INDIANA’S ELECTRICITY SECTOR

Presented to:
Indiana Farm Bureau Energy Policy Advisory Group
Indianapolis, IN

Presented by:
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History Lesson

• Indiana experienced rapid load growth in the 1950s through the early 70s
  – 5-8% growth annually

• Indiana utilities built a significant amount of new generating capacity
  – almost all of it was coal-fired due to the relative economics at the time
Mid-70s through Mid-80s

- The energy crisis, oil embargoes, and rust belt recession caused electricity demand growth to slow
- Utility forecasts continued to project that the previous load growth would return, resulting in overbuilding of generating capacity
Marble Hill and Bailly

- In the mid-80s, Indiana had a 50% reserve margin
- Electric rates climbed
- Construction was halted on 2 nuclear plants, with one utility entering bankruptcy
- SUFG was formed in 1985 and the IURC was granted Certificate of Need authority
New Normal

- Coming out of the recession, load growth stabilized at a lower level (2-3% per year)
- Very little generating capacity was built
- Real (inflation-adjusted) electric rates start to drop
More Recently

- Boom in non-utility (merchant), natural gas-fired generation around 2000
- Real electric rates start to rise around 2003, mostly due to costs associated with environmental controls
- Recession hits in 2008-09
- Hydrofracturing results in lower natural gas prices
- Wind and biogas power start to be significant
Renewables Share of Indiana Electricity Generation

Data source: EIA
Present

• Indiana is heavily dependent on coal (76% of electricity in 2013)
  – most of our coal fleet is over 30 years old
• Electric rates are no longer in the lowest group in the nation but are still below the national average
  – 14th lowest according to EIA
• Solar is having an impact
Age of Indiana’s Coal Fleet

- ~37% of Indiana’s coal fleet is > 40 years old
- ~80% of Indiana’s coal fleet is > 30 years old
- ~98% of Indiana’s coal fleet is > 20 years old

Data source: IURC 2014 Annual Report
2013 Forecast Highlights

• 2013 forecast growth is lower than in previous forecasts due to increases in efficiency
  – Higher prices reduce customer usage
  – Utility DSM
  – Efficiency standards

• Resource requirements are lower than in previous forecasts
  – Additional resources needed by 2016
Indiana Real Price Projections (2011 $)

- Effect of inflation removed
- Includes the cost of new resources
- Includes expected cost of finalized EPA rules
  - MATS
- Non-finalized rules are not included
Indiana Electricity Requirements

- Retail sales by investor owned and not-for-profit utilities
- Includes estimated transmission and distribution losses
- Growth rates
  - 2013 forecast: 0.74%
  - 2011 forecast: 1.30%
  - 2009 forecast: 1.55%
Energy Efficiency Programs

- SEA 340 (2014) will affect the forecast
- If the utility DSM programs are added back in, energy grows at 1.17% per year
- This does not include the impact of prices changing
Retirements

• The 2013 forecast included about 2,300 MW of retirements in 2015, largely associated with MATS compliance.
• Another 430 MW of “scheduled” retirements were included between 2020 and 2029.
• Compliance with the EPA CO2 rule could result in earlier retirement of additional generation.
Indiana Resource Requirements

• Resources may be provided by conservation measures, contractual purchases, purchases of existing assets, or new construction
• Existing resources are adjusted into the future for retirements, contract expirations, and IURC approved new resources
## Indiana Resource Requirements (MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Baseload</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>120</td>
<td>410</td>
</tr>
<tr>
<td>2017</td>
<td>210</td>
<td>630</td>
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<tr>
<td>2018</td>
<td>460</td>
<td>890</td>
</tr>
<tr>
<td>2019</td>
<td>570</td>
<td>1,060</td>
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<tr>
<td>2020</td>
<td>650</td>
<td>1,280</td>
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<tr>
<td>2021</td>
<td>740</td>
<td>1,450</td>
</tr>
<tr>
<td>2022</td>
<td>790</td>
<td>1,540</td>
</tr>
<tr>
<td>2023</td>
<td>920</td>
<td>1,820</td>
</tr>
<tr>
<td>2024</td>
<td>1,060</td>
<td>2,050</td>
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<tr>
<td>2025</td>
<td>1,190</td>
<td>2,370</td>
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<tr>
<td>2026</td>
<td>1,420</td>
<td>2,790</td>
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<tr>
<td>2027</td>
<td>1,530</td>
<td>3,210</td>
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</tbody>
</table>
Residential Trends (Annual Percent Change)

<table>
<thead>
<tr>
<th>Period</th>
<th>Households</th>
<th>Electricity Rates</th>
<th>Income</th>
<th>Electricity Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965-1974</td>
<td>2.0</td>
<td>1.8</td>
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<td></td>
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<tr>
<td>1974-1984</td>
<td>1.1</td>
<td>4.7</td>
<td>0.5</td>
<td>2.1</td>
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<tr>
<td>1984-1999</td>
<td>1.3</td>
<td>3.1</td>
<td>1.3</td>
<td>2.5</td>
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<tr>
<td>1999-2005</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.5</td>
</tr>
<tr>
<td>2005-2011</td>
<td>2.3</td>
<td>2.3</td>
<td>0.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

1965-1974: 8.7%
1974-1984: 4.7%
1984-1999: 3.1%
1999-2005: 2.4%
2005-2011: 2.3%
Residential Drivers

• Households grow at an average of 1.17 percent per year (was 1.00 percent in 2011 forecast)

• Real personal income grows at an average rate of 2.73 percent per year (was 2.80 percent in 2011 forecast)

• Real electric rates increase at an average of 1.34 percent per year (increase occurs in first ten years)
Residential Electricity Sales

• Estimated from:
  – demographics
  – households
  – energy prices

• Growth rates
  – 2013 forecast: 0.37%
  – 2011 forecast: 0.71%
  – 2009 forecast: 1.75%
Commercial Trends (Annual Percent Change)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Rates</td>
<td>-3.8</td>
<td>1.3</td>
<td>-2.9</td>
<td>-2.2</td>
<td>-2.3</td>
</tr>
<tr>
<td>Energy-weighted Floorspace</td>
<td>4.3</td>
<td>2.9</td>
<td>3.1</td>
<td>1.5</td>
<td>2.1</td>
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<tr>
<td>Intensity</td>
<td>4.7</td>
<td>2.5</td>
<td>2.4</td>
<td>2.6</td>
<td>2.2</td>
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<tr>
<td>Electric Sales</td>
<td>9.0</td>
<td>-0.4</td>
<td>3.3</td>
<td>-0.4</td>
<td>-0.1</td>
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</tbody>
</table>
Commercial Drivers

• Energy-weighted floor space grows at an average rate of 0.90 percent per year (was 1.18 percent in 2011 forecast)

• Non-manufacturing employment grows at an average rate of 0.97 percent per year (was 1.31 percent in 2011 forecast)

• Real electric rates increase at an average of 1.43 percent per year (increase occurs in first ten years)
Commercial Electricity Sales

- Estimated from:
  - floor space inventory
  - end use intensity
  - employment
  - energy prices
- Growth rates
  - 2013 forecast: 0.33%
  - 2011 forecast: 0.89%
  - 2009 forecast: 1.18%
Industrial Drivers

- Manufacturing GSP grows at an average rate of 2.86 percent per year (was 3.95 percent in 2011 forecast)
- Real electric rates increase at an average of 1.56 percent per year (increase occurs in first ten years)
<table>
<thead>
<tr>
<th>SIC</th>
<th>Name</th>
<th>Current Share of GSP</th>
<th>Current Share of Electricity Sales</th>
<th>Current Intensity</th>
<th>Forecast Growth in GSP Originating by Sector</th>
<th>Forecast Growth in Electricity Intensity by Sector</th>
<th>Forecast Growth in Electricity Sales by Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Food &amp; Kindred Products</td>
<td>4.73</td>
<td>5.83</td>
<td>0.58</td>
<td>3.40</td>
<td>-1.16</td>
<td>2.24</td>
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<tr>
<td>24</td>
<td>Lumber &amp; Wood Products</td>
<td>2.63</td>
<td>0.66</td>
<td>0.12</td>
<td>3.40</td>
<td>-0.94</td>
<td>2.45</td>
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<tr>
<td>25</td>
<td>Furniture &amp; Fixtures</td>
<td>3.09</td>
<td>0.47</td>
<td>0.07</td>
<td>1.57</td>
<td>-1.09</td>
<td>0.49</td>
</tr>
<tr>
<td>26</td>
<td>Paper &amp; Allied Products</td>
<td>1.83</td>
<td>2.94</td>
<td>0.76</td>
<td>3.40</td>
<td>-0.88</td>
<td>2.52</td>
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<tr>
<td>27</td>
<td>Printing &amp; Publishing</td>
<td>3.44</td>
<td>1.24</td>
<td>0.17</td>
<td>3.40</td>
<td>-2.19</td>
<td>1.21</td>
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<tr>
<td>28</td>
<td>Chemicals &amp; Allied Products</td>
<td>16.41</td>
<td>19.98</td>
<td>0.58</td>
<td>3.40</td>
<td>-1.59</td>
<td>1.81</td>
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<tr>
<td>30</td>
<td>Rubber &amp; Plastic Products</td>
<td>3.66</td>
<td>5.76</td>
<td>0.74</td>
<td>2.85</td>
<td>-1.03</td>
<td>1.82</td>
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<tr>
<td>32</td>
<td>Stone, Clay, &amp; Glass Products</td>
<td>3.13</td>
<td>5.08</td>
<td>0.77</td>
<td>1.57</td>
<td>-0.77</td>
<td>0.80</td>
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<tr>
<td>33</td>
<td>Primary Metal Products</td>
<td>7.59</td>
<td>27.01</td>
<td>1.68</td>
<td>0.76</td>
<td>0.59</td>
<td>1.35</td>
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<tr>
<td>34</td>
<td>Fabricated Metal Products</td>
<td>5.95</td>
<td>6.39</td>
<td>0.51</td>
<td>3.20</td>
<td>-1.27</td>
<td>1.92</td>
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<tr>
<td>35</td>
<td>Industrial Machinery &amp; Equip.</td>
<td>10.42</td>
<td>4.62</td>
<td>0.21</td>
<td>2.74</td>
<td>-1.20</td>
<td>1.54</td>
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<tr>
<td>36</td>
<td>Electronic/Electric Equipment</td>
<td>5.18</td>
<td>5.87</td>
<td>0.54</td>
<td>0.71</td>
<td>-0.62</td>
<td>0.09</td>
</tr>
<tr>
<td>37</td>
<td>Transportation Equipment</td>
<td>20.01</td>
<td>8.97</td>
<td>0.21</td>
<td>3.61</td>
<td>-1.07</td>
<td>2.54</td>
</tr>
<tr>
<td>38</td>
<td>Instruments/Related Products</td>
<td>4.20</td>
<td>1.01</td>
<td>0.11</td>
<td>1.57</td>
<td>-1.86</td>
<td>-0.29</td>
</tr>
<tr>
<td>39</td>
<td>Miscellaneous Manufacturing</td>
<td>2.27</td>
<td>1.20</td>
<td>0.25</td>
<td>1.57</td>
<td>-3.32</td>
<td>-1.75</td>
</tr>
<tr>
<td></td>
<td>Total Manufacturing</td>
<td>100.00</td>
<td>100.00</td>
<td>0.47</td>
<td>2.86</td>
<td>-1.20</td>
<td>1.66</td>
</tr>
</tbody>
</table>
Industrial Electricity Sales

- Estimated from:
  - GSP by industry
  - energy prices
- Growth rates
  - 2013 forecast: 1.29%
  - 2011 forecast: 2.11%
  - 2009 forecast: 1.63%
Sources of Future Generation

- Right now, new coal cannot compete with new natural gas-fired capacity on a purely economic basis
- Renewable sources will probably continue to make some inroads
Barriers to Renewables

• Major barrier is cost
  – Most renewable technologies have high capital costs
  – According to EIA Indiana’s average electric rate in 2014 was 8.97 cents/kWh vs. the national average of 10.45 cents/kWh

• Limited availability for some resources
  – Solar/photovoltaics, hydropower

• Intermittency for some resources
  – Solar/photovoltaics, wind
Capital Costs for Various Generation Sources

Data source: EIA

- Conventional Hydropower: 2,936
- Municipal solid waste: 4,362
- Geothermal (binary): 3,873
- Photovoltaic (large 150 MW): 4,183
- Photovoltaic (small 20 MW): 2,213
- Solar Thermal: 5,067
- Wind (onshore): 4,114
- Biomass (bubbling fluidized bed): 5,530
- Biomass (combined cycle): 8,180
- Nuclear: 8,312
- Advanced combustion turbine: 676
- Conventional combustion turbine: 973
- Advanced natural gas combined cycle: 1,023
- Conventional natural gas combined cycle: 917
- Advanced pulverized coal (dual unit): 2,934

Data source: EIA
Wind

The annual wind speed estimates for this map were produced by TrueWind Solutions using their Mesometrix system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.
Energy Crops

• Transportation fuels
  – Ethanol
  – Biodiesel

• Other possibilities
  – Fast growing hardwood trees (hybrid poplar/willow)
  – Grasses (switchgrass)

• Barriers to overcome
  – Other high-value uses for the land
  – Price of competing fossil fuels
  – Harvesting and transportation costs
Organic Waste Biomass

• Until 2007, this resource was the largest source of renewable energy in Indiana, primarily due to the use of wood waste
  – Now 3rd behind ethanol and wind

• It is the 3rd largest source of renewable electricity generation in the state
  – Landfill gas
  – Municipal solid waste
  – Animal waste biogas
  – Wastewater treatment
Solar Energy

Photovoltaic capacity in Indiana

Data source: National Renewable Energy Laboratory
Photovoltaics

• Growing rapidly in Indiana, but still a small contributor overall

• 313 installations totaling over 4.4 MW of capacity
  – Fort Harrison Federal Compound
  – Metal Pro Roofing
  – Johnson Melloh

• 10 MW project under construction at Indianapolis airport

• Feed-in tariffs have large PV capacity committed
  – IPL 100 MW
  – NIPSCO 12.3 MW
Hydroelectric Power

- Indiana has 73 MW of hydroelectric generating capacity.
  - mostly run-of-the-river (no dam)
  - 2nd largest source of renewable electricity

- American Municipal Power is constructing an 84 MW facility at the Cannelton Locks on the Ohio River
  - originally expected to be operational in 2014 but has been pushed back to 2015/16
Further Information

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  – gotham@purdue.edu

• www.purdue.edu/discoverypark/energy/SUFG/