the EPA to establish emission standards for any category of new and modified stationary sources that the EPA finds 'causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.'[38] The endangerment finding is not required for source categories already listed and for which other pollutants are controlled, such as EGUs. Once the EPA defines a category of industrial sources of pollution, it must propose a federal standard of performance to regulate all new sources within that category. A NSPS must reflect emissions reductions achievable under 'the best system of emission reduction' (or BSER) 'which . . . [EPA] determines has been adequately demonstrated,' taking into account costs and other factors.[39]

The proposed NSPS under section 111(b) for new plants applies only to new fossil fuel-fired EGUs in the continental US with over 25 megawatts (MW) net electrical output.[40] The EPA's rule governs two categories of new fossil fuel-fired EGUs: (1) coal-fired utility boilers or integrated gasification combined cycle (IGCC) units, and (2) natural gas-fired combustion turbine EGUs. The standard of performance for new coal-fired EGUs and IGCC units prohibits affected plants from emitting more than 1,100 pounds of CO_2 per megawatt hour.[41] This output-based performance standard is based on the CO_2 emissions from a state-of-the-art natural gas-fired plant—a highly efficient, natural gas combined cycle facility—which the EPA has determined is the BSER. As the proposed rule made clear, coal-fired units are not likely to achieve this standard without using carbon capture and sequestration (CCS) technologies.[42]

The extent to which the proposed rule would inhibit construction of coal-fired EGUs was hotly debated. Opponents charged it would completely bar new construction and thereby harm reliability of the electric grid, and that CCS had not been commercially demonstrated.[43] The EPA observed

[37] Clean Air Act, 42 USC s 7411 (2012).
[38] Clean Air Act, 42 USC s 7411(b) (2012).
[39] Clean Air Act, 42 USC s 7411(h) (2012).
[40] Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1430 (proposed 8 January 2014) (to be codified at 40 CFR pt 60).
[41] Ibid.
[42] Ibid.
[43] Rhetoric v Reality: Does President Obama Really Support an 'All-of-the-Above' Energy Strategy?: Hearing Before the House Committee on Oversight and Government Reform, 112th Cong. 5–6 (2012) (statement of Peter Glaser,

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org/ercc-comments-submitted-ep
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[44] United States Environmental
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[45] Standards of Performance
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[46] *Las Brisas Energy Center L*
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[47] Standards of Performance
Stationary Sources: Electric Utility
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[48] Full-Year Continuing App
(2011); Energy Tax Prevention Act
the War on Coal Act of 2012, HR

that inexpensive natural gas had made new coal-fired power plants less appealing even before the new NSPS, and that even without the new rule, new plants built by 2020 would use natural gas.[44] In the short term, moreover, the EPA proposed to exempt 15 proposed coal-fired EGUs that had received approval for their preconstruction permits, but had not yet commenced construction.[45] Any 'transitional source' would be allowed to continue to construction if it had already obtained a final air quality permit prior to publication of the GHG NSPS, and if it could commence construction within one year of publication. As noted below, however, utilities and industry groups argued that this requirement introduced an unresolvable conflict with the new EPA rule for controlling mercury emissions from power plants, which envisioned a longer timetable for implementation.

Developers of new coal-fired EGUs and an industry trade group challenged EPA's original 2012 GHG NSPS rule for new power plants in the DC Circuit. This challenge was dismissed because the US Administrative Procedure Act requires an agency rule to be final before it may be challenged.[46] Moreover, the challenge was moot. Mere days before the proposed NSPS rule was to be published, the EPA announced it was delaying it, bowing to the political pressure from utilities and other opponents. As noted above, the EPA issued the replacement rule proposal in January 2014. It differed from the first proposal by establishing separate standards for coal-fired EGUs and natural gas-fired EGUs.[47] There is extensive opposition in the US Congress to any NSPS rule, as shown by the House of Representatives' passage of several bills to bar the EPA from issuing any rule (although the Senate has not followed suit).[48]

Troutman Sanders LLP); ERCC Comments Submitted to EPA on the New Source Performance Standards for Power Plant Carbon Emissions, Electric Reliability Coordinating Council (June 25, 2012), <http://www.electricreliability.org/ercc-comments-submitted-epa-new-source-performance-standards-power-plant-carbon-emissions> accessed 3 February 2014.

[44] United States Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units ES-3 (2012).

[45] Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, Proposed Rule (n. 44).

[46] *Las Brisas Energy Center LLC v EPA* No. 12-1248 (DC Cir. 2012); Clean Air Act, 42 USC s 7607(b)(1) (2012).

[47] Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed Reg 1430 (proposed 8 January 2014) (to be codified at 40 CFR Parts 60, 70, 71, and 98).

[48] Full-Year Continuing Appropriations Act, HR 1, 112th Cong. s 1746 (2011); Energy Tax Prevention Act of 2011, HR 910, 112th Cong. s 2 (2011); Stop the War on Coal Act of 2012, HR 3409, 112th Cong. s 201 (2011).

In June 2013, President Obama called upon the EPA to regulate *existing* EGUs by 2015.[49] The authority for this is CAA section 111(d). That subsection provides that if emissions from existing stationary sources are not controlled through other CAA regulation, CAA section 111(d) authorizes EPA to regulate them as well with performance standards. Section 111(d) applies to any existing source of an air pollutant, if (1) the air pollutant is not regulated as a criteria pollutant or as a hazardous air pollutant (HAP) under the CAA (and GHGs are not directly regulated as criteria pollutants or HAPs), and (2) an NSPS would apply if the existing source were a new source.[50] There is debate over whether the EPA rule governing emissions of mercury and other air toxics from power plants (discussed below) precludes any regulation under section 111(d).

In June 2014, the EPA issued the 'Clean Power Plan,' a proposed rule under section 111(d) that applies to existing power plants.[51] The EPA has set minimum standards based on a BSER that provides a range of implementation options to the state, with states then called upon to develop plans to regulate pollutants from existing sources. The proposed range of measures includes four main categories, including reducing emissions at EGUs, dispatching lower-emitting EGUs and zero-emitting energy sources, and increasing end-use energy efficiency. Thus, the proposed rule explicitly contemplates that states might not impose full responsibility for emissions reductions entirely upon emitting EGUs; instead, states' plans might include measures and policies (for example, demand-side energy efficiency programs and renewable portfolio standards) for which the state itself is responsible. In fashioning the standards, EPA has allowed states the flexibility to use measures including greater deployment of renewable energy and market-based approaches such as tradable credits. The intent of this is to provide utilities greater regulatory certainty as they weigh large investment decisions on upgrading or retiring older plants, and give them flexibility to reduce emissions as cost-effectively as possible.[52] Nonetheless, the Clean Power Plan has been extremely controversial, and has sparked numerous legal challenges.

[49] Juliet Eilperin, 'It's official: EPA delays climate rule for new power plants' *Washington Post* (12 April 2013); Memorandum on Power Sector Carbon Pollution Standards, 1 Public Papers 457 (25 June 2013).

[50] Clean Air Act, 42 USC s 7411(d) (2012).

[51] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed Reg 34,829 (proposed 18 June 2014) (to be codified at 40 CFR Part 60).

[52] Dallas Burtraw, Arthur G. Fraas and Nathan Richardson, *Resources For The Future, Tradable Standards for Clean Air Act Carbon Policy* (2012).

II. OTHER FEDERAL CONTROL REGIM EMISSIONS

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A. Mercury and Air Toxics S

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[53] Clean Air Act, 42 USC s 74

[54] Clean Air Act, 42 USC s 74

[55] National Emission Standar Oil-Fired Electric Utility Steam G for Fossil-Fuel-Fired Electric U Small Industrial-Commercial-Ins 9,304 (16 February 2012) (to be c

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II. OTHER FEDERAL CAA AIR POLLUTION CONTROL REGIMES IMPACTING GHG EMISSIONS

As noted above, CAA Title I is a complex regulatory scheme with a number of different, interconnected programs. These programs are mature, comprehensive schemes in existence since the 1970s, with demonstrated effectiveness in controlling stationary sources of pollution. They also change periodically in light of new scientific information and new mandates by the US Congress.

These programs do not regulate GHG emissions directly, but are included here as mitigation strategies for two principal reasons. First, they may require pollution controls that may assist with GHG emissions mitigation, depending on the precise technology required and its effectiveness in reducing GHG emissions. Also, regulation of power plants may shift the electricity generation mix toward more efficient coal-fired plants (or alternatives such as natural gas-fired plants) and reduce GHG emissions in that manner.

A. Mercury and Air Toxics Standard for Utilities/*White Stallion* Lawsuit

Coal-fired EGUs emit mercury and other pollutants that the CAA regulates under section 112 as 'hazardous air pollutants' (HAPs).[53] This technology-focused program addresses toxic or hazardous emissions of pollutants that present significant health risks. It gives the EPA broad authority to regulate toxic substances, and states do not play a significant role in setting these emissions standards or administering them. The program requires new and existing major sources of HAP emissions to obtain permits and incorporate technology-based controls. Under section 112, sources are required to use the 'maximum achievable control technology' (MACT) to reduce their HAP emissions.[54] MACT standards are based on emission limitations achieved by the best performing 12 percent of existing sources, and cost cannot be considered.

In February 2012, the EPA issued the Mercury and Air Toxics Standards for Utilities (MATS) rule,[55] setting emission standards under

[53] Clean Air Act, 42 USC s 7412 (2012).

[54] Clean Air Act, 42 USC s 7412(d)(2) (2012).

[55] National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed Reg 9,304 (16 February 2012) (to be codified at 40 CFR Part 63).

CAA section 112 for HAPs emitted from coal and oil-fired EGUs. The MATS rule emission standards applied to new EGUs ('new source standards') and existing EGUs ('existing source standards').[56] CAA section 112 requires compliance within three years (or by March 2015 in the rule's original timetable, since extended), although state permitting agencies may grant an extra year to comply, and the EPA can extend the deadline by another year on a case-by-case basis.

The EPA noted that, 'The MATS Rule can be implemented through the use of demonstrated, existing pollution control technologies.'[57] The MATS rule will require most coal plants to upgrade existing controls and/or install additional controls, such as wet or dry scrubbers and activated carbon injection. As a result, some coal-fired EGUs will be retired or replaced with natural gas-fired plants and/or new transmission, which will impact GHG emissions, although the extent to which this will take place is disputed. Utilities and other opponents have claimed that the MATS rule will interfere with electric power reliability, because coal-fired power plants would be taken off line faster than they can be replaced.

The EPA rejects this argument.[58] It also claims that EGU retirements and replacements, and upgrades to existing plants, will yield GHG emission reductions. The EPA states that GHG emissions reductions come 'largely from projected increases in electricity generation from natural gas sources and reductions in coal-fired generation by 2016' and from 'generation shifts away from the least efficient units towards units that are more efficient to operate.'[59]

The MATS rule followed 20 years of legal battles over establishing a standard for air toxics emissions from power plants. Utilities posed more than 30 specific legal challenges to it, consolidated in the DC Circuit in the case of *White Stallion Energy Center v EPA*.[60] In addition, pollution control equipment vendors and industry opponents (including the developer of a proposed new coal-fired EGU) lodged petitions for administrative reconsideration of the MATS rule with the EPA.

One industry argument against the MATS rule relates to its intersection with the GHG New Source Performance Standards for new power plants

[56] Ibid. 9,366.

[57] The White House, Presidential Memorandum on Flexible Implementation of the Mercury and Air Toxics Standards Rule (2011), 1 Public Papers 961.

[58] United States Environmental Protection Agency, Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards 3–14, 18 (2011).

[59] Ibid. ss 5.6, 5–91.

[60] *White Stallion Energy Center LLC v EPA* No 12-1100 (DC Cir.); *White Stallion Energy Center LLC v EPA* No 12-1272 (DC Cir.).

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B. Cross-State Air Pollution
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[61] *White Stallion Energy Cen*
petitions on 28 June 2012).

[62] Letter from Gina McC
Environmental Protection Age
LLP (20 July 2012), <http:/
3 February 2014.

[63] United States Environm
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Commercial-Institutional, and
Generating Units, 78 Fed Reg 2

[64] *White Stallion Energy Cen*

[65] United States Environme
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[66] *North Carolina v EPA* 53
550 F3d 1176 (DC Cir. 2008).

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awaiting construction. The developers of these power plants argued they faced a regulatory Catch-22. They had to commence construction within one year or be subject to the NSPS, but they could not begin construction because they face uncertainty about how to comply with the MATS rule. The DC Circuit put this part of the case on a fast track schedule for decision and severed that part of the lawsuit from the main *White Stallion* lawsuit.[61] Shortly thereafter, the EPA issued a letter stating that it intended to grant the petitions for reconsideration,[62] and then issued a revised final rule in April 2013 that made certain technical adjustments to the rule.[63] In 2014, the DC Circuit rejected the industry challenges to the MATS rule.[64]

B. Cross-State Air Pollution Rule (*EME Homer City Generation*/Clean Air Interstate Rule)

As its name suggests, the 'Cross-State Air Pollution Rule' (CSAPR)[65] aimed to address interstate transport of power plant emissions of sulfur dioxide (SO_2) and nitrogen oxides (NOx) that contribute to pollution problems (and therefore to nonattainment of the applicable NAAQS) in downwind states.

In July 2008, the US Court of Appeals for the DC Circuit overturned a prior attempt to address the problem, the EPA's Clean Air Interstate Rule (CAIR), for, among other reasons, failing to properly address reducing upwind states' contributions to NAAQS violations in downwind states.[66] The CAIR remained in effect until the EPA finalized the new CSAPR in

[61] *White Stallion Energy Center LLC v EPA* No 12-1272 (severed from original petitions on 28 June 2012).

[62] Letter from Gina McCarthy, Assistant Administrator, United States Environmental Protection Agency, to Patricia T. Barmeyer, King & Spalding, LLP (20 July 2012), <http://epa.gov/mats/pdfs/20120720letter.pdf> accessed 3 February 2014.

[63] United States Environmental Protection Agency, Reconsideration of Certain New Source Issues: National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 78 Fed Reg 24,073 (24 April 2013).

[64] *White Stallion Energy Center LLC v EPA* 748 F.3d 1222 (DC Cir. 2014).

[65] United States Environmental Protection Agency, Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed Reg 48,208 (8 August 2011) (to be codified at 40 CFR pts. 51, 52, 72, 78, and 97) [hereinafter 'Cross-State Air Pollution Rule'].

[66] *North Carolina v EPA* 531 F3d 896 (DC Cir. 2008), modified on rehearing, 550 F3d 1176 (DC Cir. 2008).

2011. The CSAPR was designed to require 27 states to reduce power plant emissions of SO_2 and NOx significantly, to 73 percent below 2005 levels in the covered states in 2014.[67] It interpreted the CAA's 'good neighbor' provision, which requires states to ensure that in-state sources do not have significant detrimental impacts on air quality in other states.[68] The CSAPR defined the emissions reduction responsibilities of each upwind (contributing) state, and, rather than relying on SIPs, prescribed Federal Implementation Plans (FIPs) to bring about the required reductions. The EPA estimated that about 4.8 gigawatts of coal-fired electric generating capacity would come off line, which would reduce CO_2 emissions from EGUs by as much as 25 million metric tons annually.

However, in its August 2012 decision in the *EME Homer City Generation* lawsuit, the US Court of Appeals for the DC Circuit invalidated the CSAPR.[69] The DC Circuit concluded that the rule violated the CAA by using a two-step process for determining each listed upwind state's emission reduction obligations, which the CAA did not permit the EPA to do. According to the court, by establishing FIPs to implement the rule, the CSAPR also unlawfully removed the states' initial right to issue their own SIPs. The court held that the EPA can only step in to impose an FIP when a state fails to submit a workable SIP. Finally, the DC Circuit directed the EPA to continue administering the CAIR until the EPA can finalize a replacement rule.

In 2014, the US Supreme Court reversed the DC Circuit's judgment.[70]

III. STATE AND REGIONAL INITIATIVES—GHG EMISSIONS REDUCTIONS

US states were active through the 2000s in regulating GHG emissions, in part because they were acting in the absence of federal involvement, and have continued their efforts in recent years. State laws and programs range from hortatory state action plans to mandatory GHG emission reduction standards. A number of states have developed climate action plans and GHG emissions targets, which are discussed in this section. California, the leader among US states, has a comprehensive law and regulations designed to limit GHG emissions throughout the state's economy. Other

[67] Cross-State Air Pollution Rule (n. 65) at 48,214–15.

[68] Clean Air Act of 1970, 42 USC s 7410(a)(2)(D)(i)(I) (2012).

[69] *EME Homer City Generation LP v EPA* 696 F3d 7, certiorari granted No 12-1182 (US 2013).

[70] *EPA v. EME Homer Generation LP* 134 S. Ct. 1584 (2014).

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[71] 'Letter from Bob Martin,
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[72] 'Regional Greenhouse G
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[73] 'Regional Greenhouse Ga
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[74] Regional Greenhouse Ga
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measures, including renewable portfolio standards (often including separate standards for energy efficiency), net metering, green pricing, and building energy codes, have multiple goals besides GHG reduction. These goals include reducing consumption of electricity and promoting increased use of non-fossil fuel sources of electricity generation. For this reason, those programs and incentives are discussed in other sections.

A. State and Regional Cap-and-Trade Programs (RGGI; California 'AB 32')

Cap-and-trade programs (discussed further in Chapter 22) seek to cap overall emissions and give regulated entities flexibility in deciding whether and how to decrease their individual emissions. They place an overall limit (cap) on total GHG emissions and reduce emissions by requiring regulated firms to hold tradable permits (known as 'allowances') equivalent to yearly emissions or those of other regulated time periods. Firms can buy and sell allowances or make cost-efficient improvements designed to reduce emissions.

In 2009, ten states in the northeast and mid-Atlantic regions of the US launched the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade program to reduce CO_2 emissions from electric power plants. New Jersey withdrew from RGGI in 2011,[71] but the other states remain members. RGGI's first phase covers CO_2 reductions from power plants, with plans to expand later to cover other CO_2 emitters. As of early 2013, proceeds of allowance auctions totaled over $1.3 billion.[72] Member states have plans in place that specify uses for the proceeds from allowance auctions in part for purposes that contribute to further GHG emissions reductions, such as energy efficiency and renewable energy programs, and worker training for clean energy industries.[73] An RGGI report from November 2012 estimates that these investments have avoided 12 million tons of CO_2 emissions.[74]

California approved an economy-wide GHG cap-and-trade program in 2012, commonly known as 'AB 32' after the 2006 law that led to its

[71] 'Letter from Bob Martin, Commissioner NJ Department of Environmental Protection to the Honorable Dannel Malloy, Governor of Connecticut' (29 November 2011), <http://rggi.org/docs/Documents/NJ-Statement_112911.pdf> accessed 3 February 2014.

[72] 'Regional Greenhouse Gas Initiative, Auction Results' <http://rggi.org/market/co2_auctions/results> accessed 11 September 2013.

[73] 'Regional Greenhouse Gas Initiative, State Investment Pages' <http://rggi.org/rggi_benefits/program_investments> accessed 11 September 2013.

[74] Regional Greenhouse Gas Initiative, 'Regional Investment of RGGI CO_2 Allowance Proceeds, 2011' (2012) <http://www.rggi.org/docs/Documents/2011-Investment-Report.pdf> accessed 11 September 2013.

creation. AB 32 established a goal of reducing California's GHG emissions to 1990 levels by 2020 and 80 percent from 1990 levels by 2050. The first of three compliance periods between 2013 and 2020 caps emissions from electric generating utilities, electricity importers and large industrial facilities. By 2020, the program will cover an estimated 85 percent of the state's emissions. The initial cap matched emissions forecasts for 2012, and will decrease by about 2 percent each year in the first compliance period.

California has held several auctions of allowances under the AB 32 program since the first quarterly auction of November 2012. Much auction revenue has gone to finance climate change mitigation programs. As of mid-2013, roughly 50 million allowances had been sold, raising $256 million for clean energy investments in California.[75] In 2013, in a move criticized as potentially unlawful under state law, Governor Jerry Brown proposed borrowing $500 million of auction revenue to balance the state's budget,[76] so it is unclear how much future revenue will be used for climate mitigation purposes.

B. State and Local Climate Action Plans and Emissions Targets

The majority of US states have enacted climate action plans, and some others have adopted GHG emissions targets. As of mid-2013, 32 states had climate action plans with frameworks for reducing GHG emissions.[77] These plans are typically developed by state environmental agencies, climate change commissions with broad stakeholder representation, or other bodies established by state law to develop and implement the plans. Plans generally inventory GHG emissions and set forth appropriate mitigation strategies, including specific policy recommendations, which states will use to address climate change and reduce GHG emissions in different sectors of states' economies.[78] Some state plans also include adaptation strategies. A typical plan is the Maryland Commission on Climate Change's 2008 Climate Action Plan.[79]

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[75] California Environmental Protection Agency, 'Air Resources Board, Auction Information' <http://www.arb.ca.gov/cc/capandtrade/auction/auction.htm> accessed 11 September 2013.

[76] Jeremy B. White, 'Cap-and-trade loan in state budget deal irks environmentalists' *Capitol Alert* (11 June 2013).

[77] United States Environmental Protection Agency, 'Climate Change Action Plans' <http://www.epa.gov/statelocalclimate/state/state-examples/action-plans.html> accessed 11 September 2013.

[78] Ibid.

[79] Maryland Commission on Climate Change, 'Climate Action Plan' (2008) <http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/legislation/index.aspx> accessed 11 September 2013.

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[80] Center for Climate an
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[81] Establishing a Goal to
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[82] City of Portland, 'Planni
www.portlandoregon.gov/bps/

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September 2013.

Twenty states, plus the District of Columbia, have state GHG emissions targets.[80] These targets are typically adopted in climate action plans, and identify emission reduction levels that states set out to achieve by a specified time. For example, a 2009 Governor's Executive Order in New York state set a goal of reducing the state's GHG emissions 80 percent from 1990 levels by 2050.[81] Other targets vary greatly by state, in terms of both the emissions reduction levels specified and the timing of emissions reductions. Some state emissions targets (like New York's) are stated as goals, while others are written into state law and are legally binding.

A number of US cities (including Seattle, Miami, Cincinnati and others) and counties have comprehensive GHG emissions reduction plans. In 1993, Portland, Oregon was the first US city to adopt a plan, and has updated and expanded it since then.[82] Over 1,000 US cities and municipalities have signed the United States Conference of Mayors' Climate Protection Agreement, which calls for cities to reduce their GHG emissions. Many cities also have created sustainability departments, which act as focal points for GHG mitigation strategies and other environmental programs.

IV. REGULATORY REGIMES PROMOTING REDUCED CONSUMPTION AND ALTERNATIVES TO FOSSIL FUEL COMBUSTION

The federal and state programs and incentives described in this section feature measures of two basic types:

1. Measures promoting increased use of alternative sources of electricity generation other than fossil fuels; and
2. Energy efficiency and conservation measures, designed to lead to reduced consumption of electricity.

[80] Center for Climate and Energy Solutions, 'Greenhouse Gas Emissions Targets' <http://www.c2es.org/us-states-regions/policy-maps/emissions-targets> accessed 11 September 2013.

[81] Establishing a Goal to Reduce Greenhouse Gas Emissions Eighty Percent by the Year 2050 and Preparing a Climate Action Plan, (2009) New York State Executive Order No. 24, XXXI New York Daily Register 35.

[82] City of Portland, 'Planning and Sustainability, Climate Action Plan' <http://www.portlandoregon.gov/bps/49989> accessed 11 September 2013.

These measures can reduce demand for electricity generated from fossil fuels, and thereby help curb GHG emissions. They are so varied that this section will use only a representative sample of state and federal programs.

A. Incentives For Electricity Generation From Clean Energy Sources (Clean Energy Standards/Feed-In Tariffs/Net Metering/Community Choice Aggregation/Tax Credits)

These programs and incentives aim to reduce generation from fossil fuels by promoting small-scale and utility-scale generation from renewable sources or other sources deemed 'clean,' which can lessen GHG emissions from the electric power sector. These programs and incentives typically have multiple policy goals in addition to climate mitigation, including spurring the deployment of clean energy technologies and creating jobs.

The most popular mechanism in the US is 'renewable portfolio standards' (RPS) or 'clean energy standards' (CES) that require electric utilities to supply specified percentages of their electricity sales from wind, solar, or other qualifying renewable energy sources.[83] As noted above, nearly three-fourths of US states and the District of Columbia have some form of RPS or CES.[84] The typical design allows utilities to demonstrate compliance either by generating power from the required percentage of renewable energy sources, or by acquiring tradable 'renewable energy certificates' (or a combination of the two). Some state standards allow credit for electricity consumption reductions from increased use of energy efficiency and conservation. Some states define 'clean' energy more broadly, including as 'clean' some non-renewable electricity generation technologies, such as new nuclear power and coal with carbon capture and storage (CCS).[85]

Net metering is another popular incentive for generation from small facilities, such as residential solar photovoltaic systems, powered by renewable energy sources. This incentive allows residential and commercial customers who generate their own electricity to 'run the meter backwards' at times when they make more electricity than they need, sending the excess power they do not use back into the electric grid.[86]

[83] Center for Climate and Energy Solutions, Clean Energy Standards: State and Federal Policy Options and Implications (2011).

[84] United States Energy Information Administration, Most States Have Renewable Portfolio Standards (3 February 2012) <http://www.eia.gov/todayinenergy/detail.cfm?id=4850> accessed 3 February 2014.

[85] Center for Climate and Energy Solutions (n. 83) at n. 21.

[86] Solar Energy Industries Association, 'Net Metering' <http://www.seia.org/policy/distributed-solar/net-metering> accessed 11 September 2013.

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Net metering is accomplished through a billing mechanism that credits system owners for the electricity they add to the grid. If a customer generates more electricity than it uses (for example, a solar system receiving full sunshine during daylight hours), the electricity meter will run backwards. This will provide a credit against charges for electricity consumed at other times, when the customer's electricity use exceeds the system's output. At prescribed intervals, the utility bills the customer for 'net' energy use.

Many US states have enacted net metering laws.[87] In some other states, utilities offer net metering programs voluntarily or are required to offer them by state public utility commissions (PUCs), not by legislatures. These programs differ widely, notably in total program size (usually expressed in megawatts) and maximum allowable size of individual facilities.[88] In some states, utilities and other opponents have challenged net metering, arguing that it gives an impermissible subsidy to participating ratepayers, with corresponding higher costs for all other consumers. California is a high-profile example of this, and the regulatory decisions of the state's PUC promoting net metering have been upheld over these objections.[89]

A smaller number of US states and localities have adopted 'feed-in tariffs' (FIT) which encourage renewable electricity generation from small solar, wind and other facilities by typically offering stable, long-term contracts of up to 15–20 years in length. These contracts typically guarantee specific payments (usually expressed in cents per kWh) to project owners for the total amount of renewable electricity they produce, and require utilities to allow facilities access to the electric grid. An example of this is California's Section 399.20 FIT program, which requires the state's three largest investor-owned utilities to purchase power from small-scale generators using renewable sources at specified rates under the terms of standardized contracts, and counts the power purchased toward the utilities' RPS obligations.[90]

Six US states have laws and policies encouraging 'community choice

[87] United States Energy Information Administration, 'Policies for compensating behind-the-meter generation vary by State' (9 May 2012) <http://www.eia.gov/todayinenergy/detail.cfm?id=6190> accessed 11 September 2013.

[88] Database of State Incentives for Renewables and Efficiency, 'Summary Tables: Net Incentives for Renewable Energy' <http://www.dsireusa.org/library/includes/type.cfm?Type=Net&Back=regtab&CurrentPageID=7&EE=0&RE=1&Search=TableType> accessed 12 September 2013.

[89] California Public Utilities Commission, Decision 12-05-036 (24 May 2012).

[90] California Public Utilities Commission, Decision 13-05-034 (23 May 2013).

aggregation' (CCA), under which localities can aggregate individual customers into one unit for purposes of procuring electricity.[91] The aggregated entity may purchase electricity from renewable energy sources. According to one estimate, CCA entities currently serve more than 2 million customers in the US.[92] A notable example is the Marin Energy Authority (MEA) in Marin County, California, a nonprofit agency that administers California's first CCA.[93] Under the MEA's governing documents, including an Integrated Resource Plan, customers currently receive electricity that is 50 percent or more generated from renewable sources.[94]

Federal tax incentives have played a vital role in spurring considerable renewable energy technology deployment. Two significant tax incentives are the wind Production Tax Credit (PTC) for utility-scale projects (primarily wind)[95] and the Investment Tax Credit (ITC) for owners of individual renewable energy systems.[96] As of 2013, the PTC is set at 2.3¢/kWh for wind, geothermal, and closed-loop biomass, and 1.1¢/kWh for other eligible technologies through December 2013.[97] The PTC faces near-constant battles for reauthorization, but recently has helped lead to significant expansions of US wind energy capacity.[98] The ITC provides a credit for up to 30 percent of the cost of qualifying technologies, for systems put in place before December 2016.[99]

[91] United States Department of Energy, 'Energy Efficiency and Renewable Energy, Community Choice Aggregation' <http://apps3.eere.energy.gov/greenpower/markets/community_choice.shtml> accessed 13 September 2013) (listing California, Illinois, Massachusetts, New Jersey, Ohio, and Rhode Island as states promoting community choice aggregation).

[92] Shawn E. Marshall, Forming a National Community Choice Aggregation Network: Feasibility, Findings and Recommendations 5 (2010).

[93] Marin Energy Authority, <http://www.marinenergyauthority.org/> accessed 13 September 2013.

[94] Marin Energy Authority, Marin Clean Energy: Integrated Resource Plan Annual Update (2012).

[95] Internal Revenue Code, 26 USC s 45 (2012).

[96] Internal Revenue Code, 26 USC s 48 (2012).

[97] This was accomplished by the most recent reauthorization of the PTC, in Section 407 of the American Taxpayer Relief Act of 2012 in January 2013. American Taxpayer Relief Act of 2012, Public Law No. 112-240, s 407 (2013).

[98] United States Energy Information Administration, 'Wind Energy Tax Credit Set to Expire at the End of 2012' (21 November 2012) <http://www.eia.gov/todayinenergy/detail.cfm?id=8870> accessed 12 September 2013.

[99] Internal Revenue Code, 26 USC s 48(a)(2) (2012).

B. Utility Demand-Side M

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[100] Public Utility Regulat
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[101] United States Energy I
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[102] Energy Policy Act of
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[103] Public Utility Regulato

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B. Utility Demand-Side Management (DSM) Programs

Since the 1970s, and in particular the enactment of the Public Utility Regulatory Policies Act of 1978 (PURPA),[100] federal and state programs and initiatives have aimed to reduce consumption and improve energy efficiency. Numerous techniques exist to reduce energy consumption by household appliances, industrial equipment and buildings; these are discussed in the following section. This section focuses on utilities' 'demand-side management' (DSM) energy efficiency and conservation programs and incentives that aim to reduce electricity demand and GHG emissions.[101] Curtailments to usage at specific times in response to financial or other incentives, known as 'demand response' are discussed separately below.

1. Public Utility Regulatory Policies Act (PURPA) requirements and the rise of DSM Programs

Utilities are often criticized for inadequate demand-side efforts, as their success would result in less of their own product being consumed. Also, traditional rate-making methods discouraged utilities' DSM programs. In response, and to promote a national policy of encouraging efficiency and conservation, the US Congress has acted several times to encourage and require utilities to engage in DSM programs. PURPA set forth an initial set of requirements, and three subsequent omnibus federal energy policy acts contained additional requirements. These laws were the Energy Policy Act of 1992 (EPAct 1992), the Energy Policy Act of 2005 (EPAct 2005), and the Energy Independence and Security Act of 2007 (EISA).[102]

PURPA's demand-side provisions, as set forth in Title I of the 1978 law, aimed to encourage conservation of energy supplied by electric utilities, optimal efficiency of electric utility facilities and resources, and equitable rates for electric consumers. PURPA did not mandate that utilities undertake specific actions, but instead encouraged the states to adopt regulatory policies.[103]

The statute set forth six specific federal standards for utilities' services

[100] Public Utility Regulatory Policies Act of 1978, Public Law No. 95-617 (1978).

[101] United States Energy Information Administration, 'Electric Utility Demand Side Management' <http://www.eia.gov/electricity/data/eia861/dsm/index.html> accessed 11 September 2013.

[102] Energy Policy Act of 1992, Public Law No. 102-486 (1992); Energy Policy Act of 2005, Public Law No. 109-58 (2005); Energy Independence and Security Act of 2007, Public Law No. 110-140 (2007).

[103] Public Utility Regulatory Policies Act of 1978, 16 USC s 2621 (2012).

and rates: (i) rates should reflect the actual cost of electric power generation and distribution; (ii) rates should not decline with increases in electric power use unless the cost of providing the power decreases as consumption increases; (iii) rates should reflect the daily variations in the actual cost of electric power generation; (iv) rates should reflect the seasonal variations in the actual cost of electric power generation; (v) rates should offer a special 'interruptible' electric power service rate for commercial and industrial customers; and (vi) each electric utility must offer load management techniques to their electric consumers that will be practicable, cost effective and reliable, as determined by the state public utility commission.[104] State PUCs, which have responsibility for setting the rates of electric utilities, were required to consider whether adopting these standards would accomplish PURPA's objectives. Section D.2 below discusses the use of alternative rate-setting strategies as a means of encouraging electricity conservation and GHG emissions reduction.

EPAct 1992 amended PURPA to add two new standards for state consideration under PURPA: (1) the use of Integrated Resource Planning (discussed separately below), and (2) the encouragement of DSM investments by 'the utility's prudent investments in, and expenditures for, energy conservation and load shifting programs and for other demand-side management measures [. . .] are at least as profitable [. . .] as prudent investments in, and expenditures for, the acquisition or construction of supplies and facilities.'[105] This latter statutory standard requires that state regulators link a utility's rate and recovery of its costs to its performance in implementing cost-effective DSM programs.[106]

2. Utility DSM programs

Implementing PURPA's encouragement of DSM investments, state PUCs empowered electric utilities to recover costs associated with DSM programs. This led many electric utilities to adopt DSM programs. Specific DSM techniques include such programs as encouraging consumers to use energy-saving appliances and high-efficiency heating and air conditioning systems, usually in response to financial incentives. Consumer characteristics such as knowledge, awareness, and motivation often influence the success of a program. External influences, such as energy prices and the market availability of relevant technologies, also affect a DSM program's success.

[104] Public Utility Regulatory Policies Act of 1978, 16 USC ss 2621(d)(1)–(19) (2012).
[105] Public Utility Regulatory Policies Act of 1978, 16 USC s 2621(d)(8) (2012).
[106] Ibid.

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[107] Toshi H. Arimura, 'Cos
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[108] Database of State Incenti
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[109] United States Energy Info
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[110] United States Environm
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1978, 16 USC ss 2621(d)(1)–(19)

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Spending on utility DSM peaked in the early 1990s. After the advent of electric utility restructuring, many utilities decreased their DSM efforts or discontinued their programs altogether, as electricity markets were being transformed to introduce more competition, and utilities tended to view expenditures on DSM programs as unnecessary extra costs that competitors did not incur.[107]

A number of states stepped into the gap, funding DSM programs that utilities were reducing or discontinuing. The typical means of accomplishing this was a 'system benefits charge' (also known as a 'public benefits fund'), established in 15 states and the District of Columbia through a small fee imposed on all electric customers' bills. These small charges can yield considerable sums. As of early 2013, public benefit funds were expected to hold $7.7 billion by 2017, with California being responsible for nearly two-thirds of the total, but other states have multi-million-dollar funds.[108] In most states, these funds can be used for energy efficiency, conservation, and renewable energy purposes, although program design and administration vary widely among the states.

Data available from the EIA show that spending on DSM programs, funded in part by systems benefit charges, has rebounded in recent years. In 2010, electric utilities spent $4.2 billion on DSM programs and reduced 33 GW of peak load electricity demand.[109]

C. Federal and State Energy Efficiency Standards

Since the 1970s, the US Congress, federal Department of Energy (DoE), and states have recognized that improved energy efficiency of products, manufacturing processes and buildings can reduce energy consumption and thereby reduce GHG emissions. Residences, businesses, schools, governments, and industries account for more than half of US electricity consumption, so improving their energy efficiency can contribute significantly to reducing US GHG emissions.[110] A 2009 study concluded that by

[107] Toshi H. Arimura, 'Cost-Effectiveness of Electricity Energy Efficiency' (2012) 33 *The Energy Journal* 63, 64.

[108] Database of State Incentives for Renewables & Efficiency, 'Public Benefits Funds for Renewables' <http://dsireusa.org/documents/summarymaps/PBF_Map.pdf> accessed 13 September 2013.

[109] United States Energy Information Administration, 'Annual Energy Review' (2012) <http://www.eia.gov/totalenergy/data/annual/showtext.cfm?t=ptb0813> accessed 3 February 2014.

[110] United States Environmental Protection Agency, Understanding Cost-Effectiveness of Energy Efficiency Programs ES-1 (2008).

2020, the US could consume 23 percent less energy per year with aggressive investments in energy efficiency techniques.[111] According to a recent estimate by the nonprofit Center For Climate and Energy Solutions, federal energy efficiency standards alone could lead to reductions in GHG emissions by 2035 equal to the annual emissions of 49 coal-fired power plants.[112]

Federal and state governments seek improved energy efficiency through minimum energy performance standards for new appliances and other energy consuming products, and minimum efficiency requirements for buildings. The 2013 Climate Action Plan set a goal of reducing GHG emissions by three billion metric tons cumulatively by 2030 through the use and expansion of appliance standards and energy efficiency standards for federal buildings, or 'nearly one-half of the carbon pollution from the entire US energy sector for one year.'[113] For a discussion of energy efficiency programs and incentives for buildings, see Chapter 9.

With respect to appliances, the US Congress first set minimum energy efficiency standards in the Energy Policy and Conservation Act of 1975.[114] Those standards have been expanded and amended by the federal energy policy laws enacted since then, including the EPAct 2005 and EISA. In general, the DoE must set appliance efficiency standards at levels that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified.[115] Specific standards are prescribed for numerous categories of products. For example, the EISA established an energy efficiency standard for light bulbs that by 2020 requires that bulbs must consume 60 percent less energy than today's bulbs, which will effectively result in the end of use of the incandescent light bulb.[116] The Department of Energy recently established other new minimum energy efficiency standards for a wide range of appliances, electronics, and other equipment.[117]

[111] Hannah Choi Granade, Jon Creyts, Anton Derkach, Philip Farese, Scott Nyquist and Ken Ostrowski. McKinsey & Co., Unlocking Energy Efficiency in the US Economy 7–8 (2009).

[112] Center for Climate and Energy Solutions, Federal Action on Climate Change and Clean Energy (2013).

[113] The President's Climate Action Plan (n. 2), at 9.

[114] Energy Policy and Conservation Act of 1975, Public Law No. 94-163, Title III (1975).

[115] Energy Policy and Conservation Act, 42 USC ss 6291–95 (2012).

[116] Energy Policy and Conservation Act, 42 USC s 6291(30) (2012).

[117] United States Department of Energy, 'New Energy Efficiency Standards for Residential Clothes Washers and Dishwashers to Save Consumers Billions on Energy Bills' (16 May 2012) <http://energy.gov/articles/new-energy-efficiency-

D. Actions By State Public Side Options

1. Integrated resource plan

After the EPAct 1992's enco of state PUCs adopted it, a IRP has two components: plan to meet the projected f ates both traditional suppl and transmission lines) and conservation) in making dec electric energy needs.[119] By e resources, IRP aims to cha supply to meet projected de tions, if more efficiency an included in the resulting pla

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[118] State & Local Energy Resource Planning to Encoura Measures 1 (2011).

[119] Ibid.

[120] Rachel Wilson and Pa Survey of State Integrated Res

[121] The most recent state Environmental Protection, B Resource Plan for Connecticut

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D. Actions By State Public Utility Commissions Promoting Demand-Side Options

1. Integrated resource planning (IRP) requirements

After the EPAct 1992's encouragement of IRP, as noted above, a number of state PUCs adopted it, and 34 states now have some form of IRP.[118] IRP has two components: an assessment of future electric needs and a plan to meet the projected future needs. It is 'integrated' because it evaluates both traditional supply-side resources (building new power plants and transmission lines) and demand-side resources (energy efficiency and conservation) in making decisions about how best to meet projected future electric energy needs.[119] By explicitly adding consideration of demand-side resources, IRP aims to change the traditional pattern of building more supply to meet projected demand. This can lead to GHG emissions reductions, if more efficiency and conservation programs and incentives are included in the resulting plans.

In the 1990s, restructuring of electric utilities adversely impacted IRP. States that partially deregulated (restructured), such as Maryland, empowered consumers to choose from among different generation options. As a result, some restructured states discontinued centralized planning to define options to meet projected demand.[120] In some restructured states, such as Connecticut, however, IRP is still used for procurement of new resources, including energy efficiency and conservation options.[121]

Other incentives for energy efficiency, established in a number of US states, are statutory or regulatory mechanisms for utility-administered energy efficiency programs, and performance-based incentives for utilities'

standards-residential-clothes-washers-and-dishwashers-save-consumers> accessed 12 September 2013 (providing a list of the products covered from 2009 through 2012, including products such as small electric motors, residential clothes washers, and residential dishwashers); United States Department of Energy, 'Energy Efficiency and Renewable Energy, Appliance & Equipment Standards' <http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notices.html> accessed 12 September 2013.

[118] State & Local Energy Efficiency Action Network, Using Integrated Resource Planning to Encourage Investment in Cost-Effective Energy Efficiency Measures 1 (2011).

[119] Ibid.

[120] Rachel Wilson and Paul Peterson, Synapse Energy Economics, A Brief Survey of State Integrated Resource Planning Rules' Requirements 13 (2011).

[121] The most recent state IRP is Connecticut Department of Energy & Environmental Protection, Bureau of Energy & Technology, 2012 Integrated Resource Plan for Connecticut (2012).

energy efficiency programs. Some PUCs approve long-term plans spanning three years or more. An example is Massachusetts, where the 2008 Green Communities Act requires utilities to file energy efficiency plans every three years for approval by the state's electricity regulator, the Department of Public Utilities (DPU).[122] The Green Communities Act requires the DPU to ensure that energy efficiency programs 'are delivered in a cost-effective manner capturing all available efficiency opportunities, minimizing administrative costs to the fullest extent practicable, and utilizing competitive procurement processes to the fullest extent practicable.'[123] Performance-based incentives use several different mechanisms (such as allowing a utility to earn a percentage of program costs for achieving a savings target) to give utilities added incentives to deploy energy efficiency.[124]

2. State rate policies favoring demand-side options (dynamic pricing and decoupling)

PUCs in states that have not restructured their electricity markets set retail electric rates under traditional cost of service formulas.[125] Utilities recover their fixed and variable costs, and earn a rate of return on assets devoted to production and distribution of electricity. PUCs can play a central role in encouraging reduced consumption of electricity, by crafting intelligent pricing structures that reward consumers for consuming less (especially at times of peak demand) while also allowing utilities to earn profits.

However, at present, most retail electric rates in the US do not encourage customers to reduce their electricity consumption.[126] They do not reflect the real time price of electricity, which, in restructured states, is a function of prices on wholesale electricity markets, and in traditionally regulated states, is generally fixed based on an average cost throughout the year. As a result, consumers typically have no incentive to limit or shift consumption when the cost of generation is high (at peak hours in

[122] Massachusetts General Laws chapter 25 s 21 (2012). The Green Communities Act was An Act Relative to Green Communities, 2008 Massachusetts Acts 169.

[123] Massachusetts General Laws chapter 25 s 21(b) (2012).

[124] Institute For Electric Efficiency, State Electric Efficiency Regulatory Frameworks 14–21 (2012).

[125] Regulatory Assistance Project, Electricity Regulation in the US—A Guide 36 (2011).

[126] United States Department of Energy, Benefits of Demand Response in Electricity Markets and Recommendations For Achieving Them (2006), <http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/DOE_Benefits_of_Demand_Response_in_Electricity_Markets_and_Recommendations_for_Achieving_Them_Report_to_Congress.pdf> accessed 3 February 2014.

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[127] Ibid. at 7.

[128] Ibid. at 54–6.

[129] Federal Energy Regulat
Demand Response Potential, at x

[130] Ibid. at 47–9.

[131] National Renewable Ener
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summer afternoons, for example), which results in over-consumption during system peaks.[127]

To reduce consumption and cut peak demand, a number of US states have adopted 'dynamic pricing' requirements. Dynamic pricing includes a variety of tariffs (pricing structures), such as 'real-time pricing,' under which the price of electricity reflects the system's marginal cost of producing electricity, and 'time-of-use,' under which prices are set for specific time periods.[128] As discussed below, a prerequisite for these advanced pricing structures is that consumers have 'smart' electric meters that display prevailing prices. At present, most US electric meters do not have this function, and utilities are rapidly moving to deploy smart meter infrastructure.

Under dynamic pricing, customers can adjust their electricity consumption according to the prevailing price. The Federal Energy Regulatory Commission believes adoption of dynamic pricing and more widespread deployment of demand response (see below) could save as much as 188 GW of electricity by 2020,[129] and some pilot programs have shown reductions in consumption.[130] Dynamic pricing could also reduce peak demand, thereby offsetting the need for maintaining additional generation capacity to meet peak demand. This would reduce GHG emissions because generators used to meet peak demand are often inefficient, polluting plants that are run least often.

Another well-known drawback of the rate-setting process, in states with traditional regulation, is that it does not encourage utilities to make investments in energy efficiency and conservation. Under the cost of service formula for rates, utilities recover their fixed and variable costs based on the amount of electricity they project to sell. The retail electric rate is fixed between rate cases, so if the amount of electricity sold later decreases due to efficiency and conservation measures, the utility recovers less revenue unless it can reduce expenses. Thus, utilities have traditionally relied on increasing sales, not decreasing them, as a means of increasing their profits. The concept of 'decoupling,' adopted in 14 US states,[131] changes this incentive. There are several formulas for implementing decoupling, but all allow for price adjustments between rate cases to tie revenue to

[127] Ibid. at 7.
[128] Ibid. at 54–6.
[129] Federal Energy Regulatory Commission, A National Assessment of Demand Response Potential, at x, (2009).
[130] Ibid. at 47–9.
[131] National Renewable Energy Laboratory, Decoupling Policies: Options to Encourage Energy Efficiency Policies for Utilities (2009).

actual expenses and break (decouple) the link between sales and revenue. It is controversial in part because its opponents believe it gives utilities the functional equivalent of increased rates without a rate case, but it does remove the utilities' incentive to increase customer demand and provide an incentive for utilities to adopt efficiency and conservation programs (although they still may not do so).

E. 'Smart Grid' Laws, Policies, and GHG Reduction Potential

'Smart Grid' is a shorthand term for two different, but related concepts: overhauling the antiquated US electric grid with modern technologies to make it 'smarter' (with digital technologies replacing older ones, with benefits such as greater ability of the grid to integrate renewable power), and offering new products and services to consumers that could lead to substantial reductions in GHG emissions.[132]

As part of its regulatory jurisdiction over the wholesale power markets, the Federal Energy Regulatory Commission (FERC) has issued new regulations aimed at making the grid smarter and cleaner. A significant rule is FERC Order 1000,[133] designed to improve the economic viability of renewable power generation and transmission. Order 1000 requires a regional planning process to make it easier to site new transmission lines to integrate renewable power sources into the grid and reduce GHG emissions. The process of implementing Order 1000 is ongoing.

At the consumer level, reaping Smart Grid benefits requires much more widespread adoption of smart meters that measure electricity consumption on an hourly (or more frequent) basis. For example, dynamic pricing requires the ability to view near-real-time consumption figures to determine how much the consumer should pay under the applicable pricing structure.[134] Utilities are moving to deploy smart meters and other associated equipment, known generally as 'advanced meter infrastructure.' Typically, this involves approval of cost recovery for expenses incurred in AMI deployment from state PUCs, which usually require a showing of benefits to consumers from smart meters. The 2009 American Reinvestment and Recovery Act prompted some utilities to move forward with smart meter deployment proposals, by providing funding for federal cost sharing. Another federal policy that can prompt more widespread

[132] Joel B. Eisen, 'Smart Regulation and Federalism for the Smart Grid' (2013) 37 *Harvard Environmental Law Review* 1, 6–7.

[133] National Assessment of Demand Response Potential (n. 129), at x.

[134] Tom Simchak and Lowell Ungar, Alliance to Save Energy, Realizing the Energy Efficiency Potential of Smart Grid 6 (2011).

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[138] Joel B. Eisen, 'Distribu
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[139] National Assessment o

[140] Ibid.

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development of Smart Grid infrastructure is the innovative public-private partnership, led by two federal agencies (the National Institute of Standards and Technology, and Federal Energy Regulatory Commission) to develop Smart Grid technical standards.[135]

One Smart Grid application that can provide consumer benefits is 'demand response,' which is different from increased energy efficiency or conservation. Demand response involves consumers reducing their consumption at specific times, or shifting usage to non-peak times, in response to price signals, financial incentives or other inducements.[136] Increased use of demand response can have numerous benefits that would lead to GHG emissions reductions. It reduces peak electricity use and thus reduces the need for new fossil-fuel burning plants to operate at peak times, without generating additional emissions (unless, as some contend, the reductions in use lead to some larger consumers operating their own onsite generators, which must be carefully monitored). In the aggregate, it can also serve as a resource that grid operators can use to meet demand, rather than calling on existing power plants.[137] Because it can be used virtually instantaneously in some settings, it can also help regulate the grid and offset the inherent variability of renewable energy resources, thus making it easier to integrate them into the electric grid and reducing emissions further.[138]

There are a wide variety of demand response techniques. For years, US utilities have used 'direct load control,' shutting off power to individual devices during peak load hours in return for a financial incentive (typically bill credit).[139] Utilities have also had 'interruptible load' programs (contractual agreements with larger industrial or commercial customers) that allow the utilities to curtail (interrupt) service during peak demand hours.[140] The usual incentive for an interruptible load agreement is a discounted electricity rate that takes into account the customer's agreement to curtail on request. Emerging demand response techniques rely on a customer's smart meter and a dynamic pricing structure. For example, a smart meter could prompt a customer to operate a specific device at

[135] Eisen, 'Smart Regulation and Federalism for the Smart Grid' (n. 132).
[136] United States Department of Energy, Benefits of Demand Response in Electricity Markets and Recommendations For Achieving Them (n. 126), at v.
[137] Joel B. Eisen, 'Who Regulates the Smart Grid?: FERC's Authority Over Demand Response Compensation in Wholesale Electricity Markets' (2013) 4 *San Diego Journal of Climate and Energy Law* 69.
[138] Joel B. Eisen, 'Distributed Energy Resources, "Virtual Power Plants," and the Smart Grid' (2012) 7 *University of Houston Environmental and Energy Law and Policy Journal* 191.
[139] National Assessment of Demand Response Potential (n. 129), at 22.
[140] Ibid.

non-peak hours and reduce electricity costs, or a system could even manage electricity consumption more automatically.

Another factor in providing an incentive for demand response is the increased availability of time-of-use or other forms of dynamic pricing.[141] In addition, the FERC has a policy of encouraging demand response in the wholesale electricity markets that it regulates. Its regulation, FERC Order 745,[142] calls for aggregated amounts of demand response to be bid into wholesale markets and receive the same prevailing price as generators receive for their electricity. This concept of putting negawatts (reductions in consumption) on a level playing field with megawatts generated has been controversial.[143] In 2014, the DC Circuit struck down Order 745.[144] If an appeal to the Supreme Court of this decision is successful, some observers believe that Order 745 may spur growth in demand response deployment, and set an important precedent for federal government involvement in facilitating the growth of the Smart Grid.[145]

F. Laws Promoting Energy Research, Development, and Deployment

Federal government funding and other support for basic and applied research (for example, research at federal facilities such as the National Renewable Energy Laboratory) has long played an important role in advancing energy technologies. A number of federal energy laws, including the omnibus acts listed above (EPAct 1992, EPAct 2005, and EISA) have provisions funding for energy research and development. A recent program of note is the Advanced Research Projects Agency – Energy (ARPA-E),[146] modeled on the long-established and well-known military innovation agency, DARPA.[147] ARPA-E's mission is to promote research and development of 'high-potential, high-impact energy technologies that

[141] Simchak and Ungar (n. 134), at 6.

[142] Demand Response Compensation in Organized Wholesale Energy Markets, 76 Fed Reg 16,657 (24 March 2011) (to be codified at 18 CFR Part 35).

[143] Richard J. Pierce, Jr., 'A Primer on Demand Response and a Critique of FERC Order 745' Winter 2012 *George Washington Journal of Energy & Environment* 102.

[144] *Electric Power Supply Association v FERC*, No. 11-1486, 23 May 2014 (DC Cir.).

[145] Eisen, 'Who Regulates the Smart Grid?' (n. 137).

[146] Advanced Research Projects Agency – Energy, <http://arpa-e.energy.gov/> accessed 12 September 2013.

[147] Defense Advanced Research Projects Agency, <http://www.darpa.mil/> accessed 12 September 2013.

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Energy, <http://arpa-e.energy.gov/>

Agency, <http://www.darpa.mil/>

are too early for private-sector investment to move innovative technologies into the marketplace.'[148]

V. CONCLUSION

Fossil fuel-fired electric power plants are the largest concentrated source of emissions in the United States, and numerous GHG mitigation measures have been crafted to apply to the US electric power industry. As the systems of federal, state, regional, and local regulation of GHG emissions associated with electricity generation, transmission and distribution continue to grow and evolve, it has become apparent that no single comprehensive regulatory program addresses mitigation of adverse climate change impacts in the electric power industry.

Instead, there is a wide range of measures, both direct regulation and indirect measures encouraging less consumption or switching to alternative energy sources aimed at GHG mitigation.

[148] Advanced Research Projects Agency – Energy, <http://arpa-e.energy.gov/?q=arpa-e-site-page/about> accessed 12 September 2013.