Integrated Energy-Environmental Modeling for Regional Scenario Analysis

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EPA CNS Progress Review Workshop
18 October 2005

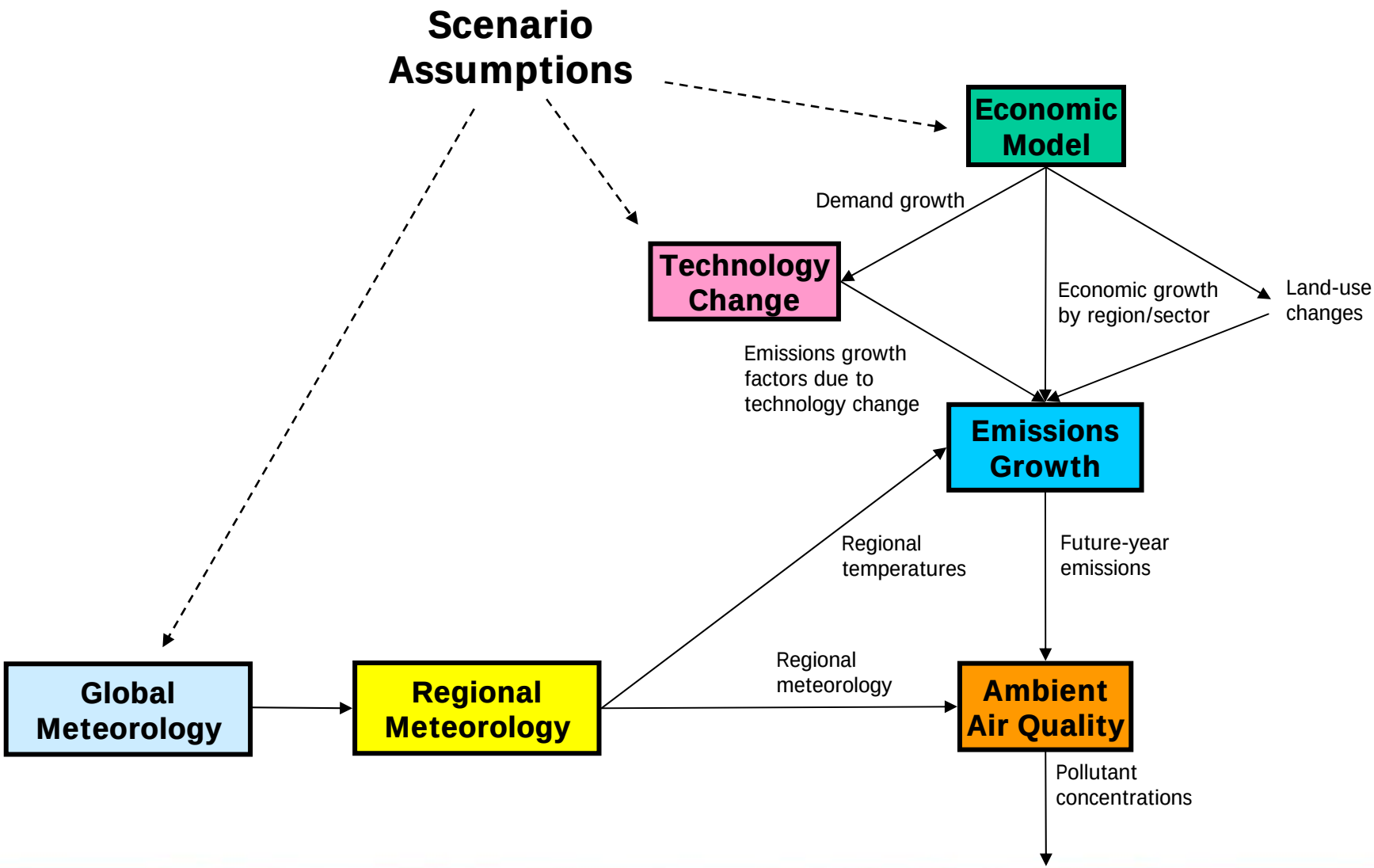
NRMRL's Integrated Strategic Assessment Workgroup (ISA-W)

- Support ORD Global Change Program (MARKAL modeling)
  - Develop and assess scenarios of future technologies thru 2050
  - Focus on transportation and electricity sector
  - Better understand how technological evolution could impact future regional air emissions
  - Transition program from emissions to adaptation focus
- Provide useful analyses and tools to states and regions that are trying to make energy/technology decisions

EPA Energy System Analysis

- Origins in EPA's *Global Change Research Program*
- How might global climate change affect regional weather and (in turn) atmospheric pollution?
- Drivers of atmospheric pollution:
  - Chemical reaction and transport
  - Biogenic emissions
  - Anthropogenic emissions
- Technological change is fundamental to the latter
- The analysis requires an *integrated* modeling framework

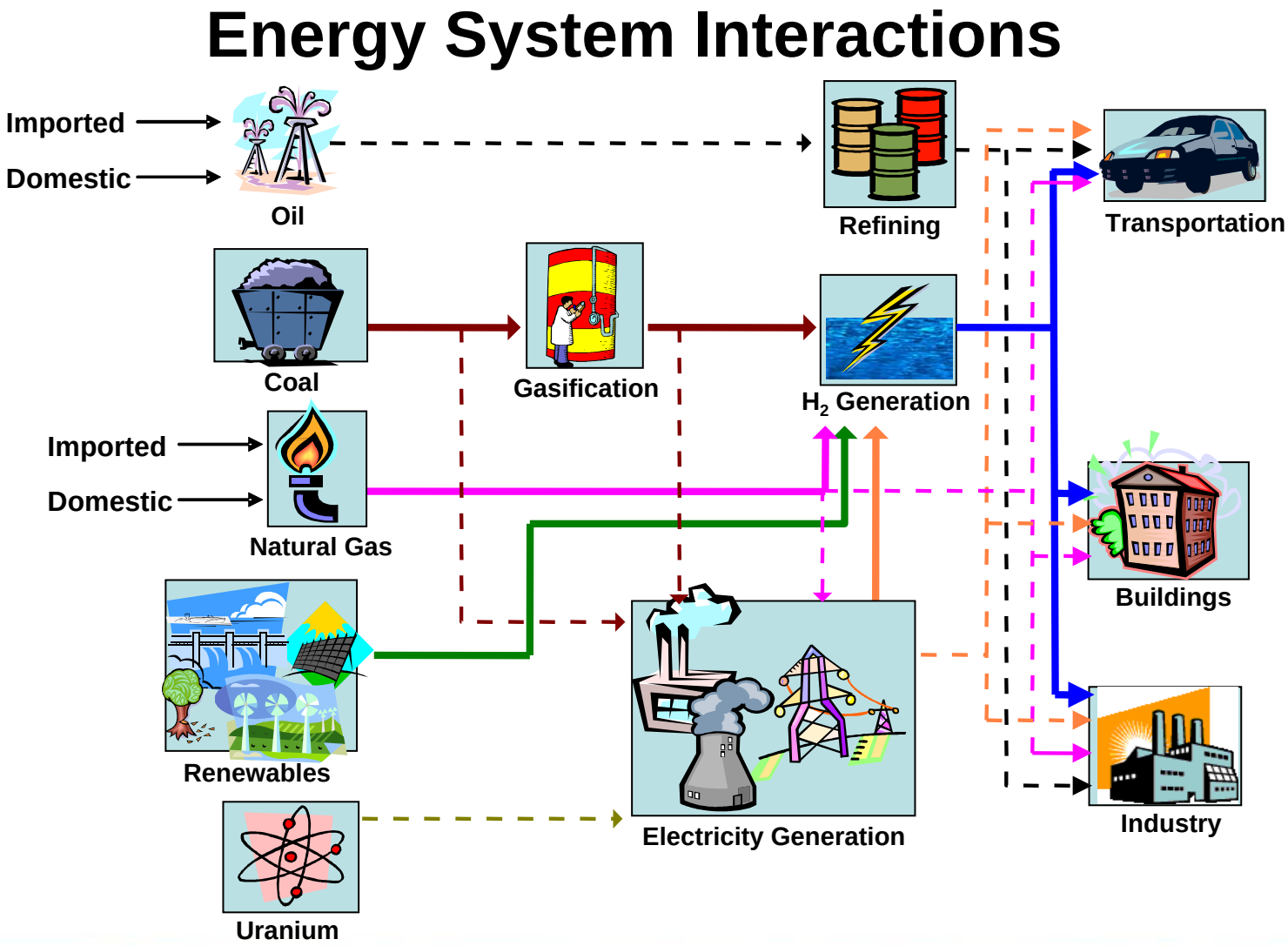
EPA Global Climate Change Program's Air Quality Assessment



ISA-W Modeling Goals

- Develop and assess scenarios of energy technology evolution in emissions-intensive sectors of the U.S. economy (transportation and electricity) and calculate associated emissions trajectories
- Scenario analysis – *NOT* prediction
- Focus on 2000 to 2050 timeframe
- Take into account driving forces:
  - Technological change
  - Energy supply, demand, and price dynamics
  - Environmental, energy, and land use policies
  - Region-specific factors (demand patterns, technology preferences, fuel availability)

MARKAL Modeling of Energy System

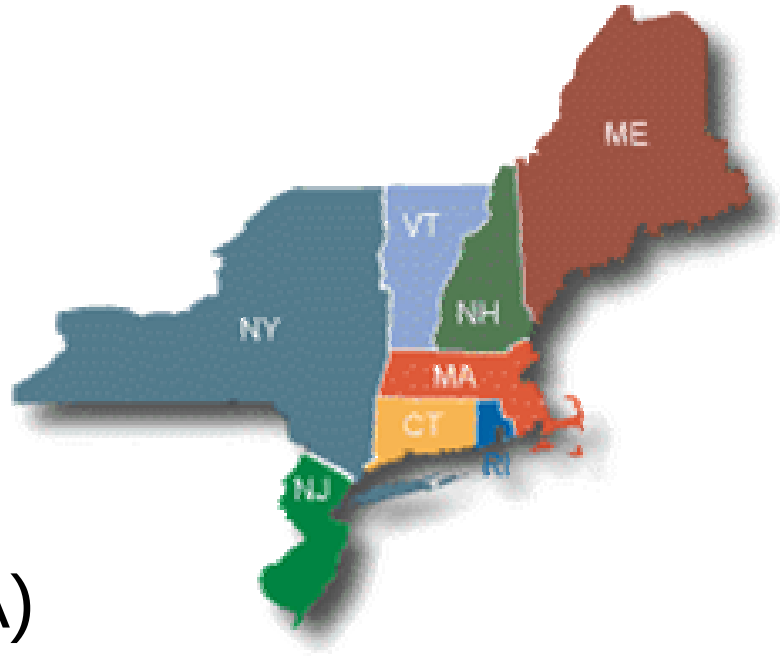


Regional MARKAL: Motivation Behind New England Pilot Effort

- Decisions about technology and impacts from technology choice occur at regional and local scales
- Policy actions relevant to climate and air quality are being taken at regional and local scales
  - e.g., Criteria pollutant mitigation, technology portfolio standards, systems benefits charges, climate considerations
- States and local entities need tools to assess energy-technology-environment policies

New England MARKAL Project

- Northeast States for Coordinated Air Use Management (NESCAUM) is developing, hosting, and running the model
- Six states, each modeled as its own region (now adding NY, NJ, DE; later MD, DC, PA)
- EPA has sponsored model development – not analysis



Outcomes: The New England MARKAL Project Is Helping EPA . . .

- Determine what data are readily available at state and regional levels and what gaps must be filled
- Prepare structures for handling regional model data
- Test the model development and utilization process
- Demonstrate the value of a regional modeling framework

Specific Projects

- Assess regional differences in technology suitability (wind, solar, biomass, CO_2 sequestration, distributed generation, H_2 infrastructure)
- Compare emission trading schemes
- Examine smart growth proposals in the context of their environmental benefits
- Analyze benefits of region-specific policy levers (renewable portfolio standards, systems benefits charges, green power purchases)

TACT

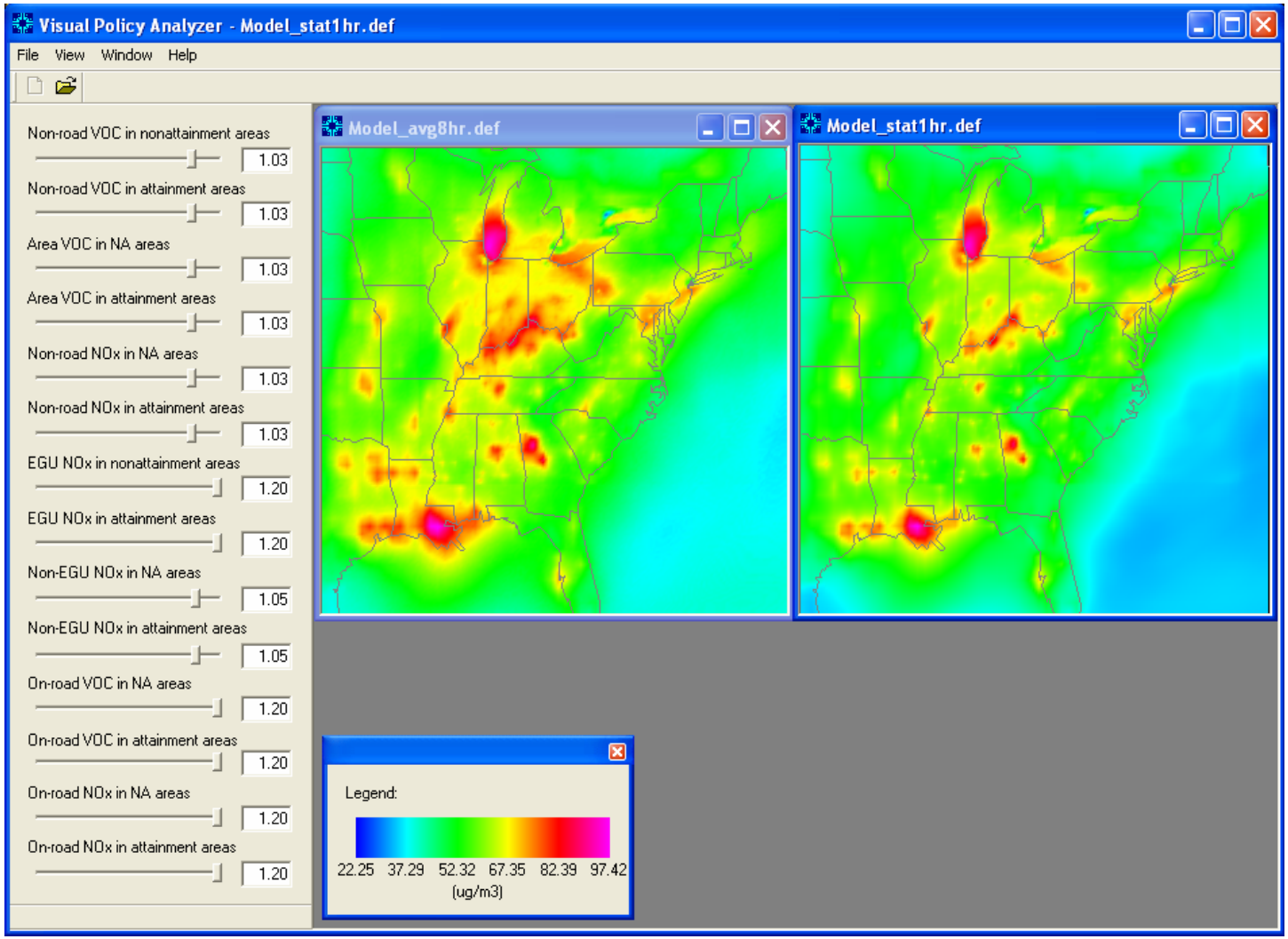
Climate Change Briefing

May 3, 2004

Broader EPA Regional Research Questions

- What are the multimedia implications of global change (e.g., climate variability, population growth, economic development, and technology adoption) on future regional-scale environmental quality?
- What are the relative economic costs and environmental benefits of adaptation options?
- What strategies are available to decision-makers to adapt to global change and improve environmental quality?
- What information, analyses, and tools do decision makers actually need? How should it be packaged?

Linkage to OAQPS Response Surface Model for Air Quality Screening



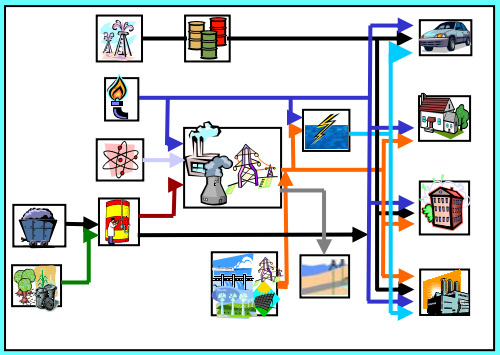
Decision Support Tool Design and Development

Decision-maker/Analyst

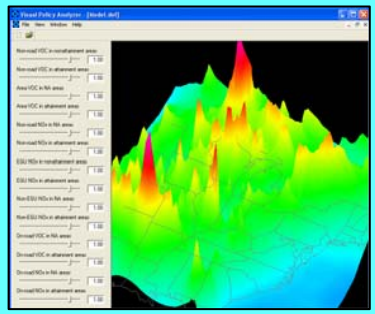
Decision Support System

Modeling Framework

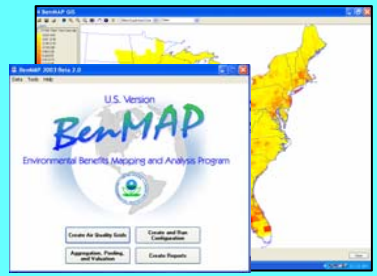
NE-MARKAL
Energy System Model



Response Surface Model
Air Quality Model Surrogate



BENMAP
Health Benefits Model



Emissions

Ambient Air Quality

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