

Integrated Energy-Environmental Modeling for Regional Scenario Analysis

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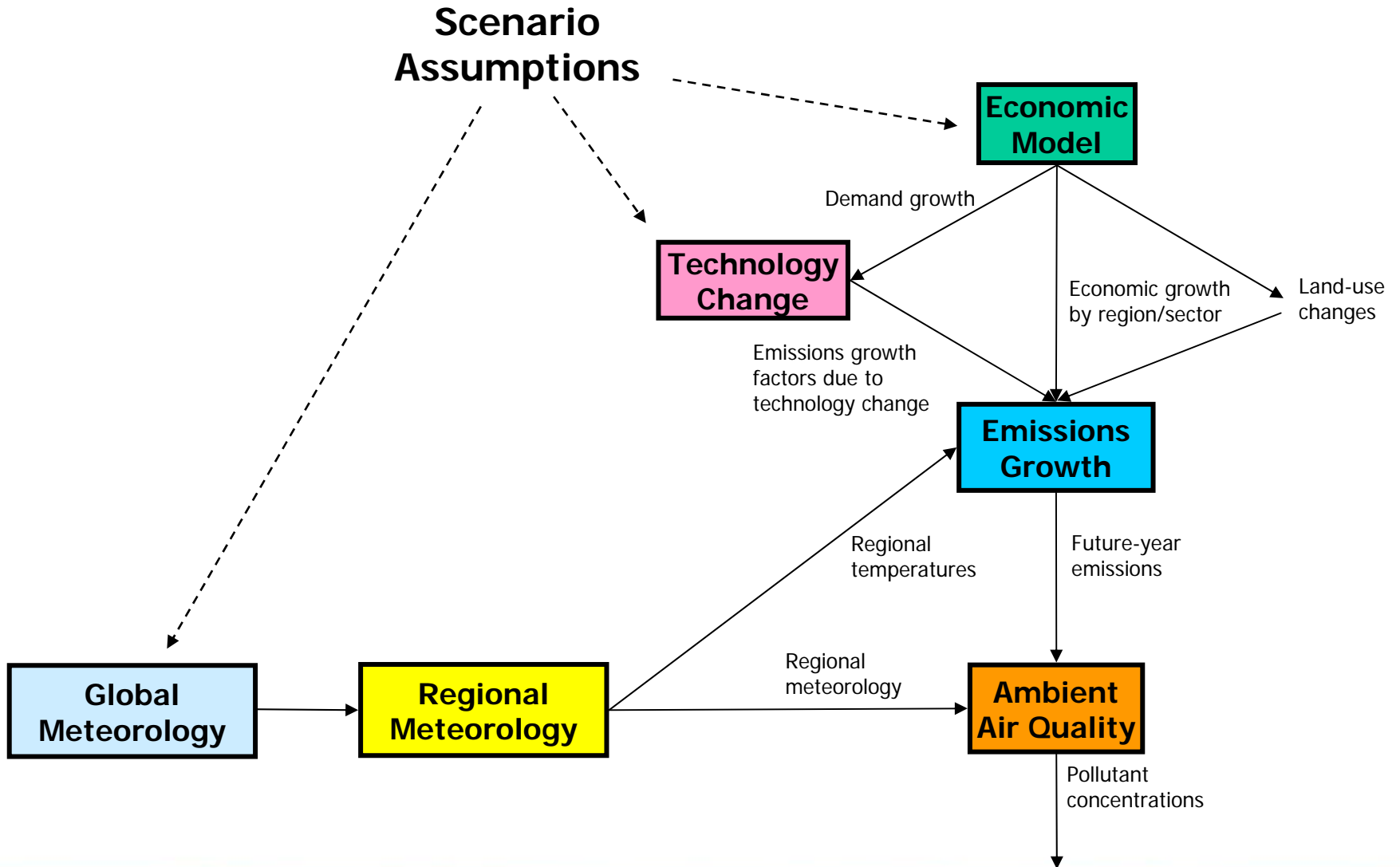
NRMRL's Integrated Strategic Assessment Workgroup (ISA-W)

- 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



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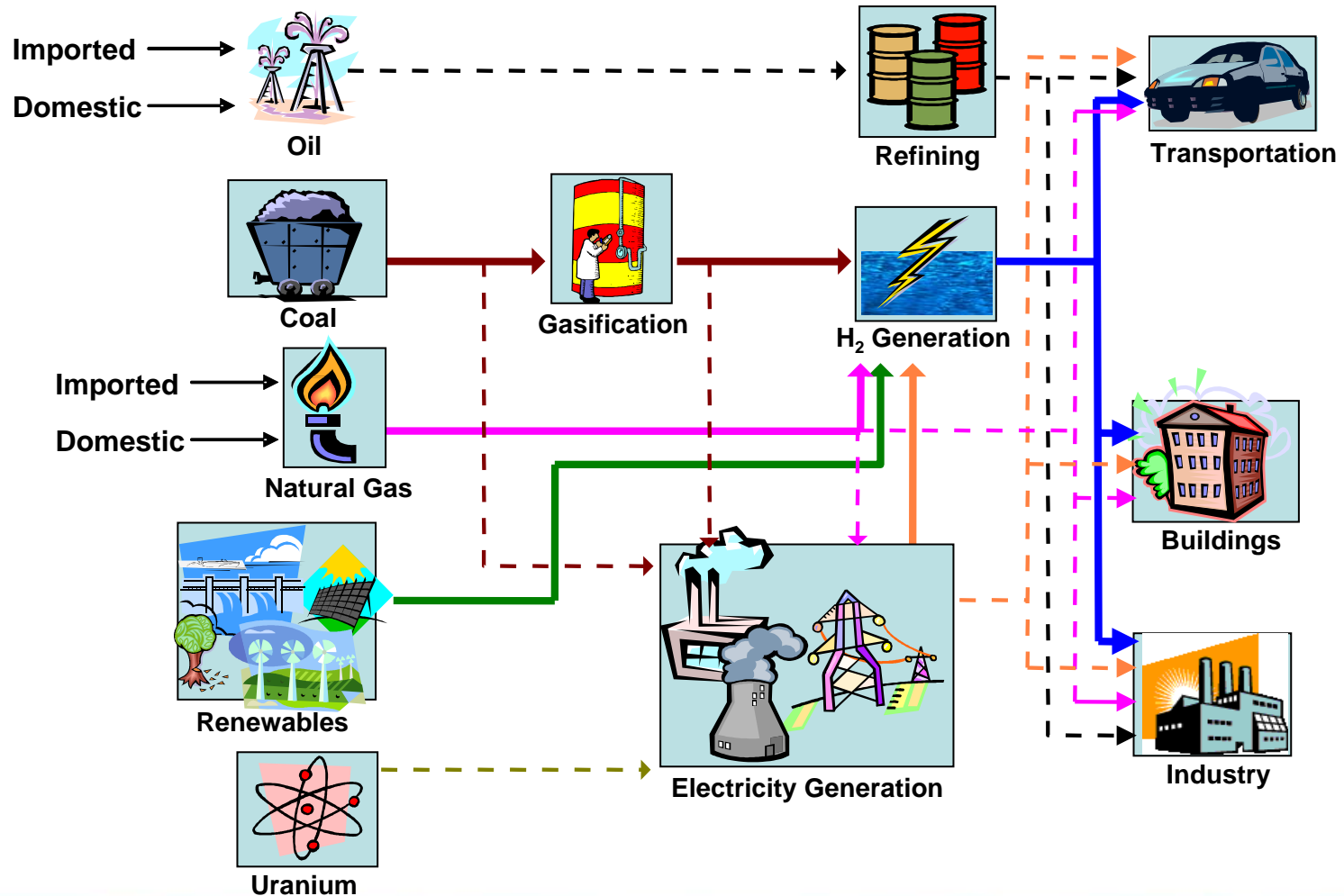
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ISA-W Modeling Goals

- 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

Energy System Interactions



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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, CO₂ sequestration, distributed generation, H₂ 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

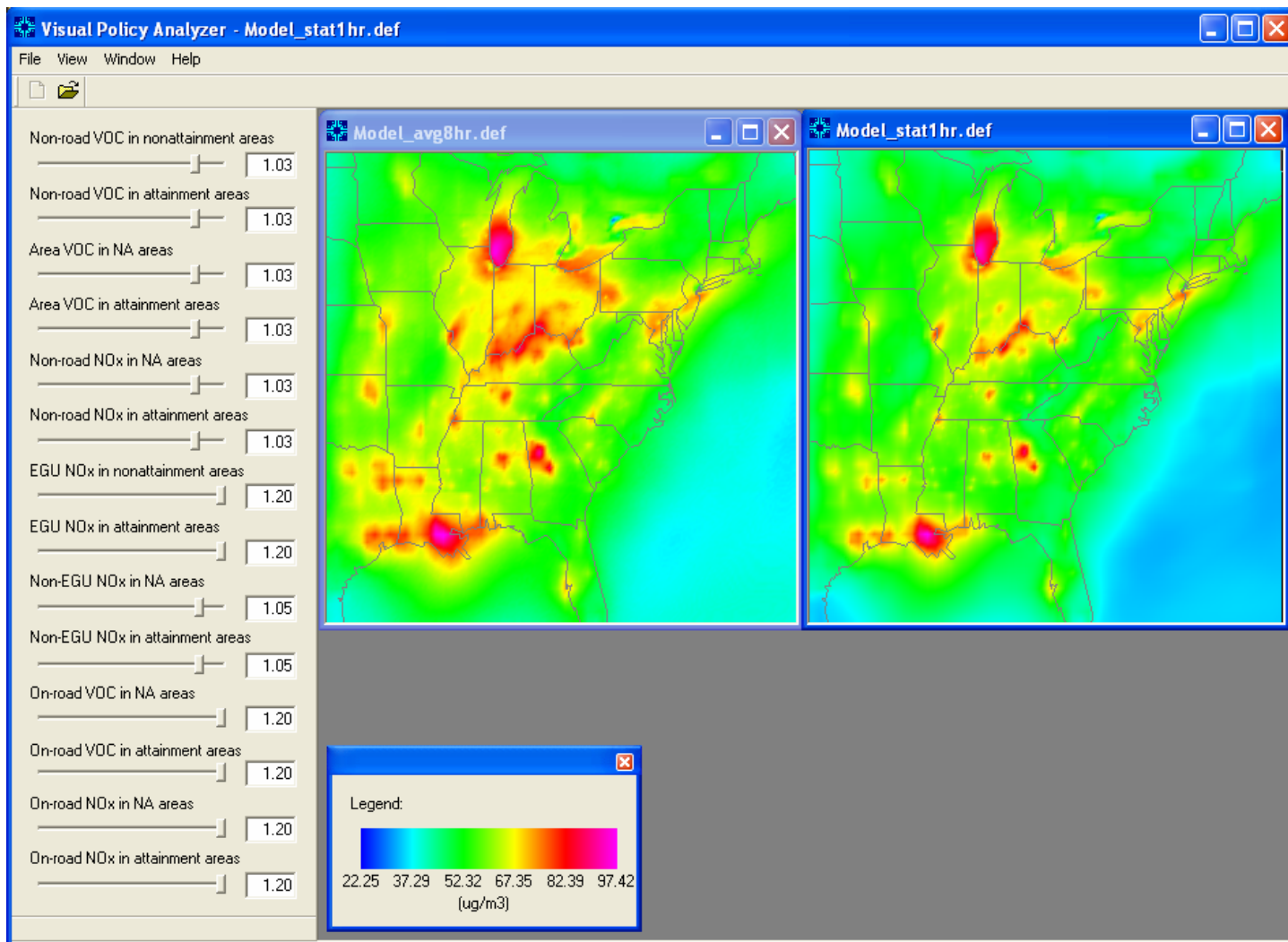
May 3, 2004



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



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Decision Support Tool Design and Development

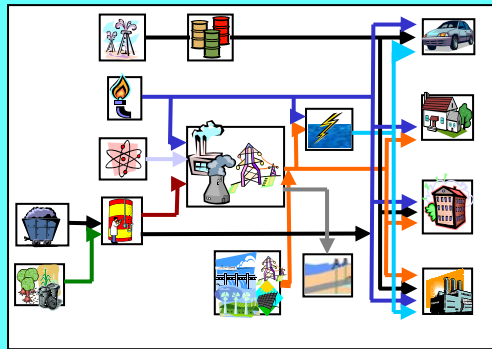
Decision-maker/Analyst



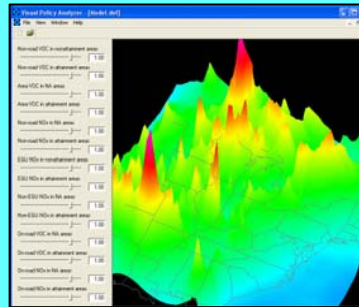
Decision Support System

Modeling Framework

NE-MARKAL
Energy System Model



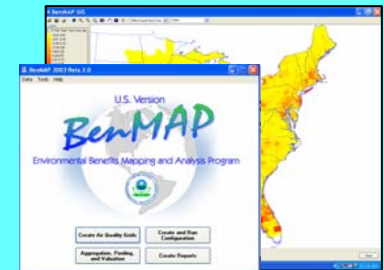
Response Surface Model
Air Quality Model Surrogate



Emissions

Ambient Air Quality

BENMAP
Health Benefits Model



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