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Integrating Electricity and Environmental Markets

Problems and Solutions from the US Experience



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Overview

- **Electricity and the Environment: Efforts to Open and Integrate Electricity Markets**
 - **Concern:** Opening Electricity Markets and Industry Restructuring Will Negatively Impact the Environment
 - Changing incentives for individual power plant owners/developers
 - Shifting of industry impacts with shifting of industry output
 - **Response:** 2 Approaches in US to Address the Potential Problems
 - Addition of environment-related provisions to industry restructuring laws and regulations
 - Adaptation of existing emission-control programs



Changing Incentives: Generation Cost Recovery in Traditional and Restructured Contexts

Traditional:

Most power plants owned and operated by utilities

Recovery of pollution control costs generally guaranteed through regulated electricity rates

Large capital expenditures for emission controls increase rate base

Restructured:

Power plants owned and operated by independent merchant companies or generation affiliates

Pollution control costs can only be recovered through market price

Pollution control costs negatively impact profits, can threaten economic viability

 **Result: Stronger Resistance to Control Requirements**



Shifting Industry Output: Regional Differences in US Electric Industry

- Clear differences among states
 - Areas with abundant coal supplies (Rockies, Midwest states) tended to build coal plants
 - Pacific Northwest, Tennessee Valley and New York rely on large hydroelectric generating plants (federally "rural electrification" efforts from the 1930s)
 - Northeast US strongly dependent on imported oil and gas
- The variations in different regions' fuel mix means electricity prices and politics vary widely across the U.S.
- Price separation invites changes in generation patterns with increased market scope and deregulation
- Variations also imply very different emission profiles for generation in each region



Shifting Industry Output: Regional Differences in US Environmental Regulation

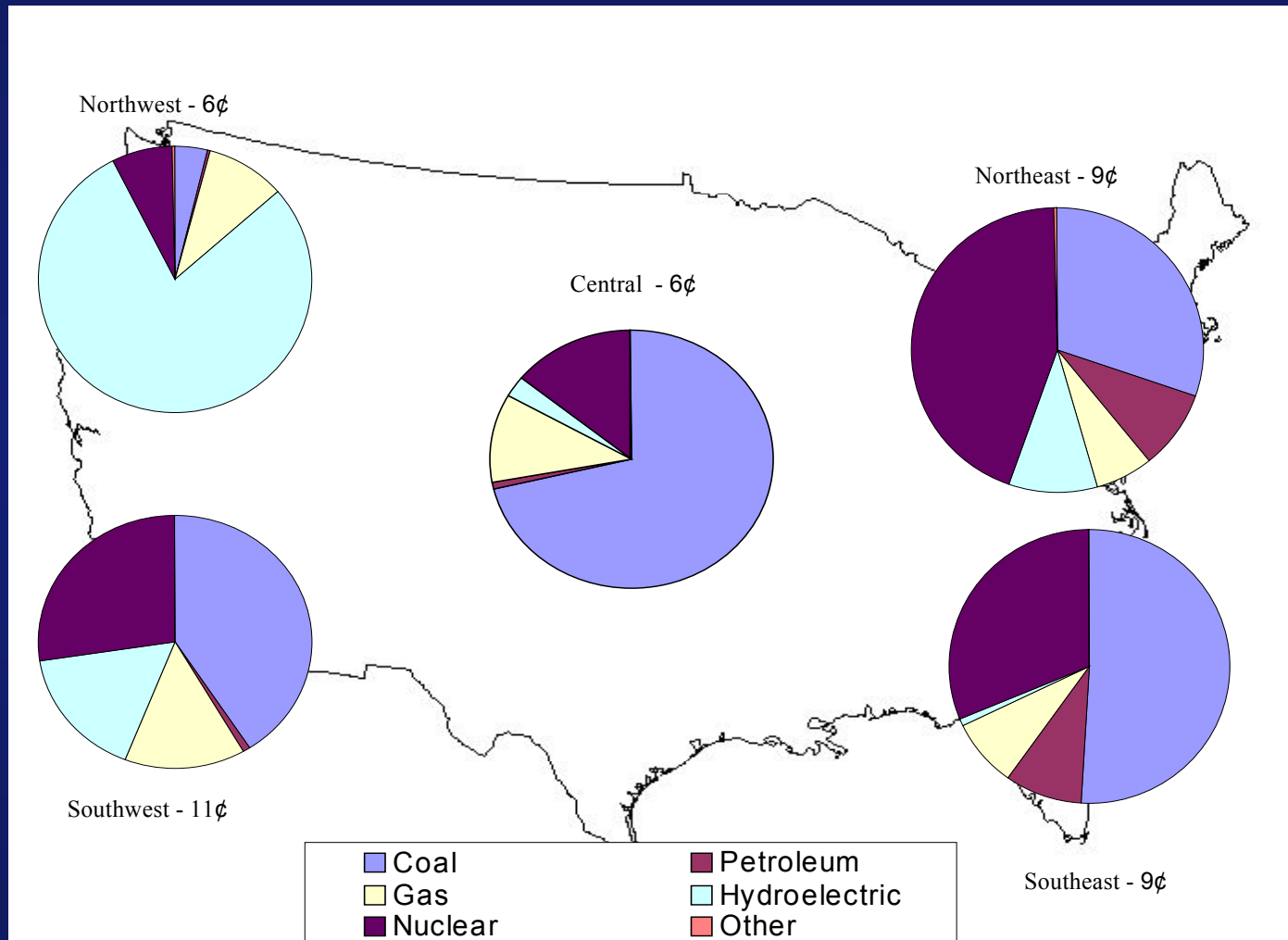
□ Disparate industry, physical, and socioeconomic features of states can affect the setting of emission control requirements

- Economic importance and political strength of the polluting industries;
- The mix of fuels for electricity generation in a state or region;
- Public perception of the importance of environmental protection;
- Organization and political effectiveness of environmental interests;
- Exposure and sensitivity of the population and ecosystems of the state to the impacts of local and regional environmental pressure; and
- Cost and rate impact of achieving additional reductions
- E.g.: politics of regulation of coal power plants – upwind Midwest states versus downwind Northeast states

□ Regional Price/Emission Differences in US Analogous to Differences – US, Mexico, Canada?



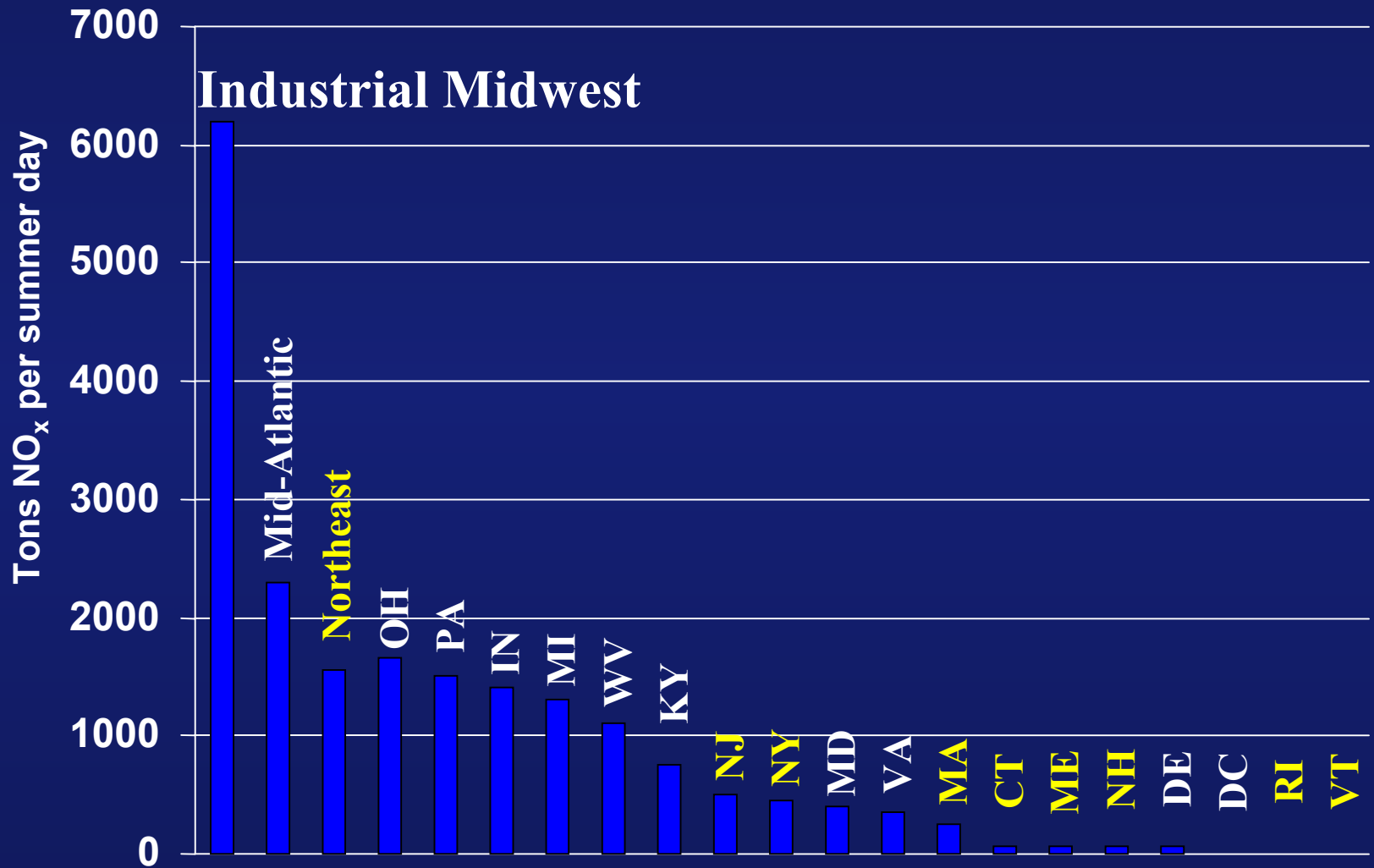
Electricity Price and Fuel Mix by Major Region in the United States



Source: Energy Information Administration.



Emission Disparity in US Electricity Generation



RESPONSE:

State Restructuring Legislation & Regulations: Emission-Related Provisions

- **Portfolio Standards**
 - **Renewable Portfolio Standards**
 - **Emission Portfolio Standards**

- **Fuel and Emissions Disclosure**

- **System Benefit Charges**
 - **Renewable R&D**
 - **Demand-Side Management**

- **Siting: Minimum Technology Standards**



Portfolio Standards

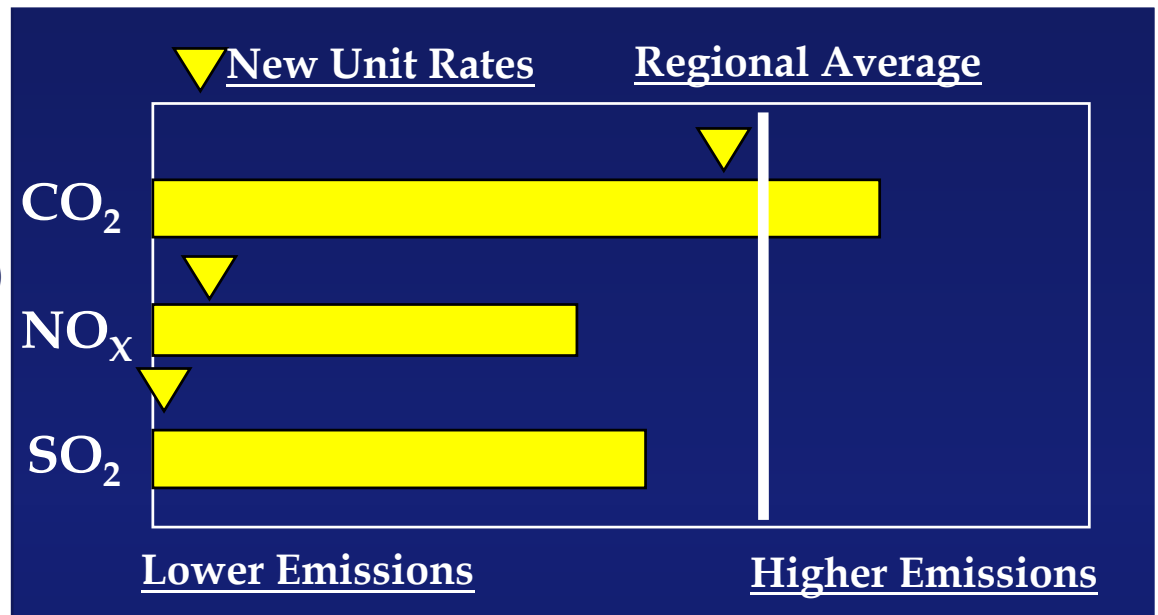
- ❑ Portfolio requirements for all retail suppliers (sellers)
- ❑ Renewable Portfolio Standards
 - Minimum percent from renewables resources
 - Typically increases over time
 - Disparate definitions of “renewable”
 - Different requirements for new, existing resources
- ❑ Emission Portfolio Standards
 - Weighted average emission rate (lb/MWh) of all resources operated &/or purchased to meet load
 - Regardless of where power is purchased
 - Cannot exceed state-prescribed standards



Emissions Disclosure: MA Example

Air Emissions

Carbon Dioxide (CO₂), nitrogen oxide (NO_x), and sulfur dioxide (SO₂) emission rates from elec sources, relative to the regional average, and to the emission rates of new generating unit



- ❑ Bars: average rates of supplier's portfolio or "product"
- ❑ Regional Average: average of all New England units
- ❑ New Unit: State-of-art new unit rates
- ❑ Also: Fuel mix

System Benefit Charges

- ❑ **Unit Charges on all Electricity Consumers**
- ❑ **Fund-Building Charges**
- ❑ **Demand-Side Management**
 - **To continue (or start) investment to reduce electricity consumption and/or peak load**
 - **Administered by distribution utilities, private companies, state agencies**
- ❑ **Renewable Power**
 - **For research and development of renewable resources**
 - **Funds managed by utilities and/or government agencies**



Energy Facility Siting

- ❑ Purpose: To reduce administrative burdens on facilities that are state-of-the-art with respect to environmental controls
- ❑ Siting Board periodically establishes emission standards reflective of low-impact facilities
- ❑ Air emissions can include at least SO₂, NO_x, PM, fine particulates, CO, VOCs, HM
- ❑ Siting process significantly streamlined for proposed facilities that meet the emission standards



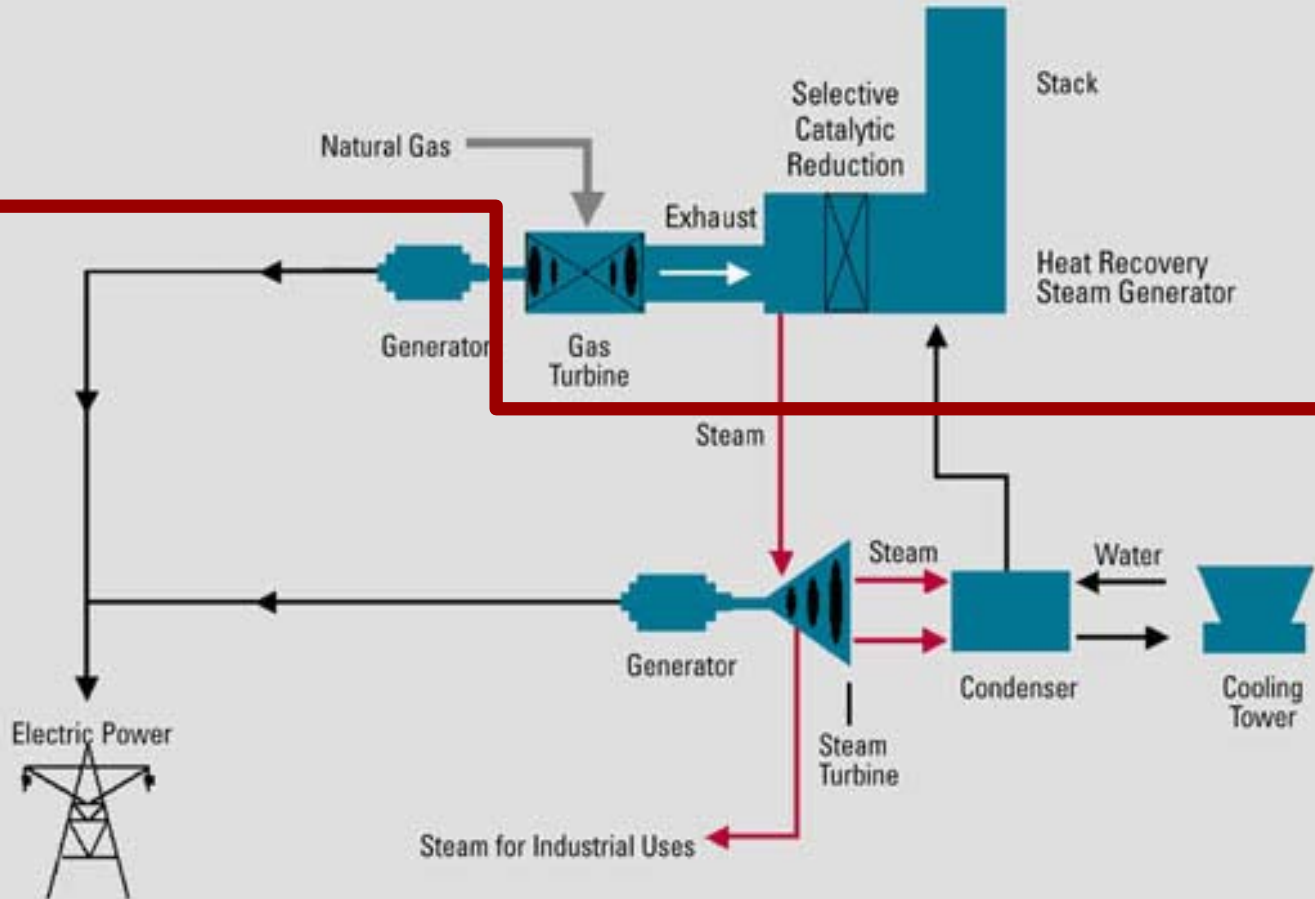
RESPONSE:

Output-Based Standards (OBS)

INPUT
(mmBtu)

OUTPUT
(MWh)

EMISSIONS (Lbs)



Output-Based Standards (OBS)

- **Emission Standards Based on *Electrical Output* (lb/MWh) Instead of *Fuel Input* (lb/MMBtu)**
- **Unit or Facility Rate-Based Standards**
 - **Maximum emission rate (lb/MWh) from individual power plants**
 - **CO₂, NO_x, SO₂**
- **Allocations of Allowances in Cap/Trade Programs**
 - **Allocation of allowances based on electrical output**
 - **To states**
 - **To sources within a state**

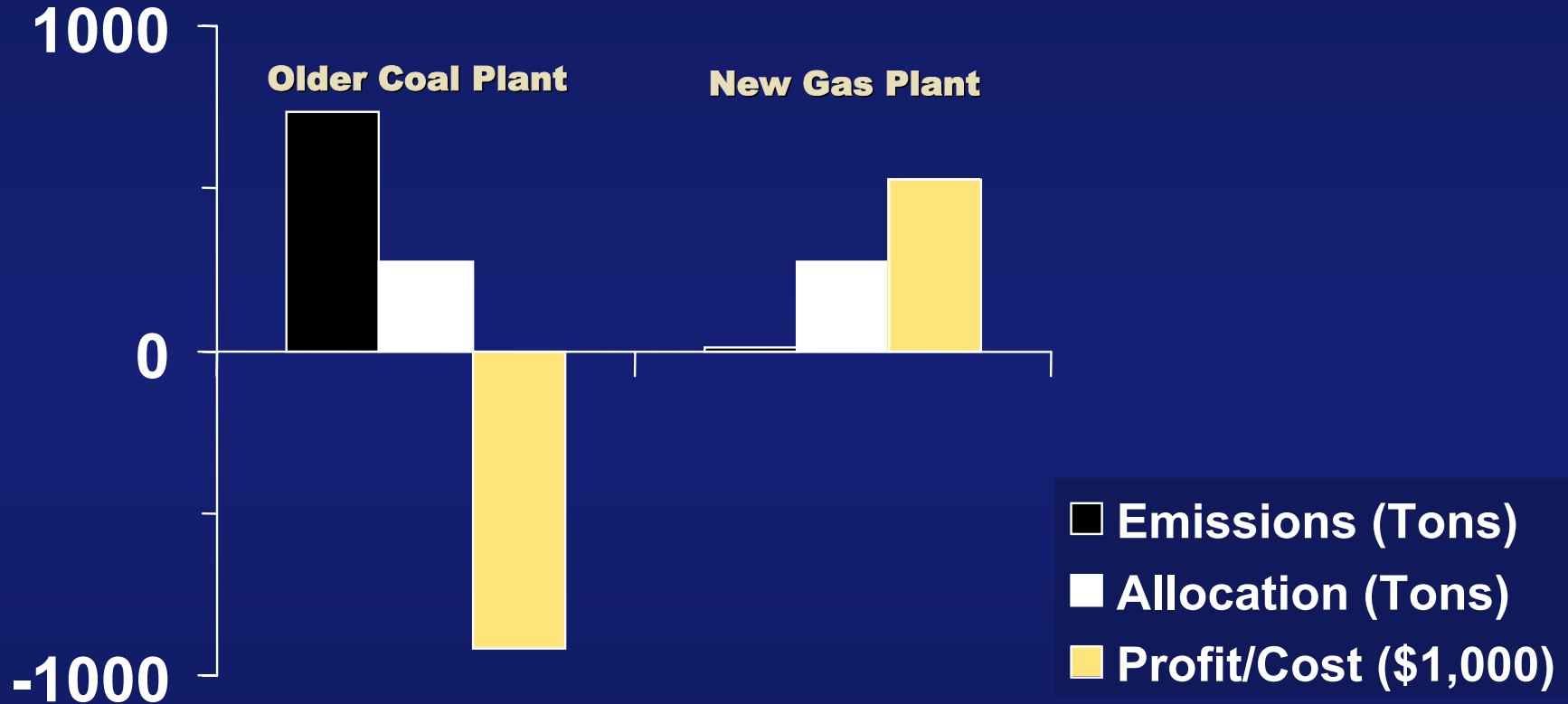


Purpose of OBS

- **Encourage and reward improvements in generating unit efficiency**
 - Efficiency improvements become an emission control strategy
- **Provide incentive to improve overall efficiency of electric system**
 - Economic advantage for most efficient units
- **Promote equity among power plants in a competitive context**
 - Emission control standard matches financial metric of competitive market (i.e., MWh output)



Hypothetical Output-Based Allocation: Economic Impacts on Two 100 MW Plants



Conclusion

- ❑ There has been concern that integrating or expanding wholesale and retail markets in the US will worsen the environmental footprint of the electric industry
- ❑ Policy mechanisms have been included in US state programs to address potential adverse environmental consequences
- ❑ Focus and format of existing environmental regulation has also begun to adapt to the new industry structure
- ❑ Similar programs may be considered in the context of integrating electricity markets in North America





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