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A Greenhouse Gas Emissions Performance Standard for the European Union: Design and Implementation Considerations

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Introduction and Summary:

On October 7, 2008, the European Parliament voted in favor of an emissions performance standard (EPS) for new power plants constructed in the European Union. Under the proposed standard, any new electric power plant constructed from 2015 and beyond with a capacity of more than 300 megawatts (MW) would be limited to a maximum of 500 grams (g) of carbon dioxide (CO_2) emissions per kilowatt-hour (kWh), on an annual average basis. The vote was part of a series of actions laying out the European Parliament's position in climate and energy negotiations with European Union leaders, for final agreement in late 2008 or early 2009.

Parliament's proposed EPS is referred to as the "Schwarzenegger-clause"[1] primarily because the 500 g of CO_2/kWh performance level essentially equates to the 1100 lbs/MWh level adopted for the California standard in 2007.[2] Attachment A provides an overview of the California EPS. As discussed in Section 1 below, both serve a similar purpose: to reduce the financial and reliability risks associated with new investments in high carbon-emitting power plants. However, there are key differences between the EPS proposed for the European Union and the EPS adopted in California and (shortly thereafter) in the state of Washington.

Sections 2 through 5 of this paper explore these differences with respect to: (1) the types of long-term financial commitments covered by the EPS, (2) the facility threshold for meeting the EPS, (3) net emissions associated with cogeneration and biomass facilities, and (4) application of the EPS to carbon capture and storage (CCS) and the associated issue of EPS implementation date. In doing so, I highlight the advantages and disadvantages of alternative approaches, and suggest several design and implementation improvements that European leaders and interested stakeholders should consider as negotiations proceed for a final agreement. In summary, these are:

- In addition to new power plants, apply the EPS to any new investments in existing facilities that expand a plant's rated capacity or its effective useful life, or both, by a specified amount. As currently written, the proposed EPS would permit generators to circumvent the standard by making investments that significantly expand capacity or extend the effective life of existing high CO_2-emitting generating plants (e.g., repowering).

- Add language to clarify how the net emissions from cogeneration (combined heat and power) facilities will be calculated. Otherwise, the EPS as currently written will effectively preclude the construction of any large (over 300 MW) cogeneration facilities, depriving the European Union of facilities that can result in net emission reductions. This is a realistic concern for cogeneration facilities dedicated to large industrials (e.g., cement and petrochemicals).

[1] *Equipping Power Plants to Store CO_2 Underground*, October 6, 2008, European Parliament Press Service, p. 1.

[2] 1100 lbs/MWh = 1.1 lb/kWh x 453.6 g/lb = 498.96 g/kWh.

- Add language to clarify how the net emissions from biomass-fueled electric generation will be calculated. Although new biomass facilities are likely to be significantly smaller than 300 MW (and therefore not subject to the standard as currently proposed), the few that may be built on a large scale should be encouraged to utilize agricultural and wood waste or landfill gas, rather than growing fuel. As discussed below, the proposed EPS would preclude such facilities even though they would meet the EPS on a net emissions basis.

- Most importantly, make the EPS rule effective immediately, rather than defer its start date until 2015. As currently written, the proposed EPS will most surely "open the floodgates" in the intervening eight years to the construction of new unabated coal plants and other types of power plants that would not meet the performance standard, thereby severely undermining the purpose and effectiveness of the EPS. Address concerns about coal by adopting the California and Washington EPS approach that permits project approval if the carbon capture and storage (CCS) plan meets certain pre-approval requirements, even if CCS commences some years after the power plant comes on line.[3]

Further, development of a final EPS would benefit from additional information on the following:

- The risk that exempting all units under 300 MWs from the EPS will encourage construction of a significant number of smaller power plants that would otherwise fail the standard by a substantial margin. This could include certain gas-fired technologies, coal-fired cogeneration, as well as biomass-fueled plants where growing fuel is required. Reducing or eliminating the minimum size threshold may need to be considered, depending upon the magnitude of this risk.

- The risk of emissions "leakage" if voluntary standards or varying implementation timeframes among member states will be considered. [4] Leakage would happen if, for example, the United Kingdom adopted an EPS but imported power from coal plants in Germany while Germany either was not covered by the EPS or adopted a later timetable for implementation. If that risk is high, it may be necessary to expand the overall scope of the EPS along the lines of the "new long-term commitment" approach taken by California and Washington, i.e., to also cover new long-term contracts with high-emitting facilities. [5]

Understandably, most of the debate over the proposed EPS focuses on how it will affect the future of coal in the European Union. Therefore, ensuring that the EPS does not "slam the door" on CCS has become critically important to that debate. As discussed in this paper, a well-designed EPS can keep this door open while accomplishing its fundamental purpose, namely, to "raise the bar" for performance of new electricity-generating power plants in a carbon-constrained economy.

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[3] Carbon capture and storage (CCS) –also referred to as "carbon sequestration"-- is an approach to mitigating GHG emissions based on capturing CO_2 from large point sources such as coal generation plants and storing it (e.g., by injecting the CO_2 into geological formations) instead of releasing it into the atmosphere.

[4] As discussed in Section 2 below, the risk of leakage due to power imports from outside of the European Union under a mandatory EPS appears to be quite limited at this time.

[5] The level of this risk depends in large part on how costly leakage becomes under the 2013 GHG emissions cap in the Europe Union, which in turn depends upon the level of that cap.

1. What is an EPS and What Purpose Does It Serve?

An EPS establishes a maximum level of CO_2 emissions (or CO_2 equivalent) per unit of output from an electricity-generating power plant. It is analogous to an energy efficiency appliance standard. In the case of appliance standards, if a consumer purchases a new refrigerator, he or she has a variety of models to choose from—each with a different upfront purchase price, operating cost and other design attributes. However, at a minimum, each refrigerator must meet the threshold for appliance efficiency established by the standard. Similarly, an EPS establishes a minimum performance requirement for electricity-generating power plants from the perspective of emissions per unit of output.

In California, the Legislature and California Public Utilities Commission (CPUC) observed that if utilities or other load-serving entities were allowed to enter into new long-term commitments with high-greenhouse gas (GHG) emitting power plants, California ratepayers would be exposed to high costs of retrofits (or the need to purchase expensive offsets) under future emission control regulations. California ratepayers would also be exposed to potential supply disruptions when these high-emitting facilities are taken off line for retrofits, or retired early, in order to comply with future regulations. [6] The state of Washington made similar findings when it adopted an EPS modeled after California's approximately six months after California issued its final EPS rules. [7]

Therefore, in both California and Washington, legislators concluded that an EPS was necessary to protect ratepayers and the economy from these risks and costs, as a complement to other key policies that encouraged investment in cost-effective energy efficiency and renewable energy resources. It was designed to "raise the bar" for new long-term financial commitments to electricity generation --much in the same way that energy-efficiency standards and codes serve this purpose on the demand-side for appliances and new buildings. And similar to the impact of performance standards in other arenas, the EPS was designed to spur technology development in electricity generation, resulting in benefits to the overall economy.

2. Types of Long-term Financial Commitments Covered Under the EPS

Both the California and proposed European EPS serve the purposes discussed above, but the types of long-term financial commitments included under each standard differ significantly. The EPS introduced by the European Parliament focuses exclusively on financial commitments to investments in new electricity (combustion) generating plants, at least at this time:

"Member states shall ensure that from 1 January 2015 the operating permit for all electricity-generating large combustion installations with a capacity greater than 300 MW granted a construction permit or, in the absence of such a procedure, granted an original operating permit after 1 January 2015 include conditions

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[6] Senate Bill (SB) 1368 (Stats 2006, ch. 598), Section 1(f)-(m) at http://www.leginfo.ca.gov/pub/05-06/bill/sen/sb_1351-1400/sb_1368_bill_20060929_chaptered.pdf. CPUC Decision 07-01-039 issued on January 25, 2007 in Rulemaking 06-04-009, at page 3. (http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/64072.htm.)

[7] SB 6001 (Stats 2007, ch. 307), Sections 4(a)-(c); See: http://apps.leg.wa.gov/billinfo/summary.aspx?year=2007&bill=6001; Washington Administrative Code rules to enforce the law: http://www.efsec.wa.gov/rulerev.shtml#CO2

requiring compliance with an emission performance standard of 500 g CO_2/kWh. By 31 December 2014, the Commission shall conduct a review of the provisions of this Article.

"The review shall consider in particular the emission performance standard referred to in paragraph 1, the possibility of widening the scope to include existing installations and installations other than those generating electricity, and the possibility of introducing derogations to address the concerns of Member States that may be unable to comply with the requirement referred to in paragraph 1. The review shall include participation of all relevant stakeholders and, on its conclusion, the Commission shall bring forward appropriate proposals." [8]

In contrast, the EPS adopted in California includes the following types of long-term financial commitments *in addition to* investments in new plant construction (with some limited exceptions): [9]

- New investments in existing power plants owned by the electric utility that increase the rated capacity of the power plant or extend the life of one or more units by 5 years or more.
- Acquisition of new or additional ownership in existing power plants previously owned by others.
- New (or renewal) contracts with both in-state and out-of-state generators for a term of five years or more.[10]

Not surprisingly, the California statute and implementation rules are quite complex, since the trigger for the California EPS involves several types of long-term commitments, including long-term contracts. [11] In contrast, the European EPS has the advantage of focusing on a more tractable regulatory trigger (the permitting process), and therefore is simpler to implement and monitor.

However, focusing exclusively on the permitting process for new plant construction has its downside to the extent that other types of long-term financial commitments proceed to lock European customers into power production from high-emitting generation plants. One way this could happen is if generators significantly expand capacity or extend the effective life of existing high CO_2-emitting generating plants (e.g., repowering), since such investments do not trigger the requirement to comply with the EPS as currently proposed.

The narrower focus of the European EPS also introduces an incentive for the construction of high-GHG emitting plants just outside European Union borders, creating "leakage," although this appears to be a very limited risk at present. [12] However, to the extent that some member states adopt the EPS and others do not—or

[8] Amendment text from October 7, 2008 European Parliament's Environment Committee, approved motion.
[9] The scope of new financial commitments covered under the Washington EPS statute is similar to that of California.

[10] California's rules also include guidelines for when two or more contracts will be treated as one (or "linked") in determining the term of a contract, and hence, whether they will be subject to the EPS.

[11] See, for example, the implementation schematic for each type of new long-term financial commitment presented in the CPUC's final rules (Decision 07-01-039, Attachment 7). http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/64072.htm

[12] Leakage refers to the inability of the EPS to address the GHG emissions associated with power imported into the geographic areas subject to the EPS from those that are not. Leakage from beyond the European Union border is unlikely at

some member states are able to defer the start of EPS implementation relative to others—leakage within the European Union becomes a greater potential risk. The degree of leakage risk will depend in large part on how costly leakage becomes under the 2013 GHG emissions cap in the Europe Union, which in turn depends upon the ultimate level of that cap, as well as the market prices for carbon allowances and offsets that emerge in the market. [13]

In sum, the narrower scope of the EPS proposed for the European Union makes compliance and implementation much easier than the California or Washington models. However, this simplicity brings with it the creation of loopholes that have the potential to severely undermine the purpose and effectiveness of the EPS. At a minimum, European decision makers should consider expanding the proposed EPS to include any new investments in existing facilities that significantly expand a plant's rated capacity or its effective useful life, or both, by a specified amount. Depending upon the level of risk that leakage may pose, it may be necessary to adopt the "long term commitment" approach taken by California and Washington State that applies to long-term contracts. Doing so, however, would necessitate the development of more comprehensive rules and compliance procedures than an EPS approach focusing on the permitting process for new facilities, and would introduce more complexity in implementation.

3. Facility Threshold for Meeting the EPS

The proposed European EPS applies to all electricity-generating combustion facilities with capacity greater than 300 MWs. In contrast, neither the California nor Washington standards exempt any facilities based on MW size. [14] Instead, the California and Washington EPS establish a facility threshold based on the power plant's capacity factor.[15] More specifically, the EPS applies to any and all long-term commitments with "baseload" facilities defined as power plants that are designed and intended to provide electricity at an annualized plant capacity factor of at least 60%. These are facilities that essentially operate "24/7" and are not able to ramp up and down quickly, provide spinning reserves, or exhibit other operating characteristics that are associated with load-following or peaking resources. Examples of baseload plants in the United States include coal, nuclear, geothermal, biomass and run-of-river hydroelectric facilities.

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present because (1) the European Union grid system is not integrated with Russia at this time, (2) Norway is not inclined to build coal-fired plants, (3) Switzerland is land-locked without any indigenous coal supplies and (3) although Spain has a link with Morroco (which has coal plants) the grid infrastructure is limited and would not likely permit substantial sales into Europe.

[13] Discussion with Coralie Laurencin, Market Development Team, Climate Change Capital; www.climatechangecapital.com

[14] The statute adopting the California EPS (SB 1368) did not specifically limit the EPS to "combustion" facilities (as does the proposed European EPS), and therefore the law required that non-combustion technologies such as solar thermal and wind demonstrate compliance with the EPS. Based on an analysis of net emissions, the Commission determined that these renewable technologies were EPS-compliant and pre-approved them in the final rules (D.07-01-039). Moreover, the construction of new nuclear power plants is still prohibited in California. Therefore, in effect, the California EPS applies primarily to combustion facilities.

[15] "Capacity factor" is defined as the ratio of the annual amount of electricity produced by the power plant divided by the annual amount of electricity the plant could have produced based on maximum rated capacity (or maximum "permitted" capacity, if the permit limits maximum plant operation below the facility's rated capacity.)

California adopted a capacity factor threshold in order to be responsive to concerns that restricting long-term commitments to load-following or peaking facilities (which are generally designed to operate at capacity factors well below 60%) would compromise system reliability. Moreover, data presented before the CPUC illustrated that a 60% capacity factor would capture an estimated 78% of the incremental electric power to be purchased or generated in 2012 by the largest investor-owned utilities, and would capture 72% of CO_2 emissions associated with those procurement needs.[16] For these reasons, California and Washington adopted an EPS threshold based on a baseload facility's operating characteristics (i.e., capacity factor) rather than on MW plant size.

A plant size threshold, however, has the advantage of being much more straightforward to define at the permitting stage, which is the focus of the European EPS proposal. Moreover, unlike in California and Washington State, in the European Union conventional coal plants are dispatched to follow load and as peaking plants in most member states, depending on the country's generation fuel mix and relative price of coal versus natural gas. [17] Therefore, using a capacity factor threshold does not appear to be applicable to the EPS being developed for the European Union.

The objective in establishing a MW threshold should be to capture a substantial percentage of potential future GHG emissions while relieving smaller facilities (that collectively do not represent a sizeable level of future emissions) from the administrative burden of compliance. Therefore, in considering the appropriate level of a MW size threshold it is important to consider the level of GHG emissions that is expected to "fall through the cracks."

There is no quantification of this amount provided in public documents, at least not at this time. Qualitatively, however, it appears that the 300 MW level currently proposed could permit the construction of a significant number of smaller power plants that would otherwise fail the standard by a substantial margin. For example, some gas-fired power plant technologies could fall under this category (i.e., those that do not utilize the more efficient modern combined-system turbine technology), as well as biomass-fueled facilities where growing fuel is required (see discussion below). Facility experts at Pacific Gas and Electric Company have indicated that coal-fired cogeneration at specific customer sites could be less than 300 MW as well. Evaluating whether or not the proposed 300 MW size threshold is reasonable would benefit from further data collection before the EPS rule is finalized. It may be advisable to reduce or eliminate the minimum size threshold, depending upon the results of this inquiry.

4. Net Emissions Associated with Cogeneration and Biomass Facilities

Neither a size nor capacity factor threshold alone provides an appropriate screen for the emissions associated with cogeneration (combined heat and power) facilities. This is because cogeneration produces two energy products—electricity and useable thermal heat—with the same amount of energy inputs. An EPS that does not recognize this efficiency in the calculations of emission rates will penalize cogeneration facilities. They will nearly all fail the EPS as currently proposed even when emissions per unit of total output is lower than 500 g of CO_2.

[16] CPUC Decision 07-01-039, p. 40. http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/64072.htm

[17] Discussion with Coralie Laurencin, Climate Change Capital, Market Development Team.

Based on discussions with individuals familiar with this technology at Pacific Gas and Electric Company and Climate Change Capital, a significant number of cogeneration facilities dedicated to large industrials (e.g., cement and petrochemicals) could fall above the 300 MW size threshold. Fortunately, there is a relatively straightforward way to address this shortcoming. In recognition that cogeneration facilities produce a dual product, the EPS adopted in California and Washington adopt an output-based methodology that provides for a thermal energy credit against total emissions in applying the EPS to cogeneration technologies. Language specifying that the emissions rate be calculated based on the sum of kWh electricity output and useful thermal energy output (converted to a kWh equivalent) would address this issue.

In addition, as currently drafted, the proposed EPS does not address the impact of fuel source on the net GHG emissions associated with biomass-fired generating plants of any size. Studies have shown that the net impact varies greatly depending on whether the plant is fueled using "waste" biomass or biomass grown for this purpose. For this reason, California's EPS recognizes that biomass-fueled power plants should be credited for the use of "waste" biomass sources that would otherwise be disposed of under a variety of conventional methods (such as open burning, forest accumulation, landfills, composting). [18]

Biomass is currently exempt from the European Union trading scheme and falls under the renewable directive and feed-in tariffs adopted in member states. However, there is discussion of future requirements regarding sustainability of fuel and the imposition of standards for that purpose. An EPS similar to California's that takes into account net emissions for the full "life cycle" (including growing and processing of biomass fuels) in calculating net emissions from biomass-fueled plants could be one form of sustainability criteria in lieu of other standards. Although new biomass facilities are likely to be significantly smaller than 300 MW (and therefore not subject to the standard as currently proposed), the few that may be built on a large scale should be encouraged to utilize agricultural and wood waste or landfill gas, rather than growing fuel.

Therefore, the final EPS language should clarify how the net emissions from cogeneration and biomass facilities will be calculated. Otherwise, the EPS as currently written will effectively preclude the construction of any large (over 300 MW) cogeneration facilities or biomass facilities that utilize agricultural and wood waste or landfill gas, even though they would meet the EPS on a net emissions basis.

5. CCS and Implementation Timeframe

Developers of the EPS in the United States, as well as in Europe, have recognized that the building of coal-fired plants will be effectively precluded under any standard that is lower than approximately 900 to 1150 g of CO_2/KWh unless equipped with carbon capture and storage (CCS). [19] In this respect, an EPS has a powerful

[18] As documented by the research presented to the CPUC, a generating facility that utilizes waste biomass fuel actually leads to a *net reduction* in GHG emissions. This is because the usual disposal options for biomass wastes emit large quantities of methane gas, whereas the electricity production alternatives either burn the wastes that would become methane gas or burn the methane gas itself, generating CO_2. Since methane gas is on the order of twenty to twenty-five times more potent as a GHG than CO_2, and since methane has an atmospheric residence time of twelve years, after which it is converted to atmospheric CO_2, trading off methane gas for CO_2 emissions from energy recovery operations leads to a net reduction of the greenhouse effect. In contrast, a biomass generating project where growing the fuel is required does not benefit from this tradeoff, and therefore the net emissions (especially when the emissions associated with growing the fuel are considered as well) are likely to be relatively high. (See CPUC Decision 07-01-039, pp. 119-121; Attachment 6.)

[19] CPUC Decision 07-01-039, Appendix 6 provides a summary of net GHG emissions data for various fossil-fuel and renewable technologies from the data presented in *Greenhouse-Gas Emissions From the Operation of Energy Facilities*, Gleick, Morris and Norman, July 22, 1989, Table 3. That data puts the emissions from coal plants, without accounting for

potential to spur investments in CCS. However, this cannot happen immediately, since CCS is not yet at the stage where it is proven enough to allow the necessary large numbers of projects to move forward. [20]

The challenge that faced California and Washington State regulators was how to make sure that an EPS would be implemented immediately—thereby precluding any new long-term financial commitments to plants that will have high emissions over their lifetime (such as unabated coal plants)—but would not preclude viable plans for CCS that meet the standard over time. These states approached the challenge by adopting language that allows project approval even if the CCS project became operational after the power plant comes on line. However, there are certain requirements that the project must meet in order to obtain this approval.

In California the project applicant is required to demonstrate that (1) the CO_2 injection project complies with applicable laws and regulations and (2) the CO_2 capture, transportation and storage project has "a reasonable and economically and technically feasible plan" that will result in a "permanent sequestration" of CO_2 once the … project is operational. " [21] Washington law requires that the CCS plan provides for a start date within 5 years of plant operation for geological sequestration or other approved CO_2 storage method. The plan must also include penalty provisions for failure to achieve implementation of the plan on schedule. In reviewing these plans, Washington regulators will examine the project's financial resources, supporting technical documentation, provisions for monitoring the effectiveness of storage in providing "safe, reliable and permanent protection" against the GHG entering the atmosphere, as well as provisions for public notice and comment on the CCS plan.[22]

The downside to the approach taken in California and Washington is that it requires project-by-project review and approval of CCS plans on a prospective basis (i.e., before the CCS project is actually operational), which introduces a level of uncertainty and risk if the CCS project does not become operational, or its initial operational characteristics differ greatly from expectations.

Members of the European Parliament have proposed a different approach. They have selected a date for implementation eight years out in the future (i.e., 2015) with the expectation that by that time CCS technology will be sufficiently developed such that new coal plants equipped with CCS will be able to meet the standard when they become operational. This approach has the advantage of requiring all new coal plants to demonstrate that they are CCS capable at the time they go on line. However, the downside to this approach is that it most certainly will "open the floodgates" in the intervening eight years to the construction of new unabated coal plants and other types of power plants that would not meet the performance standard.

This is one aspect of the proposed European EPS that could severely undermine its fundamental purpose. For this reason the approach taken by California and Washington to address CCS technology development should be adopted instead: Make the EPS rule effective immediately, but establish a review process that will permit project approval if the CCS plan meets certain pre-approval requirements.

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carbon capture and storage, in the general range of 2000-2500 lbs of CO2 equivalent emissions per MWh. The low end of the range represents integrated gasification combined cycle technology and the high end of the range represents conventional coal-steam technology.

[20] See "A Last Chance For Coal: Making Carbon Capture and Storage a Reality," compiled by Green Alliance, October 2008, available at: http://www.green-alliance.org.uk/grea_p.aspx?id=3278

[21] CPUC Decision 07-01-039, Attachment 7, page 5. http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/64072.htm

[22] Washington State Senate Bill 6001 (Chapter 307, Laws of 2007), effective July 22, 2007, Sections (11)-(13)

6. Conclusions and Recommendations

As discussed in this paper, a well-designed EPS can keep the door open to diverse fuels and technologies while accomplishing its fundamental purpose, namely, to "raise the bar" for performance of new electricity-generating power plants in a carbon-constrained economy. To accomplish this purpose the proposed EPS should be modified to:

- apply to investments in existing power plants that significantly expand a plant's rated capacity or its effective useful life, or both;
- consider net emissions from cogeneration facilities and biomass-fueled electric generation, and clarify how they will be calculated;
- make the EPS effective immediately, rather than defer its implementation until 2015, and
- permit project approval of coal-fired generation if the accompanying CCS plan meets certain pre-approval requirements, even if CCS commences some years after the power plant comes on line.

In addition, development of a final EPS would benefit from further inquiry concerning the impact that exempting all units under 300 MWs from the EPS will have on future GHG emissions. To the extent that the European Union will be considering voluntary standards or varying implementation timeframes among member states, the risk of leakage should also be evaluated. This information may suggest the need for further modifications to the proposed EPS along the lines discussed in this paper.

About the Author:

Meg Gottstein worked on utility regulation and policy development for over 20 years as an Administrative Law Judge for the California Public Utilities Commission. In that capacity, she presided over Commission proceedings on energy efficiency and climate change policies, and was responsible for writing the regulations implementing the statute (Senate Bill 1368) that adopted the EPS for California. Meg Gottstein is currently a Principal with The Regulatory Assistance Project (RAP), a non-profit organization that provides technical and policy assistance to governmental agencies and decision-makers on complex regulatory, policy, and environmental issues. RAP is supported by the US Department of Energy, the US EPA, and major US and international foundations. Since 1992, RAP has provided in-depth assistance in more than 40 US states and in 16 other nations. RAP's Principals are all highly-experienced, former energy officials. RAP has offices in Vermont, Maine, New Mexico, California, and Beijing.

ATTACHMENT A

Overview of California's Emissions Performance Standard[23]

The State of California under Governor Schwarzenegger enacted *a minimum greenhouse gas (GHG) emissions performance standard for electricity generation* in September 2006 (with detailed regulations introduced in January 2007). The regulations describe the standard as analogous to efficiency standards set for appliances such as refrigerators, where there are **minimum** performance standards and beyond that it is up to the market to compete, so long as they meet or exceed the minimum standard.

What is the policy context?

The emissions performance standard is one element of California's comprehensive Energy Action Plan, which includes "aggressive renewable targets" and "groundbreaking" goals on energy efficiency", among other initiatives.[24] It was established in the context of California's Global Warming Solutions Act (Assembly Bill 32) that requires the adoption of statewide limits on GHG gas emissions, to be operative by January 1, 2012. [25]

What is the emissions standard?

1100 lbs CO_2/MWh (close to the 500g CO_2/kWh proposed for the European Union). This is deemed equivalent to modern performance standards for new combined cycle natural gas generators. Old gas plants may not meet this standard, and existing and new coal plants almost certainly do not. Renewable energy sources would meet the standard and there are specific rules to shortcut regulatory review of renewable plants. Net emissions of a cogeneration (combined heat and power) unit are calculated by assessing thermal load through a "conversion method." Under this method, the emissions rate is calculated by dividing the total GHG emissions from a cogeneration facility by the sum of its kWh output plus the usable thermal energy output (expressed in kWh) produced by the facility. Wasted heat is excluded in the calculations. Project approval is on a case-by-case basis.

Can performance be averaged out across a company, plant or contract?

The standard applies to each individual generating unit and can **not** be averaged out over units where some meet a higher standard and some lower. This applies to particular sites, to contracted supply, across companies or however the supply is corporately organised. The intent of the regulation is to apply directly to power plant units and so contracts would be required to specify where power will come from in order to allow regulators to assess compliance of plants with the standard.

What form of generation does the standard apply to?

[23] This Attachment is based on a document entitled: "Introduction to the California green house gas emissions performance standard power plants" authored by Matt Philips of the European Climate Foundation.

[24] See http://www.cpuc.ca.gov/PUC/061211_egyleadership.htm

[25] See http://www.arb.ca.gov/cc/docs/ab32text.pdf.

It applies to 'baseload' generation – in other words, mainstream continual grid supply. Specifically it applies to new investment in such plants or long-term contracts for supply (including renewal of existing contracts). "Long-term" contracts are defined as contracts with a term of 5 years or longer and there are rules to prevent the use of multiple short-term contracts to circumvent the standard.

Only in California?

It applies to all power being used by California ratepayers – so it also includes power generated out of California and imported.

What about old plants?

To some extent existing plants are temporarily 'grandfathered,' i.e., exempted from the standard) Typically these are established gas plants.' The regulations indicate the 'trigger' for requiring such plants to comply with the new standard is the point at which investments are considered to extend the life of the plant, to make the plant a 'baseload' plant, or to increase its capacity by more than 50MW.

What about carbon capture and storage?

The California standard allows for carbon capture and storage (CCS)–- but only if an investor can show it works. Any facility that proposes to use CCS to meet the standard must present a "reasonable and economically and technically feasible plan that will result in a permanent sequestration of CO_2 once the injection project [i.e., injection of CO_2 into permanent geological storage] is operational and that the CO_2 injection project complies with applicable laws and regulations." The calculation of net emissions of these facilities is based on reasonably projected net emissions over the life of the facility. In other words, presenting a new plant as "capture ready" is not sufficient. It must be shown that the CCS component will be technologically feasible and economically viable from the outset. This puts the onus on the investors to show CCS would work if they wish to build or enter into long-term contracts with coal plants.

How has this come about?

The main reason for the standard is the political commitment of California to reducing GHG emissions – specifically a clear understanding that power generation is pivotal to progress on cutting emissions. This follows commitments to binding GHG emissions reductions set out in the California Global Warming Solutions Act of 2006. In addition, California has concluded that an emissions performance standard serves to protect California's citizens from the economic risks associated with high GHG intensity power generation. California regulators describe this in the following terms: "*An EPS [Emissions Performance Standard] is needed to reduce California's financial risk exposure to the compliance costs associated with future GHG emissions (state and federal) and associated future reliability problems in electricity supplies. Put another way, it is needed to ensure that there is no "backsliding" as California transitions to a statewide GHG emissions cap: If LSEs [Load Serving Entities – power utilities] enter into long-term commitments with high-GHG emitting baseload plants during this transition, California ratepayers will be exposed to the high cost of retrofits (or potentially the need to purchase expensive offsets) under future emission control regulations. They will also be exposed to potential supply disruptions when these high-emitting facilities are taken off line for retrofits, or retired early, in order to comply with future regulations. A facility-based GHG emissions performance standard protects California ratepayers from these backsliding risks and costs during the transition to a load-based GHG emissions cap.*"[26]

[26] See: http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/64072.htm.)