Electricity Scenario Analysis and Transmission Planning Workshop

New Hampshire Public Utilities Commission
Legislative Office Building
Concord, NH

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ISO new england

About ISO New England

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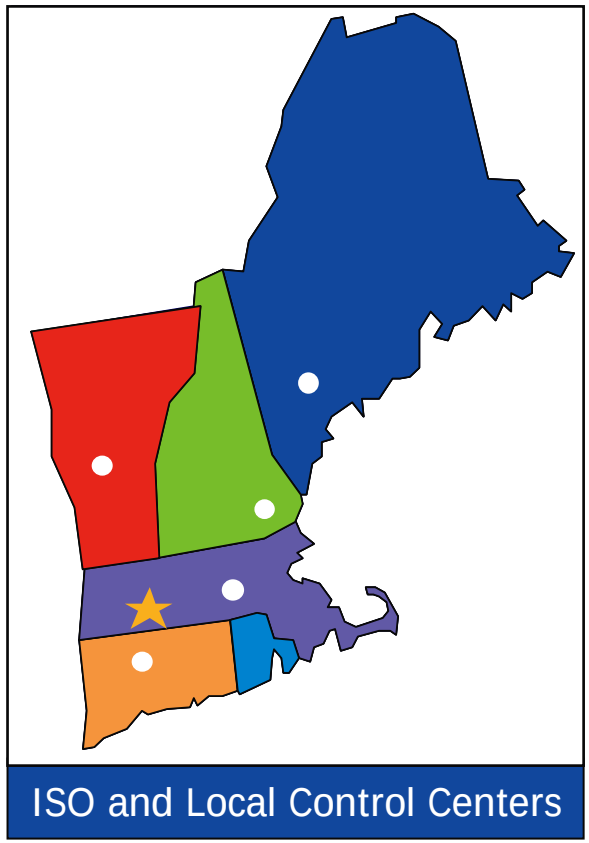
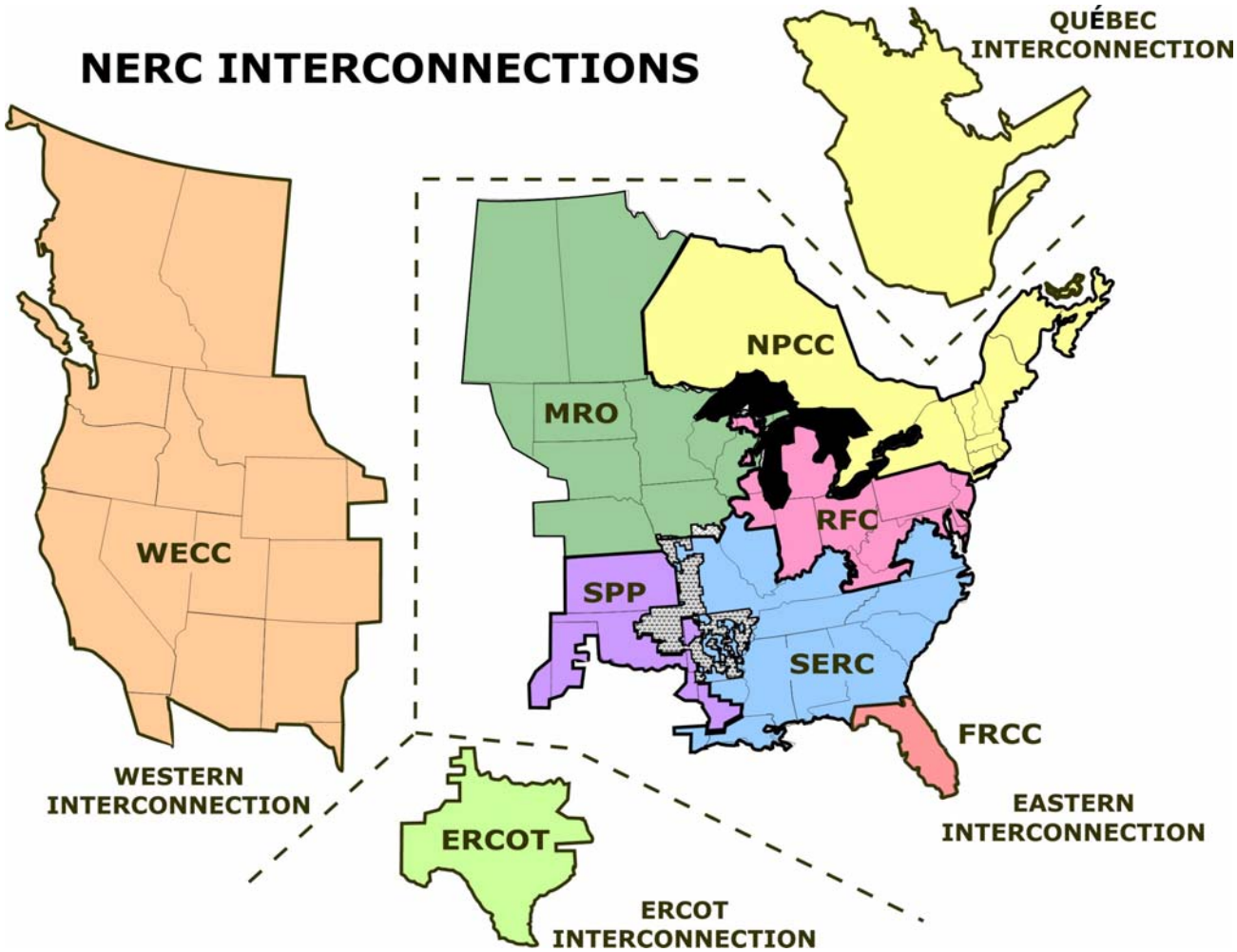
- Regional Transmission Organization for New England
  - Private, not-for-profit corporation created in 1997 to oversee the region's bulk electric power system
  - Independent of companies doing business in the market
  - Regulated by the Federal Energy Regulatory Commission (FERC)
  - Approximately 400 employees headquartered in Holyoke, MA

New England's Electric Power Grid

- 6.5 million customer meters
  - Population: 14 million
- 350+ generators
- 8,000+ miles of high voltage transmission lines
- 12 interconnections to three neighboring systems:
  - New York, New Brunswick, Quebec
- 31,000 megawatts (MW) of installed generating capacity
- 300+ market participants
- Summer peaking system
  - Summer: 28,130 MW (8/06)
  - Winter: 22,818 MW (1/04)



Part of the Eastern Interconnection



NERC: North American Electric Reliability Corp., NPCC: Northeast Power Coordinating Council

ISO-NE: Major Responsibilities

1. **Reliability**
   - Maintain minute-to-minute reliable operation of the region's bulk power generation and transmission system
   - Centralized dispatch of generation, activation of demand response
   - Coordinate operations with neighboring power systems

2. **Markets**
   - Administer and monitor New England's wholesale electricity markets
     - Energy, Capacity and Reserves
   - Internal and external market monitoring

3. **Planning**
   - System needs assessment
   - 10-year transmission plan to ensure a reliable and efficient bulk power system to meet current and future needs

Key Issues in New England

- **Meeting peak demand for electricity**
  - Peak demand is growing faster than overall demand
    - Requires additional power system infrastructure
  - Increased energy efficiency and stronger wholesale/retail linkages could help reduce and/or shift demand

- **Meeting existing and new environmental requirements**
  - Air regulations (NOx, SO_2)
  - Regional Greenhouse Gas Initiative (CO_2)
  - Renewable Portfolio Standards

- **Developing additional resources**
  - Increasing level and diversity of supply
  - Integrating demand-side resources into the market
  - Balancing reliability with reasonably priced supply

Scenario Analysis

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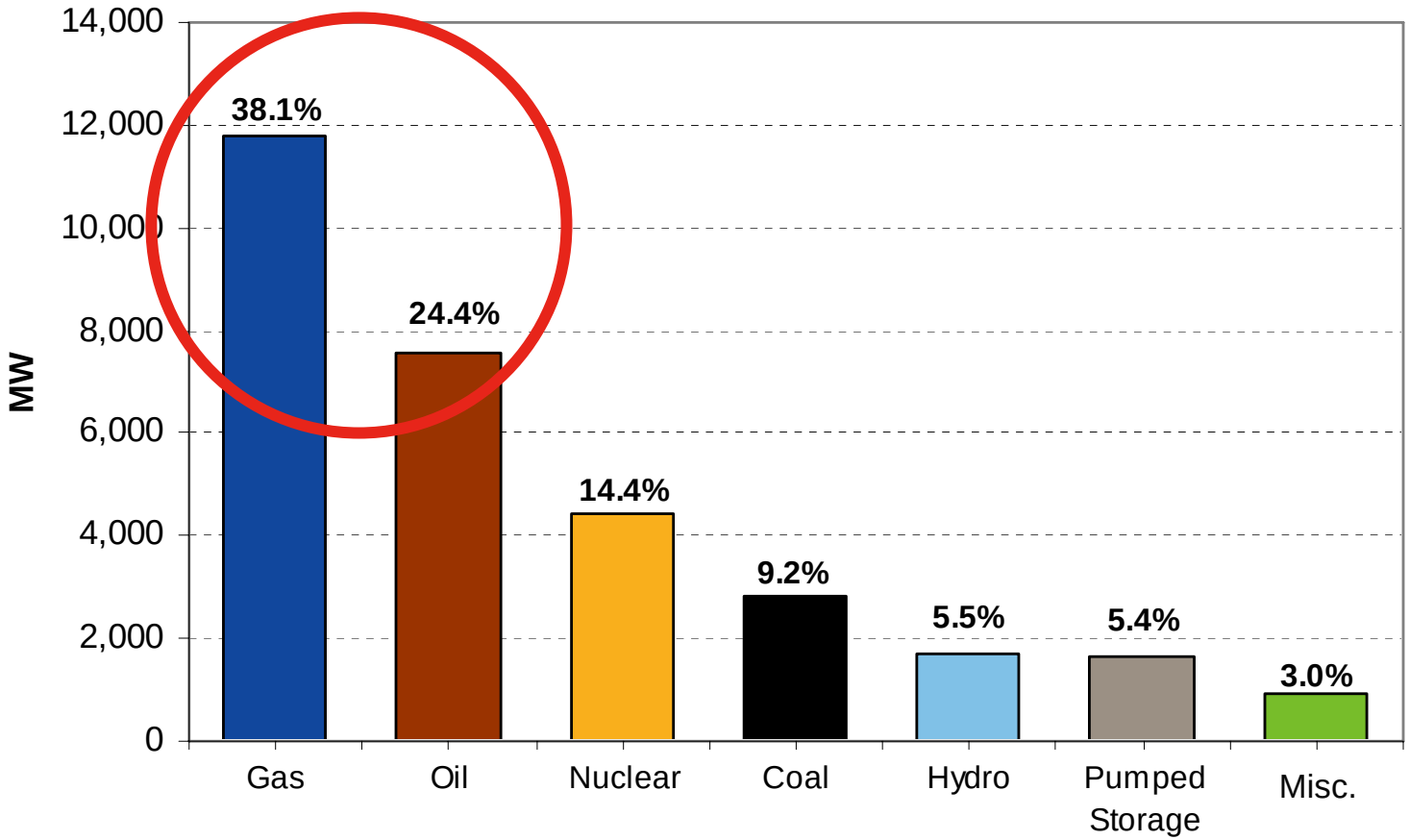
Senior Vice President and General Counsel
ISO New England

Scenario Analysis: Background

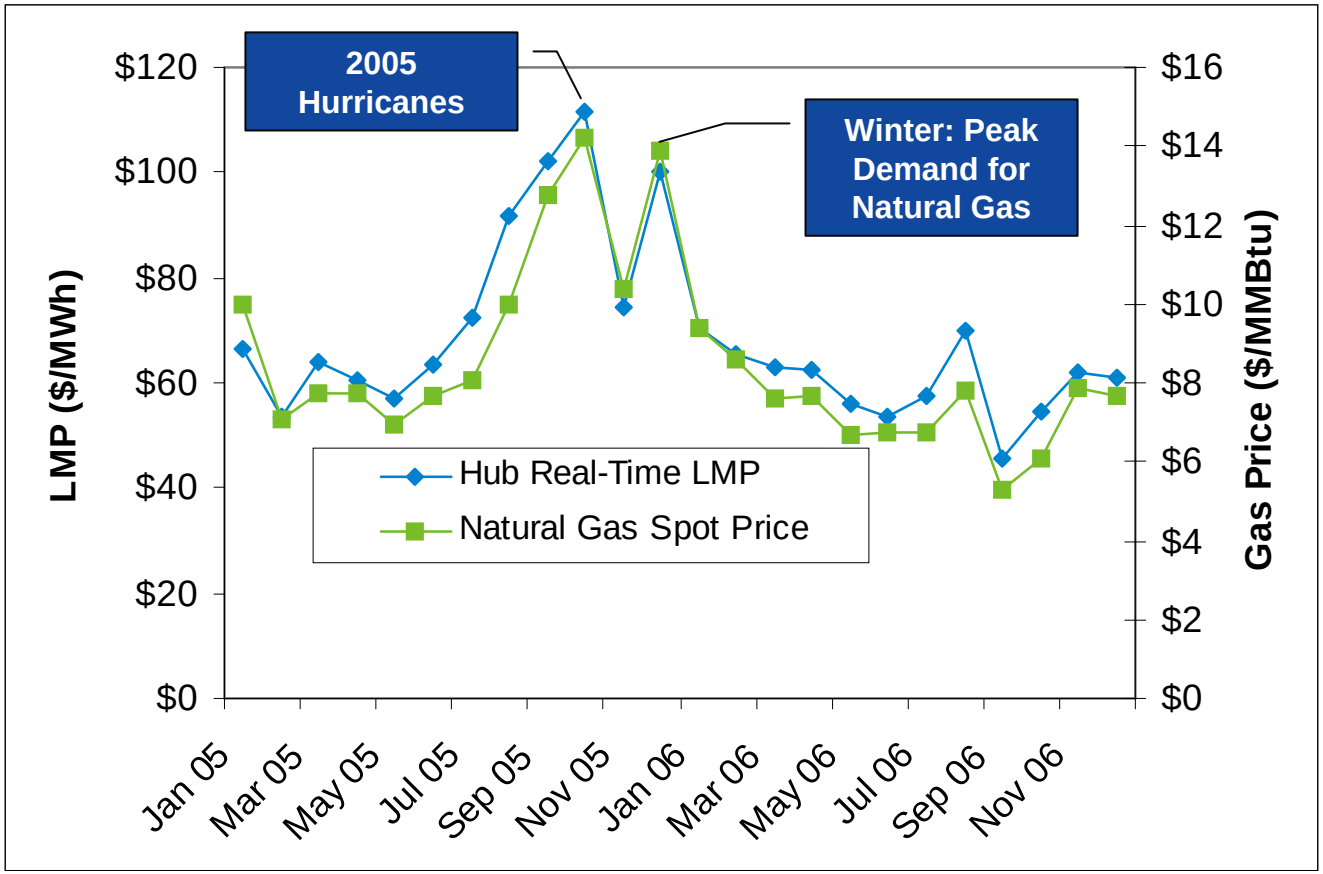
- Policymakers and electric consumers concerned about increasing electricity costs
- New England region in need of:
  - Additional resources (supply and demand)
  - Diversity of resources
  - Resources to meet environmental and renewable objectives
  - Balancing reliability with reasonably priced supply
- Lawmakers considering policies to address these issues
- All stakeholders are seeking information and solutions

Heavy Reliance on Gas/Oil for Generation

Primary fuel for more than 60% of region's existing generating capacity



Wholesale Electricity Prices Track Natural Gas Prices (2005-2006)



Scenario Analysis: Process

- Led by Steering Committee
  - ISO-NE
  - New England Conference of Public Utilities Commissioners (NECPUC)
  - New England Power Pool (NEPOOL)

- Diverse set of regional stakeholders actively engaged on Scenario Analysis project
  - States
    - Utility and environmental regulators
  - Consumers
  - Electric industry, including suppliers, transmission companies, and demand-side resources
  - Efficiency and environmental advocates

Scenario Analysis: Overview

What it is:

- Information gathering and education about future resource options
- Snapshot of all hours in a single future year
- Tools to understand key drivers of electricity costs
- Data for further comparison, analysis and discussion

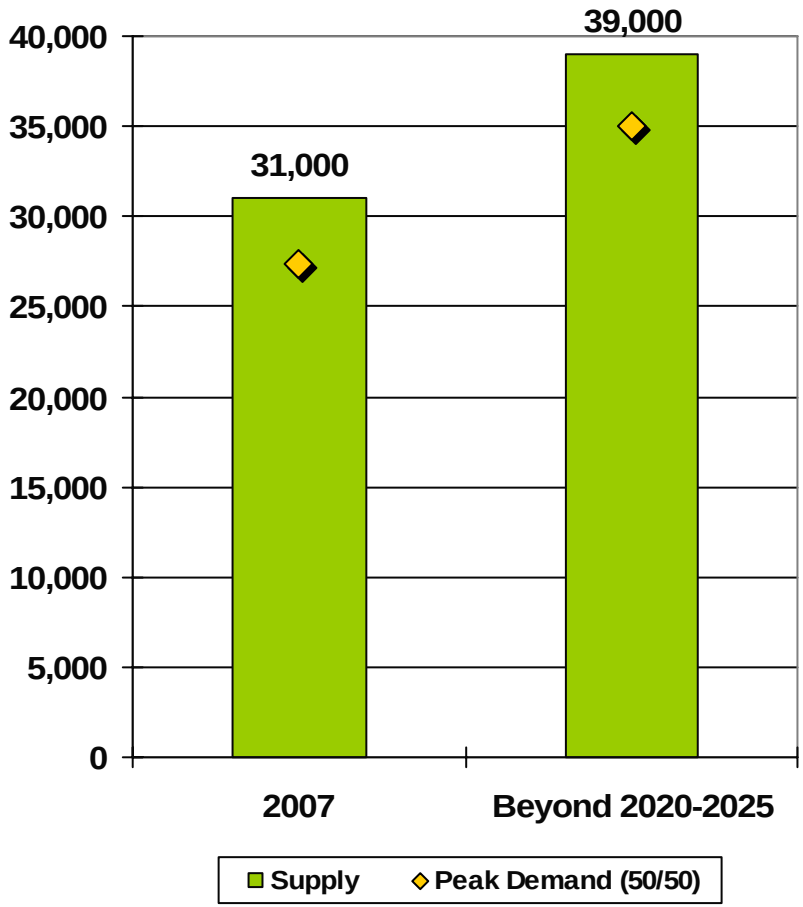
What it is not:

- Right or wrong technologies
- An integrated resource plan
- ISO's preferences for what types of technologies or resources should be developed
- An attempt to achieve a regional consensus
- A prediction of the future

Scenario Analysis: Demand & Supply

- **Demand**
  - Scenario Analysis assumes a 35,000-MW target peak demand level sometime beyond 2020-2025

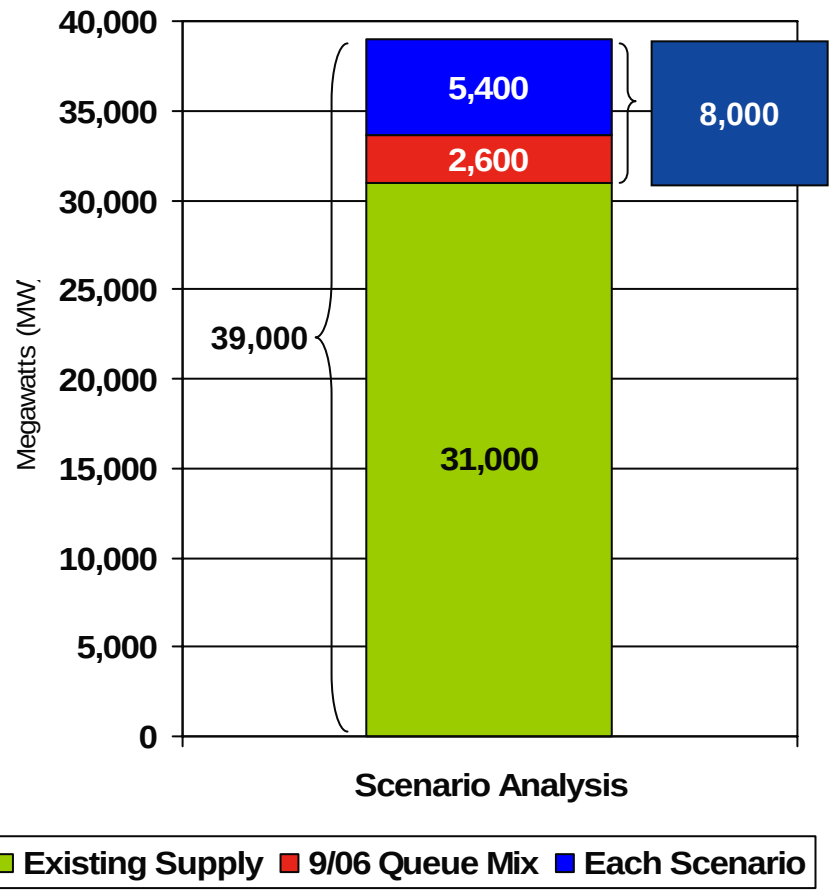
- **Supply**
  - Scenario Analysis assumes a need for 39,000 MW to serve the target peak demand level
    - An increase of 8,000 MW compared to today's supply



Scenario Analysis: Supply, cont.

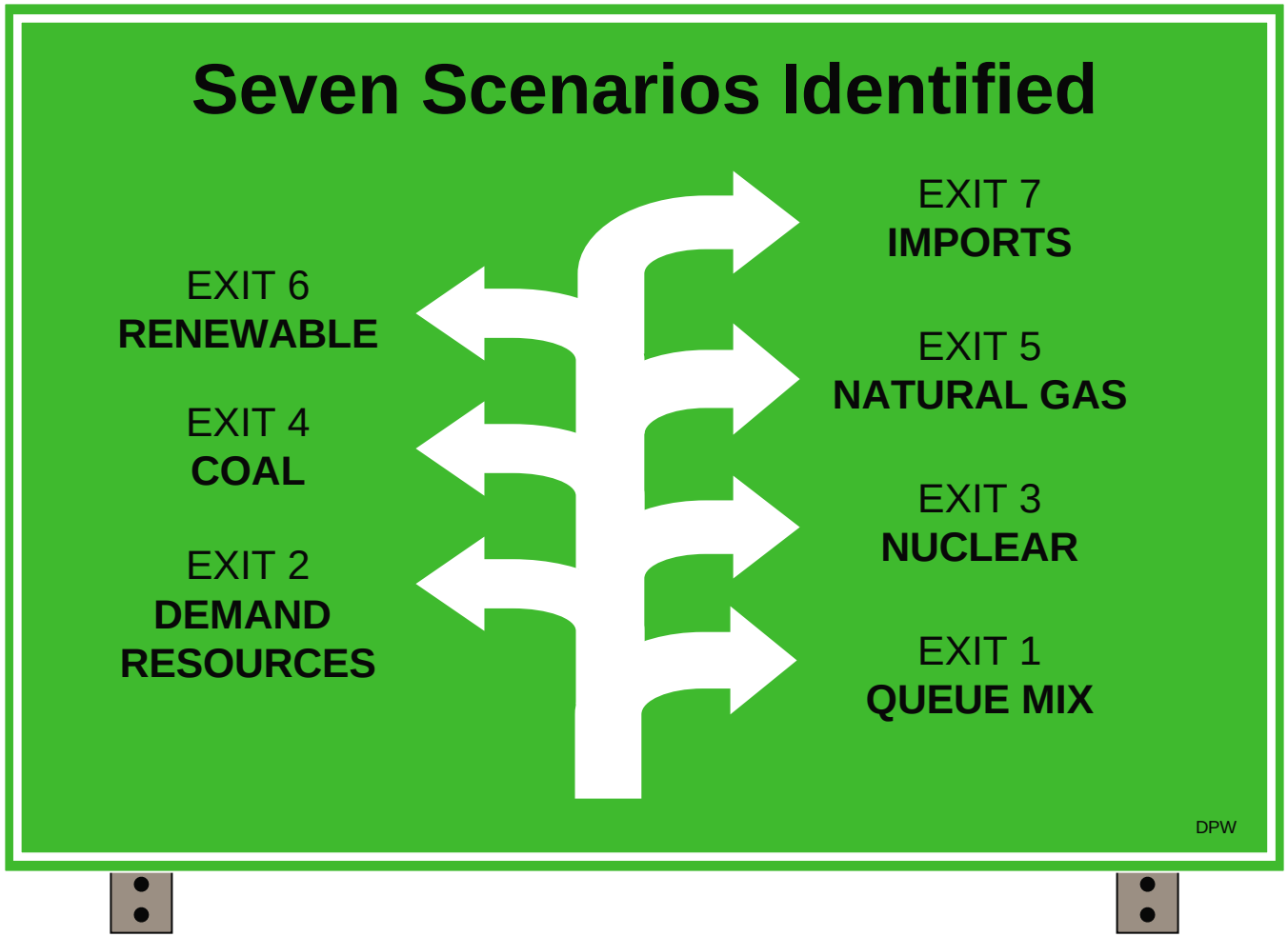
- 39,000 MW of supply assumes:
  - 31,000 MW of existing resources
  - 8,000 MW of new resources:
    - A representative mix of the resources currently being proposed (2,600 MW), *plus*
    - A large concentration of a certain technology or resource type (5,400 MW)

- Extreme cases modeled to illustrate performance differences of each technology or resource type



Many Routes to Meet Future Electricity Needs

Region most likely to choose a <u>combination</u> of these options



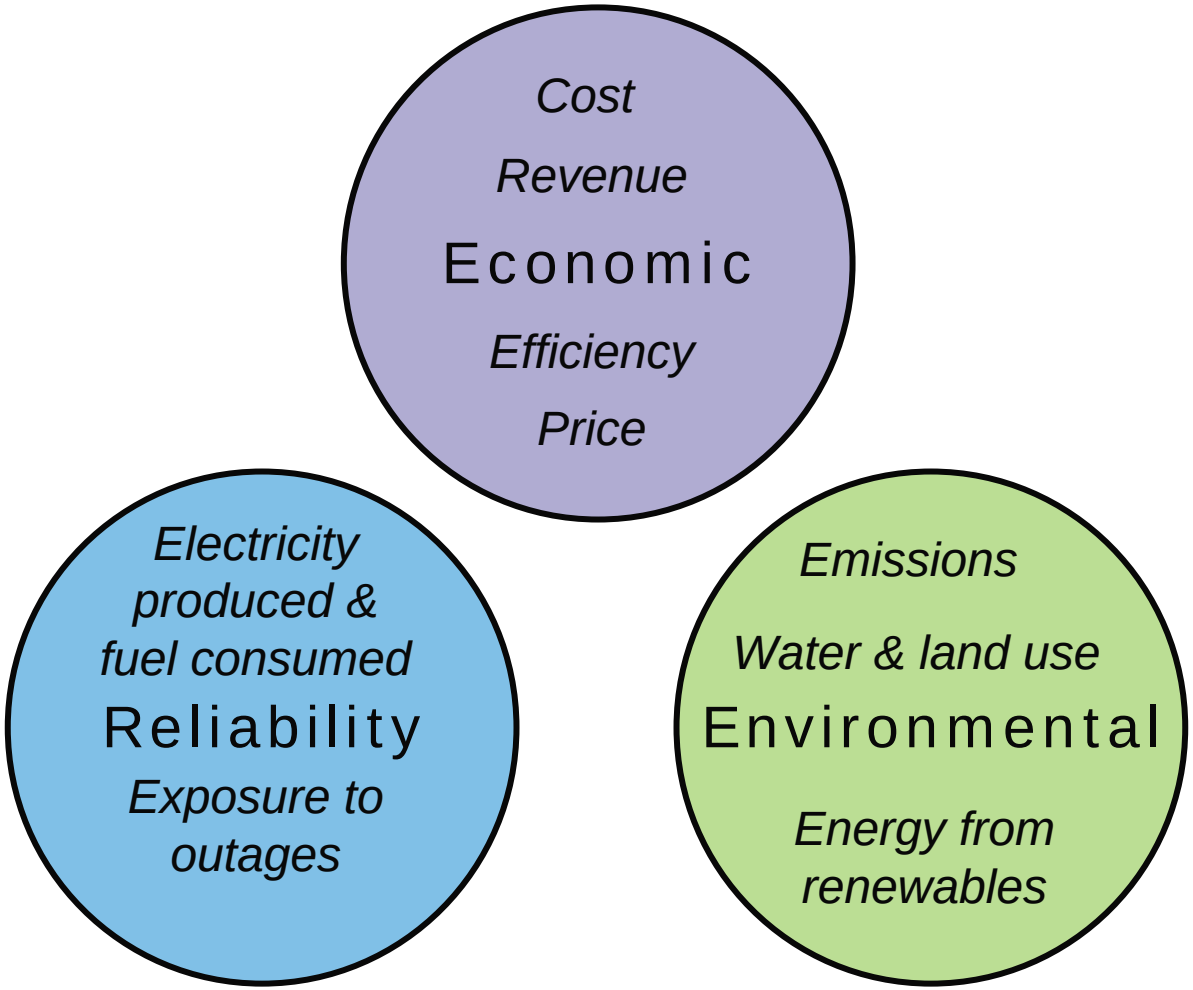
Common Assumptions

- Systemwide Assumptions
  - Summer peak demand
  - New resource level
  - Mix of resources
  - Fuel prices
  - Expansion of the transmission system
  - Market structure and revenues
- Technology-specific Assumptions
  - Capacity values
  - Energy production
  - Operating characteristics
  - Emission rates
  - Value of emission allowances
  - Water and land-use requirements

Sensitivity Analyses Also Conducted

- Certain assumptions warrant variation to understand scenario performance under changing conditions
  - High and Low Natural Gas prices
  - High and Low Carbon-Allowance prices
- Stakeholders seek to understand the impact of certain possibilities in the marketplace
  - Retirement of oldest, most inefficient power plants
  - Achievement of significant amounts of energy efficiency and demand response
  - The added cost of carbon sequestration for IGCC technology

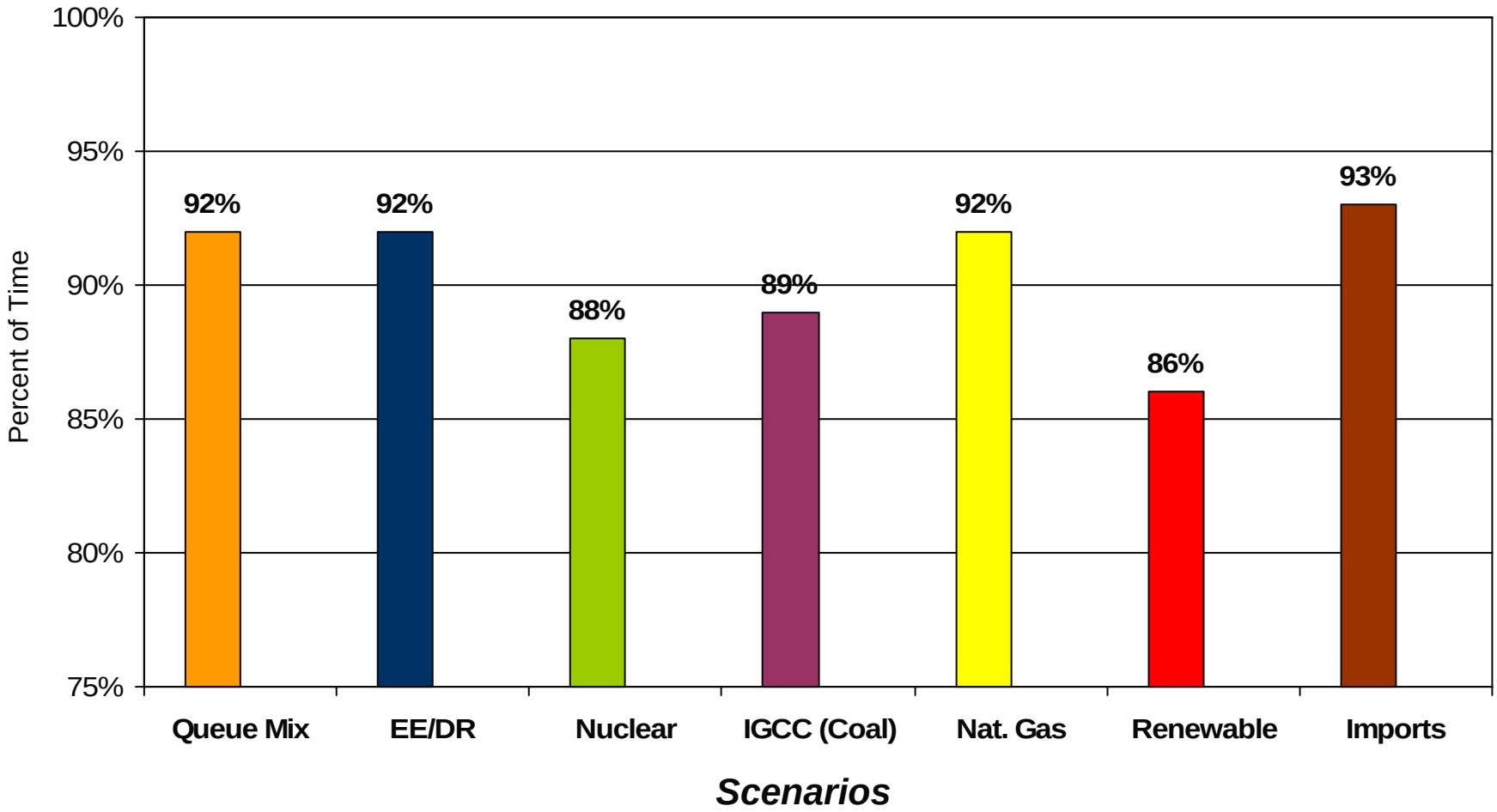
Several Performance Metrics Developed in Three Policy Categories



Some Findings and Key Themes

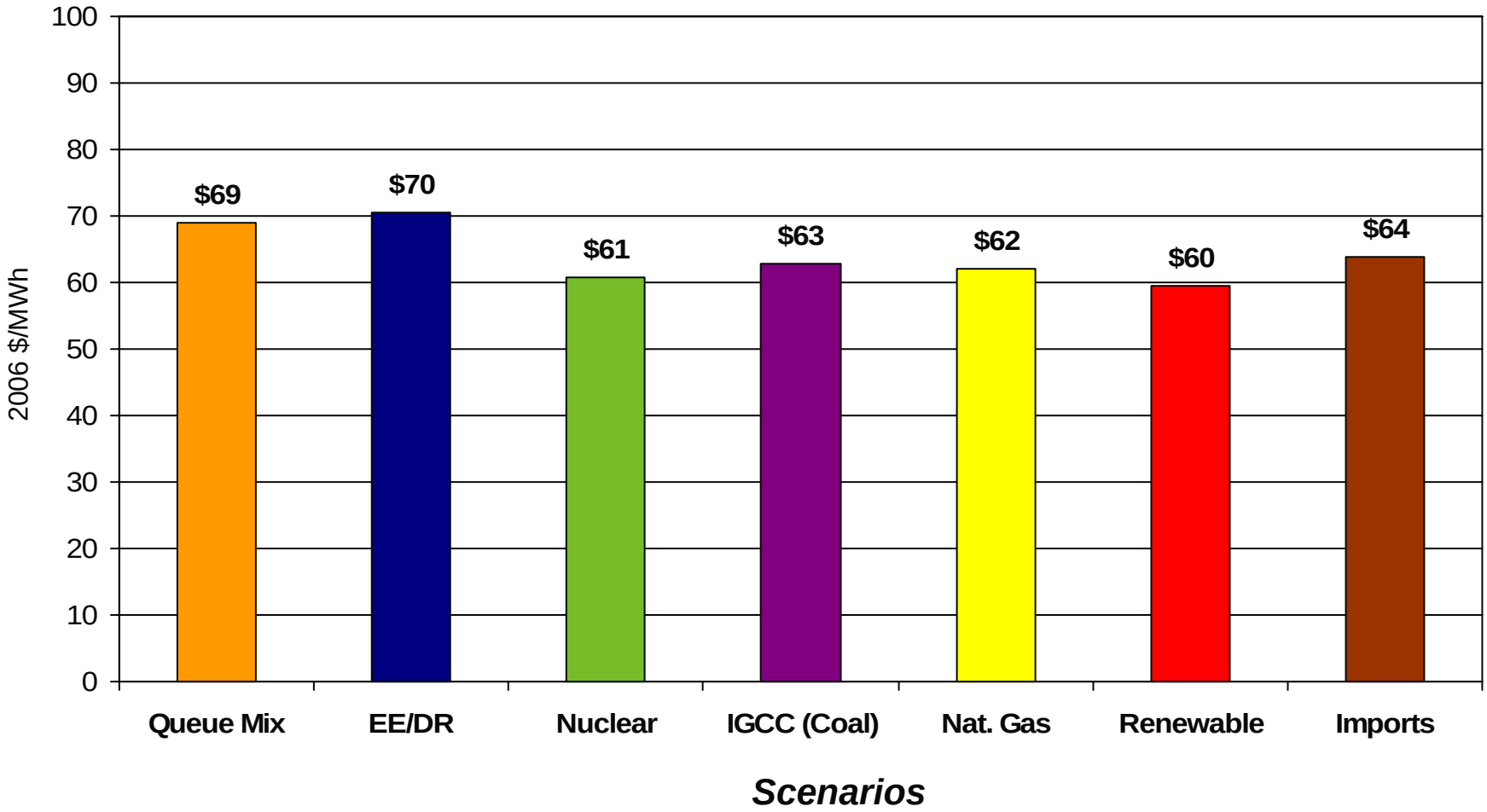
Gas-fired plants set electricity prices approx. 90% of time across all scenarios

All other (non-gas) plants set prices less than 10% of the time



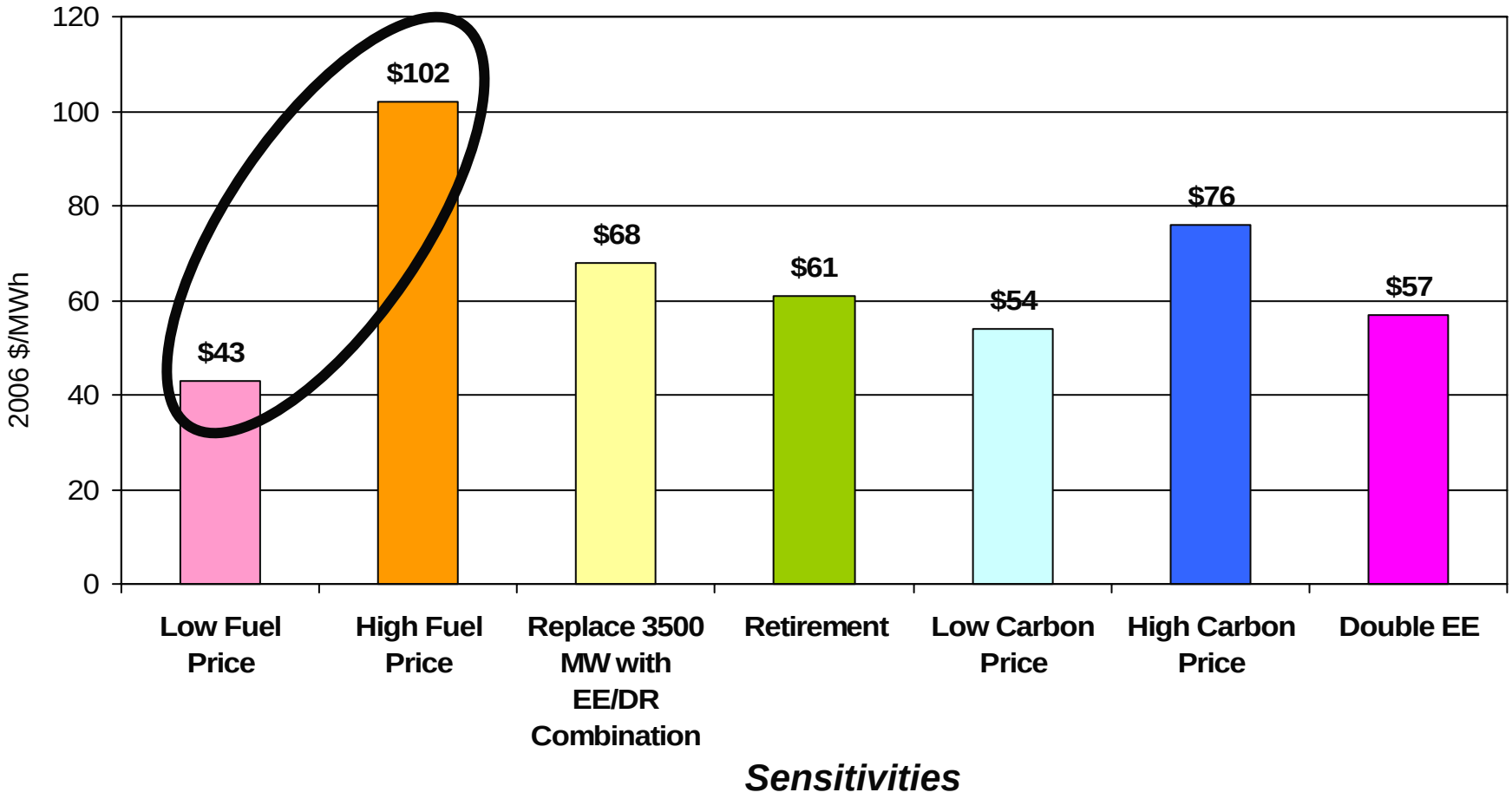
Average Clearing Prices

Less variation between scenarios…



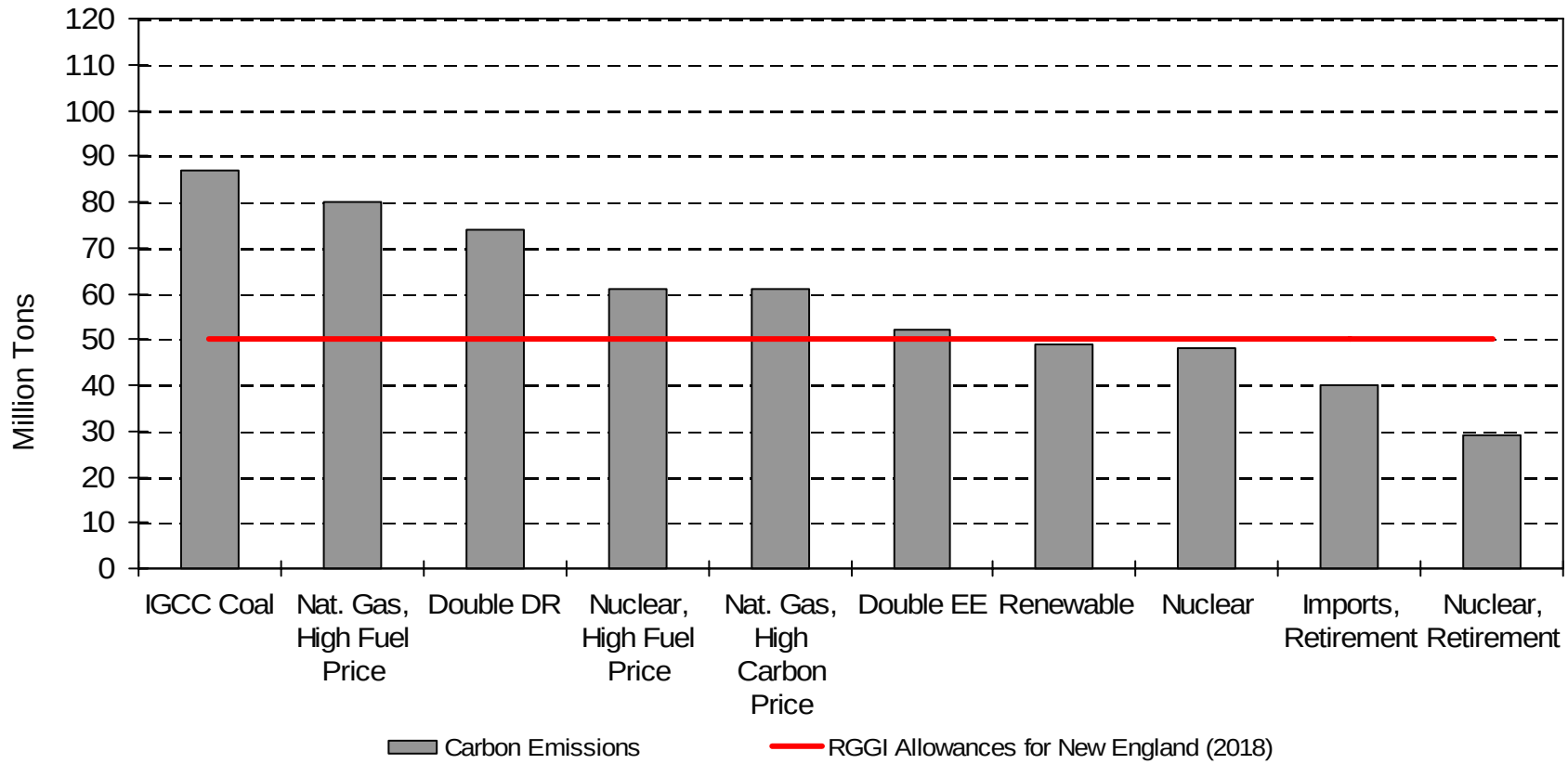
Average Clearing Prices

… More variation between sensitivities



Challenges Meeting RGGI Requirements

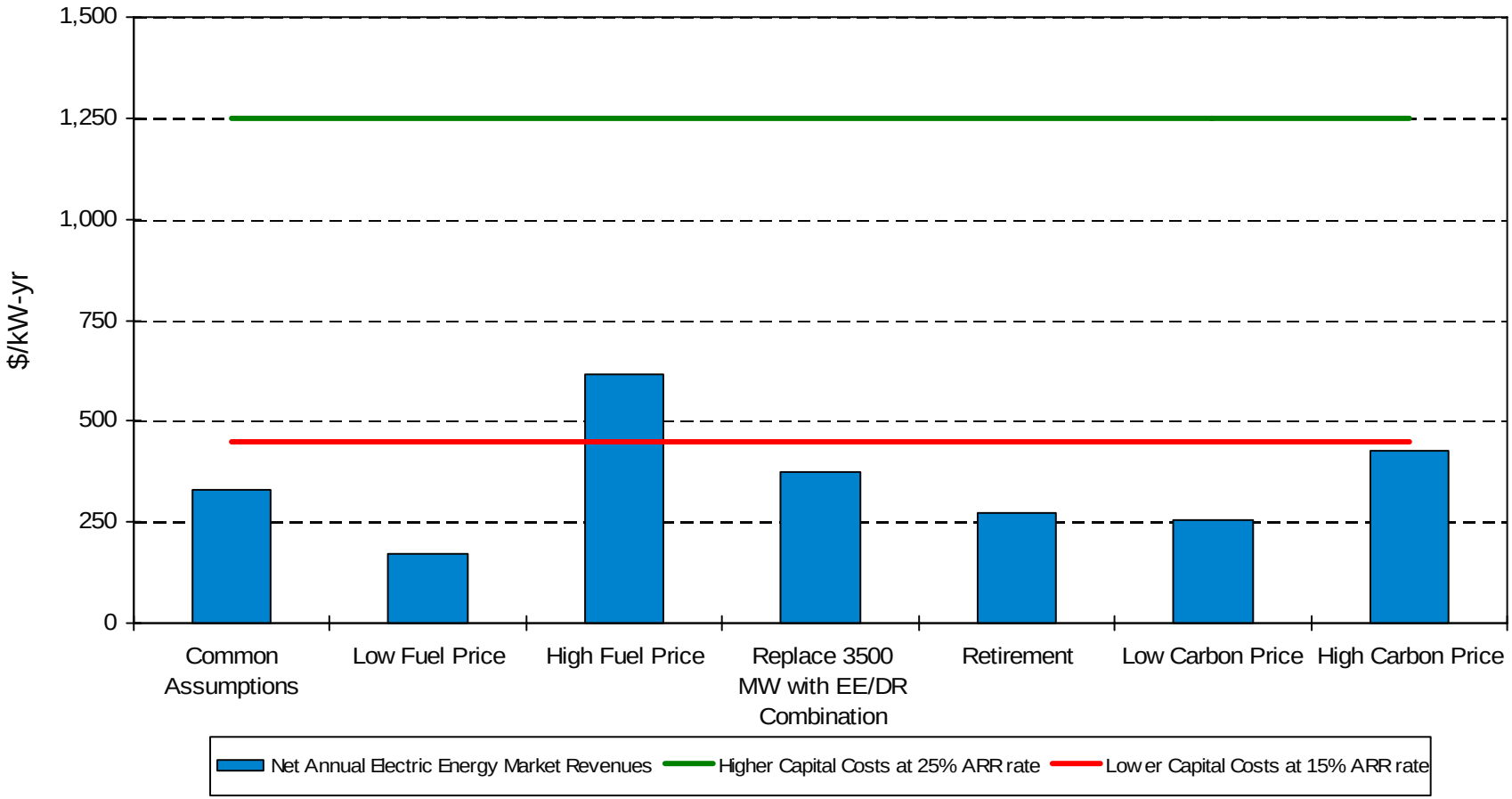
New England CO_2 Emissions vs. RGGI CO_2 Cap Allowances



Combination of Scenarios and Sensitivities

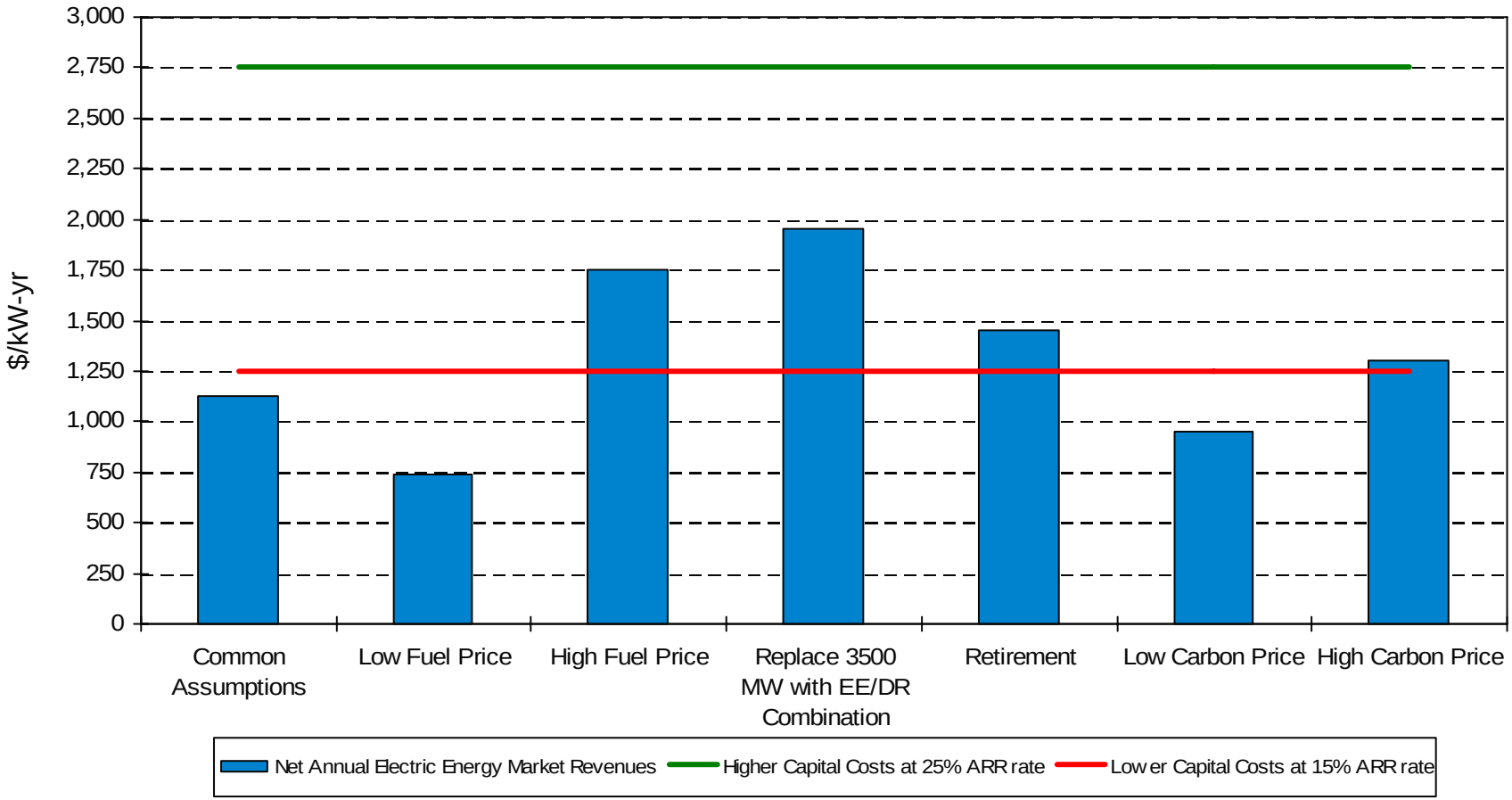
Annual Revenue Comparison

Nuclear



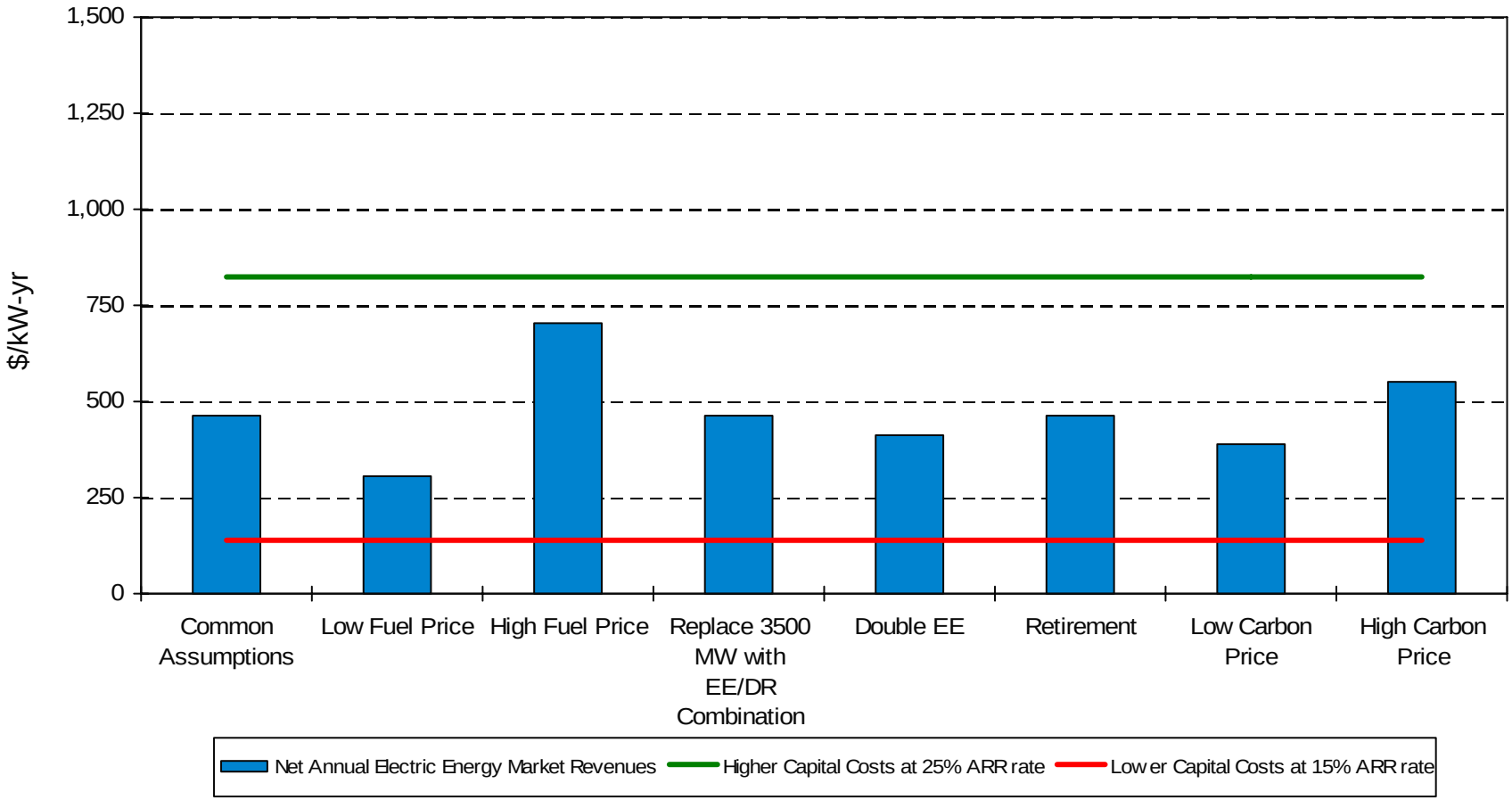
Annual Revenue Comparison

Wind



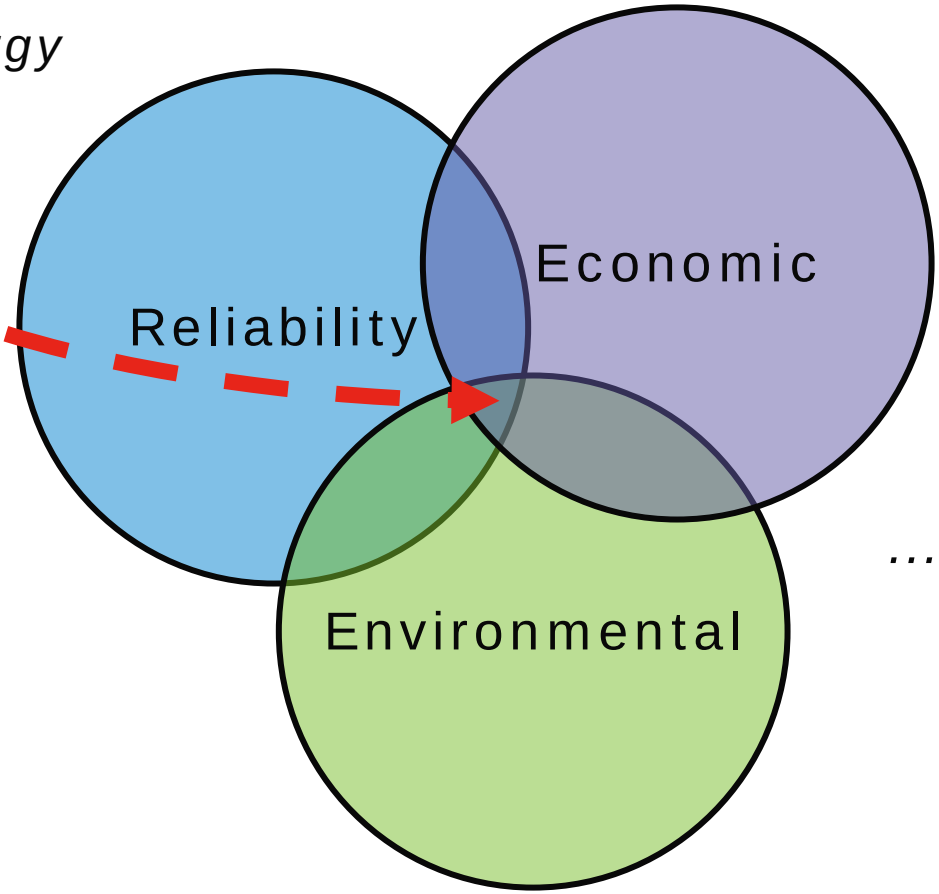
Annual Revenue Comparison

Energy Efficiency



Policy Categories May Overlap

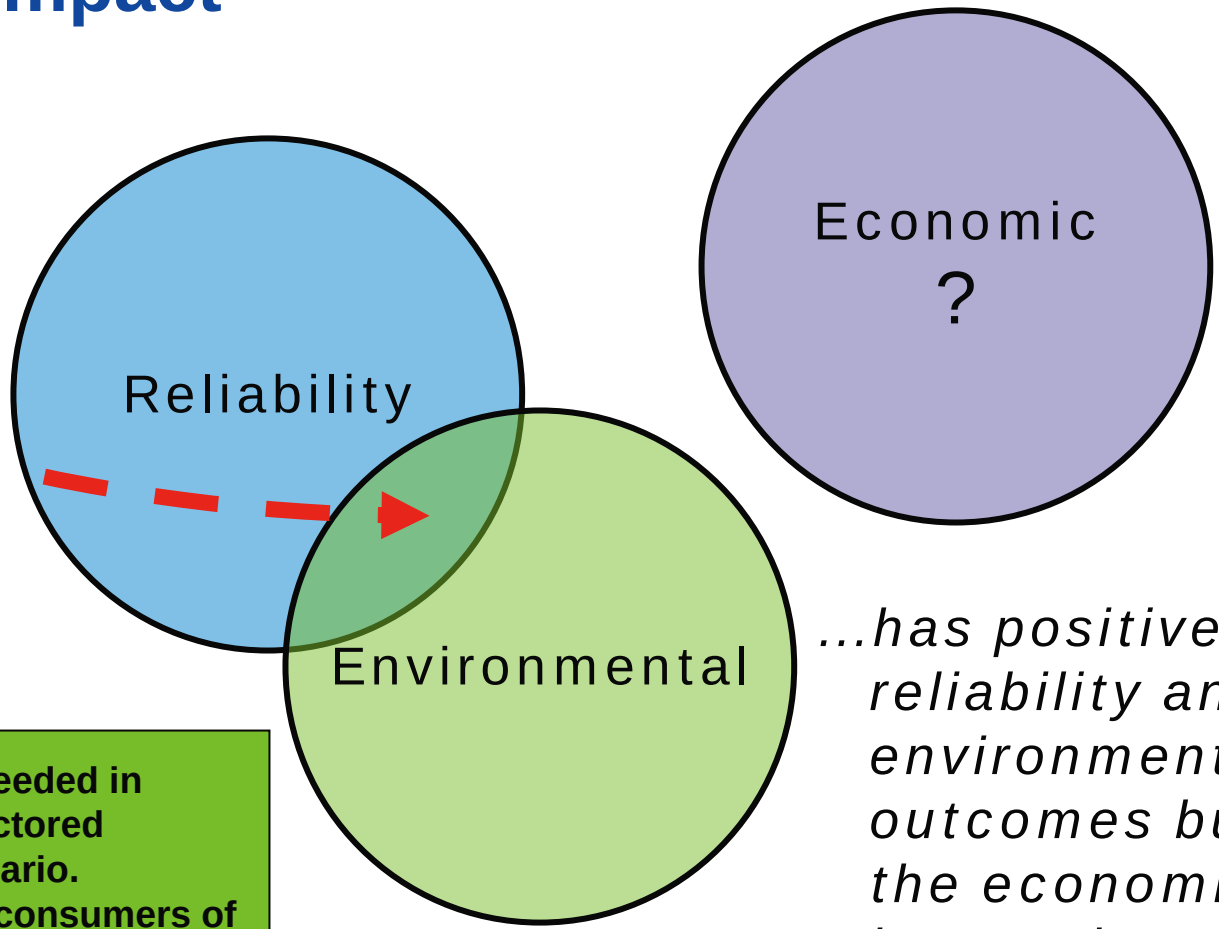
Example: Energy efficiency scenario...



...has positive economic, reliability and environmental outcomes.

Import Scenario Uncertain about Overall Economic Impact

Example: Importing large amounts of clean energy ...



...has positive reliability and environmental outcomes but the economic impact is unknown.

Only transmission needed in New England is factored into Import Scenario.
The cost to New England consumers of energy and needed Canadian transmission unknown.