Electricity: 30 Years of Industry Change

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30 Years of Energy Information and Analysis
April 7, 2008
EIA Key to Policy Development and Advocacy Activities

- Policy development
- Advocacy activities
- Stakeholder engagement
- Public outreach
- Policy analysis
- Resource mobilization
EIA Has Kept Pace With an Evolving Energy Industry

- EIA clearly provides more with less budgetary support
  - 1979: $347 million
  - 2007: $91 million (both in Real $2007)

- EIA staff resource distribution has tracked changing energy markets and information needs
Generation Options – Public Policy Drives Resource Mix

New Generation Capacity By Fuel Since 1950

Source: Henwood Energy Consulting
Transformation or Chaos?
The New Public Policy Challenges

**Enormous CapEx**
- $750 - 900 Billion
- Exceeds current capitalization
- Major new coal, nuclear and transmission

**Rising Costs and Prices**
- No longer a declining cost industry
- Fuel, infrastructure components, global industrialization and competition

**Climate Change**
- Dozen bills pending in Congress
- States becoming aggressive
- Role of Renewables
  - > $1 Trillion ???

**Energy Efficiency**
- Low hanging fruit for Climate Change
- Need to make it a sustainable business
- “Smart” appliances, buildings, grid
Demand Projected To Increase 30% by 2030


*Electricity demand projections based on expected growth between 2006-2030*
Margins Projected to Fall Below Minimum Target Levels

- **MRO**
  - 2009/2009 (US)

- **RFC (MISO)**
  - 2008/2008

- **RFC (PJM)**
  - 2012/2014

- **New England**
  - 2009/2009

- **New York**
  - 2011/2016+

- **Rocky Mtn**
  - 2008/2011

- **California**
  - 2009/2012

- **AZ/NM/SNV**
  - 2009/2011

- **SPP**
  - 2015/2016

- **SERC**

- **FRCC**

- **WECC**

**Source:** NERC 2007 Long Term Reliability Assessment

*Excludes MISO resources outside the RFC boundary*
Transmission Congestion Dramatically Increasing

Requests for transmission loading relief (TLRs) in the Eastern Interconnection

Level 2 or higher TLRs

- 2001
- 2003
- 2005
- 2007

Graph showing the increase in requests for transmission loading relief (TLRs) in the Eastern Interconnection from 2001 to 2007.
Aging Transmission Infrastructure

- “Rising Utility Construction Costs: Sources and Impacts”
  - Edison Foundation/Brattle Group Report

- 70% of transmission lines are 25 years or older
- 70% of power transformers are 25 years or older
- 60% of circuit breakers are more than 30 years old

**Significant Electric Capital Investment Required**

**Existing Net Plant in Service $750 Billion**

- Transmission: $90 billion
- Distribution: $240 billion
- Fuels: $8 billion
- Generation: $350 billion
- Regulatory Assets: $60 billion

**Investment Need for Next 15 Years: $900 Billion**

- Conservation and Efficiency: $50 billion
- Distribution: $300 billion
- Generation: $350 billion
- Transmission: $150 billion
- Environmental Retrofits: $50 billion (excl. CO₂ ~$300B?)

2. 2006 dollars

Source: Lehman Brothers. July 2007
Raw Materials Price Indexes

Sources: U.S. Geological Survey, Mineral Commodity Summaries, the Bureau of Economic Analysis, and a forthcoming report on rising utility construction costs prepared by The Battle Group for the Edison Foundation.
Equipment Price Increases 2002-2006

Sources: John Siegel, Bechtel Power Corp., "Who, What, Where, How" (presentation delivered at the Next Generation of Generation Conference [Dewey Ballantine LLP], May 4, 2006), and a forthcoming report on rising utility construction costs prepared by The Brattle Group for the Edison Foundation.
Fuel Costs Increasing Dramatically

1999 – November 2007

Table 4.1-based on $/MMBtu Delivered Cost
Aging Workforce Trend (Typical Utility)

Source: KEMA
Worldwide Electricity Demand Growth

China’s CO₂ Emissions Surpass U.S. in 2007


1990-2004 data from U.S. Department of Energy, Energy Information Administration
What Will It Take?

There Is No Silver Bullet!

- Energy Efficiency
- Renewables
- Clean Coal Technologies
- Carbon capture and storage
- Nuclear
- Plug-in hybrid electric vehicles

We need it all ... but it will be costly!
CO₂ Reductions – What’s Technically Feasible?

- Higher fuel prices
- Lower GDP, load growth rate
- More renewables, nuclear

Achieving all targets is very aggressive, but potentially feasible

**Technology** | **EIA 2008 Reference** | **Target**
--- | --- | ---
Efficiency | Load Growth ~ +1.05%/yr | Load Growth ~ +0.75%/yr
Renewables | 55 GWe by 2030 | 100 GWe by 2030
Nuclear Generation | 15 GWe by 2030 | 64 GWe by 2030
Advanced Coal Generation | No Heat Rate Improvement for Existing Plants 40% New Plant Efficiency by 2020–2030 | 1-3% Heat Rate Improvement for 130 GWe Existing Plants 46% New Plant Efficiency by 2020; 49% in 2030
CCS | None | Widely Deployed After 2020
PHEV | None | 10% of New Light-Duty Vehicle Sales by 2017; 33% by 2030
DER | < 0.1% of Base Load in 2030 | 5% of Base Load in 2030

(EPRI Prism – With EIA Update)
What Will It Take?

An Intensified National Commitment To Energy Efficiency

- Aggressive campaign for technologies
  - Smart buildings
  - Smart appliances
  - Smart electric meters and grid
  - Smart rates

- Use of “smart technologies” and new rate designs can
  - Allow consumers to control their energy usage to save money
  - Avoid wasting energy
  - Control how and when appliances do their jobs
  - Help utilities efficiently operate their systems and maintain reliability
  - Help keep supply and demand in balance
  - Support more efficient use of generating resources

- Commercializing plug-in hybrid electric vehicles
Challenge: Technologies and Timeframes

- Advanced coal technologies integrated with Carbon Capture and Storage (CCS)
  - Not commercially available until 2020-2025

- Deployment of nuclear plants
  - Not possible until 2015 at earliest

*During the transition there will be a “dash to gas”*
*Driving up both electricity and gas prices*
Range of Potential Impacts From Climate Legislation?

- Cost per household $\uparrow$ $446 - $2927 in 2020 / year
- Electricity prices $\uparrow$ 21% - 35% in 2020
- Natural gas prices $\uparrow$ 20% - 39% in 2020
- GDP $\downarrow$ 0.7% - 1.74% (~ $336B out of $\sim$19.2T GDP)
- Employment $\downarrow$ 1.1 - 2.78 million in 2020
- Coal consumption $\downarrow$ 42% - 66% in 2020
- Permit prices ($ / ton CO$_2$ equivalent) $\uparrow$ $18 - $48 / ton in 2020
- Total US GHG emission (mmtCO$_2$-equivalent) $\downarrow$ 4887 – 6654 in 2030 (“Business As Usual” 9672 in 2030)

*It’s All About The Assumptions!*
Who’s Assumptions Are Right? Wide Ranges

- **New Renewables**
  - 16 GW ↔ 176 GW by 2030

- **Coal w/ Carbon Capture and Storage**
  - 25 GW ↔ 250 GW by 2030

- **New Nuclear**
  - 3.5 GW ↔ 117 GW by 2030

- **Energy Efficiency**
  - *Major impact – How much?*

- **Offsets**
  - 15% domestic only ↔ 30% domestic and international
Industry Challenges / Public Policy Context

- Climate change and the need to enhance the nation’s electric infrastructure are historic.

- Identify and understand assumptions:
  - Future with nuclear, coal, energy efficiency
  - Potential rate impacts of various scenarios

- EIA’s modeling and analysis role is critical to the debate and ultimate resolution of these issues.

- A modeling forum?
  - Enhance understanding and appreciation of the assumptions and models used for the analysis of critical public policy initiatives.
One Last Point ... EIA Survey Forms

- **Concern:**
  - Massive overhaul of EIA survey forms (eff. 1/1/08)

- **Result:**
  - EIA and Industry too little time to adjust (EIA still developing software for form filing)

- **Recommendations**
  1. Need to start process earlier - explain forms, understand industry issues
  2. Improve consideration of industry concerns during ongoing industry transformation
  3. At least 6 months after final approval before forms effective
Challenges Are Plentiful

- Supply margins are declining and demand is increasing
  - Need significant infrastructure investment but costs increasing rapidly

- Transmission is aging and becoming more congested

- All costs increasing – fuel, construction, equipment

- Workforce getting older
  - Need to support programs for science and engineering

- Significant concerns about the environment
  - Need to accelerate development and deployment of new technologies

- Energy efficiency is becoming increasingly important
The Path Forward

An Apollo Like Vision!

- Secure a national (worldwide) commitment to reducing GHG emissions
  - Involve all sectors of the economy
  - Aggressive education campaign - costs and benefits
  - Change attitudes about energy efficiency – all sectors

- Accelerate the development of needed technologies
  - Substantially increase funding and related incentives to stimulate research, development and deployment

- Create excitement around engineering, mathematics and science
  - Public / private partnership to replace the aging workforce and encourage the next round of technical and strategic leaders

Not because it is easy, but because it is the right thing to do!