

Electric Sector Modeling Using ORCED

Stanton W. Hadley

June 25, 1999

Oak Ridge Competitive Electric Dispatch Model

■ Multi-faceted

- ◆ Can analyze finances, prices, reliability, emissions

■ Flexible

- ◆ Excel spreadsheet
- ◆ New parameters can be added easily

■ Available

- ◆ Center for Clean Air Policy using for study
- ◆ Other groups have used
- ◆ Website being established for distribution

Used for Variety of Studies

- Impact of biomass on NO_x and SO₂ emissions
- Synergy of NO_x, SO₂, and Hg controls
- Emissions reductions from energy efficiency
- Impact of carbon charges with demand elasticity
- Reliability impacts of NO_x emission installations
- Electricity price impacts from restructuring
- Adequacy of electricity supply under restructuring
- 5-Lab study

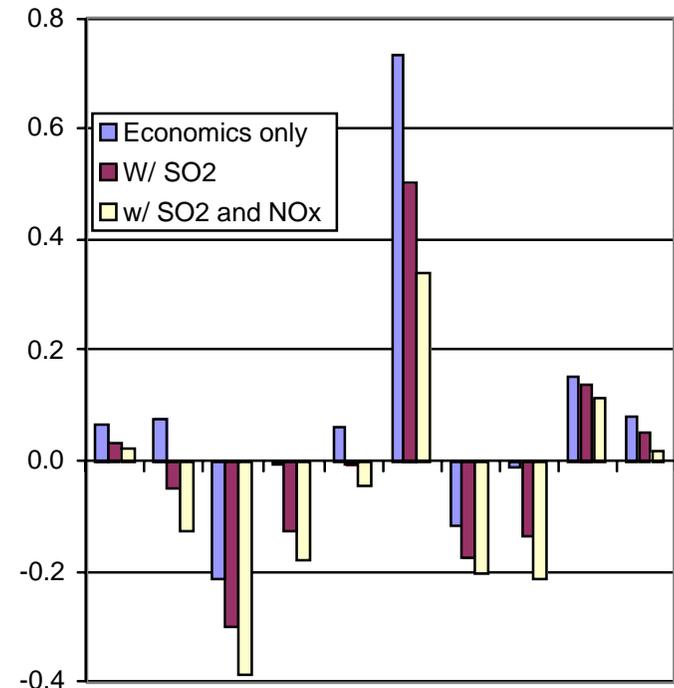
Biomass Resource Assessment

- Biomass resources for each state at different prices
 - ◆ Five types of biomass
 - ◆ Price levels between \$20/dry ton and \$50/dry ton
- Electric supply and demand for each NERC region
 - ◆ Model by technology and fuel type
 - ◆ Create capability for co-firing biomass with coal
- Optimize ORCED to minimize system cost
 - ◆ With and without SO₂ and NO_x emissions trading
 - ◆ Determine amount of biomass used

Biomass Results

- Except in MAAC, only \$20/dt biomass used
 - ◆ Little coal to displace in high-cost coal regions
 - ◆ Biomass >\$20 uneconomic in low-cost coal regions
- Emissions credits improve economics of biomass
 - ◆ Assumes \$200/ton SO₂ and \$1500/ton NO_x
 - ◆ Sensitivities on regional values could be done

Biomass Differential Cost



Multi-Emission Control Study

- Center for Clean Air Policy using ORCED
- Building data set for MAAC region
 - ◆ PA, NJ, DE, MD, VA
 - ◆ Plants, control technologies, emissions, demands
- Will look at impacts of different control strategies
 - ◆ Pollutant by pollutant controls vs early fuel switching
 - ◆ Tax incentives to encourage switching
- Emissions include NO_x , SO_2 , CO_2 , Hg

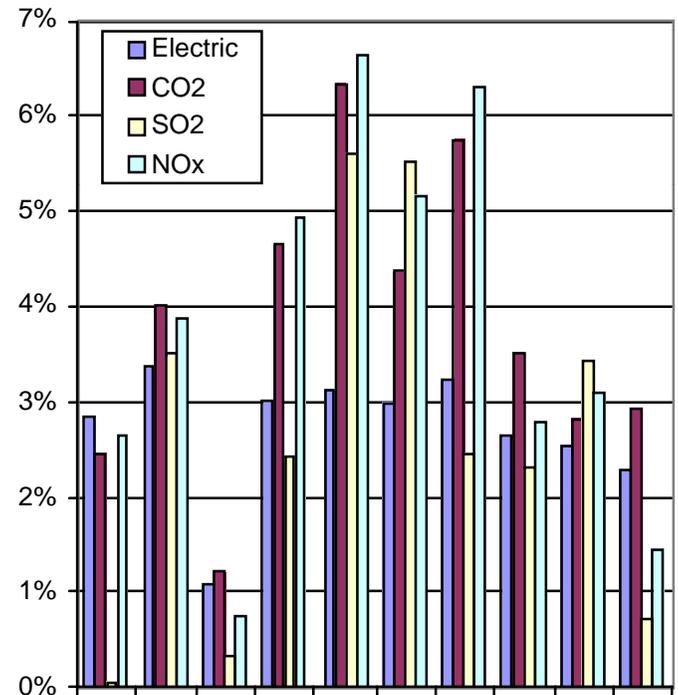
Energy Efficiency Reductions

- Determined potential energy reductions from expansion of Motor Challenge program by state
- Reduced electricity demands for each NERC region
- Examined reduction in SO₂ and peak-season NO_x
- Did not include long-term addition of new plants

Results of Motor Challenge Reduction

- Regional variation due to:
 - ◆ Industry potential
 - ◆ Fuel use
 - ◆ Emission controls
- Higher emission reductions if marginal plants are high emitters
- Long-term impact may be less if new plants are marginal production

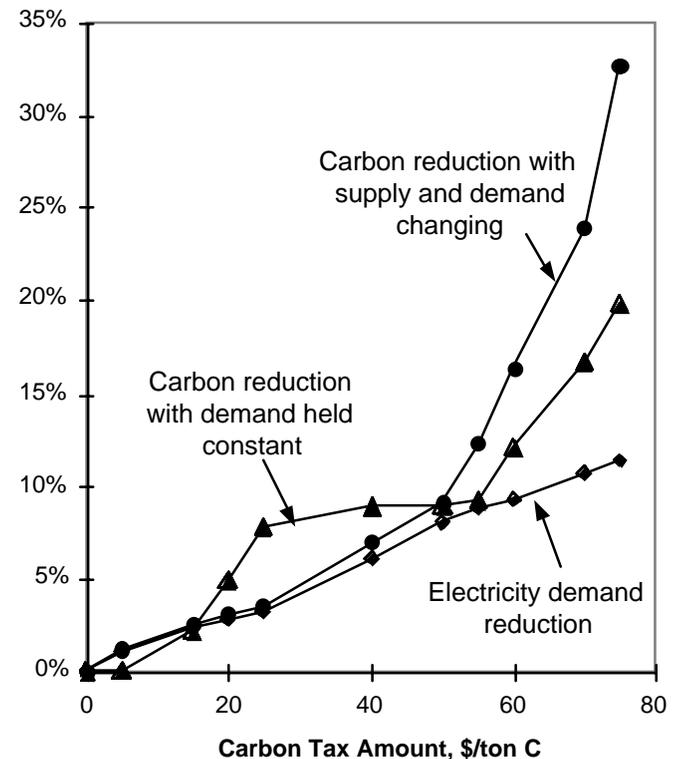
Reductions from Motor Challenge



Carbon Charge Impact on Emissions

- Model ECAR region (OH, ID, MI) for 2010
- Include demand changes from real-time pricing
- Add carbon charge at varying levels
 - ◆ At $< \$50/\text{tC}$, carbon follows demand
 - ◆ At $> \$50/\text{tC}$, coal capacity displaced

ECAR Carbon and Electricity Reductions with Carbon Charge



Possible Future Studies

- Benefits of multi-emission control strategy
 - ◆ Expansion of CCAP study to other areas
 - ◆ Analysis of other policies (taxes, efficiency programs)
- Renewable penetration in a restructured market
 - ◆ Profitability under different electricity markets
- Clean Energy Futures follow-on
 - ◆ NEMS and ORCED benchmarking
 - ◆ Sensitivity analyses from CEF scenarios