What’s In Our Future?
Trends in the electricity sector

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NARUC & Grants & Research

• NARUC members are the State PUCs that regulate investor-owned utilities
  – http://www.naruc.org

• G&R Dept. addresses research and facilitates dialogue on key questions facing Commissions


Partnerships with FCC, NCS, FERC, private sector, non-governmentals
Today’s presentation is all about my opinions, not NARUC policy or any of its members. Hopefully my opinions are mostly in agreement with those.

“There are no facts about the future, just good guesses and bad guesses.”

– Prof. Michael Dworkin, University of Vermont Law School
Summary

- Where we are now is sitting on a fence
- Factors are forcing change in the electric sector
- Implications of demand-supply balance
- Implications of a CO₂ price
- “Smart” climate policy & efficiency
- Crazy prognostications
- Potential directions
Where are we now?

• Where we are going tomorrow starts with where we are today
• Let’s explore key trend factors from recent times:
  – Market structure
  – The tools and technology we use
  – Environmentally-aware energy policies
  – Electricity delivery policy
Energy Resources In the US: where we are

EIA, 2007

- Coal: 48.5%
- Natural Gas: 21.6%
- Petroleum: 1.6%
- Other Gases: 0.3%
- Nuclear: 19.4%
- Hydroelectric: 5.8%
- Other Renewables: 2.5%
- Other: 0.3%

Total = 4,157 Billion kWh
Electric Utility Plants = 60.2%
Independent Power Producers & Combined Heat and Power Plants = 39.8%
Where we’ve been

Capacity Brought Online by Fuel Type and Average Plant Size 1950-2007

Source: Vestynx/Global Energy Decisions
Updated: 1/08
Two Models Walk Into A Bar…

…and Decide They’ve Had Enough Of Adjusting Their Markets

Source: Energy Information Administration, status as of April 2008
Market, Technology, and Policy

Boundaries
Renewables Portfolio Standards

- **WA**: 15% by 2020
- **OR**: 25% by 2025 (large utilities)
  - 5% - 10% by 2025 (smaller utilities)
- **MT**: 15% by 2015
- **CA**: 20% by 2010
- **AZ**: 15% by 2025
- **HI**: 20% by 2020
- **MN**: 25% by 2025
  - (Xcel: 30% by 2020)
- **ND**: 10% by 2015
- **MT**: 15% by 2015
- **IA**: 105 MW
- **WI**: requirement varies by utility; 10% by 2015 goal
- **IL**: 25% by 2025
- **MO**: 11% by 2020
- **TX**: 5,880 MW by 2015
- **VT**: RE meets load growth by 2012
- **ME**: 30% by 2000
  - 10% by 2017 - new RE
- **NH**: 23.8% in 2025
- **ME**: 30% by 2000
- **ME**: 30% by 2000
- **MA**: 4% by 2009 + 1% annual increase
- **RI**: 16% by 2020
- **CT**: 23% by 2020
- **NY**: 24% by 2010
- **NJ**: 22.5% by 2021
- **PA**: 18%¹ by 2020
- **PA**: 8% Tier I / 10% Tier II (includes non-renewables)
- **DE**: 20% by 2019
- **DC**: 11% by 2022
- **VA**: 12% by 2022

*Minimum solar or customer-sited RE requirement

* Increased credit for solar or customer-sited RE

¹PA: 8% Tier I / 10% Tier II (includes non-renewables)

**DSIRE**: [www.dsireusa.org](http://www.dsireusa.org) March 2008
Climate Policy in the Regions

Regional Initiatives

Source: Pew Center on Global Climate Change
Demand is growing (we hope)


*Electricity demand projections based on expected growth between 2006-2030*
Resource Choices Looked Tough Before

Efficiency looks pretty good though

Per Amory Lovins, 2008
Estimated Cost of New Generation

Nuclear
Conventional Coal
IGCC Coal
Combined Cycle
Combustion Turbine
Wind
Geothermal
Concentrated Solar

Source: Compiled by FERC Staff from various sources. Cost estimates exclude carbon capture and sequestration costs.

$0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000

2003-04
2008
$/kW

Per Eric Holdsworth, EEI
Climate Legislation

Illustration of Economy-wide Emission Reduction Targets
Legislative Proposals Introduced in the 110th Congress as of December 1, 2008

- Business-as-usual projection
- McCain-Lieberman (S.280)
- Sanders-Boxer (S.309)/Waxman (HR.1590)
- Kerry-Snowe (S.485)
- Olver-Gilchrest (H.R.620)
- Bingaman-Specter (S.1766 without “safety valve”)
- Bingaman-Specter (S.1766 optional goal)
- Boxer-Lieberman-Warner (S.3036)
- Markey (H.R.6186)
- Doggett (H.R.6316)
A “Good Guess” on Climate

- EPA may force the hand of Congress
- 113th Congress (2013): national GHG legislation
- No Post-Copenhagen framework for after 2012
- Lingering Uncertainties:
  - Will Congress make rapid progress or hit a reef?
  - How fast will EPA move on Clean Air Act intentions?
  - The economy, and (related) the stimulus package
  - What would/ will an energy bill look like?
- Likely to be C&T
  - Allowance auction and allocation, cost containment, and State programs are key issues of interest to NARUC, and others interested in reliability, affordability, and program effectiveness
More Demand, Less Supply, and Making More Demands From Our Supply.

- Inescapably, this means higher electric prices
- Strong upward pressure from:
  - New capacity additions to serve demand, as much as $1.5 trillion (EEI) exceeds current capitalization.
  - Climate may cost $1 trillion by 2030
  - Fuel and waste costs
  - New capabilities: smart grids, transportation, storage, generation resource priorities
  - Reliability, resiliency, security, and other issues
“We’ve been asking the question: ‘Given this price forecast, what should we invest in?’ The real question is, ‘Given that we don’t know what prices are, what should we invest in?’”

--Lee Raymond, CEO
Exxon-Mobil (WSJ 4-8-05)
EPRI Prism Analysis

EIA Base Case 2008

<table>
<thead>
<tr>
<th>Technology</th>
<th>EIA 2008 Reference</th>
<th>Target</th>
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<tbody>
<tr>
<td>Efficiency</td>
<td>Load Growth ~ +1.2%/yr</td>
<td>Load Growth ~ +0.75%/yr</td>
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<tr>
<td>Renewables</td>
<td>60 GWe by 2030</td>
<td>100 GWe by 2030</td>
</tr>
<tr>
<td>Nuclear Generation</td>
<td>20 GWe by 2030</td>
<td>64 GWe by 2030</td>
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<tr>
<td>Advanced Coal Generation</td>
<td>No Existing Plant Upgrades</td>
<td>130 GWe Plant Upgrades</td>
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<tr>
<td>CCS</td>
<td>None</td>
<td>Widely Deployed After 2020</td>
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<tr>
<td>PHEV</td>
<td>None</td>
<td>10% of New Vehicle Sales by 2017; +2%/yr Thereafter</td>
</tr>
<tr>
<td>DER</td>
<td>&lt; 0.1% of Base Load in 2030</td>
<td>5% of Base Load in 2030</td>
</tr>
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MERGE Economic Model Results:
Real Electricity Prices Increase - 2000 to 2050

Limited Portfolio

+260%

Full Portfolio

+45%

*Economy-wide CO₂ emissions capped at 2010 levels until 2020 and then reduced at 3%/yr
Question one: What are the key fuel and technology changes?

- Gas
- Baseload
- Intermittents
- Demand-side resources
• The LNG Partnership: contact Ivy Butts from NARUC at ibutts@naruc.org
Shale gas

Major shale gas basins in the United States with total resource potential of 500 to 1,000 tcf.
CCS

Phase II Regional Carbon Sequestration Partnerships
Nuclear

- Cost
- Waste
- Safety / public perceptions
- Proliferation
Efficiency Seems Obvious

- Costs less than a power plant!
- Pays you back – now with local benefits!
- NIMBY-proof!
- Terrorist-proof!
- Hurricane-proof!
- Hugo Chavez-proof!
- Easy to install: no wires or pipes!
- 100% NOx and SOx-free!
- Legal everywhere, and Yucca-free!
- Bird / Bat-friendly!
- Good-looking!
- More Popular Every Day!
Only! Consumers don’t always listen to economists.
Targeting efficiency saves 7x more carbon per consumer $ than carbon prices alone.

Annual CO₂ Emissions Saved by: Increasing Rates 3%; and Increasing Rates 3% to Fund Energy Efficiency (Ohio Example)

Assumptions: Electricity use increases by 1.7% per year; Retail electric sales increase by 3%; Price elasticity is -0.25 (-0.75 for a 3% increase), distributed over 5 years; Carbon dioxide emissions are 0.915 tons per MWh in Ohio; Cost of EE is 3 cents per kWh; Average EE measure life is 12 years.

Cumulative CO₂ emissions avoided from raising rates 3% and funding EE, 2006-2026: 1,557 million tons
Cumulative CO₂ emissions avoided from raising rates 3%, 2006-2026: 209 million tons
Wind Means Transmission

• But! Transmission isn’t just for wind.
• EISPC, Western, ERCOT regional transmission initiatives
• EWITS and other large scale studies are out.
• Planning is hard, but building is so much harder.
Question Two: What Scenario?

• Four wild-eyed scenarios to help imagine the future:
  – One Big Baseload Utility
  – Merchants & Intermittents
  – The Microgrid March
  – General Motors & Electric

• None of these are particularly plausible: intent is to imagine the possible boundary conditions
The Big Baseload Utility

- Strategy: focus on baseload capacity (coal with CCS, new nuclear)
- Investments: Large, centralized.
- Utility structure: “One utility, owned by Warren Buffet” – size and capital advantage
- Market structure: Vertically integrated
- Implications for technology
- Implications for regulatory structure
Merchants & Intermittents

• Strategy: focus on energy resources over capacity resources (gas, biomass, CSP and wind); transmission (for firming and intermittents)
• Investments: More diffuse, more players.
• Utility structure: Similar to what we have now, a variety of sizes and shapes
• Market structure: As above, but accommodates strong deregulation perspective
• Implications for price
• Implications for regulatory structure
The Microgrid March

- Strategy: focus on efficiency, demand response, distributed resources
- Investments: Extremely diffuse, much on the distribution-side
- Utility structure: “We help our customers manage their energy use”
- Market structure: disaggregated, “utility” redefined
- Implications for consumer involvement & empowerment
- Implications for regulatory structure
General Motors & Electric

- Strategy: Transportation electrification and smart grid as game-changers
- Investments: Large, centralized.
- Utility structure: “We’re Xcel and Exxon too”
- Market structure: A mix of models
- Implications for economics, markets
- Implications for regulatory structure
What does this mean for regulators? For States?

- New market structures and business models will have to emerge
- States (and provinces) can be proactive or reactive
- Regulators care about cost and reliability. Is low-carbon a factor to weigh, or is it a constraint under which we must (at all costs) abide?
Without Smart (State) Programs, It’s Not Gonna Be Pretty
More ways to talk to regulators!

- The National Council on Electricity Policy
  www.ncouncil.org
- National CCS and LNG partnerships
- Solar States Initiative
- Eastern Interconnection States Planning Council

To get involved Contact – me!  mkeogh@naruc.org
Efficiency-focused Answers

- Utilities aren’t always the best providers of efficiency
  - Vermont, Delaware, etc.
  - ESCOs
- Decoupling looks tempting, but implementation details are deal-makers or –breakers
  - Who you apply it to (what class and class-size?)
  - How you apply it (what normalization and structure? How to prevent risk-transfers?)
  - What else you apply (what incentives?)
- Assuming the country wants to “flip the utility”, we’ll need to revisit:
  - Technology and the extent of its deployment
  - Effectiveness and EM&V
  - Project and payback duration
  - Cost recovery
  - Incentives
  - Risk issues for Customer Classes, and social equity issues
  - The culture of implementation – is this a resource or what?
  - Policy consistency
Broader climate-responsive State policy

– Respond to a price on carbon, but don’t expect a miracle
– Accelerate efficiency using a broad toolbox: non-utility EE providers, rate design for EE and DR, “loading” orders, carbon performance standards, EERS, investment incentives, guarantees, infrastructure authorities, etc. And yes, probably a good dose of decoupling.
– Rediscover and update planning: IRP and Portfolio Management (and look regionally)
– New renewables: RPS is a tool that works, but transmission policy, interconnection, netmetering, and other strategies still need lots of improvement.
– New capacity: Accelerate the transition with explicit policies for low-carbon resources (e.g., CCS, nuclear) and find ways to turn energy-strong intermittent resources into stronger capacity resources.
– Promote a new business model for load-serving utilities. (Incentives, Decoupling, PBR, owned DG, etc.)
– Create new businesses for EE and carbon-reducing technologies (DG, smart grid, PHEVs, etc.)
– Keep talking to each other and to the Feds.
I Will Now Confront Your Most Challenging Questions!

Or! Later if you prefer!

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