Emission Performance Standards: Global Practice and Options for Europe

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Regulatory Assistance Project (RAP)

RAP is a global, non-profit NGO providing technical and policy assistance to government officials on energy and environmental issues. We have worked in more than 30 nations and 55 states and provinces. Offices now in China, India, Europe (Berlin and Brussels) and the U.S.

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Topics Today

• Carbon pricing – Important, but not enough
• What is an EPS and can it help?
• EPS experience & design options
• Beyond EPS – speeding the transition in Europe
(1) Carbon Pricing is Not Enough – The Case for Complementary Policies
A mix of policies and programs is needed to deliver carbon savings.

- 20% EE targets; ESD, Building codes; appliance standards...
- ETS...directionally correct for whole curve, most effective here.
- RES targets & FITS; EPS and CCS

**Abatement cost**

- € per tCO$_2$e

**Abatement potential**

- GtCO$_2$e per year

**Energy solutions**

for a changing world
Carbon Price Can Raise Prices without Changing Dispatch or Emissions

Dispatch depends on ‘gas Vs coal’ price & CO2 €

Source: “The Change in Profit Climate” -- Public Utilities Fortnightly May 2007 -- Victor Niemeyer, EPRI
ETS (logically) increases prices in EU power markets – but with modest impact on dispatch & emissions

Figure 5.3  ETS-induced increases in power prices in EU countries under two COMPETES model scenarios
Note: Both scenarios are based on a carbon price of 40 €/tCO₂ and a price elasticity of power demand of 0.2.
# “High cost tonnes” in EU power markets

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Carbon price 20 Euros</th>
<th>Carbon price 40 Euros</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event/Result</td>
<td>No demand response</td>
<td>Price-elasticity -.2</td>
</tr>
<tr>
<td>(a) Power price increase</td>
<td>€ 10.9 /MWh</td>
<td>€ 23.2 /MWh</td>
</tr>
<tr>
<td>(b) Total sales</td>
<td>3016 TWh</td>
<td>2881 TWh</td>
</tr>
<tr>
<td>(c) Total Cost increase</td>
<td>€ 33 Billion</td>
<td>€ 66.8 Billion</td>
</tr>
<tr>
<td>(d) Emission reduction</td>
<td>133 Mt</td>
<td>363 Mt</td>
</tr>
<tr>
<td></td>
<td>(all due to redispatch)</td>
<td>(165 Mt from dispatch, 198 Mt from demand response)</td>
</tr>
<tr>
<td>(e) Consumer cost per tonne reduced</td>
<td>€ 248 per tonne</td>
<td>€ 184 per tonne</td>
</tr>
</tbody>
</table>

Source: Sijm, et al, The Impact of the EU ETS on Electricity Prices, Final Report to DG Environment, December 2008 (ECN-E-08-007)

[Row (e) is a RAP calculation based on Tables in the report, as shown.]
High Carbon Prices Needed to Displace Existing Coal Plants

Just one scenario showing the complex choices facing investors.
Investor’s dilemma – where is the crossover point between gas and coal?

ETS prices not as predicted

Gas prices are volatile

* And fuel prices are more important than carbon prices.
* In 2020, a 15% drop in the price of gas would offset a 50% increase in cost of carbon (Source: DECC analysis)
(2) Emissions Performance Standards: Experience & Design Options
Emissions Performance Standard

What is an EPS?

• An output-based requirement: it establishes a maximum level of emissions (CO\(_2\) or CO\(_2\)e) per unit of electrical output from a power plant

  – It is technology neutral and fuel neutral – just emissions-focused

• Analogous to other output-based requirements: e.g., for SO\(_2\), NO\(_X\), PM, etc. or for industrial production (tonnes steel/MWh)
Emissions Performance Standard

Purposes

• To drive investment in lower-emitting resources
• To block the long-term “lock-in” of emissions from new investments in high-emitting generators
• To drive retirement or retrofit of non-complying resources
• To reduce risks for both consumers and investors
Where do power sector reductions actually come from?

Four main possibilities:
• Reduce **consumption**
• **Re-dispatch** the existing fleet
• **Shut down** high-carbon units
• Lower the emission profile of **new generation** (including repowering)

For each opportunity, ask:
• How many tonnes will it avoid?
• How much will it cost society (or, cost consumers per ton)?
• What tools get the best results on #1 & #2?
GHG generator standards in 6 US states

Figure 4: States with Greenhouse Gas Performance Standards

- Applies to new units and power purchase agreements
- Applies only to new units
- Requires or incentivizes carbon capture and storage at new coal-fired power plants

States with standards:
- California
- Oregon
- Washington
- New York
- Maine
- Montana

Last updated 8/5/2013
Experience with EPS (1)

Four US States: California, Washington, Oregon, New York

Rules are similar (but not exactly the same). In most:

- Standard: 1100 lbsCO$_2$/MWh (approx. 500 gCO$_2$/kWh): equivalent to combined cycle gas turbine (CCGT)
- Applies to any long-term (5 years+) financial commitments with facilities that operate at capacity factor 60%+
- Triggered by new plants, significant upgrades, or new purchase contracts
- “Anti-leakage policy” – CA rule applies equally to purchases from plants even outside the state
- California found that the EPS led to cancellation of 30 coal plant projects throughout the US West
- EPS runs in parallel with cap-and-trade schemes in California’s and New York.
New National EPS Rules (2)

- **UK:**
  - EPS for coal and gas generators larger than 50 MW set at 450g/kWh, but calculated as an annual limit, based on running as “baseload” or 85% of the year. This permits higher-emitting plants to run, but for fewer hours.
  - Applies to new plants, and to those with significant upgrades or life extensions

- **Canada:**
  - After 1 July 2015, new coal-fired electricity generation units will be required to meet an EPS of 420 t/GWh (equivalent of CCGT)
  - Also applies to any unit that has reached the end of its “useful life” (if they want to keep operating). *50-year cutoff creates a known schedule for retirements.*

- **USA:**
  - **New units:** Under the Clean Air Act, CO2 is now a regulated pollutant; emission rate cap for new coal electric generators is 1100 lbs/MWh (approx. 500 gCO2/kWh) and for large new gas plants 1000 lbs/MWh.
  - **Existing units:** covered under a complex state-by-state plan to reduce overall emissions from power generation by 30%. *State targets permit orderly retirements of coal, linked to available gas capacity.*
China’s approach – focus on generator fuel efficiency

Output-based efficiency standards for eight industrial sectors, including electric generation

- **Fuel input** per unit of output
- For electricity, set in **grams of coal/kWh**
- Related policies:
  - **Electricity:** Forced closure of 80 GW of small (<100 MW) generating units –
  - Other industries: Electricity price penalties for failure to meet the standards (the more inefficient you are, the higher the price you pay)
CCS Mandates

Illinois “clean coal” content requirement

- Starting in 2015, electric utilities in Illinois are required to acquire 5% of their supply from a “clean coal” power source
- Target rises to 25% by 2025
- Plants operating before 2016 qualify as clean coal as long as at least 50% of CO₂ emissions are captured and sequestered (CCS)
  - Requirement rises to 70% for coal power plants expected to commence operating in 2016 or 2017, and to 90% thereafter

Montana: No new coal obligation without 50% CCS

Norway: No gas power plant can be built without CCS
EPS Policy Questions

• Is an EPS compatible with the ETS?
  Yes, just adds certainty to a part of the picture (see California and UK).

• Will an EPS drive investment in CCS?
  With today’s EPSs, probably not. Gas is the performance level and gas is cheaper than CCS.

• Will an EPS impair power system reliability?
  Rules usually include “reliability-must-run” exemptions; Models show limited impacts.
EPS Design Questions

• Must it be EU-wide? or Member States on their own?
• Coverage: Just new plants, new + renewed, or all fossil generation?
  Not many new, high-emitting plants expected. But legacy plants have a very large footprint
• How to cover existing plants?
  • At time of new commitment or refurbishment? (California)
  • At end of “useful life”? (Canada)
  • Through annual quantity-based (not rate-based) caps per MW of capacity? (DIW Berlin proposal)
• Emission rate details – numerous choices re: rates, size triggers, biomass co-firing, CCS credits, averaging, etc.
(3) Beyond EPS: Speeding the Transition From High-Emissions Electricity
Going backwards?  
Getting capacity markets right

- **SE&FI**: Capacity reserves for spot market deficits only
- **RU**: Capacity market with price restrictions. Long-term capacity supply agreements for obligatory investments
- **GB**: Developing full-scale capacity auctions, legislation to be ready in 2013
- **IE&NI**: Capacity payments since 2005
- **FR**: Capacity purchase obligations planned to be implemented by 2016, but new government could change the NOME law
- **PT**: Same as in Spain for new units
- **ES**: Capacity payments for new units and to existing coal, gas, oil and hydro capacity
- **DE**: Study 3/2012 for the government proposes full-scale mechanism, but political opinion still open
- **GR**: Capacity obligation mechanism since 2005
- **PL**: Nodal pricing and capacity market may be implemented in 2014
- **IT**: Minor payments. New capacity market mechanism to be implemented by 2017

*) No capacity payments to power plants in the day-ahead and intraday markets, but balancing market reserve capacity is contracted in advance.

Source: Industrial Intelligence, May 2012

Energy solutions for a changing world
Net demand – the new imperative

More volatile than overall demand, lacking a repeatable pattern. Demand and availability of variable renewables can be moving in opposite directions 24/7/365

A challenging week for West Connect, USA, assuming 35% wind penetration
Capacity Markets can put high-emitting units on “life support” payments

PJM capacity market payments

$42 Billion total:
- $12.6 Billion to coal
- $8.8 Billion to nuclear
- <1% to RES and EE
Firm supply margins in Germany

Wind: 11.450 MW  
Solar: 10.150 MW  
[Bio/hydro: ~2.500 MW]  
konvent. 27.400 MW  
max. Last 22.230 MW  

**Firm margin ~32%**

Wind: 12.025 MW  
Solar: 4.480 MW  
[Bio/hydro: ~3.000 MW]  
konvent. 19.250 MW  
max. Last 14.130 MW  

**Firm margin ~54%**

Wind: 5.210 MW  
Solar: 6.670 MW  
[Bio/hydro: ~2.000 MW]  
konvent. 39.800 MW  
max. Last 30.720 MW  

**Firm margin ~29%**

Wind: 613 MW  
Solar: 3.838 MW  
[Bio/hydro: ~500 MW]  
konvent. 11.000 MW  
max. Last 12.550 MW  

**Firm margin ~[12%]**

(as of Feb. 2012)

Quellen: Amprion, Transnet BW, 50Hertz (07/2012), Tennet (12/2011); UBA (02/2012), BNetzA (06/2012)  
Courtesy of Deutsche Umwelt Hilfe
Beyond EPS: What could be in a “retirement plan” for high-emissions generation?

• First, “do no harm”- avoid life support mechanisms (e.g., badly-designed capacity mechanisms) for high-emissions units

• Schedule “timely exits” for units in need of major upgrades or at end of economic useful life

• Create “early exit” incentives for units that choose orderly shut-down ahead of mandates

• Create “on ramp” for CCS
The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

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