CEPS POLICY BRIEF
Thinking ahead for Europe

US Climate Change Policy Efforts

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No. 255, September 2011

Introduction

Until recently, most of the attention in US climate policy was focused on legislative efforts to introduce a price on carbon through cap and trade. Since that policy has stalled, at least at the national level, the Clean Air Act has assumed the central role in the development of regulations that will reduce greenhouse gas (GHG) emissions in the US. The modern Clean Air Act (CAA) was passed in 1970 and conveys broad authority to the Environmental Protection Agency (EPA) to develop regulations to mitigate harm from air pollution. In 2007 the Supreme Court confirmed that this authority applied to the regulation of GHGs (*Massachusetts v. EPA)*.[1] Subsequently, the agency made a formal, science-based determination that GHGs were dangerous to human health and the environment, which compels the agency to mitigate the harm and forms the basis for the agency's regulation of GHG emissions.

In 2011 the EPA implemented the regulations affecting two major sectors of the economy – new corporate average fuel efficiency standards for cars and trucks, and construction permitting for major new and modified sources, such as power plants and industrial facilities. The third regulatory action anticipated by the EPA will be the development of operating performance standards affecting new and, in particular, existing stationary facilities.[2] Existing facilities are the source of the largest share of GHGs emissions and provide the greatest opportunity for cost-effective reductions in emissions according to economy-wide modelling (EIA, 2009).

While the EPA regulatory framework unfolds at the federal level, policy efforts at the state and regional level also continue to evolve and to influence the direction for federal policy. Since 2009, 10 northeast states launched a cap and trade programme

[1] 549 US 497 (2007).

[2] Standards under §111(b) of the CAA apply to new sources (these are termed New Source Performance Standards, or NSPS), and those under §111(d) to existing sources.

The climate policy research programme Clipore, supported by the Swedish Foundation for Strategic Environmental Research (Mistra), focuses on future international policies in the area of climate change. Carried out by a consortium of universities, think tanks and non-governmental organisations in Europe, India and the US, the main aim of the programme is directed towards the use of economic incentives and instruments in the implementation of climate policies, and towards the development of new frameworks. CEPS contributes to the outreach of the Clipore research programme through the European Climate Platform (ECP), a joint initiative of CEPS and Clipore.

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affecting electricity generation in the region, and California will introduce a similar programme in 2013 that will evolve into an economy-wide programme in 2015. One important development will be how these programmes interact with the federal regulations under the Clean Air Act.

This Policy Brief summarises the emerging regulations at the national level, reporting our assessment of potential emissions reductions under the Clean Air Act. We also describe the efforts at the subnational level, and the interaction of these policies with the Clean Air Act under the particular structure of so-called 'environmental federalism'. This structure places central responsibility for implementation of regulations at the state level, making the architecture of existing state-level policies increasingly relevant and influential. Finally, we compare the Act with comprehensive cap and trade legislation that was proposed in the previous Congress, and argue that comparable emissions mitigation may be achieved in the domestic economy by 2020. The big difference likely to emerge in the short run is the ability of the US to meet its financing obligations under the Copenhagen agreement. And, in the long run, mitigation with a regulatory approach is likely to become increasingly expensive.

1. Emissions reductions under the Clean Air Act

Under the Clean Air Act, the EPA will use three sets of tools to mitigate GHGs. The first is new vehicle fuel economy standards regulations that took effect in January 2011, affecting vehicles beginning with the 2012 model year. The standards impose annual improvements in fuel efficiency of 5% a year raising the fleet average fuel efficiency for light trucks and sport utility vehicles to 30 miles per gallon (MPG) (7.84 litres/100km) by 2016, and to 39 MPG (6.03L/100km) for cars, resulting in a combined fleet average of 35.5 MPG (6.63L/100km). Over the next decade these standards are expected to roughly offset increases in vehicle miles travelled. By 2030, these standards are expected to reduce emissions from these vehicles by 21% compared to business as usual. Even stricter standards are in development that are expected to require additional fuel-efficiency improvements of 40%, to be phased in beginning in 2017 and ultimately raising the combined fleet average equivalent to 54.5 MPG (4.32L/100km) by 2025. Complementary regulations addressing medium- and heavy-duty vehicles will take effect in 2014.

The second tool is known as 'new source review', which requires permits for new construction and major modifications to existing stationary sources. Permitting requires site-specific, technology-based review of control technology. Permitting is usually done at the state level, although the technological inquiry is national in scope and subject to EPA oversight. Starting in January 2011, this permitting process applies to about 900 construction projects per year at sources that emit large quantities of GHGs.

The third tool is regulatory standards that apply to the operation of stationary emissions sources. Ultimately, EPA decisions in this area will have the greatest effect on GHG emissions in the United States. The agency will apply performance standards (e.g. pounds of pollution per million British thermal units of energy input) for new sources in various source categories. The agency also has the authority to set guidelines for existing sources, and it has pledged to issue such standards contemporaneously with its release of standards for new sources. The EPA will begin by proposing rules for new and existing fossil-fired steam power plants and refineries in 2011 and finalise those rules in 2012.

Existing steam boilers at power plants fuelled with coal, oil and natural gas, along with petroleum refineries account for more than one-third of GHG emissions in the United States. Conceivably, the EPA could issue standards that mandate large-scale substitution away from coal to natural gas or non-emitting technologies. However, indications are that in 2012 the EPA will not issue standards that require a major substitution away from coal. Instead, the agency is looking initially at improving the operating efficiency of power plants and refineries.

In its preliminary notice of a proposed rule-making, the agency indicated that operating efficiency at existing facilities might be improved by 2-5%, resulting in a comparable reduction in emissions without changing the electricity output from these facilities (EPA, 2008). A 5% reduction in emissions from existing coal-fired power plants would amount to over 90 million tonnes per year, or about 1.4% of total US emissions. The agency identified the possibility of additional emissions reductions of 2-5% if coal-fired facilities co-fired with biomass. These potential emissions reductions would be consequential. We reviewed the total potential emissions reductions and costs associated with short-term measures in six sectors (excluding transportation) that account for 62% of domestic emissions (Burtraw, Fraas & Richardson, 2011).[3] Existing studies identify opportunities to reduce emissions from these sectors by up to 10%, or 6.2% of total US emissions (see Table 1). These short-term measures, which include energy and process efficiency improvements, beneficial use of process gases and limited material and product changes, have been identified by various authors as 'cost effective' – meaning they are zero-cost options for the firm after accounting for the cost of energy saved. These calculations are based on engineering costs; the broader economic costs, such as opportunity costs of scheduling investments and alternative use of space and resources, are not included. Nonetheless, the evidence presented in the table suggests that mitigation options are available at moderate costs to firms that could reach 6.2% of US emissions.

Table 1. Emissions reduction options and costs of identified 'cost-effective' measures

Source category	CO_2e emissions (percentage of US total in 2005)	CO_2e emissions ($MtCO_2e$ in 2005)	Potential CO_2e reduction (percentage of sector)	Potential CO_2e reduction (percentage of US total)	Potential CO_2e reduction ($MtCO_2e$ in 2005)	Average gross cost (2008$/$tCO_2e$)**
Iron and steel	1	72	19	0.19	14	1.54–2.58
Pulp and paper	1.4–3	100–214	14	0.2–0.4	14–29	41.06
Cement plants	2	143	1–10	0.02–0.2	1.4–14	–
Boilers (industrial, commercial, institutional)	20	1429*	1–10	0.2 – 2*	14–143	0.40–15.37
Petroleum refineries	3	214	1–10	0.03–0.3	2.1–21.4	Few cost figures; paybacks 0.5–5 years
Boilers (electric power)	34	2430	5–9	1.7–3.1	122–222	–
Coal-fired: efficiency gains	*28*	*2001*	*2–5*	*0.56–1.4*	*40–100*	*10.74–63.91*
Coal-fired: biomass cofiring			*2–5*	*0.56–1.4*	*40–100*	–
Totals	61–63%	4388–4503*	N/A	2.34–6.19%*	167–442	N/A

*Boilers double count emissions and reductions, potentially overstating total reductions by up to 0.6%.

**Average cost does not include the cost savings from reduced energy use that make the listed measure cost effective from an engineering cost perspective (see text). Ranges indicate costs in different processes used in the sector.

Notes: Attribution of percentage of emissions among sectors is based on EPA estimates. Specific measures identified may have already been implemented. Totals may not sum due to rounding. For additional discussion of sources and calculations, see Burtraw, Fraas & Richardson (2011).

Source: Burtraw et al. 2011a.

[3] We exclude transportation because the improvement in fuel efficiency approximately offsets increases in vehicle miles travelled through the end of this decade.

2. Early opportunities in the electricity sector

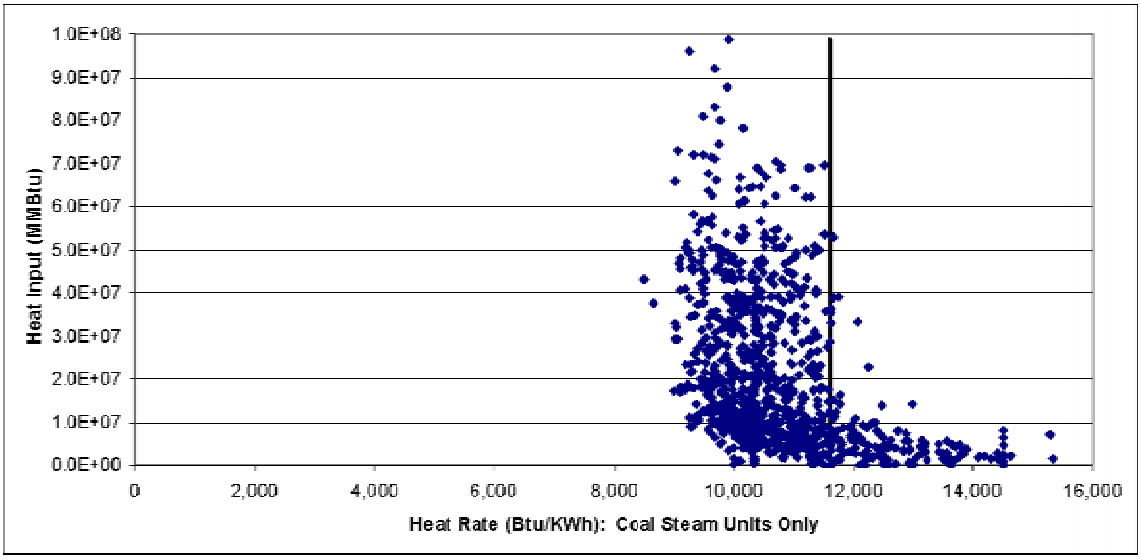
An important example of a source of possible emissions reductions that could be achieved through the Clean Air Act is existing sources in the electricity sector. These sources are likely to constitute the majority of GHG emissions from this sector for decades into the future. Currently coal-fired electricity generation represents 50% of electricity generation and 80% of emissions from electricity.

Initial evidence suggests there are improvements that could be achieved in the short run from changing the operation of existing facilities. Figure 1 displays the heat rate (i.e. the operating efficiency as measured by BTU per kilowatt-hour) of existing coal-fired plants along the horizontal axis. The vertical axis displays heat input (i.e. fuel use) at each facility. A higher heat rate means that more coal is used. As one might expect, the plants with the highest capacity factors are among the most efficient, with heat rates less than 10,000 BTU per kWh of electricity generation. However, the figure has a substantial right-hand tail, with many facilities that appear to be efficiency outliers, suggesting that there are a number of plants for which substantial energy efficiency gains are available. The vertical line in the figure denotes a heat rate of 11,609 BTU per kWh. Some 5% of total heat input (fuel use) at coal-fired power plants occurs at units with a heat rate greater than this amount.

Several hypotheses may explain the heterogeneity in operating efficiency of these facilities. Technology, vintage and fuel type are potential explanations, but none of these factors appears to fully explain the distribution of heat rates across plants. One does observe that regions of the country with less-efficient facilities appear to be the regions with relatively lower coal cost, which suggests that facilities simply respond to the price of fuel. Alternatively, an institutional factor that appears to play a significant role in the efficiency of coal-fired electricity production is the ownership structure. Independently-owned (merchant) plants tend to be the most efficient, and investor-owned utilities tend to be slightly less so. However, both types of plants appear to be substantially more efficient than publicly-owned plants, which are predominantly found in regions with the least efficient plants.

Other possible institutional factors include fuel-cost adjustment clauses under state-level regulation that allow for the automatic pass-through of fuel cost into rates. Such provisions eliminate the risk of price fluctuations; unfortunately, they may also remove incentives to adopt low-cost efficiency improvements. Analysts have also suggested that modifications to improve efficiency might trigger other regulatory requirements at these plants, thereby providing a disincentive to make such modifications. Understanding the causes of heterogeneity will be important to determining early opportunities to reduce emissions from the electricity sector.

Figure 1. Coal steam units – Heat-input weighted heat rates



Source: Richardson et al. (2011). See references cited and discussion therein. This analysis uses data on existing electricity-generating units in the lower 48 states during 2007.

Even more important, however, is the approach the EPA uses to implement regulations affecting existing sources. One approach would be to adopt strict, inflexible performance standards; a second could allow compliance flexibility such that standards might not necessarily be achieved at an individual facility, but would be achieved on average. Either of these approaches would target technological performance but would not explicitly cap emissions.

We have evaluated these options using a highly parameterised regional, intertemporal economic model of investment and operation of the US electricity system (Burtraw, Paul & Woerman, 2011). To facilitate a comparison of their cost effectiveness, these various policies are calibrated to achieve equivalent emissions reductions of 5.4% (141 million short tonnes) from baseline in the electricity sector in 2020. These emissions reductions are achieved almost entirely from improved operation of existing facilities. No credit is given for biomass or natural gas co-firing at coal facilities. There is a small amount of substitution to generation at other facilities but the policies are designed to not encourage that. The modelling indicates that a flexible standard would result in an increase of 1.3% in electricity prices. This compares to an increase of 3.3% under an inflexible standard. We find the overall costs of a flexible standard, including the costs on firms, would be just one-third that of an inflexible standard.

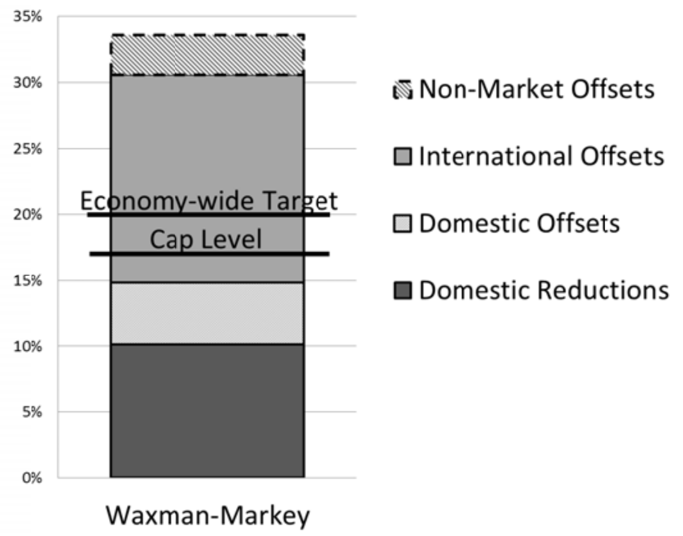
These scenarios only examine flexibility within an emissions source category defined as coal-fired steam boilers. Greater degrees of flexibility are possible within the law (Wannier et al., 2011), and they could yield substantially greater emissions reductions at the same or less cost. For example, it is plausible that rules could be established that allow fuel substitution from coal to natural gas as a means to achieve an improvement in emissions rates.

Another way that flexibility, and greater emissions reductions, could emerge under the Clean Air Act is through action taken at the subnational level. The EPA's promulgation of performance standards at the federal level will assign states the responsibility to enforce regulations affecting existing facilities. Each state will be required to develop an implementation plan, and plans that could differ in principle according to local conditions, costs, etc., so long as the overall emissions reductions goal of the national regulation is achieved. An important question is how EPA will accommodate existing state cap-and-trade programmes in the Northeast Regional Greenhouse Gas Initiative and in California. These programmes have argued that their efforts should be treated as equivalent to and be sufficient to actions required under the CAA. In fact, these state programmes could give their industries an advantage relative to industries in other states and could provide a template for expansion of state programmes that capture the potential efficiency gains from compliance flexibility.

3. Meeting commitments made in Copenhagen

At the Copenhagen climate meetings in December 2009, President Obama pledged the United States to emissions reductions "in the range of" 17% below 2005 levels by 2020. At the time, the President rested hopes for meeting this goal on comprehensive cap-and-trade legislation. The Waxman-Markey legislation that passed the House in June 2009 set a domestic target of 17% reductions by 2020, with an additional 3% anticipated from international forestry projects. We illustrate the source of the emissions reductions in Figure 2, which is based on EIA (2009) estimates.

Figure 2. Emissions reductions in 2020 from 2005 levels



Source: EIA (2009).

The expected emissions reductions under the bill approach 33% from 2005 levels by 2020. However, these reductions include offsets, which are emissions reductions occurring outside the regulated sector. Of the 33%, 5% was expected to come from domestic offsets, and more than 15% was expected to come from international offsets – a policy tool unlikely to be available under the CAA (Richardson, 2010). Only 10% of the reductions were expected to come from domestic sources covered by the emissions cap.

The banking of allowances further clouds the assessment of emissions reductions under the Waxman-Markey legislation. Banked allowances can be used to cover emissions in excess of the cap at a later time; hence, while banking reduces short-term emissions and overall costs, it does not have an effect on long-term emissions. "If one were to ignore emissions reductions that are banked, and one were to scale back the total emissions reductions proportionally, the Waxman- Markey cap-and-trade programme would appear to achieve permanent domestic emissions reductions equal to just 6% below 2005 levels.

It is largely a matter of perspective which benchmark one chooses to represent emissions reductions under Waxman-Markey: 33% including offsets, the President's stated target of 17%, or domestic emissions reductions of 10% (6% if adjusted for the bank). However, these different benchmarks are important to keep in mind when evaluating the strictly domestic emissions reductions that might be achieved under the Clean Air Act in the domestic economy.

We estimate reductions under the Clean Air Act could total 6% by 2020 from changes in the operation of existing facilities described in Table 1. Furthermore, there are other plausible reductions that are not included in Table 1. Under an emissions cap, emissions reductions from state and regional-level programmes would not be additional (Goulder & Stavins, 2011). However, under a regulatory approach, emissions reductions at the subnational level would be additional to those required by regulation. And, as noted above, the estimates in Table 1 do not account for any switching of fuels in electricity generation. Accounting for these additional reductions could yield emissions reductions of up to 10% by 2020 under regulatory approaches, roughly matching those reductions that would have been achieved under cap and trade.

Conclusion

In summary, regulatory measures could be expected to yield reductions that are comparable to what would have been achieved under comprehensive cap and trade legislation in the domestic economy by 2020. However, regulatory action would not be equivalent or preferable to new legislation from Congress, especially over the long term. Introducing a price on carbon would allow for the market to make decisions that ultimately can be expected to be more efficient than the actions of regulators. Also, in the long run the price signal could be expected to do a better job of igniting a technological transition and changing economic behaviour. But, at least in the short run, the regulator can see the low-hanging fruit and under the Clean Air Act much of this fruit will be harvested.

Perhaps to the surprise of many, the US may be able to achieve mitigation outcomes comparable to the commitment made in Copenhagen for 2020, even in the absence of comprehensive cap and trade. The bigger challenge, and one that is unlikely to be satisfied under a regulatory approach, is how the US can meet its financing obligations without comprehensive climate legislation. Cap and trade provided a vehicle and incentive to direct private capital towards investment in developing countries through the purchase of emissions offsets. It also provided a source of funds for the federal government through the portion of allowances that would have been auctioned under the programme. In the absence of these policies, the US is likely to have great difficulty meeting its commitment to financing international investments.

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