UM 1751 Energy Storage Workshop #3

May 9, 2016

PacifiCorp

UM 1751 Workshop #3 Topics

- Most viable and beneficial applications (HB 2193 time frame: 2018-2019)
- Emerging high value applications (long term)
- Projects under consideration for HB 2193 as of today
- How will the Company evaluate projects?
- Recommendations for the Commission to evaluate projects
- How should the Commission encourage investment?
- How will storage potential be evaluated?

Most viable and beneficial applications (HB 2193 time frame)

- Distribution system deferral, either feeder or substation transformer upgrades, through peak shaving
- Local area regulation (voltage)
- Generation capacity deferral
- Electric energy time shift (arbitrage)
- Wind firming

Best technologies: lithium chemistries and flow (depending on energy capacity requirements)

Stacking of use cases will likely be necessary

Emerging high value applications (2020 and beyond)

- Distribution system deferral, including feeder or substation transformer upgrades, through peak shaving
- Renewables energy time shifting
- Renewables capacity firming
- Regulation / Reserves
- Reliability – customer benefit
- Electric energy time shift (arbitrage)

Projects under consideration for HB 2193 as of today

- Company believes HB 2913 requires:
  - Storage resource(s) to be located **in Oregon**
  - One **or more** storage projects with a **combined** energy capability of 5 mega-watt-hours storage capability
- Area distribution planning and the budgeting process have been key tools to identify potential storage opportunities
- Recent notification of potential step changes in load (i.e. major new load)

Projects under consideration for HB 2193 **as of today**

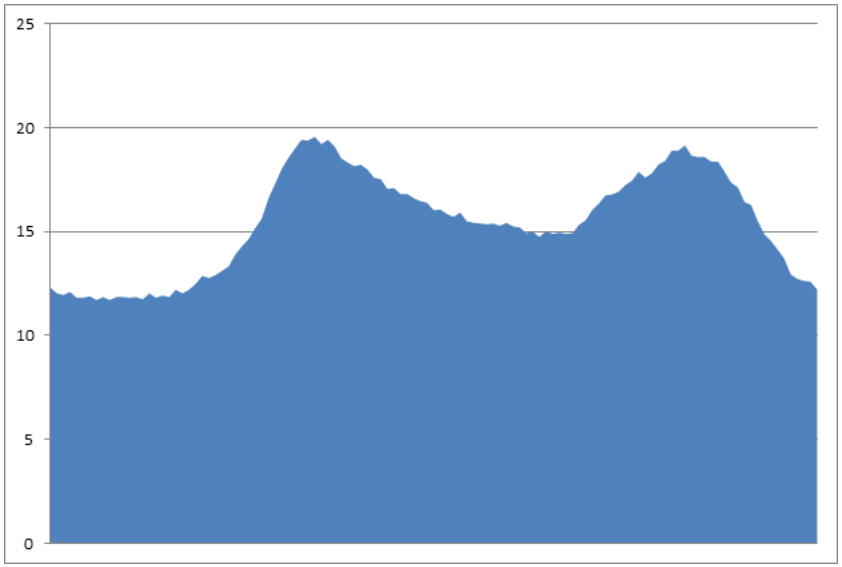
Key selection criteria:

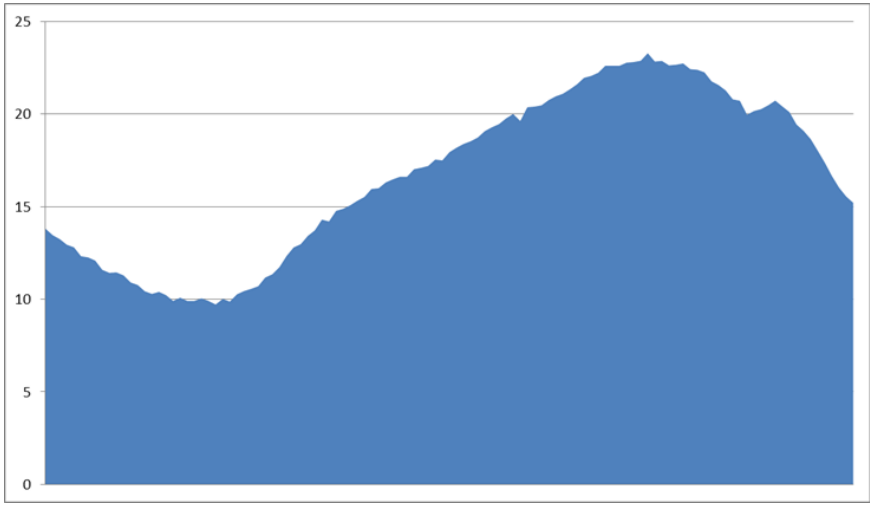
- Approaching design capacity
  - Expected load growth
  - Historical load growth patterns
- Investment need
- Reliability statistics
- “Peaky” load (limited energy requirements)
- Permitting/approval challenges
- Physical space availability
- Utility side of the meter

Projects under consideration for HB 2193 as of today

- Potential distribution substations/feeder capacity/congestion issues that have been identified:
  - Gleneden
  - Redmond
  - Shevlin Park
  - Warrenton
- Large customer to address high reliability requirement

Shifting Peaks – Winter & Summer





Projects under consideration today

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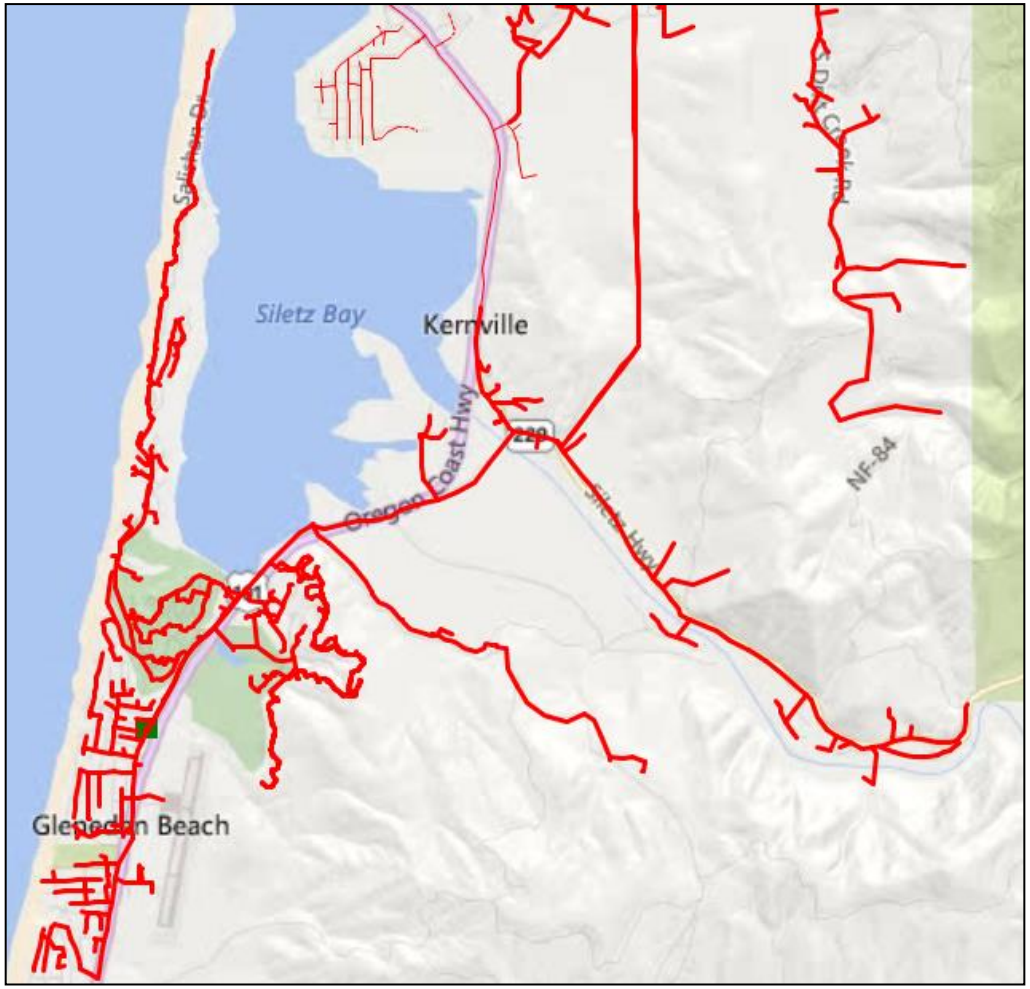

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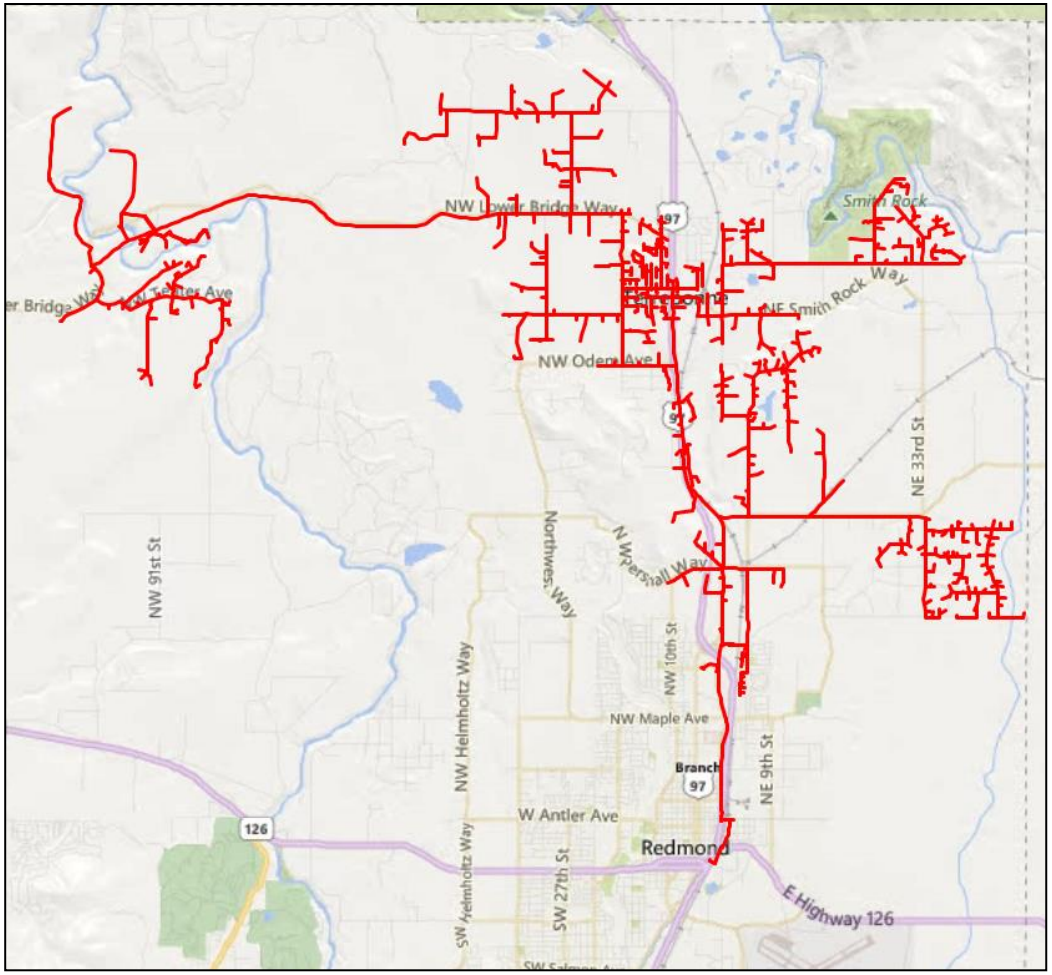
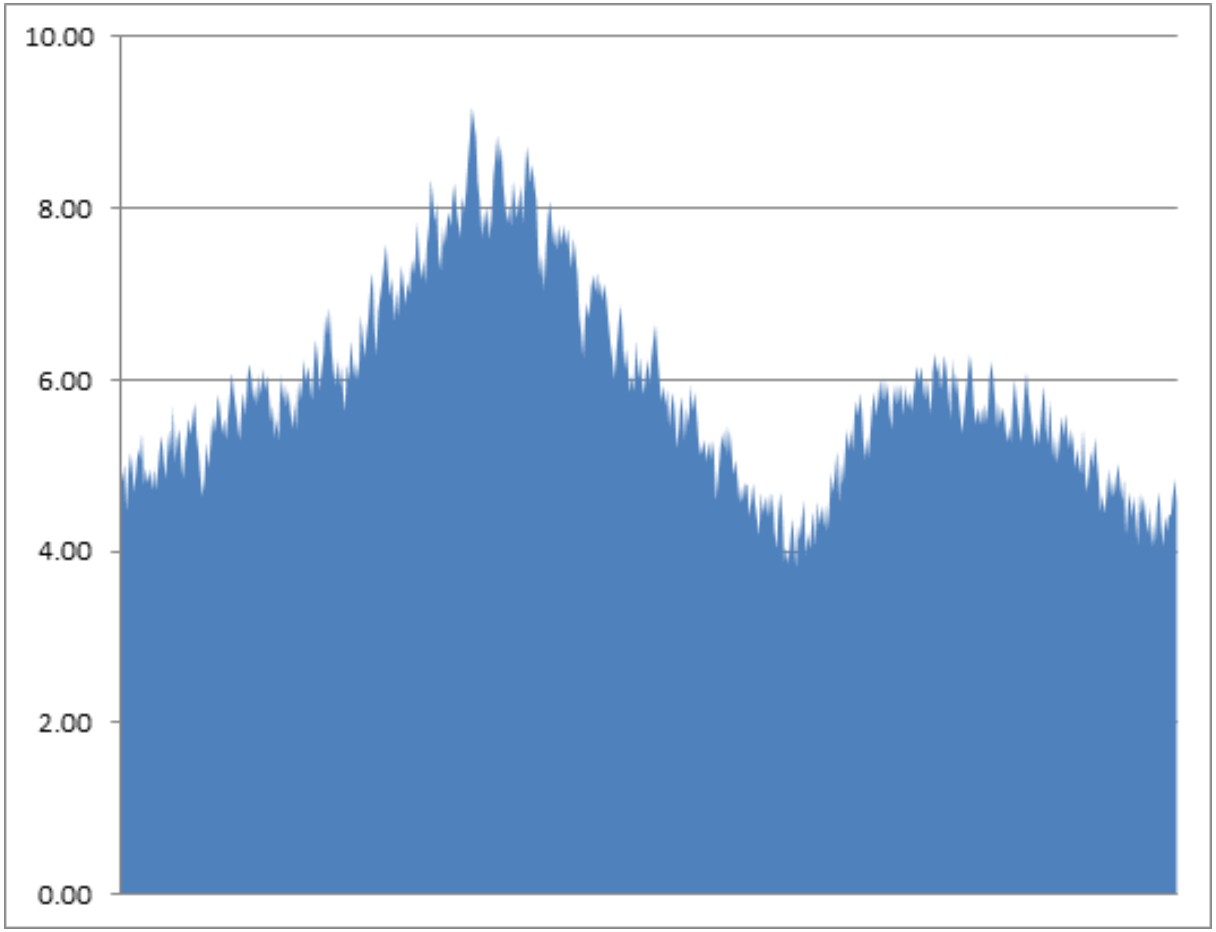


Redmond 5D22 Winter Peak



How will the Company evaluate projects?

- Prioritize and short list potential projects based on the value of investment deferral and in-house data base of costs and performance
- Apply a storage evaluation software tools [such as PNNL's Battery Storage Evaluation Tool (BSET) or EPRI's StorageVet] to identify best set(s) of stacked use cases
- Hold a competitive technical RFI/RFP to evaluate full life cycle costs assuming a set of use cases to identify applicable technologies/chemistries and optimum O&M practices. This will include an assessment of the commercial viability of the company/technology.

How will the Company evaluate projects? (cont'd)

- Perform a present value of revenue requirements analysis of short-listed responses to the competitive solicitation. This will include a comparison to a traditional solution (if the application warrants-such as a substation upgrade).
- Valuation metrics that need development:
  - Avoided balancing charges (renewable firming)
  - Regulation
  - Reserves (spinning and non-spinning)

How should the Commission encourage investment?

Consider supporting multiple projects to advance emerging use cases and/or promising technologies such as:

- “Behind the meter” applications of distributed residential storage (especially in neighborhoods with high solar PV penetration)
- Customer reliability applications
- Emerging battery chemistries

Recommendations for the Commission to evaluate projects

- Highest net present value of revenue requirements
- If the net benefit is negative, rank order projects based on minimizing cost impacts to customers recognizing and balancing:
  - Long term performance risk versus
  - Providing a mechanism to foster and assess emerging/promising technologies
  - Consider a mix of technology development project(s) (higher risk), market scenario cases (regional RTO) and higher value projects

How will storage potential be evaluated?

- Storage potential will be evaluated in the context of need (current and future loads and generation portfolio), value and economic benefit to customers
- Storage potential will be indicated by future capital requirement “triggers” for either generation or T&D resources and the evolution of transparent markets (regional RTO)
- Short term (next 5 years) storage potential will be identified in the context of storage as an alternative to traditional T&D solutions