The Evolution of Indiana’s Supply and Demand for Energy

presented to
Indiana Conference on Energy Management
August 14, 2013

presented by
Doug Gotham
State Utility Forecasting Group
Electricity
Electricity Prices

• Electricity prices have been increasing nationally over the past decade.
• While Indiana’s price is still below the national average, our relative advantage has been declining recently.
2001 Electricity Price (cents/kWh)

IN 5.30 Rank #6

U.S. average 7.29
2006 Electricity Price (cents/kWh)

IN 6.46 Rank #10

U.S. average 8.90
2011 Electricity Price (cents/kWh)

IN 8.01 Rank #13

U.S. average 9.90
Electricity Demand

• At the bottom of the recession, utility sales in 2009 were below 2002 levels (combination of economy and cool summer)
• 2010 bounced back with a 6.7% increase in sales, primarily in the industrial and residential sectors (hot summer)
• 2011 similar to 2010 (slow economic growth offset by slightly milder weather)
Electricity Demand

• Slow demand growth can be expected in the future
  – rising electricity prices
  – utility demand-side management
  – customer-owned generation
  – efficiency standards
Net Metering

Source: IURC 2013 Net Metering Summary
Feed-in Tariffs

- IPL and NIPSCO feed-in tariff programs are essentially fully subscribed at 100 MW and 30 MW, respectively
IPL Feed-in Tariff

- 39 customers
- 100 MW
- All solar photovoltaics
  - all but 1MW are from installations above 100 kW in size
NIPSCO Feed-in Tariffs

• 67 customers
• 30 MW
  – roughly half solar-half biomass, with a small amount of wind
• 18 MW in service and 12 MW in queue
• Another 10 MW of pending applications
  – since program is full, will only make it if someone drops out
Average Energy Consumption for New Refrigerators
(kiloWatt-hours/year)

Average 1961 model had approximately 12 cu.ft. of capacity, used 1013 kWh/a and used fiberglass insulation.

1972, first oil price shocks (1726 kWh/a)

Average 1980 model had 19.6 cu.ft. of capacity, used 1278 kWh/a and used CFC-blown foam insulation.

1990 Standard (976 kWh/a)

1993 Standard (686 kWh/a)

By 2001, a typical model has 20 cu.ft. of capacity, features more through-the-door services like ice and water, uses about 63% less energy (476 kWh/a) than the 1980 models and uses ozone-friendly foam insulation.

2001 Standard (476 kWh/a)

Electricity Supply

• Coal still supplies the majority of the electricity in Indiana
  – roughly 82-85% in 2011, depending on whether you are looking at generation physically located in Indiana or generation supplying Indiana customers

• Natural gas and wind have increased noticeably
% of Indiana Generation from Various Sources


- Coal
- Natural Gas
- Wind
- Other
Environmental Regulations

• Recently finalized or proposed environmental regulations continue to put pressure on coal-fired generators
  – Cross-State Air Pollution Rule
  – Mercury and Air Toxics Standards
  – Greenhouse gases
  – Cooling water
  – Coal ash
Coal Retirements & Repowering

- Over 2,300 MW of Indiana’s coal-fired generation is expected to be retired or switched to natural gas by 2016
Natural Gas
Henry Hub Gulf Coast Natural Gas Spot Price ($/MMBTU)
Natural Gas Monthly Average Price ($/mmBtu)

- **JAN** to **DEC** (1997-2008 and 2009-2013)

<table>
<thead>
<tr>
<th>Month</th>
<th>1997-2008</th>
<th>2009-2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JUN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JUL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OCT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Average Price ($/mmBtu):**
  - JAN: $5.00
  - FEB: $4.75
  - MAR: $4.50
  - APR: $4.25
  - MAY: $4.00
  - JUN: $3.75
  - JUL: $3.50
  - AUG: $3.25
  - SEP: $3.00
  - OCT: $2.75
  - NOV: $2.50
  - DEC: $2.25

**Note:** The data for 2009-2013 is shown with a lighter color compared to 1997-2008.
Lower Natural Gas Prices

• Natural gas prices have been lower in the last five years than they were in the period previous to that.
  – Mean price from 1997-2008: $5.09/mmBtu
  – Mean price from 2009-now: $3.76/mmBtu
  – These are in nominal dollars, so adjusting for inflation would increase the price difference
Natural Gas Prices

- The relationship between NG prices and oil prices have changed.
- Prior to 2009, oil prices and NG prices were highly positively correlated
  - Henry Hub vs. WTI crude shows a correlation coefficient of 0.81
- Since 2009, the correlation is actually negative
  - correlation coefficient is -0.33
Wet Gas

- Shale gas development has been focused on wet gas (includes petroleum liquids) instead of dry gas
- High petroleum prices lead to increased shale drilling, which leads to increased NG production, which lowers the NG price
Reduced NG Price Volatility

• Natural gas prices have become much more stable as well
  – Price variance from 1997-2008: 7.05
  – Price variance from 2009-now: 0.69
• Fuel switching for electricity generation
• No major supply disruptions
Annual Price Spread (max – min) ($/mmBtu)

Note: 2013 is a partial year
Fuel Switching

- Over the past few years, there has been sufficient electricity generating capacity in the region to allow switching between natural gas-fired generators and coal-fired generators depending on the NG price
  - An increase in NG price results in switching to coal, reducing demand for NG
  - A decrease in NG price results in switching from coal, increasing demand for NG
Fuel Switching

- As coal retirements occur due to economics, environmental regulations, and age, we may not have the flexibility to switch back and forth
NG Supply Diversity

- The development of unconventional sources has increased the geographic diversity of NG supply
  - less susceptible to single event disruptions, such as hurricanes
- In 2000, six states produced at least 1Tcf
- In 2011, nine states did
From 2007 to 2011

- U.S. production ↑ by 15%, while U.S. off-shore production ↓ by 30%
- PA production ↑ by 620%
- AR production ↑ by 300%
- ND production ↑ by 120%
- IN production ↑ by 150% (but still very small)
Conventional Gas Production (2009)

Gas Production in Conventional Fields, Lower 48 States

Source: Energy Information Administration based on data from EIA, IN Geological Survey, USGS
Updated: April 8, 2009
Shale Gas

Source: Energy Information Administration based on data from various published studies. Updated: May 9, 2011
Risks For The Future

• Environmental restrictions
  – water
  – earthquakes

• Increased demand
  – LNG exports
  – transportation
  – industrial feedstock/processes
From My Crystal Ball....

• Slower demand growth for electricity
• Increasing electricity prices
• Continued reduction in reliance on coal for electricity
• Reduced natural gas price volatility, at least in the short term
Further Information

• Doug Gotham
  – 765-494-0851
  – gotham@purdue.edu

• http://www.purdue.edu/dp/energy/SUFG/