Tomorrow’s Energy Industry – Challenges and Opportunities

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Edison Electric Institute, Washington DC
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Public Mood
Generally speaking, would you say things in this country are heading in the right direction, or are they off on the wrong track?

When you think about the overall energy situation we face today as a nation, and how we are addressing it, do you think the U.S. is heading in the right direction, or are we off on the wrong track?
Most Important Issue Facing the U.S.

What do you feel is the most important issue facing the U.S. today?

- Economy: 34%
- Unemployment: 23%
- Healthcare: 20%
- Government: 18%
- Environment: 7%
- Debt/Spending: 6%
- War/Iraq: 6%
- Energy/Natural Resources: 5%
Energy Cost Concerns

How concerned are you about the price you pay for each of the following types of energy?

- **Heating Oil***: 28%
- **Natural Gas**: 56%
- **Gasoline**: 88%
- **Electricity**: 84%

*Heating oil has much lower penetration than other energy sources, with 47% of consumers say they do not use heating oil.
Primary Cause of Increasing Electricity Costs

Thinking specifically about electricity, what would you say is the primary cause of increasing electricity costs?

- Increased demand: 17%
- Greed/Profit: 11%
- Fuel costs/Type of fuel: 11%
- Generation costs: 7%
- Government: 6%
- Increase profits: 5%
- Don't know: 12%
Despite concerns about the price of electricity, 59% feel the value they receive from their electric utility in terms of the actual product delivered - electricity - is good, down notably from Q4 08 (64%).
Growth in electricity use continues to slow

3-year rolling average percent growth

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual Growth</th>
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<td>1950s</td>
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<tr>
<td>2008-2035</td>
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</table>

Source: Annual Energy Outlook 2010
Reducing Our Dependence on Foreign Oil

- Senator Obama in March 2007
  “Stop sending $800M a day to Mideast dictators for oil”
  (http://www.ontheissues.org/Energy + Oil.htm)

- Obama – Biden Campaign
  “Dependence on oil is one of the greatest (threats) we have ever faced. It’s a threat to our national security, our planet and our economy.”
  (www.barackobama.com)

- Pickens Plan
  “America is addicted to foreign oil. It’s an addition that threatens our economy, our environment and our national security.” (www.pickensplan.com)

- Speaker Nancy Pelosi in 2008
  “American consumers remain at the mercy of OPEC…”
  (www.speaker.gov/legislation?id=0201)
Reducing Our Dependence on Foreign Oil

- Yet…Oil represented
  - 34% of world’s Total Primary Energy Supply (TPES) in 2007. (IEA)
  - 48% of OECD’s TPES
  - 61% consumed by Transport

Source: International Energy Agency
Although we are the third largest crude oil producer, most of the petroleum we use is imported…

U.S. Consumption: 19.5 million barrels in 2008

Source: U.S. Energy Information Administration.
Western Hemisphere nations provide about half of our imported petroleum.

Sources of U.S. Net Petroleum Imports, 2008

- Western Hemisphere: 45%
- Africa: 22%
- Persian Gulf: 21%
- Other: 12%

Source: U.S. Energy Information Administration.
Oil Facts

• Our biggest suppliers:
  • Canada 19%
  • Saudi Arabia 12%
  • Mexico 10%
  • Venezuela 9%
  • Nigeria 8%
Net imports have generally increased since 1985 while U.S. production fell and consumption grew.

Source: Energy Information Administration, Annual Energy Review, Table 5.1. (June 2008)
Oil Issues

• Supply

• Price Volatility

• Non-OECD/Non-OPEC Production
  • Russia
  • Brazil
  • Kazakhstan

• Canadian Oil Sands
Coal
What the Headlines are saying...

Barker: PGE, Idaho Power will close power plant
Idaho Statesman, Jan. 25, 2010

Proposal for Waterloo Coal Plant is Scrapped
Des Moines Register, Jan. 7, 2009

Report: Appalachian states should look beyond coal
Fox12idaho(KTRV-TV), Jan. 19, 2010

THE DEATH OF U.S. COAL
Financial Times, Jan. 25, 2010

Utilities Turn from Coal to Gas

Another Bad Week for Coal
The Nation, Feb. 21, 2008

Turmoil in Power Sector

NM Governor Would Pull Air Permits of Coal-Based Power Plants
Forbes, Jan. 22, 2010
Cancelled Plant Implications

- Predominately due to economic environment and regulatory uncertainty.
- Cancellations before or during the permitting phase are not unusual
  - Announced projects are not necessarily strong indicators of capacity additions.
- Delayed or abandoned projects still represent future opportunities
  - Land, fuel, transportation and water availability still exists
  - Specifically: Mine mouth opportunities and waste coal piles are still there
Geographical Map by State: Coal-Fired Plants (Permitted, Near Construction and Under Construction)

Source: Ventyx – Velocity Suite 10/8/09
Proposed New Capacity
Coal, Natural Gas and Wind

Source: Ventyx – Velocity Suite 10/8/09
Coal-Fired Build Rate

China and U.S.

Figure 8

Ventyx – Velocity Suite 10/8/09
Current National Fuel Mix Compared To EIA's 2035 Projections

2008 National Fuel Mix

- 48.5% Coal
- 21.3% Natural Gas
- 19.6% Nuclear
- 5.9% Hydro
- 3.9% Non-Hydro Renewables
- 1.1% Fuel Oil
- 0.5% Other

2035 Projections

- 43.8% Coal
- 20.8% Natural Gas
- 17.1% Nuclear
- 5.8% Hydro
- 11.2% Non-Hydro Renewables
- 0.9% Fuel Oil
- 0.4% Other

*Includes generation by agricultural waste, landfill gas recovery, municipal solid waste, wood, geothermal, non-wood waste, wind, and solar.
**Includes generation by tires, batteries, chemicals, hydrogen, starch, purchased steam, sulfur, and miscellaneous technologies.

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Nuclear
Nuclear Renaissance

- Global – Yes
  - 436 plants, 370 GW Today
  - 1100 GW by 2060; possibly up to 3500 GW (WNA)
- US – Not so certain
  - At best 4 – 8 new plants in commercial operation by 2016. (NEI)
Nuclear Power – Good News

• 44 plants under construction around the world in 12 countries
  • China (11), India (6), Korea (5) and Russia (8)
  • No new plants in the United States
• Performance of the 104 U.S. nuclear plants excellent
U.S. Nuclear Industry Capacity Factors
1971 – 2008

Source: Energy Information Administration
Updated: 4/09
Nuclear Power – Good News

- President Obama budget proposes increasing loan guarantees to $54 billion.
- New approach to reactor licensing
- 17 applications for combined construction and operating licenses for 26 reactors have been submitted to the NRC.
- Extended operating licenses.
- Public acceptance for nuclear power.
## New Nuclear Plants Under Consideration

<table>
<thead>
<tr>
<th>Company</th>
<th>Site</th>
<th>Design</th>
<th>Number of Reactors</th>
<th>Date for Filing COL² Application</th>
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<tr>
<td>Alternate Energy Holdings</td>
<td>Elmore County, ID</td>
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<td>Amarillo Power</td>
<td>Amarillo, TX vicinity</td>
<td>EPR</td>
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<td>Detroit Edison</td>
<td>Fermi (MI)</td>
<td>ESBWR</td>
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<tr>
<td>Dominion⁵</td>
<td>North Anna (VA)</td>
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<tr>
<td>Duke Energy</td>
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<td>Entergy⁴</td>
<td>River Bend (LA)</td>
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<td>Entergy⁴ (NuStart Energy⁵)</td>
<td>Grand Gulf (MS)</td>
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<td>Exelon</td>
<td>Clinton (IL)</td>
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<td>Exelon</td>
<td>Victoria County, TX</td>
<td>ABWR</td>
<td>2</td>
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<td>Florida Power &amp; Light</td>
<td>Turkey Point (FL)</td>
<td>AP1000</td>
<td>2</td>
<td>June 2009</td>
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<tr>
<td>Luminant</td>
<td>Comanche Peak (TX)</td>
<td>APWR</td>
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<td>NRG Energy/STPNOC</td>
<td>South Texas Project (TX)</td>
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<td>PPL Corporation</td>
<td>Susquehanna (PA)</td>
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<td>Progress Energy</td>
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<td>UniStar Nuclear⁶</td>
<td>Nine Mile Point (NY)</td>
<td>EPR</td>
<td>1</td>
<td>October 2008</td>
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</table>

Source: NEI Status and Outlook for Nuclear Energy in the United States  October 2009
Nuclear Issues

• Cost

• Work Force

• Supply Chain

• Waste Disposal
Nuclear – How Much Will It Cost?

- Florida Power and Light – 2007 FLPSC filing
  - $3108/kW → $4540/kW
  - 2 units = $12.1 billion → $18 billion

- Progress Energy Florida – 2008 filing
  - $4260/kW
  - 2 units = $14.1 billion

- SCE & G/Santee Cooper
  - $4122/kW
Natural Gas
<table>
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<th>Decade</th>
<th>Year-0</th>
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<th>Year-2</th>
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- = No Data Reported; -- = Not Applicable; NA = Not Available; W = Withheld to avoid disclosure of individual company data.

Release Date: 12/29/2009
Next Release Date: 1/29/2010

Source: U.S. Energy Information Administration
Natural gas and renewables account for the majority of capacity additions from 2008 to 2035.

2008 capacity:
- Natural gas: 338 gigawatts (33%)
- Coal: 312 gigawatts (31%)
- Nuclear: 101 gigawatts (10%)
- Other renewables: 40 gigawatts (4%)
- Other: 119 gigawatts (12%)
- Hydropower*: 99 gigawatts (10%)

Capacity additions 2008 to 2035:
- Natural gas: 116 gigawatts (46%)
- Coal: 31 gigawatts (12%)
- Nuclear: 8 gigawatts (3%)
- Other renewables: 92 gigawatts (37%)
- Other: 2 gigawatts (1%)
- Hydropower*: 1 gigawatt (0.4%)

* Includes pumped storage

Source: Annual Energy Outlook 2010
Renewables
U.S. Renewable Energy Policy

- Obama-Biden Campaign in 2008
  - 25% by 2025

- President Obama in 2009
  - Double Renewable Energy in 3 years
U.S. Renewable Energy Policy

• American Clean Energy and Security Act of 2009 (HR 2454: Waxman-Markey)
  • 20% by 2020
    • Up to 40% can be met by energy efficiency

• American Clean Energy Leadership Act of 2009 (S. 1462-Bingaman)
  • 15% by 2021
    • Up to 26.67% can be met by energy efficiency
31 States including D.C. have Renewable Energy Portfolio Standards (RPS)
10 have at least 25% by 2025

- ND: 10% by 2015
- SD: 10% by 2015
- NE: proposed an RPS
- KS: 20% by 2020
- OK: studying an RPS
- MN: 25% by 2025; Xcel: 30% by 2020
- IA: 105 MW
- MO: 15% by 2021
- WI: 10% by 2015
- IL: 25% by 2025
- MI: 10% MWh and 1,100 MW by 2015
- OH: 12.5% by 2025
- WV: 25% by 2025
- KY: report recommends RPS
- ME: 40% by 2017
- NH: 23.8% by 2025
- VT: 20% by 2017; all growth to 2012 from RE and EE
- MA: 15% by 2020
- RI: 16% by end 2019
- CT: 27% by 2020
- NY: 25% by 2013
- NJ: 22.5% by 2020
- PA: 18% by 2020
- DE: 20% by 2019
- DC: 20% by 2020
- MD: 20% by 2022
- VA: 15% by 2025; goal with production incentives
- NC: 12.5% by 2021
- TVA: 50% by 2020

Updates at: http://www.ferc.gov/market-overview/othr-mkts/renew.asp

Notes: An RPS requires a percent of an electric provider’s energy sales (MWh) or installed capacity (MW) to come from renewable resources. Most specify sales (MWh). Map percents are final years’ targets. TVA’s goal is not state policy; it calls for 50% zero- or low-carbon generation by 2020. Alaska has no RPS.

Sources: Derived from data in: LBNL, PUCs, State legislative tracking services, Pew Center, and the Union of Concerned Scientists. Details, including timelines, are in the Database of State Incentives for Renewables and Energy Efficiency: http://www.dsireusa.org

Updated October 19, 2009
U.S. Support for Renewable Energy

- Production tax credit – $0.021/kWh
- Investment tax credit – 30% for solar, small wind & fuel cells
- Grants in lieu of credits
- Renewable Portfolio Standards – 35 states with mandatory or voluntary standards
- Feed-in Tariffs – 8 states
- Increased RDD&D for Dept. of Energy $2.5 billion
- Dept. of Energy loan guarantees
Planned capacity additions reflect state RPS requirements

Non-hydro renewables make up 4% of US capacity today but 34% of planned capacity additions through 2020.

Source: Ventyx Global Energy and Bernstein Analysis
Renewables gain electricity market share; coal share declines

billion kilowatthours and percent shares

<table>
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<tr>
<th>Year</th>
<th>Natural gas</th>
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<th>Coal</th>
<th>Nuclear</th>
<th>Oil and other</th>
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<td>43.8</td>
<td>17.1</td>
<td>1.4</td>
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</tbody>
</table>

Source: Annual Energy Outlook 2010

Edison Electric Institute
Nonhydropower renewable sources meet 41% of total electricity generation growth from 2008 to 2035

Source: Annual Energy Outlook 2010
What Proponents Say

• Energy security – reduces foreign oil consumption
• Reduced CO² emissions
• New jobs
  • 5.1 million per 25 x ‘25
  • 700,000 in hydropower per NHA
  • 297,000 per Union of Concerned Scientists
• Little or no additional costs
• Positive economic impact
  • $700 Billion per 25 x ‘25
What Opponents Say

• Costs too much
  • Minnesota Power seeking 20% rate increase to cover green energy investments
  • Duluth, MN business, ME Global, says electric prices have increased dramatically

• Lack of storage
What Opponents Say

- Inefficient land use – sprawl from wind farms
- Renewables are located far from load centers
- Not as reliable – variable & intermittent resource
- Lack of transmission to deliver renewables
Introduction of a single nuclear reactor unit (1.38 million kW)

- CO₂ emission reduction by approx. 7 million tons
- Equivalent to approx. 10 million kW in solar power and 6 million kW in wind power

(Premise)
85% in capacity factor, approx. 10.3 billion kWh in annual power generation, replacing petro thermal plants 12% in solar power capacity factor, 20% in wind power capacity factor

Comparison of construction costs

One nuclear power station
1 million KW class
(300 billion yen)

Solar power
Roughly the same as the size of Manhattan (approx. 67km²)
(6-7 trillion yen)

Wind power
4 times the size of Manhattan (approx. 246km²)
(1 trillion yen)

*At present, systems based on natural energies such as solar power and wind power are susceptible to output fluctuations and require back-up power sources.

[Source] TEPCO estimation, taken from "Operational Status of Nuclear Facilities in Japan"

[Source] Compiled by TEPCO based on the Nuclear Power Nation Plan
U.S.-Japan: Key Partnership for Powering the World's Energy and Environment
Copyright © 2009 TEPCO
Climate
Opinions on Global Warming

Global Warming Really Happening

- Yes: 66%
- No: 24%
- DK: 10%

Believe Global Warming Will Have Serious Impact

- Current Env.: 89%
- Future Env.: 95%
- Personal Impact: 53%
Opinions on Causes of Global Warming

Human Activity Most Responsible for Global Warming

- Transportation: 45%
- Manufacturing: 23%
- Electric Power: 9%
- DK: 14%
- Other: 9%
Awareness of the Energy and Climate Debate

How familiar are you with the debate in Washington DC about proposed new laws that would address energy issues and global warming?

- Very unfamiliar: 21%
- Somewhat unfamiliar: 15%
- Neither: 20%
- Somewhat familiar: 36%
- Very familiar: 5%
Public Understanding of Cap-and-Trade

How well do you feel you understand the term “Cap-and-Trade” in the context of Congress passing new laws to address the problem of global warming?
Reactions to Cap-and-Trade Description

- One way to reduce greenhouse gas emissions and lower the costs of compliance with a mandatory greenhouse gas reduction program is to set up a cap-and-trade system.

- Under a cap-and-trade system, a cap, or maximum limit on emissions, is set by the government. Companies that emit greenhouse gases, such as electric companies, would be required to have allowances or permits to emit specific amounts of greenhouse gases. If a company reduces its emissions below the cap, it can benefit by selling (or trading) its allowances. Companies that can’t reduce emissions will have to pay by purchasing allowances.

- A cap-and-trade system means companies that can easily and cheaply reduce emissions will do so, achieving the greenhouse gas reductions at the lowest possible cost to society.
Assuming no new policies, growth in energy-related CO2 is driven by electricity and transportation fuel use.

- **2008**
  - Electric Power: 2,359 million metric tons (41%)
  - Buildings and Industrial: 1,530 million metric tons (26%)
  - Transportation: 1,925 million metric tons (33%)
  - Total: 5,814 million metric tons

- **2035**
  - Electric Power: 2,634 million metric tons (42%)
  - Buildings and Industrial: 1,571 million metric tons (25%)
  - Transportation: 2,115 million metric tons (33%)
  - Total: 6,320 million metric tons

Growth: 8.7% between 2008 and 2035, or 0.3% per year.

Source: Annual Energy Outlook 2010
### EIA Base Case 2009

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<thead>
<tr>
<th>TECHNOLOGY</th>
<th>EIA AEO BASE CASE</th>
<th>EPRI PRISM TARGET</th>
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<td>END-USE EFFICIENCY</td>
<td>Load Growth ~ +0.95%/year</td>
<td>8% Additional Reduction in Consumption</td>
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<tr>
<td>T&amp;D EFFICIENCY</td>
<td>None</td>
<td>20% Reduction in T&amp;D Losses by 2030</td>
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<tr>
<td>RENEWABLES</td>
<td>60 GWe by 2030</td>
<td>135 GWe by 2030 (15% of Generation)</td>
</tr>
<tr>
<td>NUCLEAR</td>
<td>12.5 GWe New Build by 2030</td>
<td>No Retirements; 64 GWe New Build by 2030</td>
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<tr>
<td>FOSSIL EFFICIENCY</td>
<td>40% New Coal; 54% New NGCCs by 2030</td>
<td>+3% Efficiency for 75 GWe Existing Fleet; 49% New Coal; 70% New NGCCs by 2030</td>
</tr>
<tr>
<td>CCS</td>
<td>None</td>
<td>90% Capture for All New Coal + NGCC After 2020 Retrofits for 60 GWe</td>
</tr>
<tr>
<td>ELECTRIC TRANSPORTATION</td>
<td>None</td>
<td>100 Million PHEVs and 3x Increase in Non-Road Use by 2030</td>
</tr>
<tr>
<td>ELECTRO-TECHNOLOGIES</td>
<td>None</td>
<td>Replace ~4.5% Direct Fossil Use by 2030</td>
</tr>
</tbody>
</table>

Source: EPRI Prism/MERGE Analyses 2009
Climate

• U.S. Legislation – not this year

• World Standing – Better

• EEI supports legislation with:
  • Reasonable and Achievable Targets and Timetables
  • Allocation of Allowances
  • Price Collar
  • Offsets
Electric Vehicles
Electric Vehicles – How Many?

- Obama - Biden Campaign
  - 1 million by 2015 (United States)
- EPRI
  - 100 million by 2030 (United States)
- Boston Consulting Group
  - 14 million sold in 2020 (Global)
- IHS Global Insight
  - 20% of global market by 2030
- Mckinsey
  - 16% of new vehicle sales by 2015
Electric Vehicles – How Much?

- **Stimulus Legislation**
  - $2 billion for Advanced Automotive Battery Technologies
  - $400 million for Demonstration and Deployment Projects
  - $2500 to $7500 tax credit to first 200,000 vehicles
Electric Vehicle Benefits

• Energy Security

• Climate

• Lower operating costs
  • 100+ mpg

• Green Jobs
Electric Vehicle Concerns

• Cost of EV
  • Price parity with Internal Combustion Engine (Ford)
  • Recoup costs in 3 years or less (Ford)

• Battery Issues
  • Cost
  • Storage capacity
  • Charging Time
  • Infrastructure Requirements
  • Domestic Suppliers
Electric Vehicle Concerns

• Consumer Education
  • Higher up front costs vs. lower operating costs
  • Range limitations vs. environmental benefits
Utilities’ Role

• **Infrastructure**
  • Address any potential system impacts on electrical grid.
  • Develop comprehensive local charging infrastructure.

• **Customer Support**
  • Customer service process
  • Rate options and incentive plans
  • Streamlined charging installation process
Utilities’ Role

- Customer and Stakeholder Education
  - Education program highlighting the benefits of
    - Electric transportation
    - Electricity as an alternative fuel
  - Public-access charging infrastructure
  - Steps to get plug-in ready
  - Importance and benefits of off-peak charging

- Vehicle and Infrastructure Incentives
  - Purchase incentives
  - Tax rebates
  - Off-peak charging rates
  - Preferential and/or free parking
  - Grants charging infrastructure installation
Utilities’ Role

• Utility Fleets
  • Fleet acquisition and operations plans
  • Specifications by weight class
  • Fuel economy requirements
  • Fleet user education programs
  • Best practices
Mild and full hybrid systems dominate new light-duty vehicle sales by 2035

Source: Annual Energy Outlook 2010
Conclusion

• What’s In:
  • Smart Grid
  • Renewables
  • PHEVs
  • Efficiency
  • Technology

• What’s Not:
  • Baseload Coal
  • CO² Emissions
  • Natural Gas Cars
  • Incandescent Lighting