Technical Conference on Environmental Regulations and Electric Reliability, Wholesale Electricity Markets, and Energy Infrastructure

Western Region

February 25, 2015       Denver, CO
Western Region States

- WA
- OR
- ID
- MT
- WY
- NV
- UT
- CO
- AZ
- NM

States in the Western Region of the United States.
Installed Capacity and Generation

Source: Based on data derived from Ventyx, Velocity Suite, January 2015.

Current Installed Capacity
225,130 MW

2012 Generation
739,906 GWh
Electricity Generation by Sub Regions

- **Basin**: 83,212 GWh
  - Coal: 63%
  - Natural Gas: 15%
  - Water: 14%
  - Geothermal: 3%
  - Other: 1%

- **CA N**: 114,573 GWh
  - Natural Gas: 53%
  - Water: 18%
  - Nuclear: 16%
  - Geothermal: 6%
  - Other: 3%

- **CA S**: 83,605 GWh
  - Natural Gas: 73%
  - Nuclear: 1%
  - Water: 7%
  - Geothermal: 8%
  - Other: 4%

- **Desert SW**: 170,669 GWh
  - Coal: 39%
  - Natural Gas: 34%
  - Nuclear: 19%
  - Water: 6%
  - Geothermal: 2%

- **NWPP**: 206,324 GWh
  - Water: 68%
  - Coal: 10%
  - Natural Gas: 9%
  - Nuclear: 5%
  - Geothermal: 7%
  - Other: 1%

- **RMPA**: 81,517 GWh
  - Coal: 72%
  - Natural Gas: 13%
  - Water: 3%
  - Geothermal: 12%
  - Other: 4%

Source: Data derived from Ventyx, Velocity Suite, January, 2015.
Projected 24,940 MW Capacity Additions by 2025

Another 109,099 MW are in early development stage.

Source: Data derived from Ventyx, Velocity Suite, January, 2015.
Peak Demand

Source: The North American Electric Reliability Corporation's (NERC's) 2014 Electric Supply and Demand Database.
Net inter-regional deliverability 2012 (in GWh)

- Imports: 8,576 GWh
- Exports: 4,367 GWh
- Net Imports: 4,209 GWh

Source: Data derived from Ventyx, Velocity Suite, January, 2015.
**Existing Transmission**

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>Line Length (Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>35,334</td>
</tr>
<tr>
<td>345</td>
<td>11,516</td>
</tr>
<tr>
<td>500</td>
<td>17,184</td>
</tr>
<tr>
<td>DC</td>
<td>1,651</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>65,685</strong></td>
</tr>
</tbody>
</table>

Source: Data Derived from 2014 NERC Electric Supply and Demand Database; Ventyx, Velocity Suite, February 2015 and Staff Database.
Projected Transmission through 2030

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>Line Length (Miles)</th>
<th>Investment Cost (Millions $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>3,271</td>
<td>8,550</td>
</tr>
<tr>
<td>345</td>
<td>1,416</td>
<td>2,905</td>
</tr>
<tr>
<td>500</td>
<td>4,990</td>
<td>17,260</td>
</tr>
<tr>
<td>DC</td>
<td>3,335</td>
<td>15,229</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13,012</strong></td>
<td><strong>43,944</strong></td>
</tr>
</tbody>
</table>

Source: Data Derived from 2014 NERC Electric Supply and Demand Database; Ventyx, Velocity Suite, February 2015 and Staff Database.
Electricity Prices 2014 ($/MWh)

All prices are average on-peak day-ahead market prices.

- Mid-Columbia: $38.37
- NP-15: $51.06
- Palo Verde: $42.07

Source: Derived from Platts and ISO data.
GAS INFRASTRUCTURE
Source: Data derived from Ventyx, Velocity Suite January 2015; ICF International January 2015 Data Base; and FERC’s Jurisdictional Storage Fields in the US.
Western Region Natural Gas Consumption

Source: ICF International January 2015 Data Base and Compass Report
Western Region Natural Gas Production by Type

Actual

Projected

Tcf


Conventional  Shale  Coalbed Methane  Tight Sands

Source: ICF International January 2015 Data Base and Compass Report
## Gas Facts (In Tcf)

<table>
<thead>
<tr>
<th></th>
<th>2013 United States</th>
<th>2013 West</th>
<th>2020 United States</th>
<th>2020 West</th>
<th>2030 United States</th>
<th>2030 West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Gas Consumption</td>
<td>26.4</td>
<td>4.9</td>
<td>27.6</td>
<td>4.7</td>
<td>31.3</td>
<td>5.1</td>
</tr>
<tr>
<td>Total Gas Production</td>
<td>24.3</td>
<td>4.5</td>
<td>30.4</td>
<td>4.5</td>
<td>36.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Total Working Storage Capacity</td>
<td>4.4</td>
<td>0.6</td>
<td>4.7</td>
<td>0.7</td>
<td>4.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Total LNG Imports</td>
<td>0.1</td>
<td>0.0</td>
<td>0.19</td>
<td>0.0</td>
<td>2.0</td>
<td>0.00</td>
</tr>
<tr>
<td>Total LNG Exports</td>
<td>0.0</td>
<td>0.0</td>
<td>2.38</td>
<td>0.0</td>
<td>2.41</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Net Imports from Canada</td>
<td>1.9</td>
<td>1.0</td>
<td>1.4</td>
<td>1.0</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Total Net Exports to Mexico</td>
<td>0.7</td>
<td>0.2</td>
<td>1.9</td>
<td>0.3</td>
<td>2.5</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Source: ICF International Q4 2013 and Q1 2015 Data Bases and Compass Reports, and EIA Spreadsheets for 2013 data on LNG imports, and Canadian & Mexican import/exports.
Actual and Projected Net Canadian Imports to U.S.

Source: ICF International January 2015 Data Base and Compass Report; and EIA Natural Gas Annuals and Spreadsheets
Actual and Projected Net U.S Exports to Mexico

Source: ICF International January 2015 Data Base and Compass Report; and EIA Natural Gas Annuals and Spreadsheets
Net Interregional Deliverability 2013 (in Bcf/d)

Import Capacity
10.3 Bcf/d

Export Capacity
8.5 Bcf/d

Source: ICF International January 2015 Data Base and Compass Report,
**Net Interregional Deliverability 2030 (in Bcf/d)**

- **Import Capacity**: 10.3 Bcf/d
- **Export Capacity**: 9.9 Bcf/d

Source: ICF International January 2015 Database and Compass Report,
Natural Gas Prices 2014 ($/MMBtu)

- Malin: $4.39
- Cheyenne: $4.41
- PG&E Citygate: $4.82
- SoCal Border: $4.50

Source: Derived from ICE data
Henry Hub Price Forecasts

Source: Derived from Bloomberg, CERA, RBAC, and EIA’s STEO and AEO