Utility Industry 2.0: Legacy, Uncertainty, Opportunity

Overview

August 30, 2017
Greatest Engineering Achievement
of the 20th Century

Electrification

“The workhorse of the modern world.”
Utility Industry

1.0

Natural monopoly
- High fixed costs
- Economies of scale

Regulated Monopoly
- Reliability
- Public Safety
- Price Stability

Disciplined, long term planning
Utility Industry 2.0

Technology Change + Regulatory¹ Change

Unprecedented Change

Transformation of the Utility Business Model

¹ Includes legislative, initiative, exec. order
Before We Begin: Fundamental Concepts

1. All Megawatts are Not Equal
2. All U.S. Electric Regions are Not Equal
3. All Northwest Utilities are Not Equal
# All Megawatts are not Equal

<table>
<thead>
<tr>
<th></th>
<th>Hydro</th>
<th>Wind</th>
<th>Solar</th>
<th>Natural Gas</th>
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<tr>
<td>Low Cost of Energy</td>
<td>✓</td>
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<tr>
<td>Carbon Free</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Peak Capacity</td>
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<td>Flexibility</td>
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<tr>
<td>Transmission Support</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>

**Northwest**

- No economical grid-scale storage today
- Except for hydro
2. All Electric Regions are Not Equal

North American Electric Reliability Corporation (NERC)

Last Line of Defense for Electric Reliability

8 reliability regions
Fuel source dependencies
Transmission constraints

38 Balancing Authorities in WECC
Ensure that power system demand and supply are finely balanced
3. All Northwest Utilities are Not Equal

**Primary Fuel Source**
- Hydro
- Nuclear
- Coal/Natural Gas
- Wind

**Governance**
- Investor-owned
- Consumer-owned

**Consumer-Owned**
- Self-generation (dams)
- Different BPA contracts

Perspectives: Some Shared, Some Different
So What’s Changing?

- Technology
- Regulatory Policies
Technology Landscape

Technology is a **good** thing, but disruption is painful!

- Energy efficiency
- Smart grid
- Solar efficiency and price
- Natural gas: hydraulic fracturing

**Somewhere on the horizon, but coming fast:**

- Battery storage
- Electric vehicles
- Solar roofs
- Solar windows
Regulatory Landscape

Energy efficiency mandates
- EIA* - all cost-effective conservation

Renewable Portfolio Standards (RPS)
- EIA* - buy 9% of load from renewables

Carbon abatement
- Clean Air Rule
- Upcoming Initiatives?

Net metering (primarily rooftop solar)
- Sell excess generation to utility
- Reimbursement at full retail rate

*EIA = Energy Independence Act (Initiative 937)
New Power Resource Costs – Northwest

Green bars represent Energy Independence Act "qualifying resources"

- Geothermal: $106
- Coal (W/O Carbon Tax): $83
- Small Modular Reactor: $78
- Wind* (W/ Federal Subsidy): $68
- Biomass: $64
- Landfill Gas (W/O Carbon Tax): $44
- Nat Gas/CCCT (W/O Carbon Tax): $44
- Conservation: $30
- Wholesale Markets: $25

Levelized Cost of Energy – Northwest

- District Conservation: $23/MWh
- BPA Power Cost: $35/MWh

Levelized $/MWh

No Solar?

"The last solar price you heard is wrong"

"It’s lower!"

Last Year = $45

Note: Costs can vary considerably in other regions and change significantly in one year.
The Sub-$50/MWh PPA is Here to Stay

PPA = Power Purchase Agreement

Nationwide PPAs – includes federal tax credits
Unprecedented Change

Change Drivers

- Technology
- Regulatory Policy

Impacts

- More wind/solar
- Devalued infrastructure
- Flat/declining utility loads
- Non-utility entrants
- Expanded customer choice
- ?????????
- ?????????
- Seeing **absolutely dramatic** changes in the industry

- Caused by **rooftop solar** units, **community choice aggregation efforts**, **battery storage** and **direct access service** for commercial and industrial customers

- **As much as 25 percent** of retail load formerly provided by investor-owned utilities, or IOUs, will be served by non-IOU sources later this year

- **No central strategy or coherent plan** for dealing with all this change

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Michael Picker, President
California Public Utilities Commission
May 19, 2017

*As reported in Public Power Daily May 23, 2017*
Commercial & Industrial C&I’s are Changing the Game

Direct Access Service

MGM Resorts, Wynn planning to leave NV Energy
16 Comments

July 13, 2017 at 7:05 pm
Microsoft gets OK for buying green power outside Puget Sound Energy

State regulators approve Microsoft move to lower its carbon footprint by acquiring clean power on wholesale markets rather than buying from PSE.
California Solar Explosion

Both rooftop & utility-scale solar driven by:

- Plentiful sun, high retail rates
- Regulatory policies
  - Renewable portfolio standards – 50% by 2030 (100% by 2045?)
  - Generous net metering policies

End result

- Shortened payback period
- Electric reliability concerns (Duck Curve)
**California Duck Curve (2014 forecast)**

Net Load: served by traditional\(^1\) generating sources – March 31

- **2012**: prior to the solar explosion
- **Estimated 2020**
- **Actual May 2016**

\(^1\)Natural gas, nuclear, hydro, other
Can the Northwest adapt to CA?

When it absolutely, positively has to be there overnight.

In the next five minutes

Maximize Hydro’s Flexibility Value
Northwest Power Picture

2007

- Low carbon electric sector
- Low electric rates
- Stable electricity supply

2017

- Lower carbon replacing coal
- Surplus energy
- Growing winter peak concern
- Rising electric rates
Lower Demand, More Resources

Energy efficiency measures
Codes and standards
Aluminum plant load loss
Global recession

Load and Resource Time Series Chart
Load Forecast Slips Again
forecast years 2013 - 2017

ANNUAL ENERGY - MWA

2013 2014 2015 2016 2017

2013 2014 2015 2016 2017

2013 2014 2015 2016 2017

2013 2014 2015 2016 2017

2013 2014 2015 2016 2017

2013 2014 2015 2016 2017

2013 2014 2015 2016 2017
Energy overbuild
- Energy Independence Act
- Production tax credit ($23/MWh)

Nameplate: 4,782 MW
Capacity Factor: 30%
Focus on Winter Peak

MEGAWATTS

2018 2019 2020 2021 2022

- Hydro
- Coal
- Nuclear
- Natural gas
- Imports
- Wind
- Demand response
- Other

Firm requirements

3,200 MW gap
Make Up of Existing Generation

Winter Peak Capacity
34,800 MW

Energy
21,700 MWa
BPA Sets Record Summer Peak
Tuesday, Wednesday, Thursday
Unprecedented Change

Change Drivers
- Technology
- Regulatory Policy

Impacts
- More wind/solar
- Devalued infrastructure
- Flat/declining utility loads
- Non-utility entrants
- Expanded customer choice
- Lower energy prices
- Higher retail rates

Huh???
Declining Revenues

Flattening retail revenues
- AND -
Lower secondary market revenues

Chelan PUD predicts challenging financial times ahead
APRIL 23, 2017

Seattle City Light faces millions in lost revenue
MAY 31, 2017

Falling BPA revenue may trigger additional electricity fee
MAR 23, 2017
BPA adopts rates to strengthen finances and adapt to a rapidly changing electricity industry

The 5.4 percent increase results in an average wholesale power rate of $35.57 per megawatt-hour, an increase of 2.7 percent annually. The overall rate increase is primarily due to a lower-than-expected demand for power, a declining forecast of surplus power sales revenues due to lower market prices, and escalating costs of programs driven by legal requirements. BPA is working with regional partners to identify new revenue streams and continued cost-containment strategies that may help mitigate these rising cost pressures.
How Secondary Market Sales Work

**Simplified Example**

Many NW utilities have secondary market sales – particularly BPA

Power Purchase Contract thru 2028

- Power Markets Northwest & California
- Rate changes biannually; Trend is higher
- Price changes hourly; Trend is much lower

Excess Power Sold on Market Used to Buy Down Retail Rates

- 3.0¢ kWh + Other Costs (2016 Avg: 6.7¢)
- 2.6¢ kWh

Customers

Same Issue Impacting BPA

BONNEVILLE
POWER ADMINISTRATION

BENTON PUD

Power Markets Northwest & California
Benton PUD Secondary Market Sales
Historical Market Price of Power

Dollars per Megawatt-hour

- Technology: Shale gas
- Technology: Energy Efficiency
- Regulatory: Mandates & tax credits

Budget

Lower Wholesale Energy Prices but Higher Rates?

Average retail price of electricity, annual

Source: US Energy Information Administration
Late Breaking News

Staff Report to the Secretary on Electricity Markets and Reliability

The industry has experienced extraordinary technological and resource changes in recent years. While these changes are providing more choices for consumers, they are also challenging the regulatory paradigm that has guided the industry’s growth for decades. The core objective of electricity regulation has always been, and should continue to be, to ensure a reliable and resilient electric supply system that serves customers in an equitable manner.

It is apparent that in today’s competitive markets certain regulations and subsidies are having a large impact on the functioning of markets, and thereby challenging our power generation mix. It is important for policy makers to consider their intended and unintended effects. Federal and State policy makers must continue to work together in close consultation to address these important issues that have a deep impact on grid reliability and resilience.
Looking Ahead
Energy efficiency can meet 90% of region’s new requirements.
Change is Happening…………
But Which Way Do We Go?

Northwest Markets
- BPA wholesale rate trends?
- California Duck Curve?
- Snake River Dams?

Technology
- Solar Prices?
- Battery Storage?
- Electric Vehicles?
- Smart Grid Technology?

Utility 2.0

Regulation
- Higher RPS\(^1\) in Washington?
- Washington Carbon Tax?
- Higher RPS in California?

\(^1\) Renewable Portfolio Standards

National Markets
- Natural Gas Prices Stay Low?
- Nuclear/Coal Plant Closings?
- Small Modular Reactors?
Strategic Environment

- Safety
- Reliability & Resiliency
- Customer Value

Flexibility in Operating Model
- Culture of Change "Fast Follower"
- Power Risk Management
- Maximize the Value of Hydro
- Load Preservation
- Customer Engagement
- Mandates RPS vs. Carbon Regulation
- Fair & Equitable Rate Design
# Average Retail Rates\(^1\) per kWh

**APPA\(^2\) 2015 Report on Average Revenue (Cents per kWh)**

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Commercial</th>
<th>Industrial</th>
<th>Total</th>
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<tbody>
<tr>
<td>Benton PUD</td>
<td>7.7</td>
<td>6.4</td>
<td>4.7</td>
<td>6.4</td>
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<tr>
<td>WA Publicly Owned</td>
<td>8.4</td>
<td>7.3</td>
<td>4.7</td>
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<tr>
<td>WA Investor Owned</td>
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<td>9.6</td>
<td>7.6</td>
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</tr>
<tr>
<td>WA Cooperatives</td>
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<td>7.6</td>
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<td>7.8</td>
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<tr>
<td>National Average</td>
<td>12.7</td>
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<td>6.9</td>
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<td>California</td>
<td>16.2</td>
<td>15.6</td>
<td>12.3</td>
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\(^1\) Revenues - includes all charges to customer

\(^2\) American Public Power Association
Questions / Discussion