Power Sector Economics

Wayne Shirley

Director

The Regulatory Assistance Project

50 State Street, Suite 3
Montpelier, Vermont USA 05602
Tel: 802.223.8199
Fax: 802.223.8172

177 Water St.
Gardiner, Maine USA 04345
Tel: 207.582.1135
Fax: 207.582.1176

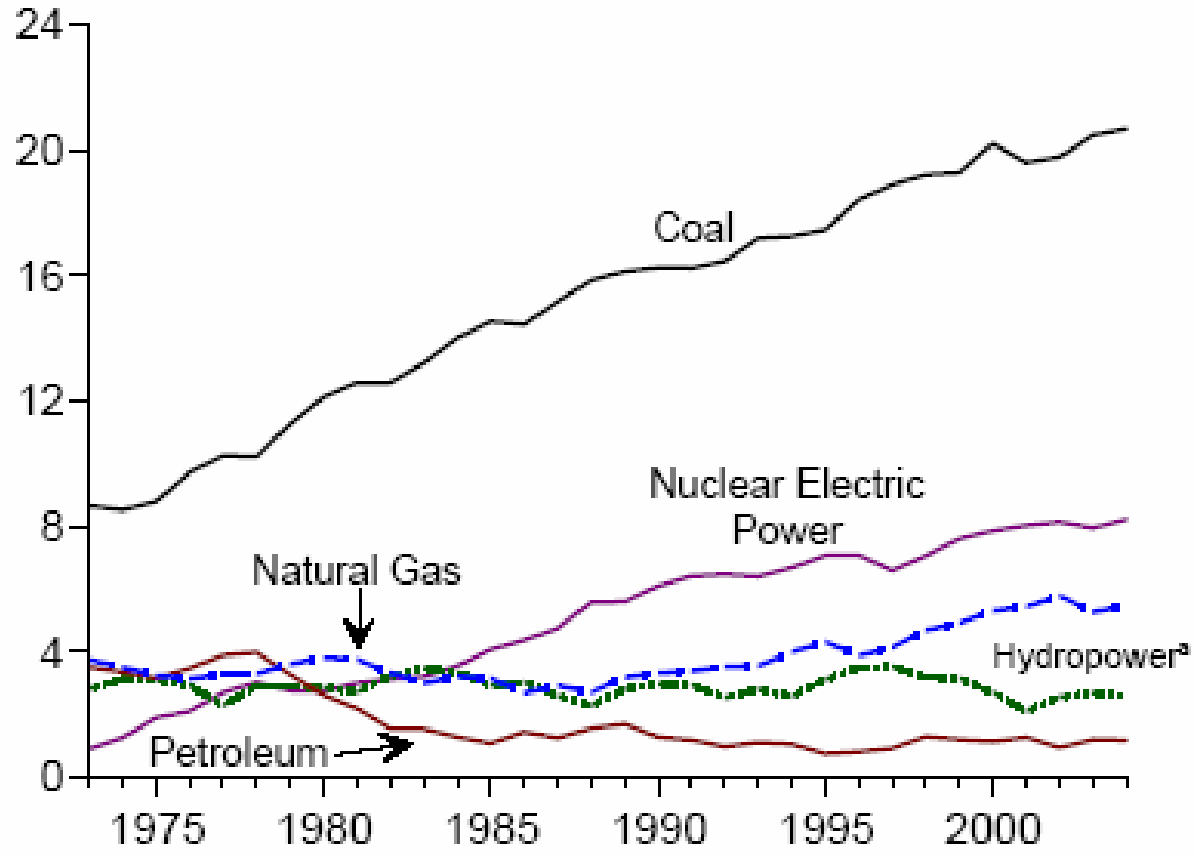
Website:
http://www.raponline.org

Developmental History

- Vertically integrated monopolies
  - "Cost of service" regulation
- Selected "marginal" competition
- Unregulated wholesale competition
- Retail competition

US Power Supply

By Major Sources, 1973-2004



Economic Model for Regulation

- Utilities considered natural monopolies
  - Technical definition: Market where the average cost curve is decreasing when it intersects with the demand curve, creating an equilibrium price that is below the average cost to produce
  - Translation: It's too expensive to have two or more sets of generators and wires

Cost Experience

- Until early 1970s industry experienced declining cost curve
  - Every new generator or expansion of the system resulted in lower unit costs and lower prices
- Power supply options have been universally either
  - High capital cost – low fuel cost (coal, nuclear, renewables)
  - Low capital cost – high fuel cost (oil and gas)
- Fossil fuel power production is inherently inefficient -- typically less than 25% of the energy in fuel is turned into productive work

Nuclear Power Radically Changed Cost Path

- Originally expected to continue on the path of declining costs
- First wave of “production” plants budgeted at about $300/kW of capacity
- Actual completion costs were in the $3,000/kW range
- 1978 TMI accident closed door on new nuclear plants
- Originally billed as “too cheap to meter”, nuclear became too expensive to complete

Public Utility Regulatory Policy Act of 1978

- Response to:
  - Increasing costs from nuclear power
  - Oil embargos
- Introduced
  - Competition at generation level
  - Concept of avoided costs
  - Opened door for renewable energy and energy efficiency as alternative to fossil and nuclear generation

Energy Policy Act of 1992

- Created “exempt” wholesale generator class
- Provides foundation for unbundling of industry into generation, transmission and distribution
- Led to commoditization of electric energy and creation of energy markets
  - Wholesale market
  - Energy-only pricing

Power Sector vs. Other Sectors

- High capital costs
- No storage - supply must equal demand in real-time
- Requires excess capacity for reliability

Numerous Externalities

- Environmental
- Health
- High potential for customer to customer wealth transfer
- Water use

Energy Market: Market Failures

- Demand Response (e.g. California experience)
- Market Power
- Energy Efficiency
- Failures attributable to:
  - Inadequate information
  - Disconnect between decision-making and consequences

A Closer Look at Energy Efficiency

- Average cost of energy efficiency is about $0.015-$0.02/kWh, while incremental generation and associated transmission and distribution is about $0.06 or more
- Reduces costs to affected customer
- Avoids or defer other system costs
  - Transmission
  - Distribution

Multiplier Effect of Energy Efficiency

- Because of losses inherent in system (almost all in the form of heat), 1 kWh saved at end-use level equals roughly 1.3 kWh (or more) of generation avoided:
  - Less fuel burned
  - Less pollution emitted
- Efficiency gains are often multi-faceted, for example Compact Fluorescent Lighting:
  - Uses less power than incandescent bulbs
  - Also produces less heat, reducing A/C load

Annual Health Costs of Power Plant Pollution

- Deaths: 23,600
- Hospital Admissions: 21,850
- Emergency Room Visits for Asthma: 26,000
- Heart Attacks: 38,200
- Chronic Bronchitis: 16,200
- Asthma Attacks: 554,000
- Lost Work Days: 3,186,000
- Monetized Health Costs: $167.3 billion annually

Source: Clean Air Task Force

Or put another way…

- Health cost per ton of SO2: $14,633
  - Compare to the $724 paid by this class
- Health cost per ton of NOx: $30,907
- Health cost per kWh of generation: $0.044

Challenges Ahead

- Assuring that costs of externalities are revealed to consumers, the public and politicians and eventually internalizing those costs
- Enabling mechanisms to capture public benefits, such as energy efficiency
- Enabling the demand-side of energy markets
- Enabling low emitting distributed resources to compete with traditional generation