Overview of Western Renewable Energy Markets and Transmission Planning

Scott Haase
David Hurlbut

BLM Transmission Training Webinar Series

Webinar 1

October 23, 2012
MAP Pending High Voltage Tlines
Webinar 1 Objectives

• Provide an overview of renewable energy markets and development activities within the western United States (2010-2020 timeframe)

• Understand the transmission planning process in the western U.S.: key players, policies, regulations and drivers

• Within the context of these drivers, understand the current and future potential of BLM’s renewable energy and transmission projects
Presenters

• Scott Haase, Senior Engineer/DOI Liaison

• David Hurlbut, Ph.D., Senior Economist
Section 1:
Renewable Energy Markets and Drivers: 2020 Crystal Ball
General Background of BLM Drivers

- Energy Policy Act of 2005 established BLM goal to permit 10,000 MW of renewable energy on public lands by 2015
- Secretary Salazar has elevated the priority of renewable energy and transmission planning within DOI
- BLM has instituted activities to help meet these objectives:
  - Renewable Energy Coordination Offices, Solar PEIS, high priority projects
  - Interagency coordination and weekly strike team meetings
  - Rapid Response Transmission Team
- State based actions
  - California: Renewable Energy Action Team; Desert Renewable Energy Conservation Plan
  - Arizona: Restoration Design Project
- Fundamental question: How do all of these BLM activities fit within the broader context of energy markets and transmission planning efforts in the western U.S., and how can we optimize the value of the BLM assets?
Western Region Renewable Energy Markets: Implications for the Bureau of Land Management
Scott Haase, Lynn Billman, and Rachel Gelman

Produced under direction of the Bureau of Land Management by the National Renewable Energy Laboratory (NREL) under Interagency Agreement L11FO00000 and Task No WF17.100H.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Technical Report NREL/TP-6A30-53540
January 2012
Contract No. DE-AC36-08GO28308

http://www.nrel.gov/docs/fy12osti/53540.pdf
Study Overview

- Develop current electricity supply and demand profiles for 11 western states in the territory of the Western Electricity Coordinating Council (WECC)*
- Estimate 2020 demand for renewable energy
  - based only on existing renewable portfolio standards (RPS)
  - estimate 2020 projected load
- Estimate new renewable generation under construction or advanced development in WECC
- Evaluate balance between planned supply and projected demand
- Assist BLM with understanding how its projects fit within this broader market context

* Throughout this document, “WECC” refers to only the 11 U.S. states in WECC, not British Columbia or Mexico
Caveats

- Data herein represent a snapshot in time from the summer and fall of 2011
  - Estimate of current and expected future development
- Gathering the data is difficult – no central repository
- Renewable demand forecasts based on current RPS requirements:
  - Some would like to expand these
  - Some would like to roll back RPS (e.g. NM HB 546)
- Utilities scaling back future load expectations due to poor economy, which impacts 2020 RPS needs
  - (e.g. Xcel Energy PUC filing on 10/31/11 stating it only needs 292 MW of new generation by 2018, not 1,000)
- As cost of renewable energy decreases, utilities may go beyond RPS limits
- Low natural gas prices are impacting renewable development
## Project Applications on BLM Land (MW, as of November 2011)

<table>
<thead>
<tr>
<th>Geothermal Approved (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>128</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>278</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solar Authorized (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>654</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4,242</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wind Authorized (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>296</td>
<td>0</td>
<td>139</td>
<td>0</td>
<td>150</td>
<td>0</td>
<td>80</td>
<td>0</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>716</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Approved or Authorized (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>4,034</td>
<td>0</td>
<td>139</td>
<td>0</td>
<td>932</td>
<td>0</td>
<td>80</td>
<td>0</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>5,236</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Geothermal Pending (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>298</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>584</td>
<td>15</td>
<td>23</td>
<td>37</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>970</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solar Pending (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,308</td>
<td>11,618</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16,437</td>
<td>2,200</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>48,563</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wind Pending (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>2,272</td>
<td>0</td>
<td>465</td>
<td>0</td>
<td>1,780</td>
<td>0</td>
<td>604</td>
<td>593</td>
<td>90</td>
<td>2,073</td>
<td>0</td>
<td>8,377</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Pending (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,808</td>
<td>14,188</td>
<td>478</td>
<td>0</td>
<td>0</td>
<td>18,801</td>
<td>2,215</td>
<td>627</td>
<td>630</td>
<td>90</td>
<td>2,073</td>
<td>0</td>
<td>57,910</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Approved and Pending (MW)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,838</td>
<td>18,222</td>
<td>617</td>
<td>0</td>
<td>0</td>
<td>19,733</td>
<td>2,215</td>
<td>627</td>
<td>710</td>
<td>90</td>
<td>2,094</td>
<td>0</td>
<td>63,146</td>
</tr>
</tbody>
</table>
Total WECC generation: 731,000 GWh (18% of US)

- 7.7% non-hydro renewable (~54,000 GWh)
- 30% renewable w/hydro
- 60% coal and gas
- 40% CO₂ neutral or zero (nuclear, hydro, RE)
2010 Generation Mix, by State (GWh)

CA represents 38% of WECC’s load but only 28% of generation.
### Summary of Western Renewable Portfolio Standards

<table>
<thead>
<tr>
<th>Capacity Factor for Non-Specified RE Generation</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total WECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>4,882</td>
<td>89,259</td>
<td>12,227</td>
<td>n/a</td>
<td>1,508</td>
<td>7,464</td>
<td>3,814</td>
<td>7,610</td>
<td>n/a</td>
<td>n/a</td>
<td>134,372</td>
<td></td>
</tr>
</tbody>
</table>

**Total RPS Qualifying Generation Needed in 2020 (GWh) (Barbose 2011)**

- **Utility Scale and Non Set Aside Capacity Required in 2020 to Meet RPS**
  - A: High Capacity Factor, Low Capacity (MW)
    - 53%: 736, 18,653, 2,741, 325, 793, 446, 1,713, 1,807, 27,205
  - B: LBNL Capacity Factors (Barbose 2011) (MW)
    - Various: 771, 27,944, 2,741, 382, 783, 473, 1,791, 34,886
  - C: Low Capacity Factor, High Capacity (MW)
    - 26%: 1,499, 31,354, 2,741, 662, 783, 909, 3,059, 3,238, 44,247

- **Distributed Generation and Set Aside Capacity in 2020 (MW) (Barbose 2011)**
  - 644, 112, 512, 20, 1,288

- **Total Capacity Required in 2020 to Meet RPS**
  - A: High Capacity Factor, Low Capacity (MW)
    - 53%: 1,380, 18,653, 2,741, 325, 896, 958, 1,733, 1,807, 28,493
  - B: LBNL Capacity Factors (Barbose 2011) (MW)
    - Various: 1,415, 27,944, 2,741, 382, 896, 985, 1,811, 2,952, 39,126
  - C: Low Capacity Factor, High Capacity (MW)
    - 26%: 2,144, 31,354, 2,741, 662, 896, 1,421, 3,079, 3,238, 45,535

AB 32 requires 80% reduction in GHG emissions over 1990 levels by 2050

CEC estimates approx 40,000 MW needed by 2040 to be on track to meet this law

- **The biggest driver for RE in the U.S. remains state based renewable portfolio standards, which typically require that a certain % of the energy used to meet demand in the state comes from renewable sources.**
- **Of the 11 states in the western U.S. only ID, UT and WY do not have an RPS**
- **There are other drivers but these will have less of an influence moving forward – tax credits for wind expiring this year; Cash in lieu of tax credit (1603) has ended; loan guarantee program has challenges**
- **No significant national legislation is expected (e.g. climate bill, national RPS)**
## 2010 Progress Towards Meeting State RPS Requirements (GWh)

<table>
<thead>
<tr>
<th>2010 Actual RE Generation (GWh) (Plants Located within the State)</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total WECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 RPS Requirement (GWh)</td>
<td>1,016</td>
<td>41,902</td>
<td>1,700</td>
<td>(a)</td>
<td>692</td>
<td>3,381</td>
<td>852</td>
<td>(a)</td>
<td>(a)</td>
<td>(a)</td>
<td>(a)</td>
<td>49,544</td>
</tr>
<tr>
<td>Total (Excluding Hydropower(^1))</td>
<td>319</td>
<td>25,450</td>
<td>3,555</td>
<td>1,014</td>
<td>1,027</td>
<td>2,287</td>
<td>1,855</td>
<td>4,757</td>
<td>3,369</td>
<td>6,617</td>
<td>3,247</td>
<td>53,496</td>
</tr>
<tr>
<td>Biomass</td>
<td>168</td>
<td>6,002</td>
<td>60</td>
<td>501</td>
<td>97</td>
<td>0</td>
<td>14</td>
<td>837</td>
<td>56</td>
<td>1,872</td>
<td>0</td>
<td>9,608</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0</td>
<td>12,600</td>
<td>0</td>
<td>72</td>
<td>0</td>
<td>2,070</td>
<td>0</td>
<td>0</td>
<td>2,865</td>
<td>0</td>
<td>0</td>
<td>17,607</td>
</tr>
<tr>
<td>Solar</td>
<td>16</td>
<td>769</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td>217</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,053</td>
</tr>
<tr>
<td>Wind</td>
<td>135</td>
<td>6,079</td>
<td>3,452</td>
<td>441</td>
<td>930</td>
<td>0</td>
<td>1,832</td>
<td>3,920</td>
<td>448</td>
<td>4,745</td>
<td>3,247</td>
<td>25,228</td>
</tr>
<tr>
<td>Hydro</td>
<td>6,622</td>
<td>33,431</td>
<td>1,578</td>
<td>9,154</td>
<td>9,415</td>
<td>2,157</td>
<td>217</td>
<td>30,542</td>
<td>696</td>
<td>68,288</td>
<td>1,024</td>
<td>163,125</td>
</tr>
</tbody>
</table>

- (a) – Oregon RPS started in 2011 and Washington in 2012; ID, UT, WY do not have RPS
## WECC 2010 Installed Renewable Capacity (MW)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11,854</td>
<td>128</td>
<td>40</td>
<td>23</td>
<td>3</td>
<td>0</td>
<td>194</td>
</tr>
<tr>
<td>Arizona</td>
<td>1,418</td>
<td>3,124</td>
<td>1,200</td>
<td>175</td>
<td>413</td>
<td>2,968</td>
<td>7,880</td>
</tr>
<tr>
<td>California</td>
<td>2,086</td>
<td>1,297</td>
<td>21</td>
<td>136</td>
<td>0</td>
<td>0</td>
<td>1,372</td>
</tr>
<tr>
<td>Colorado</td>
<td>1,148</td>
<td>288</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>441</td>
</tr>
<tr>
<td>Idaho</td>
<td>222</td>
<td>385</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>404</td>
</tr>
<tr>
<td>Montana</td>
<td>2,204</td>
<td>701</td>
<td>7</td>
<td>77</td>
<td>76</td>
<td>437</td>
<td>589</td>
</tr>
<tr>
<td>Nevada</td>
<td>204</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>738</td>
</tr>
<tr>
<td>New Mexico</td>
<td>461</td>
<td>2,046</td>
<td>12</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>2,558</td>
</tr>
<tr>
<td>Oregon</td>
<td>0</td>
<td>12</td>
<td>346</td>
<td>0</td>
<td>0</td>
<td>52</td>
<td>2547</td>
</tr>
<tr>
<td>Utah</td>
<td>461</td>
<td>2,086</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1,419</td>
</tr>
<tr>
<td>Washington</td>
<td>0</td>
<td>2,046</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2,547</td>
</tr>
<tr>
<td>Wyoming</td>
<td>11,854</td>
<td>128</td>
<td>40</td>
<td>23</td>
<td>3</td>
<td>0</td>
<td>194</td>
</tr>
<tr>
<td><strong>Percent</strong></td>
<td><strong>64%</strong></td>
<td><strong>12%</strong></td>
<td><strong>2%</strong></td>
<td><strong>3%</strong></td>
<td><strong>19%</strong></td>
<td><strong>100%</strong></td>
<td><strong>18,429</strong></td>
</tr>
</tbody>
</table>

- PV: does not include off-grid or customer sited (net-metered) systems
- California has 43% of the generation, more than three times next closest states (WA, OR)
The Crystal Ball:

2020 Projections for Load and RPS-Driven Demand (GWh)
2010 - 2035 Projected Load and RPS Eligible Load (GWh)

Projected Load Growth

Source: Galen Barbose, LBNL. 2011
## Projects Under Construction or Advanced Development in the WECC Region (MW)

|          | Arizona | California | Colorado | Idaho | Montana | Nevada | New Mexico | Oregon | Utah | Washington | Wyoming | Total |
|----------|---------|------------|----------|-------|---------|--------|------------|--------|      |            |         |       |
| Wind (MW)| 229     | 2,842      | 29       | 472   | 300     | 152    | 125        | 655    | 0     | 1,160       | 2,841   | 8,805 |
| Biomass (MW)| 0       | 98         | 0        | 9     | 0       | 14     | 0          | 20     | 0     | 0           | 0       | 141   |
| Solar (MW)| 703     | 6,659      | 62       | 20    | 0       | 1,053  | 5          | 14     | 0     | 75          | 0       | 8,590 |
| Geothermal (MW)| 113   | 769        | 0        | 63    | 0       | 155    | 0          | 174    | 0     | 10          | 0       | 1,283 |
| Hydro (MW)| 0       | 1,756      | 0        | 0     | 1       | 0      | 0          | 2,013  | 0     | 58          | 5       | 3,833 |
| Renewable Energy Total Including Hydropower (MW) | 1,045 | 12,124 | 91 | 564 | 301 | 1,374 | 130 | 2,876 | 0 | 1,303 | 2,846 | 22,653 |
| Renewable Energy Total Excluding Hydropower (MW) | 1,045 | 10,367 | 91 | 564 | 300 | 1,374 | 130 | 864 | 0 | 1,245 | 2,841 | 18,820 |

**Source:** SNL Financial, 2011

Advanced development means at least two of the following have been met: 1) Signed PPA; 2) all permits obtained; 3) EPC contractor hired; 4) financing finalized; 5) major equipment ordered.
## Estimated 2020 Gap or Oversupply (MW)

**Note:** 3,800 MW of hydro not included in the supply numbers.

<table>
<thead>
<tr>
<th>SUPPLY</th>
<th>Arizona</th>
<th>California</th>
<th>Colorado</th>
<th>Idaho</th>
<th>Montana</th>
<th>Nevada</th>
<th>New Mexico</th>
<th>Oregon</th>
<th>Utah</th>
<th>Washington</th>
<th>Wyoming</th>
<th>Total WECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Renewable Energy Plant Capacity (MW)</td>
<td>194</td>
<td>7,880</td>
<td>1,372</td>
<td>441</td>
<td>404</td>
<td>589</td>
<td>738</td>
<td>2,558</td>
<td>287</td>
<td>2,547</td>
<td>1,419</td>
<td><strong>18,429</strong></td>
</tr>
<tr>
<td>Planned Renewable Energy Projects Capacity (MW)</td>
<td>1,045</td>
<td>10,367</td>
<td>91</td>
<td>564</td>
<td>300</td>
<td>1,374</td>
<td>130</td>
<td>864</td>
<td>0</td>
<td>1,245</td>
<td>2,841</td>
<td><strong>18,820</strong></td>
</tr>
<tr>
<td>Sum of Existing and Planned Renewable Energy Capacity (MW)</td>
<td>1,239</td>
<td>18,247</td>
<td>1,462</td>
<td>1,005</td>
<td>704</td>
<td>1,963</td>
<td>868</td>
<td>3,422</td>
<td>287</td>
<td>3,792</td>
<td>4,260</td>
<td><strong>37,249</strong></td>
</tr>
</tbody>
</table>

| DEMAND | Capacity Required in 2020 to Meet Current RPS Requirements (MW) | A | High Capacity Factor, Low Capacity (MW) | 1,380 | 18,653 | 2,741 | 0 | 325 | 958 | 896 | 1,733 | 0 | 1,807 | 0 | **28,493** |
| B | LBNL Capacity Factors (Barbose 2011) (MW) | 1,415 | 27,944 | 2,741 | 0 | 382 | 896 | 985 | 1,811 | 0 | 2,952 | 0 | **39,126** |
| C | Low Capacity Factor, High Capacity (MW) | 2,144 | 31,354 | 2,741 | 0 | 662 | 1,421 | 896 | 3,079 | 0 | 3,238 | 0 | **45,535** |

| GAP | Oversupply or (Unmet Demand) in 2020 | A | High Capacity Factor, Low Capacity (MW) | (141) | (406) | (1,279) | 1,005 | 379 | 1,005 | (28) | 1,689 | 287 | 1,985 | 4,260 | **8,756** |
| B | LBNL Capacity Factors (Barbose 2011) (MW) | (176) | (9,697) | (1,279) | 1,005 | 322 | 1,067 | (117) | 1,611 | 287 | 840 | 4,260 | **(1,877)** |
| C | Low Capacity Factor, High Capacity (MW) | (905) | (13,107) | (1,279) | 1,005 | 42 | 542 | (28) | 343 | 287 | 554 | 4,260 | **(8,286)** |
Transmission Context

- BLM and WECC Foundational lines are mapped in the market assessment report, and BLM project locations plotted against these
- Latest WECC Ten Year Study summarized
- Seven pilot lines (focus of the Rapid Response Transmission Team)
  - How to best align BLM renewable energy program with ongoing transmission planning efforts?
- Several BLM Solar Energy Zones are being evaluated by WECC in current transmission studies
- David Hurlbut will talk more about transmission in next part of this webinar
All Projects W/in 5 Miles of AC Line
Major Findings

- **37,249 MW of renewables already constructed or under advanced development**
  - Projected 2020 Demand: 28,493 to 45,535 MW
  - Either already have what we need, need 8,700 more MW, or have overbuilt by 8,200 MW
- **California is likely to dominate the market for foreseeable future**
- **If constructed, the BLM projects presently approved will account for ~10% of 2020 renewable energy demand in WECC**
- **BLM pending applications = pool of potential projects moving forward**
Opportunities for BLM

• **Increase the strategic value of BLM projects**
  - Which SEZ’s and projects have highest values? Look for the “filet mignon” of zones and projects, and optimize the value
  - Locate RE near critical loads and infrastructure, so as to optimize economic value while minimizing transmission
    - For example, explore the feasibility of siting solar projects on Reclamation and BLM lands near pumping stations along the Central Arizona Project (or other water supply projects).

• Likely to see increased interest in projects closer to load (e.g. 10-20 MW infill projects)

• **Look for synergies across previously disturbed lands**

• **Coordinate across all land ownerships to optimize sites**
  - DoD needs 2,000 MW to meet internal goals;
  - possible joint BLM/DoD projects?
Other Efforts

  - technically feasible to obtain up to 80% renewable energy by 2050 across all of U.S. with today’s technologies and a more flexible electric system

  - Value to the grid from a portfolio of renewable energy technologies, especially CSP with storage
  - True value of geographic diversity
Transmission 101: Components, Functions

Bureau of Land Management
Transmission Training Webinar

David Hurlbut

October 23, 2012
Outline

• What are the grid’s major geographic pieces?
• Who are the players, and what does each do?
• What drives the need for new transmission in the West?
The Pieces (by Size)

Interconnection

Regional Reliability Organizations

Balancing Authority (BA) Areas

Regional Transmission Organizations (RTOs)

Transmission Owners
- Incumbent Utilities
- Non-incumbent Utilities
- Merchant Transmission
Interconnections

• Major U.S. interconnections: Western, Eastern, Texas

• Defined by physical ability to transfer power anywhere on the alternating current (AC) network

• Power flows between interconnections require AC-DC-AC transformers
Regional Reliability Organizations

• Ensure that the RRO’s defined area of the bulk electric transmission system is reliable, adequate and secure

• Are generally subdivisions within an interconnection, although:
  - Western Electric Coordinating Council (WECC) functions as the RRO for the entire Western Interconnection
  - The Electric Reliability Council of Texas (ERCOT) functions as the RRO for the entire Texas Interconnection
Interconnections, Reliability Organizations
BAs and RTOs

- BAs and RTOs conduct daily grid operations
- Operations must conform to standards established by the RRO
- BAs and RTOs differ with respect to:
  - The amount of operational control retained by transmission owners
  - Commercial transactions
Balancing Authorities

• Control center for all metered points (generators, substations, interchanges) in the BA area

• BA responsibilities
  o Integrate resource plans ahead of time
    – Next-day hourly load forecasts
    – Scheduled dispatch from all generators in the BA area
  o Maintain load-interchange-generation balance within the BA area throughout the operating day
    \[ \text{generation} + \text{imports} \pm \text{deployed reserves} = \text{load} + \text{exports} \]
  o Support interconnection frequency in real time
Transmission Owners in a BA Area

• Operate their systems in accordance with FERC-approved open access transmission tariff (OATT)

• Provide service to transmission customers on a nondiscriminatory basis, under approved OATT rates
  ○ “Rate pancaking”: accumulation of transmission charges by wheeling power through two or more transmission systems
Balancing Authorities in WECC
Regional Transmission Organizations

• Created to facilitate competitive restructuring of wholesale power markets
• Often combined several BA areas into one consolidated operating region
• Consolidated RTO tariff instead of separate tariffs for each transmission owner
• RTO integrates load/resource schedules, conducts market for allocating transmission capacity
• Conducts independent market operations setting wholesale prices and determining generator dispatch
  o No rate pancaking within an RTO
Regional Transmission Organizations

Alberta Electric System Operator (AESO)
California ISO (CAISO)
Ontario Independent Electricity System Operator (OIESO)
New York ISO (NYISO)
ISO New England (ISO-NE)
New Brunswick System Operator (NBSO)
Midwest ISO (MISO)
PJM Interconnection (PJM)
Southwest Power Pool (SPP)

Regional Transmission Organizations

This map was created using Energy Velocity, October 2011
Drivers for New Transmission

• **Reliability**
  - Avoid blackouts, power fluctuations
  - An upgrade at a weak point of the transmission system can decrease the probability of load loss

• **Economic**
  - Transmission to increase dispatch from least-cost generators
  - Increase access to least-cost renewables
Who Pays?

• **Historically, everyone**
  
  o When regulated monopolies dominated the utility sector, capital cost of new transmission was added to all other existing capital costs, and applied to rates for all utility customers, on the assumption that the network was the asset

• **Today, trend towards participant funding**
  
  o Some new and proposed lines have distinct specific beneficiaries; risk and cost recovery can be limited to the customers likely to use the line
Who Decides?

• Need for the line
  o Utility and its regulators, focusing on utility’s ability to serve captured customer base

• How much to charge, rules for access
  o Federal Energy Regulatory Commission (FERC)

• Routing and permitting
  o State (particularly when eminent domain is used)
  o Public lands agencies
Crossed Wires over Transmission Planning

• Cost allocation
• Incorporating public policy objectives
  o Least-cost renewable energy resources
• Consolidated operations over several BA areas
• Transformation of the electricity sector
Questions?

David Hurlbut
david.hurlbut@nrel.gov
Kim Berns, Division Chief
Division of Lands, Realty & Cadastral Survey
BLM – Washington Office
kmberns@blm.gov
202-912-7350

Lucas Lucero, Rights-of-Way Branch Chief
BLM - Washington Office
llucero@blm.gov
202-912-7342

Beth Ransel, Linear ROW/Master Agreements Program Lead
BLM – Washington Office
bransel@blm.gov
202-912-7213