Dispatch-able CHP, District Energy, and a Duck

Eric Moe – UMC Energy & Environment
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Session 2B – District Energy Carbon and Environmental Strategies
Presentation overview

Pacific Northwest energy landscape

Growing challenges for traditional electric utilities

Development of dispatchable generation and load

Case 1 – industrial district energy and cogeneration

Case 2 – next century campus

Optics
Pacific NW (PNW) energy landscape is dominated by hydropower
the market is flooded with power, especially during spring runoff, leading prices to tank

CA summer demand

PNW spring runoff
energy supply and balancing compete with fish and irrigation
coal plants are retiring and pressure is growing to retire other large remote power plants (hydro dams and must run nuclear)
low and negative pricing leads to curtailment of intermittent renewables

almost all efforts to sink surplus power are electricity centric
- batteries
- electric vehicles
- pumped hydropower
- new transmission

Credit: CAISO LMP Map
transmission constraints impede power flow from North to South across SOA gate in summer

(Bonneville cancelled $1.5 billion transmission project, seeks non-wires alternatives)

Credit: Bonneville Power Administration
historically low spark spread has limited PNW cogeneration (except industrials)

Credit: U.S. Energy Information Administration
Market value is growing in dispatchable electric generation and load resources

(net demand = demand less solar and wind)

- 13,662 MW ramp in 3 hours
- High carbon when ramping
- Belly of the duck curtailment
Growing challenges for wholesale and retail public and private electric utilities

- Falling wholesale prices
- Customer retention (cost, carbon)
- Integrating intermittent renewables
- Traditional investment opposition
- Coal and other plant retirement
- Behind the meter solar growth
- Loss of conservation revenue
- Decarbonization, regulation
- Investment pipeline

Credit: Bonneville Power Administration
Development of Dispatchable Generation and Load
Example of Dispatchable Generation and Load
http://www.emd.dk/plants/skagen/

Credit: Skagen District Heating
simple economics and carbon favor periodically making heat with wholesale electricity in lieu of natural gas

plus revenue opportunity in reserve and regulation markets

Credit: Parat
Case 1: Industrial District Energy

Dispatchable generation and load (in development)
- Existing district steam network (hog fuel, natural gas)
- Grid power supply to be integrated with local cogeneration
- Economic dispatch of CHP as hedge to market power price
- Connected customers benefit from fuel flexibility, carbon
- Features turbines, electrode boilers, fuel boilers, controls
- +/- 100 MW dispatchable co-generation
- +/- 20 MW up / down regulation
Case 2: Next Century Campus

- WA State Capitol Campus
- Currently operated as a cost center (no revenue)
- Aging steam and condensate infrastructure
- Safety, efficiency, carbon, and comfort issues
- Not competitive in service to new buildings
- Limited chilled water distribution network
- Located at base of a known landslide zone
Old Plant circa 1920

New Plant
modernization, renewal, and growth requires a different funding strategy
new district (thermal) energy enterprise structure to facilitate investment, renewal, operation, and growth
District heating infrastructure features steam to hot water conversion, thermal storage, and 2.5 MW dispatchable cogeneration.

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<thead>
<tr>
<th>Initial</th>
<th>Future</th>
<th>Description</th>
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<tbody>
<tr>
<td>12</td>
<td>21</td>
<td>Buildings (#)</td>
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<tr>
<td>1,670,217</td>
<td>3,474,823</td>
<td>Connected space (sqft)</td>
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<tr>
<td>45</td>
<td>60</td>
<td>Diversified peak heating (MMBtu/h)</td>
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<td>60</td>
<td>75</td>
<td>Installed capacity (N+1) excluding TES</td>
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<tr>
<td>26.9</td>
<td>17.3</td>
<td>Peak intensity (btu/h/sqft)</td>
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District cooling infrastructure features expansion to full campus, thermal storage, and provisions for chilled water heat recovery.

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<tr>
<td>9</td>
<td>13</td>
<td>Buildings (#)</td>
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<tr>
<td>2,440,423</td>
<td>3,521,017</td>
<td>Connected space (sqft)</td>
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<tr>
<td>2,255</td>
<td>3,806</td>
<td>Diversified peak cooling (MMBtu/h)</td>
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<td>3,200</td>
<td>5,000</td>
<td>Installed capacity (N+1) including TES</td>
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<tr>
<td>1,082</td>
<td>925</td>
<td>Peak intensity (btu/h/sqft)</td>
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LOTT Wastewater Treatment (biogas, purple water supply)

Next Century Campus

depth building retrofits

fuel flexibility

renewables and new technology
Dispatchable generation and load to reduce operating cost and carbon

Cogeneration when justified by the power price

Periodic heat generation from surplus intermittent renewables in lieu of fuel
Questions?

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