

# Economic modeling issues

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ASU Clean Power Program Workshop

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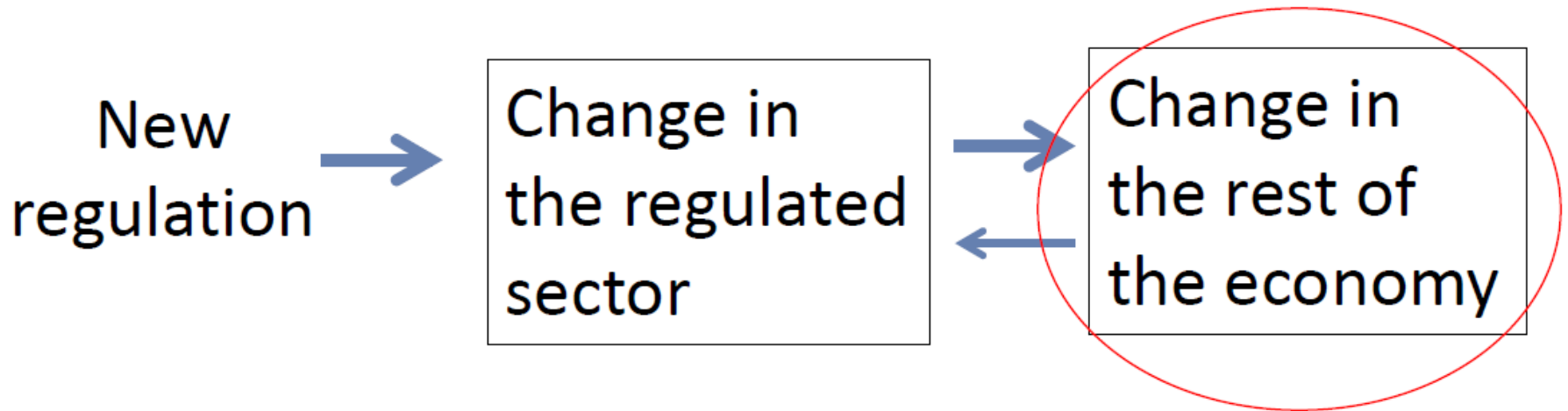
# Why is this happening

- There is a major externality associated with the use of fossil fuel, especially coal.
  - The social cost of CO<sub>2</sub> (SCC) has been estimated by US Government at \$43/ton, rising over time.
- The effective way to deal with this would be through national legislation that imposed a price on CO<sub>2</sub>.
  - Whether a tax, keyed to the SCC, or cap-and-trade.
- National legislation is currently not possible.
- The Clean Power Program is a second-best approach based on existing administrative authority.
  - Inevitably, a more costly approach than a national approach involving a carbon price.

# Analyzing the effects of a regulation



If the main focus is on the rest of the economy, need a computable general equilibrium (CGE) model

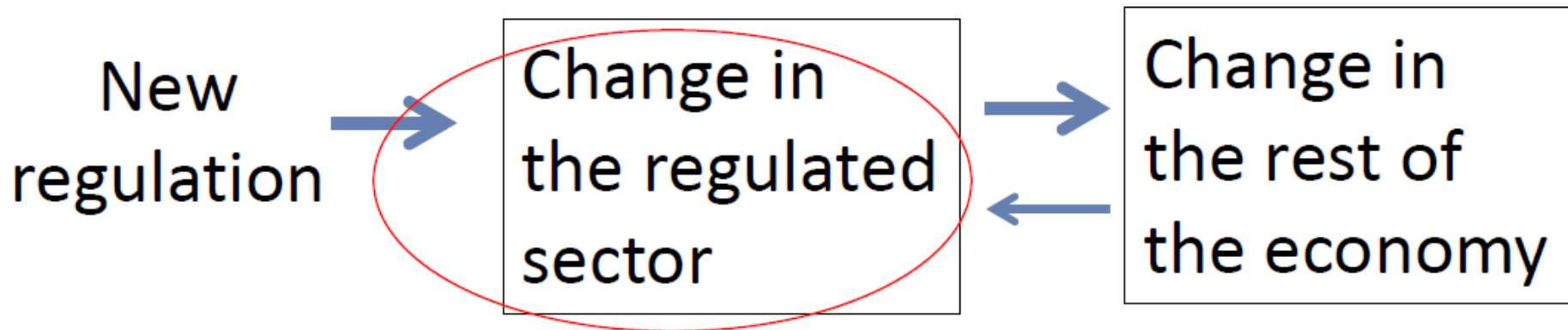


# Economic analysis approaches

- Partial equilibrium (considers a single sector) versus general equilibrium (considers economy-wide interactions).
- Flavors of general equilibrium model
  - Input-output
    - Metrics covered are output, income, jobs
    - Less general structure of production function
  - Computable General Equilibrium (CGE)
    - Metrics covered also include profit (producer surplus) and consumer surplus (consumer welfare impact)
    - More general structure of production function

In the regulation of lead in gasoline and SO<sub>2</sub>, the main action occurred within the regulated sector.

- For this, one needs a model of the regulated sector – in this case a model of the Western Power grid.



# Issues raised in comments on CPP submitted to EPA

- High efficiency of existing power plants in AZ precludes attaining Building Block 1 efficiency improvement.
- BB2 overstates amount of natural gas generating capacity available during peak periods.
- Dispatch analysis is faulty.
- Fails to recognize that half of NGCC generation in AZ is merchant-owned and contracted for.
- Lack of capacity in natural gas pipelines and electricity transmission.

- Reduced security of supply from less diversified portfolio of power sources
- Inadequate credit given to existing nuclear power generating capacity in AZ
- Overstates potential for increased renewable energy in AZ
- Overstates potential for further reductions in energy demand in AZ due to increased energy efficiency.
- Overlooks financial and timing constraints in expanding capacity.
- High magnitude of stranded assets.



# These issues all require the use of a power sector model

- Various power sector models are available.
- Vary in extent of coverage, degree of detail, type of decisions simulated, and economic metrics accounted for.
- Vary, also, in transparency and availability.
  - Most are proprietary to a greater or lesser degree.
  - Research at ASU may well require a partnership with a model owner

# Some issues raised in existing economic analyses

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## A Proximate Mirror:

*Greenhouse Gas Rules and Strategic*

*Behavior under the US Clean Air Act*

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Dallas Burtraw, Karen Palmer, Sophie Pan and  
Anthony Paul

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SSION PAPER

# Haiku electricity market model

- Covers electricity sector in the contiguous 48 states by 22 regions
- Calibrated to AEO 2013
- Simulation to 2035 for 3 seasons per year, 4 time block per season
- Dynamic, price-responsive demand side with 3 customer classes
- Each region is cost-of-service regulated or competitive
- Supply-side investment, retirement, system operation
- Endogenous investment in air pollution abatement technologies

- Rate-based
  - Tradable emissions rate performance standard
- Mass-based
  - Emissions fee
  - Cap and trade with allocation to all generators, to covered regulators, allocation to local distribution companies, or allocation to energy efficiency, or with auction.
  - Updated output based allocation
- Role of complementary policies (renewables, energy efficiency)
- Individual state approach or coordinated regional approach

# Coordination challenge in regional approach exists in two markets

## 1. Compliance markets

- Mass-based programs
  - If costs vary, linking could lead to substantial revenue and investment flows
  - Exchange rate approach leads to uncertain emissions outcome
- Rate based programs
  - A weighted average regional (“blended”) rate improves compliance market
  - If blended rate is unacceptable, an exchange rate approach is promising
  - Neither approach not solves problem of revenue and investment flows in power market....

## 2. Power markets

- Differences in rate targets provides production (dis)advantages

# Issues

- Individual states acting alone are vulnerable to predatory behavior by other states
- Leakage can occur, whereby emissions are merely transferred to another geographic area

# WORKSHOP ON OPTIONS FOR RESPONDING TO THE CLEAN POWER PROGRAM IN THE WESTERN STATES

Location: ASU

Time: Early-mid May2015

Overview of the Climate Action Plan and the Clean Power Plan -- context, goals and likely next steps.

Solar and wind: where do we stand, what are the prospects, and what are states' options?

Energy efficiency: where do we stand, what are the prospects, and what are states' options?

Coal: where do we stand, what are the prospects, and what are states' options?

Technology standards: where do we stand, what are the prospects, and what are states' options?

Cap-and-trade: where do we stand, what are the prospects, and what are states' options?

- Trading under an emissions rate standard vs an emissions mass standard
- Alternative ways to allocate allowances
- Alternative ways to update allowance allocations
- Alternative ways to allocate revenues/asset values

Economic analyses of the design and outcomes of the Clean Power Plan

Utility perspectives (panel)

State regulators' perspectives (panel)

Pros and cons of multi-state collaborations (panel)

Issues going forward -- what do we need to know? Towards an agenda (panel)