The Natural Gas Industry

Gas: The “clean” fossil fuel

![Emissions Characteristics of Major Fossil Fuels](image-url)
The Natural Gas Industry:
traditional structure

Production
- Discovery, extraction, gathering, processing

Transmission
- pipelines (inter-state and intra-state)
- Growing role of Liquified Natural Gas (LNG)

Distribution (LDCs)
- From the pipeline to the end-user
Characterized by functional separation and multi-layered regulation

Natural Gas Usage (2005)

Natural Monopoly and Regulation

Distribution (and retail sales)
- regulated by states
- usually 'cost of service' regulation

Interstate Pipelines ('sales for resale')
- regulated by the federal government (FPC and then FERC) since 1938.

Production ('first sales')
- transactions with inter-state pipelines increasingly regulated by FPC from 1938 to 1978. Rapidly deregulated after 1978
- transactions with intra-state pipelines and LDCs sometimes regulated by States.
Unnatural Movements of Natural Gas Prices

Wellhead, 1949-2006

The Unraveling of Regulation

Supply Shortages (NGPA 1978)
Common Carriage (FERC 436 and 636)
What else did pipelines do?
- ‘marketing’ (sales and re-sales)
- storage
- risk management

Competitive marketing = competitive commodity market
- no need to regulate commodity prices!

Regulation of distribution is a mixed bag
- Retail choice in some states
- Core/non-core
- Hedging concerns

Transition pains
The Future of Natural Gas

Still an attractive alternative to coal from an environmental perspective

Historically different from oil in important ways
- Continental markets served by pipelines
  - North American market fairly independent of other regions
- Fragmented production - almost no producer market power
- Competition issues focused on transportation/pipelines

With Liquified Natural Gas (LNG) the market is becoming global
- Lots of producer market power in the rest of the world
The Electricity Industry

The Electricity Industry: Traditional Structure

Production
- Generation – the process of converting, rather than extracting, inputs.

Transmission
- High voltage wires.

Distribution
- From high voltage to your living room.

Retailing
- Billing & customer service.

The industry has predominantly been vertically integrated across all four sectors.

Key Economic Characteristics of the Industry (1)

Costs vary by resource.

- Total Cost
- Gas (CT)
- Coal
- Nuclear

Q
Key Economic Characteristics of the Industry (2)

Electricity, for the most part, cannot be stored.
End-use demand is very inelastic.

Key Economic Characteristics of the Industry (3)

Physical characteristics of the transmission grid create externalities across grid “users.”
- The transmission grid has limited capacity, especially at times of peak demand.
- For example, when transmission capacity is limited, not all the generators on the Delta can supply power to San Francisco.
- The more one plant on the Delta produces, the less other plants can.

Vertical Integration and Regulation

Originally, producers needed to distribute to get their product sold
- Production and distribution linked from the beginning.
Coordination issues across sectors (e.g. externalities on the transmission grid) made vertical integration attractive.
Economies of scale
- Prevalent in every sector early on.
- Still present on the “wires side (transmission & distribution).
With vertical integration, if one sector is a natural monopoly, the whole industry must be regulated.
Market Organization

Outside US
- Nationalized, vertically integrated electric company

United States (pre-1998)
- Investor owned electric company
- Vertically integrated
- Regulated by state utility commissions
- Geographically small (Balkanized network)

The Exceptions (US)
- Federal power: the ultimate exercise in economies of scale
- Municipal utilities: going it 'alone'
- Wholesale power markets

What happened?

The golden years (1930-1970)
- Economies of scale keep driving costs down as demand keeps growing.

Everything goes wrong (the 70's)
- fuel price shocks: demand stops growing
- nuclear power and regulatory risk

Steps towards deregulation (part II, the 80's)
- the 70's continued
- PURPA
- renewable generation
- 'least-cost' planning

Average Retail Price of Electricity, 1960-2005

Different approaches give different results

2003 Average Residential Prices

Electricity Prices around the World

Average Price of Electricity (2003/04 US cents/ kWh)

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Where are we now?

International wave of privatization
- No consensus on new model

- toward unregulated generation sales
- ‘ unbundling’ of transmission
- what was in the bundle?

‘Radical’ restructuring
- beyond unbundling to ‘separation’
- the ‘Independent System Operator’ (ISO)
- California, PJM, New England, New York, Texas
- Chile, UK, Norway, Australia, New Zealand, Spain, Netherlands

Electricity and the Environment

In the US in 2004, the electricity industry accounted for:
- 38% of CO₂ emissions
- 69% of SO₂ emissions
- 22% of NOₓ emissions

The industry is also a major water user.

Location & Size of US Power Plants, 2004