Michigan Electric Capacity Need Forum

April 22, 2005
Agenda

- Capital markets and electric generation investment
  - Ellen Lapson, Managing Director Fitch Rating’s U.S. Global Power Group
  - Jonathan Cho, Director Fitch Rating’s U.S. Global Power Group
- Work group updates
  - Work group chairs
    - Demand/Forecast
    - Central Station
    - Transmission/Distribution
    - Renewable/other generation
    - Integration
- Preliminary reliability numbers
  - Rao Konidena, MISO
- Next meeting
Comments of Fitch Ratings
Michigan Electric Capacity Need
Forum

Ellen Lapson, Managing Director Fitch Rating’s U.S. Global Power Group
Jonathan Cho, Director Fitch Rating’s U.S. Global Power Group
Demand Forecast

Chairman Eric Baker, Wolverine Power
Staff Co-chair Don Mazuchowski, MPSC Staff
Demand and Energy Forecast

- Three geographic regions – Southeast Michigan, balance of Lower Peninsula, and Upper Peninsula
- Forecast period 2005 to 2025
- Forecast based on individual participants’ forecasts
- Base forecast made along with low and high scenarios
Michigan Monthly Electricity Sales
1982 to 2004

Source: Energy Information Administration, Electric Power Monthly, prepared by MPSC Staff
http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html
Michigan Electric Demand and Energy Forecast

- Total energy sales growth 1.8%
  - Southeast Michigan energy growth 1.8%
  - Balance of Lower Peninsula growth 1.9%
  - Upper Peninsula growth .9%

- Total electric demand growth 2.1%
  - Southeast Michigan growth 1.7%
  - Balance of Lower Peninsula growth 2.7%
  - Upper Peninsula growth .9%
Michigan Electric Sales Forecasts

Gwh's

Low  Base  High

2005  2010  2015  2020  2025
Michigan Electric Demand by Geographic Region

![Bar chart showing Michigan Electric Demand by geographic region from 2005 to 2025. The regions are Southeast, Balanc L.P., and U.P. The chart indicates a trend of increasing demand over the years.](image-url)
Michigan Electricity Historical Sales and Projections

Prepared by: Demand Working Group Capacity Needs Forum, April 2005
Michigan Electricity Non-Coincident Summer Peak Demand

Forecast

- Upper Peninsula
- Balance of Lower Peninsula
- Consumers Energy
- Detroit Edison

Prepared by: Demand Working Group Capacity Needs Forum, April 2005
Michigan Electricity Sales Forecast Range

Base Case + & - 10%

Prepared by: Demand Working Group Capacity Needs Forum, April 2005
Fuel Price Forecasts

- Department of Energy’s Energy Information Agency’s (EIA’s) Annual Energy Outlook 2005
- Global Insights long-term forecast
- Other studies
United States Natural Gas Consumption by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>2002</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>5.99</td>
<td>9.43</td>
</tr>
<tr>
<td>Commercial</td>
<td>4.89</td>
<td>4.05</td>
</tr>
<tr>
<td>Industrial</td>
<td>7.53</td>
<td>9.0</td>
</tr>
<tr>
<td>Electric Power</td>
<td>5.65</td>
<td>2.2</td>
</tr>
<tr>
<td>Other</td>
<td>1.79</td>
<td></td>
</tr>
</tbody>
</table>

Total Consumption: 2002 - 28.02 TCF, 2025 - 35.03 TCF
Energy Information Agency
Long-Term Natural Gas Price Forecast

Dollars/Mcf

Real Price
Nominal Price

2003 Price

2010 2015 2020 2025
Forecast Price of Central Appalachia Bituminous Coal

Dollar/Short Ton

Source: EIA
Forecast Price of Powder River Basin Low Sulfur Coal

Dollars/Short Ton

Source: EIA
Central Station Generation

Chairman Robert Palmer, Detroit Edison Company
Staff Co-chair, John King, Commission Staff
Michigan’s Current Generation Capacity by Region

Mw’s of Capacity

Southeast Michigan
- Nuclear: 1110
- Steam: 9044
- Other: 1266

Balance of L.P.
- Nuclear: 780
- Steam: 5127
- Other: 8094

U.P.
- Nuclear: 841
- Steam: 240
- Other: 0
Central Station Generation Technologies

- Pulverized Coal – supercritical and subcritical
- Circulating Fluidized Bed
- Integrated Gasification Combined Cycle
- Nuclear
- Natural Gas Combined Cycle
- Combustion Turbine
Generating Plant Cost Assumptions

- Greenfield site
- Transmission cost associated with switchyard included
- Overnight costs included
- New pulverized coal would require scrubber, baghouse, and SCR system
- Service life assumed to be sixty years
## Production Plant Estimated Costs

<table>
<thead>
<tr>
<th>Technology</th>
<th>Size (Mw's)</th>
<th>Construction Cost $/Kw</th>
<th>Fixed O&amp;M $/Kw</th>
<th>Variable O&amp;M $/Mwh</th>
<th>Heat Rate BTU/kwh</th>
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</thead>
<tbody>
<tr>
<td>Pulverized Coal Sub-critical</td>
<td>600</td>
<td>1,350</td>
<td>27.58</td>
<td>4.56</td>
<td>8,800</td>
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<tr>
<td>Pulverized Coal Supercritical</td>
<td>750</td>
<td>1,400</td>
<td>27.58</td>
<td>4.56</td>
<td>8,600</td>
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<tr>
<td>Fluidized Bed</td>
<td>300</td>
<td>1,650</td>
<td>28.00</td>
<td>4.00</td>
<td>9,500</td>
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<tr>
<td>IGCC</td>
<td>550</td>
<td>1,899</td>
<td>38.72</td>
<td>2.92</td>
<td>7,200</td>
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<tr>
<td>Nuclear</td>
<td>1,000</td>
<td>2,200</td>
<td>67.90</td>
<td>.53</td>
<td>10,400</td>
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<tr>
<td>Combined Cycle</td>
<td>250</td>
<td>500</td>
<td>12.73</td>
<td>2.12</td>
<td>6,800</td>
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<tr>
<td>Combustion Turbine</td>
<td>160</td>
<td>350</td>
<td>3.71</td>
<td>3.71</td>
<td>10,450</td>
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</table>
## Estimated Busbar Cost

<table>
<thead>
<tr>
<th>Technology</th>
<th>Fuel Cost ($/MMBTU)</th>
<th>Capacity Factor</th>
<th>Dispatch Cost ($/Mwh)</th>
<th>Fixed Costs (Cap+O&amp;M)</th>
<th>Busbar Cost ($/Mwh)</th>
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<tbody>
<tr>
<td>Pulverized Coal Sub-critical</td>
<td>1.25</td>
<td>85%</td>
<td>16</td>
<td>25</td>
<td>41</td>
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<td>85%</td>
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<td>Fluidized Bed</td>
<td>1.25</td>
<td>85%</td>
<td>16</td>
<td>30</td>
<td>46</td>
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<td>IGCC</td>
<td>2.75</td>
<td>80%</td>
<td>23</td>
<td>38</td>
<td>61</td>
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<tr>
<td>Nuclear</td>
<td>.50</td>
<td>90%</td>
<td>6</td>
<td>42</td>
<td>48</td>
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<tr>
<td>Combined Cycle</td>
<td>6.00</td>
<td>85%</td>
<td>43</td>
<td>10</td>
<td>53</td>
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<tr>
<td>Combustion Turbine</td>
<td>6.00</td>
<td>5%</td>
<td>66</td>
<td>104</td>
<td>171</td>
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## Estimated Emissions by Technology (#/ MMBTU)

<table>
<thead>
<tr>
<th>Technology</th>
<th>SO2</th>
<th>NOx</th>
<th>Particulates</th>
<th>Hg</th>
<th>CO2</th>
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<td>.10</td>
<td>.03</td>
<td>.015</td>
<td>200</td>
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<tr>
<td>Pulverized Coal Supercritical</td>
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<td>IGCC</td>
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<tr>
<td>Combined Cycle</td>
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<td>.03</td>
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<td>0</td>
<td>120</td>
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<tr>
<td>Combustion Turbine</td>
<td>.001</td>
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<td>0</td>
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<td>0</td>
</tr>
</tbody>
</table>
Other Generation

Chairman Donald Johns, Michigan Independent Power Producers
Staff Co-chair Mark Nida, MPSC Staff
Primary Objective:

Develop a series of supply curves or other representations that can be used to model the non traditional technologies deemed capable of providing significant generation resources over the next decade or less.

Expected Deliverables:

A set of equations and/or projections of supply that can realistically be expected to be made available in an economically feasible fashion at a given price or prices along with output and emissions characteristics.
Other Generation Resources Work Group

General Principals:

- Roughly Right approach
- Commercially Available
- Significant Impact
- Aggregate Averages for Modeling Purposes
- Use whatever data is practically available
Technologies Chosen to be Modeled:

- Landfill Gas
- Anerobic Digestion
- Onshore Wind
- Industrial/large commercial cogeneration at existing sites

Other emerging technologies to be addressed in a narrative and perhaps included as an annual (small) increment to be added.
Other Generation Resources Work Group

- Preliminary Results:
- Landfill Gas: 79 MW existing with 70 MW current potential growing at 5% per year @ 7 cents per kWh.
- 95% capacity factor must run generation.
- Farm Digestion: 56 MW potential @ 7 cents per kWh. 96% capacity factor must run generation.
- Wind: 420 MW potential @ 7 cents per kWh or $1200 per kW. 25% average capacity factor. Assumes 50% of all h class 4 or greater.
- Cogeneration: Sites greater 100 MLbs per
Transmission

Chairman Tom Vitez, International Transmission Company
Staff Co-chair Peter Derkos
Function And Responsibility

- Oversee integration function (modeling).
- Review other workgroup products for input into the integration model.
- Selection of sensitivities and scenarios.
- Make sure data used is comparable.
- Select/approve fuel and other economic data.
Function And Responsibility

- Review model output
Proposed Integration Methodology

- Use MISO’s modeling capability to quantify capacity needs.
- Use ITC’s power flow modeling to determine import capacity.
- Use New Energy’s Strategist to select a resource additions plan.
- Use Scenarios to quantify Energy Conservation and Emissions issues.
- Regional modeling to reflect constraint issues.
Scenarios

- Traditional power sources
- Emissions
- Energy conservation
- Non-Traditional sources
Sensitivities

- High Load
- Low Load
- High Gas Cost
- Max Import