Montana Energy Issues

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What’s New in the Bakken?
Oil Prices

Source: Federal Reserve Bank of St. Louis
Future Oil Price Trends

• Global slowdown Will dampen demand

• OPEC supply cut agreement extended

• Mideast oil supply disruptions possible
Global breakeven prices (considering only technical extraction costs) versus production. Source: Alliance Bernstein, October 2014
Technology has reduced extraction costs, but some sites are better than others

2018 Estimated Break Even Costs

- Dunn County $11
- Mckenzie County 12
- Mountrail County 12
- Burke County 40
- Golden Valley 100

North Dakota Average $13

Source: North Dakota Department of Mineral Resources
Monthly Oil Production by County

Barrels per Month

Millions

Richland
Roosevelt
Powder River
Fallon
Dawson

Source: Montana Board of Oil and Gas
<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Richland Cty, MT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Jobs</td>
<td>6,775</td>
<td>6,747</td>
<td>6,423</td>
</tr>
<tr>
<td>Live in Richland</td>
<td>3,953</td>
<td>4,265</td>
<td>4,957</td>
</tr>
<tr>
<td>Live Elsewhere</td>
<td>2,822</td>
<td>2,482</td>
<td>1,826</td>
</tr>
<tr>
<td><strong>Williams Cty, ND</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total Jobs</td>
<td>35,395</td>
<td>39,464</td>
<td>36,948</td>
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<tr>
<td>Live in Williams</td>
<td>15,732</td>
<td>17,369</td>
<td>18,507</td>
</tr>
<tr>
<td>Live Elsewhere</td>
<td>19,063</td>
<td>22,096</td>
<td>18,441</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau
The Long Road Ahead For Clean Energy in Montana
EXPAND CLEAN ENERGY IN MONTANA

• “It’s time to shift the state’s energy recourses away from greenhouse gas-emitting fossil fuels toward renewable energy.”

• “We Montanans can transform ourselves from being the West’s leader in greenhouse-gas pollution to the first state that commits to 100 percent reliance on clean energy.”

• “Few states are blessed with Montana’s wind and solar resources.”

• Missoulian 10/17/2017
## Wind Generation Potential

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>50 Meter (MW)</th>
<th>80 Meter (MW)</th>
<th>100 Meter (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North Dakota</td>
<td>480,000</td>
<td>Texas 1,901,530</td>
<td>Texas 2,320,792</td>
</tr>
<tr>
<td>2</td>
<td>Texas</td>
<td>470,000</td>
<td>Kansas 952,371</td>
<td>Montana 1,012,355</td>
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<tr>
<td>3</td>
<td>Kansas</td>
<td>420,000</td>
<td>Montana 944,004</td>
<td>Kansas 955,239</td>
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<tr>
<td>4</td>
<td>Montana</td>
<td>410,000</td>
<td>Nebraska 917,999</td>
<td>Nebraska 921,075</td>
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<tr>
<td>5</td>
<td>South Dakota</td>
<td>400,000</td>
<td>South Dakota 882,412</td>
<td>South Dakota 890,626</td>
</tr>
</tbody>
</table>

Source: American Wind Energy Association and U.S. Renewable Energy Laboratory
## Electric Generation in Montana 2015

<table>
<thead>
<tr>
<th></th>
<th>Capacity</th>
<th>Generation</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>MW</td>
<td>Percent</td>
</tr>
<tr>
<td>Total</td>
<td>6,367</td>
<td>100</td>
</tr>
<tr>
<td>Coal Generation</td>
<td>2,488</td>
<td>39.1</td>
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<tr>
<td>Hydro Generation</td>
<td>2,628</td>
<td>41.3</td>
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<tr>
<td>Gas Generation</td>
<td>456</td>
<td>7.2</td>
</tr>
<tr>
<td>Wind Generation</td>
<td>662</td>
<td>10.4</td>
</tr>
<tr>
<td>All Other Generation</td>
<td>133</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: U.S. Energy Information Agency
Montana Energy Issues
Weekly Load

KWH

Montana Energy Issues
Montana Monthly Electric Sales

KHW in Millions

Montana Energy Issues

Source: U.S. Energy Information Agency
Montana Monthly Wind Generation

Source: U.S. Energy Information Agency
Montana Electric Sales and Wind Generation 2015 to 2017

- Electric Sales
- Wind Generation
Types of Solar Generation

• Utility-scale solar generation. Large solar generation facilities that sell electricity to wholesale utility buyers.

• Distributed solar generation. Relatively small (e.g. rooftop, residential) electric generation serving end-use consumers. May sell excess generation back to utility.
Distribution of solar power plants in the Lower 48 states (as of December 2016)

- Capacity
  - 586 MW
  - 0.1 MW

- solar thermal
- solar photovoltaic

EIA

Montana Energy Issues
Dispatchable Generation (easy on-off)

• Gas Generation
• Pumped Storage
• Hydro (sometimes)
Integrated Proposal

Cost $ + $ = $$

- Renewable Sources
- Dispatchable Sources