Power System Carbon Caps: The Load-Side Option

Portfolio-based carbon management

NREL
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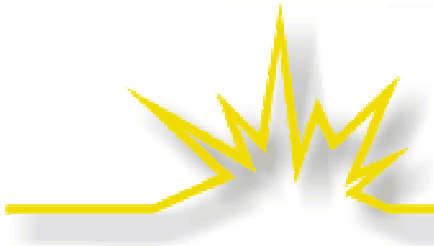

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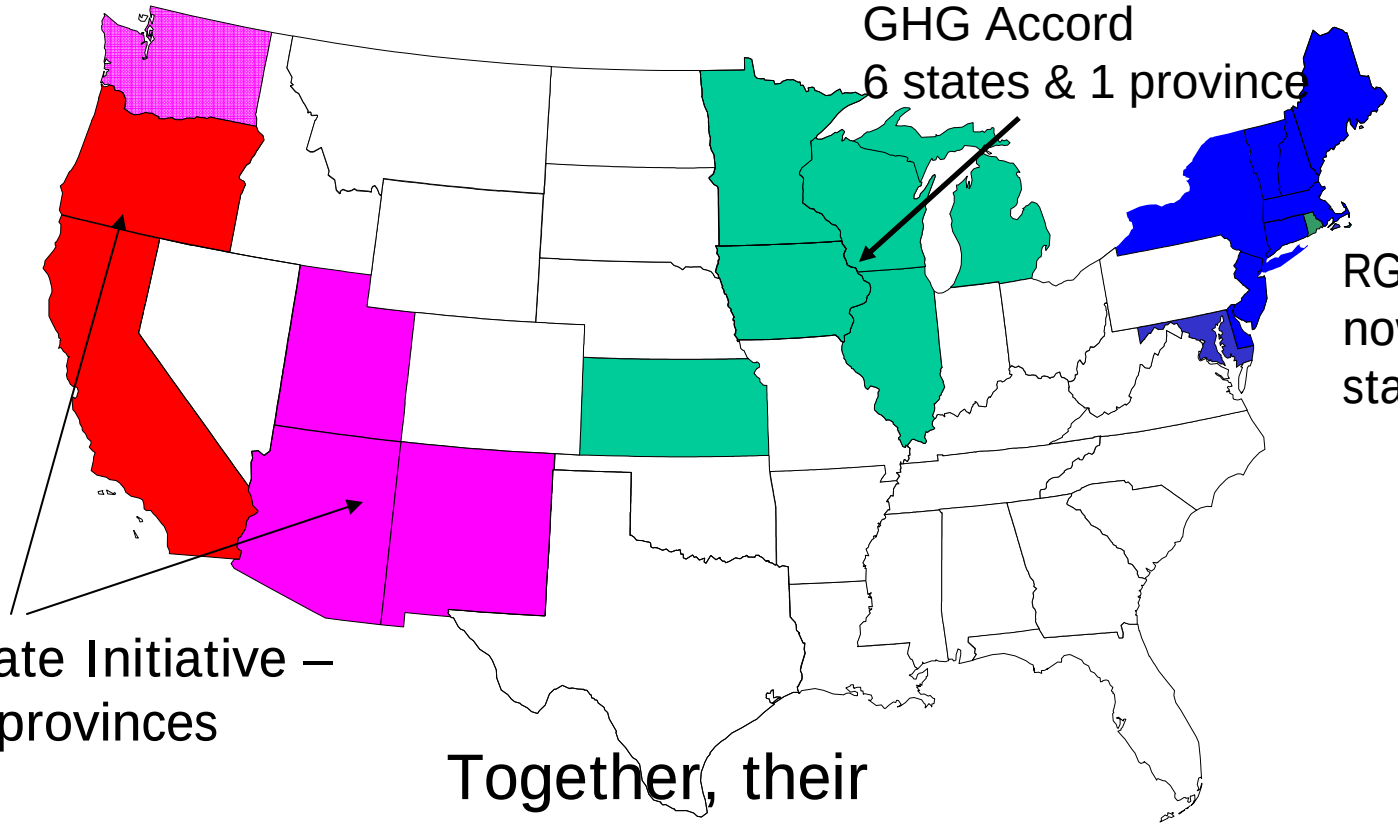
The Regulatory Assistance Project

RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP is funded by US DOE & EPA, several foundations, and international agencies. We have worked in 40+ states and 16 nations.

Richard Cowart was Chair of the Vermont PSB, Chair of NARUC's Energy & Environment Committee, and of the National Council on Electricity Policy. Recent assignments include technical assistance to RGGI, the New York ISO, the California PUC, the Oregon Carbon Allocation Task Force, the Western Climate Initiative and to China's national energy and environmental agencies.

State and regional power sector carbon caps



Midwestern GHG Accord
6 states & 1 province

California & Oregon

RGGI - now 10 states

Western Climate Initiative – 6 states & 2 provinces

Together, their carbon profiles exceed most nations.

Where will power sector reductions come from?

Possibilities:

- Reduce consumption
- Lower the emission profile of new generation
- Re-dispatch the existing fleet

NB: bigger reductions come from the first two, which are LSE activities (e.g., DSM and RPS)

For each opportunity, ask:

1. **How many tons will it avoid?**
2. **How much will it cost consumers per ton ?**
3. **What tools get the best results on #1 & #2 ?**

Which tools for the power sector ?

A. Cap and trade options

1. Generator-side cap and trade

- Free allocation of allowances to generators
- Auction of allowances – generator buys them

2. Load-side cap and trade

- Free allocation of allowances to LSEs for consumers

B. Non-cap options

3. Portfolio Management policies only (no cap/trade) such as:

- Energy efficiency programs inc. EEPS
- Renewable Portfolio Standard (RPS)
- Carbon Emissions Standard or Emissions Portfolio Standard (EPS)

4. Carbon tax (on generators or “upstream,” on fuel)

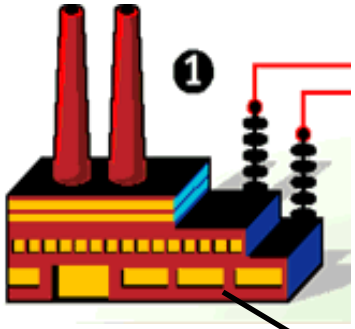
What is the best point of regulation? The LSE is in the center of the power system

"Upstream" at mines, wellheads

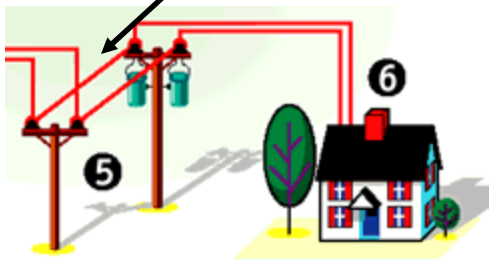
Mid-stream at generation

Midstream at load-serving entities

Downstream at customer locations



Load-serving entity/ Portfolio manager



CA & OR approach: Load-Side Cap & Trade

Basic rule: LSEs must own and retire credits to cover the emissions associated with their sales to retail customers.

>> A **"carbon budget"** for the utility portfolio manager.

How?

1. Measure historic emissions associated with electricity *serving the state* (or region) –
   - ❖ All sources, wherever located -- both in-program and imports
2. Set "hard" emissions caps to lower impact in stages
3. Distribute allowances ("carbon credits") to LSEs
4. LSEs must retire credits to match their portfolio of sources
5. EE and low-carbon sources reduce credit needs
6. It's market-based: LSEs can trade credits with other sectors, earn offset credits, etc.

Main advantages of a load-side cap

- **Lower societal costs**: directly promotes end-use efficiency, the lowest-cost low-carbon resource
- **Lower consumer costs**: Lower cost to power consumers per ton reduced
- **Environmental**: lower consumer cost permits deeper GHG reductions over time
- **Political**: Avoids most windfall gains to generators without the cost, revenue diversion and political consequences of a multi-billion $ auction

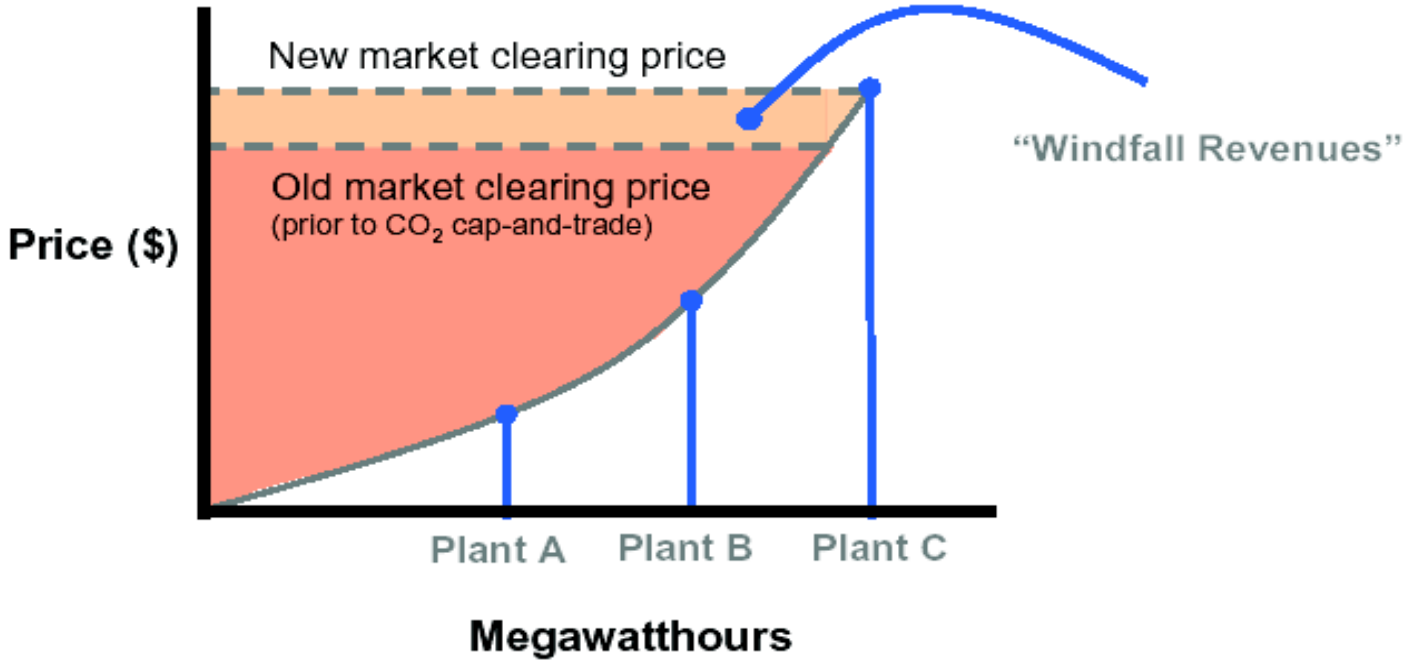
Cap and Trade architectural mistakes: Four wrong assumptions

- 1. Generators lose money under carbon cap and trade, so designers must give them allowances for free
- 2. Carbon taxes or auctions will clean up the mix at acceptable cost to power consumers
- 3. Just manage pollution, price increases and demand elasticity will deliver needed efficiency
- 4. “Allocation is just distributional” -- Initial allocation won’t affect program cost to consumers

Reality #1 Most generators make money with free historic allocation

Theoretical representation of "windfall revenues"

A fossil unit on the margin increases the market clearing price (i.e., the price paid to all generating units dispatched) to reflect the cost of CO_2 compliance



Citigroup Report on the Impact of the EU Carbon Market on European Utilities (up to 2007)

citigroup

So Winners and Losers?

- All generation based utilities – winners
- Coal and nuclear generators – biggest winners
- Hedge funds and energy traders – even bigger winners
- Losers??....herm.....Consumers!

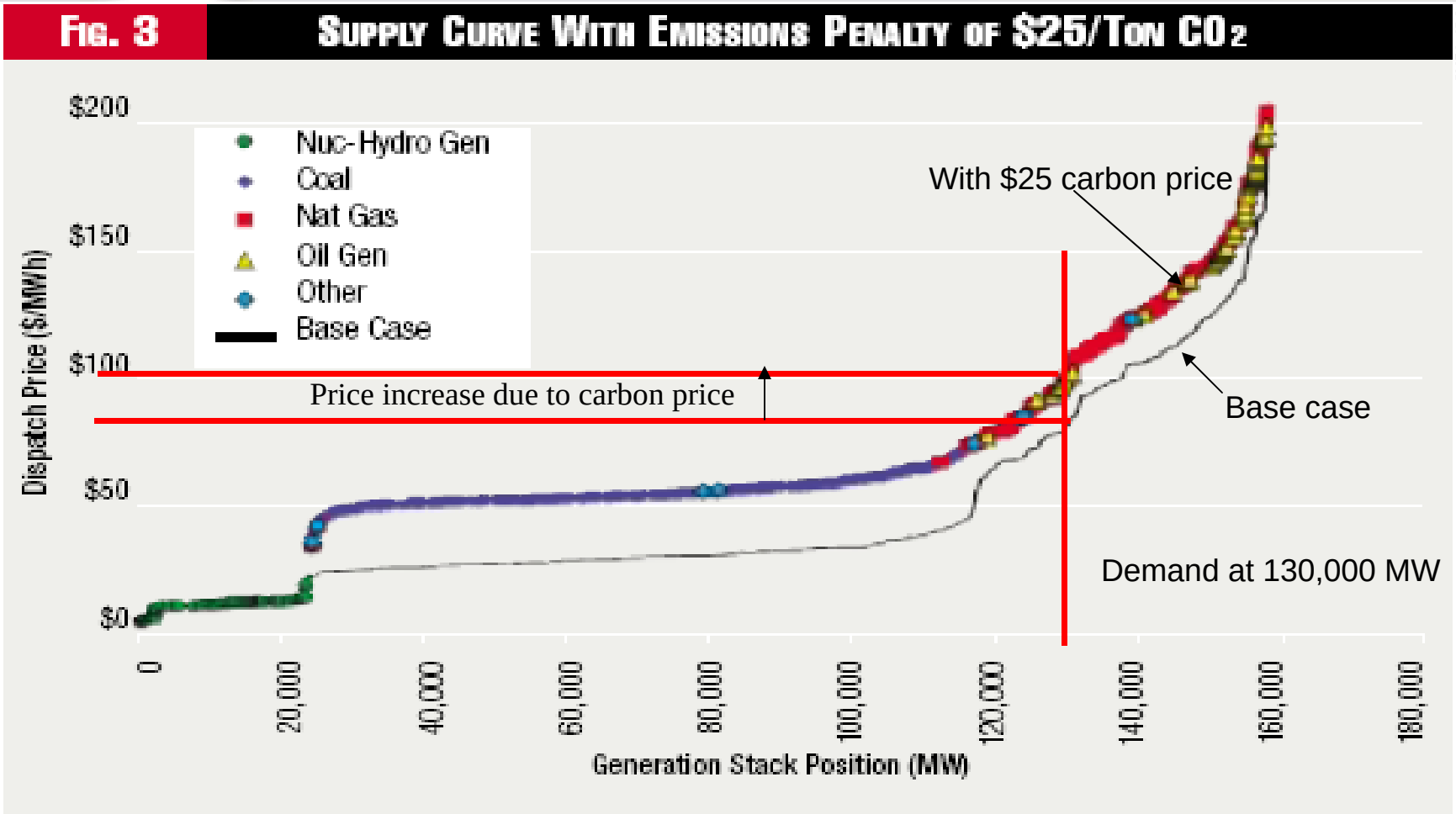
avg energy hedge fund fmc
2006 bonus { £1.5 Mm, 3.0 Mm, 5.0 Mm

across Europe approx £1 Bn flowed from consumers → elec cos's → hedge funds, et al

Requiring generators to purchase allowances helps, but problems remain

- RGGI states, California MAC and many analysts support auction or other sale to generators
- Auction is better than grandfathering, but three problems remain:
  1. ***Ratepayers still pay more*** -- Fossil generators will raise prices to cover carbon costs (this is intended); other generators will get windfall gains (a byproduct of higher clearing prices)
  2. ***Auction revenue erosion*** -- What happens to the revenue? Will it actually benefit ratepayers?
  3. ***Realities of marginal generation costs*** -- *Raising power prices is an expensive way to improve the carbon footprint of the sector* (see next slide).

Reality #2: Carbon taxes and auctions to sources can increase wholesale power prices with little effect on dispatch or emissions



Source: "The Change in Profit Climate: How will carbon-emissions policies affect the generation fleet?"
Victor Niemeyer, (EPRI) -- Public Utilities Fortnightly May 2007 <some captions, demand and price lines added>

Gen-side carbon costs can increase wholesale power prices with little effect on dispatch & emissions -- Modeling results from ECAR-MAIN and ERCOT

- In ECAR-MAIN (Upper Midwest, coal-heavy) a carbon charge of $25/ton would raise wholesale power prices $21/MWH.
  - "Even a CO2 value of $50/ton would produce only a 4% reduction in regional emissions given the current generation mix."
- In ERCOT (Texas, gas-heavy) "when gas is selling for around $8MMbtu, even a CO2 value of $40/ton produces little emissions reduction" from the existing mix.
- Thus, the most important tools to reduce emissions are new long-term investments.

Source: "The Change in Profit Climate: How will carbon-emissions policies affect the generation fleet?" Victor Niemeyer, (EPRI) -- Public Utilities Fortnightly May 2007

Load-side point: Portfolio management by LSEs is the more direct – and less costly – path to contracts for those new plants.

Winners and losers: The view from Wall Street

- "Under a cap-and-trade program, the value of allowances issued to the power sector for its emissions of CO2 will be enormous…At $25 Mt (~the EU price) the value of allowances to be allocated to the US power industry would be some $59 billion annually….the equivalent of 83% of the net income of all publicly-traded US electric utilities in 2006.**

- "The impact of CO2 emission limits on the earnings of US utilities will depend on how CO2 emission allowances are allocated by the government."**
  - **With free allocation, "unregulated generators' earnings surge"**
  - **With auction, generators recover costs in the market, and**
  - **In either case, ratepayers pay for increased power costs****
    - **Rates rise 23% to 43% at coal-heavy utilities like MDU, AEP, Ameren**
    - **Rates rise 15% to 29% at mixed-gen Southeast utilities like Duke, Entergy**

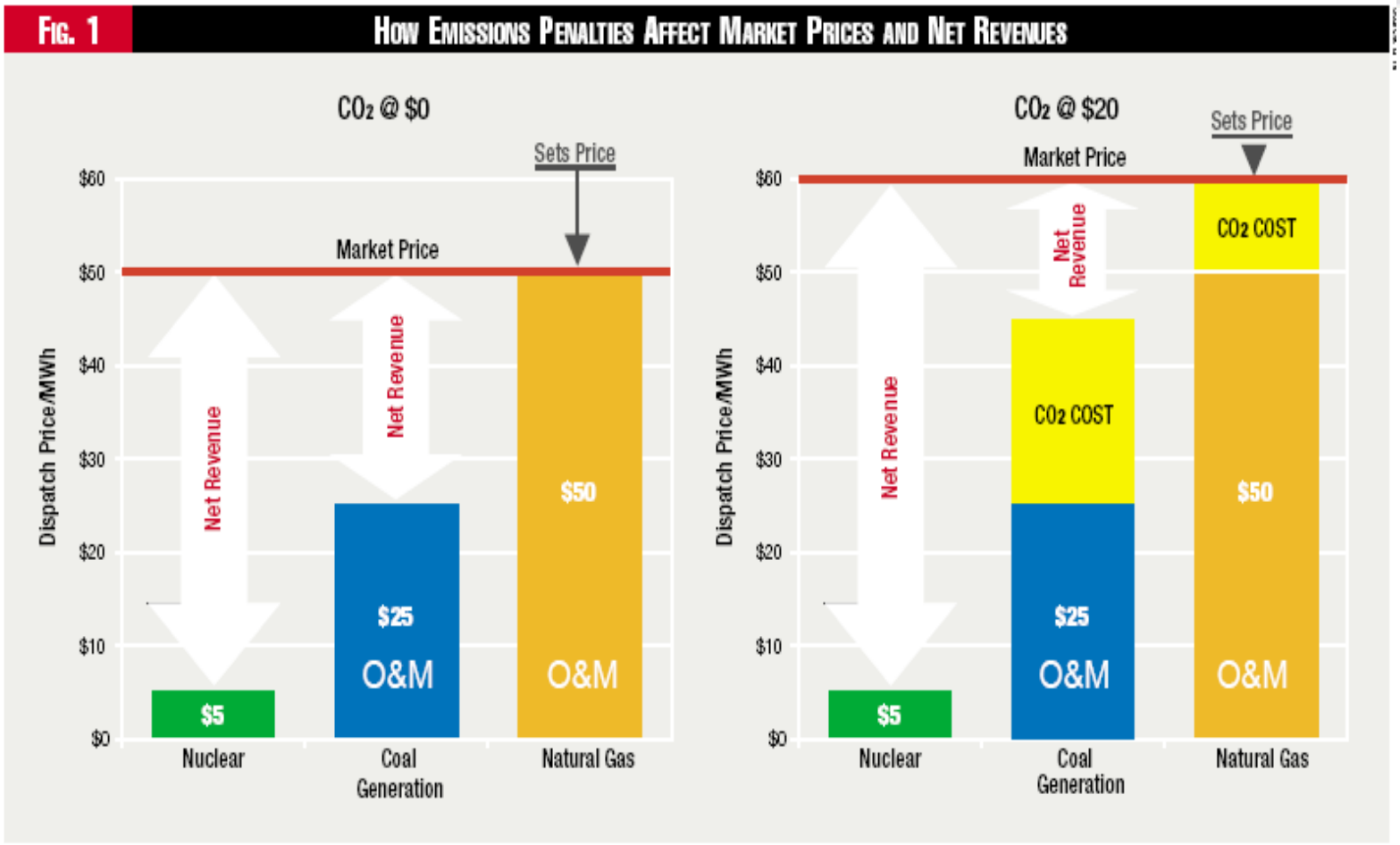
- **Conclusion: Regulators have to manage carbon risk on behalf of ratepayers**

***Source: Bernstein Research, "US Utilities: The Implications of Carbon Dioxide Regulation" (October 2007)*

Why carbon taxes and auctions create “high cost tons”

- Carbon price must be very high to save many tons (for gas to displace coal, etc.)
- Fossil units almost always set the clearing price
- Short-term clearing price provides the benchmark for longer-term and bilateral contracts
- SO: Carbon penalty on sellers raises prices generally
- Inframarginal rent a/k/a “windfall gains” to generators paid for by consumers

Why Emission Charges Can Raise Prices Without Changing Dispatch or Emissions



Source: "The Change in Profit Climate" -- Public Utilities Fortnightly May 2007 --Victor Niemeyer, EPRI

Reality #3 Carbon taxes and price increases will have minimal effect on demand

LSE-based *programs* are more powerful than rate increases

- Economic theory: just raise the price of power
- DSM reality: ***Programs*** are needed to surmount market barriers to efficiency
- **Utility DSM experience: $ spent through smart programs will deliver 5x to 13x the efficiency savings of $ charged in higher prices**
- Key conclusion: Build efficiency support into program architecture.
- BUT: Generators don't deliver efficiency
- Hmmm…who has relationships with customers?

Societal Costs

Does the cap system promote investment in low-cost GHG reductions?

- The main purpose of cap and trade is to reduce emissions at the lowest cost to the economy
- Minor improvements (e.g., heat rate) possible at existing power plants and redispatch
- Essential large reductions will come from (A) energy efficiency and (B) new plant construction
- **(A) End-use efficiency** is the lowest-cost way to reduce power sector GHGs.
- End-use efficiency does not spring from generators, or from rate increases, but from EE programs

Main point: LSEs are in the best position to deliver customer EE – aligns well with LSE carbon budget.

Reality #4: Load-side caps build on LSE practice of portfolio management

- LSEs are portfolio managers
  - Hard quantitative cap provides a carbon budget for LSEs
  - What gets built – is determined largely by contracts that LSEs are willing to sign
- Load-side cap provides a clear, market based carbon price signal – but on the "buy" side
  - The carbon value of efficiency and clean resources are realized directly by LSEs
  - ***Providers*** still have to compete on total cost terms – "clean competition" comes from the LSE budget, not a carbon tax.
- As with the RPS, paying a premium for what you want is better than paying a premium for every MWH, clean or dirty.

Portfolio-based policies can directly lower GHGs – consider the RPS

- RPS is a *content requirement* on each LSE's portfolio
- Consumers pay more to get more wind, but don't also have to pay more for all nuclear and fossil MWHs.
- EIA analysis of national 25% RPS finds that this large RPS could lower power sector emissions by 22% by 2030 (Policy case v. Reference Case).
- But this RPS has a relatively small impact on total power costs:
  - "In the Policy Case, annual consumer expenditures on electricity are very close to those in the Reference Case through 2022, as the reduction in fuel prices caused by lower fossil fuel use for electric power generation outweighs the increased capital costs of new renewable generation capacity."
  - "Cumulative (undiscounted) expenditures for electricity for the period 2009-2030 are about $65 billion (about 0.8 percent) higher than in the Reference Case, while cumulative discounted expenditures are $15 billion (0.4 percent) higher."
- Compare this impact to the cost of a carbon tax or auction that raises the price of all MWHs (see EPRI study – even very large increases in fossil prices and total power costs yield small carbon savings)

Source: Energy and Economic Impacts of Implementing Both a 25-Percent Renewable Portfolio Standard and a 25-Percent Renewable Fuel Standard by 2025 --August 2007
***Energy Information Administration** -- Office of Integrated Analysis and Forecasting U.S DOE.*

A regulator's thoughts on consumer costs

- This is not merely "political" – pricing based on the cost of service for a least-cost portfolio is integral to utility regulation.
- Providing a **carbon price signal to LSEs** is a powerful, market-based way to reflect the cost of carbon in the power sector.
- This can be a uniform, economy-wide carbon price
- If we do not have to provide billions of dollars in transfer payments to generators in order to clean up the mix, then why do it ?
- *Environmental benefit -- Lower cost reductions will permit deeper cuts and more rapid progress in meeting the state's GHG goals*.

Strategic and political questions

1. **Even if** Gen cap+auction and Load Side C&T cost the same
   - To provide the same protections a Gen-side cap would require 100% auction. **Do we believe we will get 100% auction?**
   - Gen-side requires returning all benefits to consumers. **Even if Congress creates an auction, do we believe this will happen?**
   - Look at Congress – what % is sold, what fraction of total costs is returned to power consumers?
2. The art of cap and trade design is evolving – RGGI, ETS, Oregon, California are taking new approaches and learning from implementing older ones
   - E.g., RGGI consumer allocation is a major innovation, not previously expected
3. CA and WCI can set the stage for Congress

   Why preemptively preempt better state solutions?
4. If we adopt a system that is expensive for consumers it will be harder for the nation ever to meet deep reduction goals.

Challenges and research questions

- Is an RPS a lower-cost strategy than a carbon tax to clean up the mix?
  - If not, why are we promoting RPSs at the same time as carbon auctions and taxes?
  - If yes, why don't we expand the idea to the carbon content of the portfolio generally?
- Biggest load-side challenge: tracking emissions from source to load
  - APX says it can be done – can it? What is the best approach?
- How can we retain the benefits of fluid power markets while assigning responsibility for carbon content to portfolio managers?

For more information…

- *"Another Option for Power Sector Carbon Cap and Trade Systems – Allocating to Load"* *(May 2004)*
- *"Why Carbon Allocation Matters – Issues for Energy Regulators"* *(March 2005)*
- *"Addressing Leakage in a Cap-and-Trade System: Treating Imports as Sources"* *(November 2006)*
- *"Why A Load-Based Cap?"* *(March 2007, with Julie Fitch)*
- *"Load-Side Caps for Power Systems: Environmental and Economic Goals"* *(August 2007)*

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