National Academy of Science

Assessing Economic Impacts of Greenhouse Gas Mitigation

National Energy Modeling System (NEMS)

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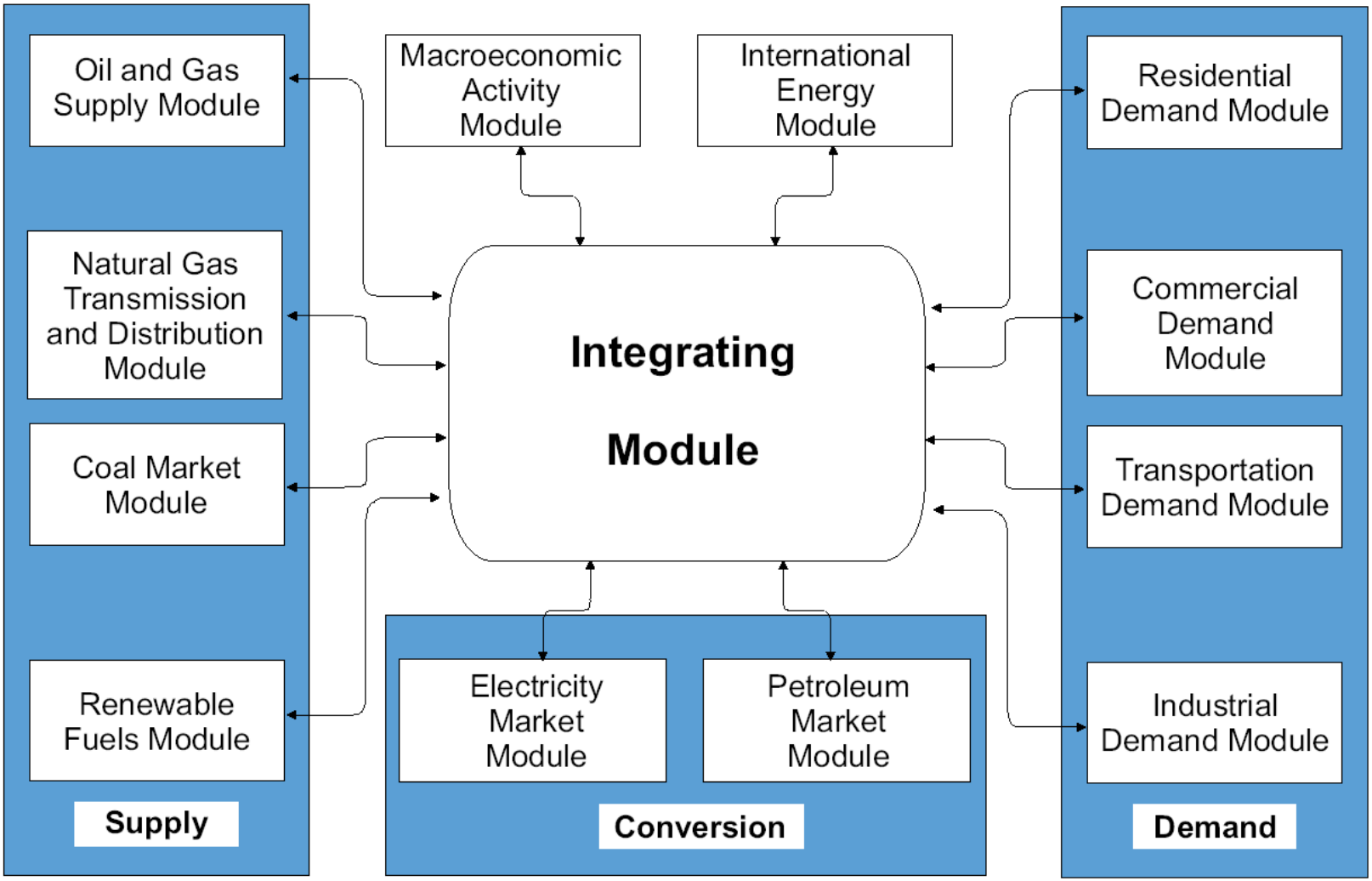
National Energy Modeling System



NEMS Overview

- The National Energy Modeling System (NEMS) is a partial equilibrium midterm energy-economy model system of U.S. energy markets.
- NEMS provides annual projections of the production, imports, conversion, consumption, and prices of energy, subject to a variety of assumptions.
- The assumptions encompass macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, technology characteristics, and demographics.
- Baseline projections and a number of sensitivities from NEMS are published in the *Annual Energy Outlook*.
- NEMS was developed and is maintained by the Energy Information Administration (EIA).
- NEMS is modular. Each individual module reflects a supply, demand, or conversion sector of the U.S. Energy Economy.
- The information flows among modules are not limited to prices and quantities, but include other information such as economic activity, capital expenditures, and international energy supply curves.
- NEMS is a regional model. Regions differ between modules and are mapped accordingly. For the Demand modules, regions are defined as the nine census divisions.
- NEMS uses various approaches regarding "foresight" depending on the behavior that has been historically demonstrated in that particular sector. These approaches include: myopic expectation, adaptive expectation, and perfect foresight.
- NEMS accounts for CO2 emissions generated in the combustion of fossil fuels. It does not specifically model other greenhouse gases, but accounts for baseline projections of these gases and abatement opportunities through marginal abatement cost curves. These curves are based on information provided by the EPA.
- Similarly, NEMS includes international GHG marginal abatement cost curves based on information provided by EPA.

Advantages and Disadvantages (1)

Criteria	Advantages	Disadvantages
Behavior	-Represents producer and consumer behavior as historically demonstrated	
Coverage: Geographic Sectors	 -Regional representation of the U.S. -Used in conjunction with the World Energy Projections System and the International Natural Gas Market Model -4 Supply, 4 Demand, 2 Conversion, and 2 other. (Allows for specific emission allocation schemes, including impact on electric utility pricing)	 -International component in NEMS is represented as marginal abatement mitigation curves
Temporal	-Annually	-Approximately 25 years coverage
Macroeconomic	-Global Insight Macroeconomics Model (Allows for treatment of allowance revenue flows) -Global Insight industrial output and employment by industry models	
Greenhouse Gasses	-CO_2 emitted in energy-related combustion	-Relies on baseline projections of non-energy related CO_2 gasses and abatement opportunities from other sources.
Modularity	-Supply, end-use, and conversion sectors are represented as modules. This makes them easier to maintain, upgrade, and swapped with compatible alternatives.	

Advantages and Disadvantages (2)

Criteria	Advantages	Disadvantages
Detail:		-Cumbersome, costly to maintain, difficult to make changes in market behavior, requires significant turnaround time from project origination to completion
Policy	-Tax, regulatory, and policy provisions can often be implemented directly	
Energy Technology	-Technology alternatives are often specifically represented. (Specific technology tax incentives can be represented)	
Capacity	-Capacity stock, vintage, turnover, and replacement are directly modeled.	
Foresight	-Use of myopic expectation, adaptive expectation, and perfect foresight depending on observed sectoral behavior.	
Banking	-Banking and Borrowing through 2030	-For policies extending beyond 2030, and exogenous assumption for the bank balance in 2030 needs to be made.
Availability	-Available free of charge to the public.	-Too difficult and unwieldy for all except professional energy modelers. -Some proprietary software (macro and optimization) would need to be procured from vendors.