Northwest **Power** and **Conservation** Council

April 2, 2019

MEMORANDUM

TO: **Council Members**

FROM: **Mike Starrett**

SUBJECT: **Impacts of Transmission on Resource Planning**

BACKGROUND:

Presenter: Mike Starrett

Summary: This presentation builds upon the "Electric Transmission Utilization in the Northwest" presentation at the Power Committee in March 2019.

The March presentation reviewed staff analysis which showed that transmission congestion in the region is more often contractual than physical. There is substantial unused physical transmission available throughout the system during most or all hours of year, even at well know 'pinch points' with very limited commercial inventory for long-term sales (*e.g.* the South of Allston flow gate).

This follow on presentation describes how transmission is commonly treated in portfolio expansion models and how that can create gaps between least-cost plans and actual resource procurements. The presentation also summarizes the process of planning, procurement, and dispatch in a centralized market to highlight the important connection between transmission products and a least-cost system.

Workplan: Prepare for 2021 Power Plan

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Impacts of Transmission on Resource Planning

Mike Starrett

April 9, 2019

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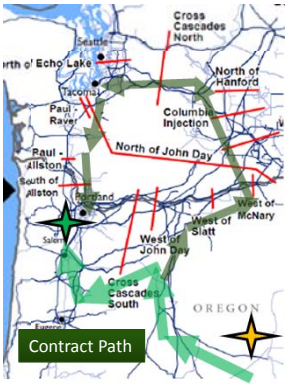
A review from last time

1. In the bilateral Northwest, project developers contract in advance for long-term firm transmission rights between their resource and the load they intend to serve*
   - This reservation is held 24/7/365 and is only released on a short term basis when not in use
2. Using power flow models with assumptions about load, resource stacks, outages, *etc.*, transmission providers only make offers for long-term firm transmission service when <u>all affected</u> flow gates have available capacity (not just those flow gate directly along the contract path)

*This presentation represents usual practices and may make some simplifications or generalizations for clarity

Moving Energy Across the Grid - Power Flow



Rules of the Power Flow Road*

1. Power will split and travel down many paths on it's way from source (POR) to sink (POD)
2. The way that power splits is based on the relative resistance of each line that it could potentially travel down
   - Longer lines have higher resistance
   - Bigger wires (500kV, *etc.*) have lower resistance
3. Power from a given source always splits the same way no matter what the rest of the grid is doing
4. You can look up what will happen in advance in an Excel workbook, it's all based on transmission line resistance
5. **No one can tell power what to do!**

Exmple: Eastern OR to SW Portland Metro

- 40% directly over the OR Cascades
- 30% through the Gorge
- 15% up through the WA Cascades and around through south of Alston
- The last 15% through other lines

*This text box is meant to be instructive at a high level. Some generalizations and simplifications were made.

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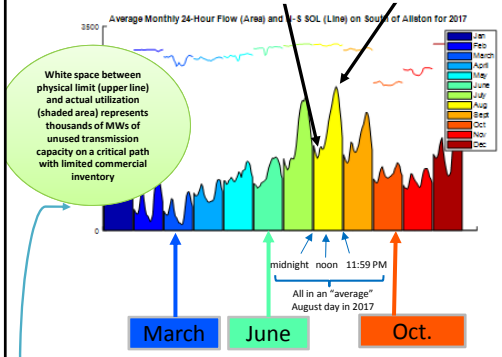
Northwest Oregon from the North

'Average' August Morning in 2017: Flows are modest overnight before beginning to pick up

'Average' August Evening in 2017: Flows hit their peak during the evening ramp before beginning to decline overnight



South of Alston

- Summer peaking path serving the Willamette Valley and exports to California from BC and elsewhere
- TTC: 3,200 MW
  - LTF Inventory: 100's of MW recently released*

- *Each color represents a different month*
- *The plotted shape shows how flows looked on an "average" day in that month*
- *The colored line above the shape shows the "average" operating limit for the path over the same time period.*
- *The gap between the shaded area and the colored line is unused physical capacity on this path*

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Takeaways so far

- There is some newly created commercial inventory of long-term firm transmission, but pinch points that limit offers across the broader system are likely to be an ongoing issue
- On most days and hours there is substantial unused physical transmission capacity, even across flow gates like South of Allston
  - Makes sense give; most days are not peak days

But remember, **unused physical capacity implies nothing about commercial inventory** of long term transmission in bilateral Northwest

Also, since it is common for new resources to need long term firm transmission, **in an era of limited commercial inventory we can't say if the resources being developed on the grid are least-cost energy or just best available with transmission**

Transmission Assumptions in Resource Planning & Bi-Lateral *vs.* Centralized Markets

Bilateral transmission in the context of resource planning

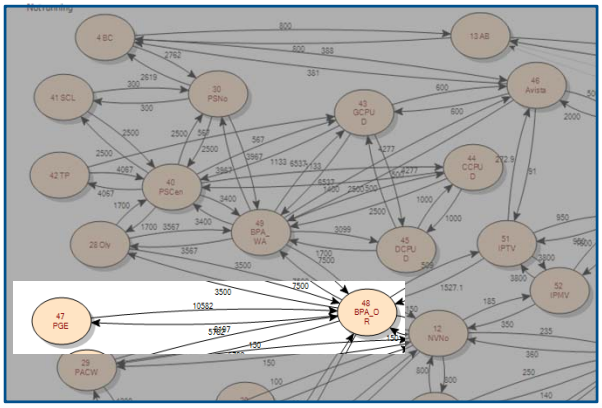
- There is limited Long Term Firm (LTF) commercial inventory but substantial physical capacity on an *average* day
- Looking ahead, it's likely that a more renewable future to meet policy goals and/or lower energy costs will result in a system nameplate capacity that *far*, *far* exceeds actual peak demand
  - If we're saving money on energy and can deliver it as available without extraordinary grid expansion, this is not necessarily a problem
- **From a resource planning perspective**,

Should a planning model assume that an intermittent resource could be built to make use of physical capacity whenever it is available? Is this actually realistic for developers to finance?

If some of the LTF transmission capacity is held by intermittent resources, is there a way to recognize that a capacity resource could still be deliverable for resource adequacy by assuming that if the renewable is not generating, the transmission will be available for the capacity resource?

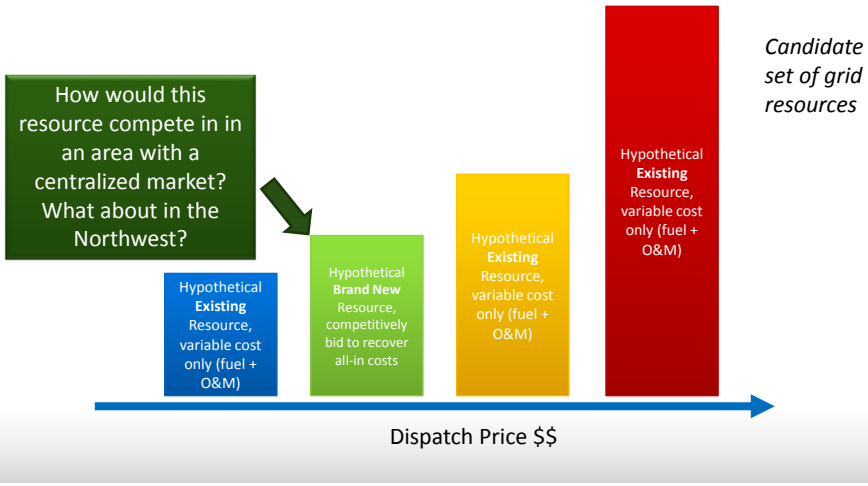
Physical *vs.* Contractual Availability in Planning Models

Should a portfolio expansion model consider the PGE-BPA connection based on **physical** or **contractual** availability?*



*This is just one example. The same consideration applies to all "sticks" and "bubbles" in the model

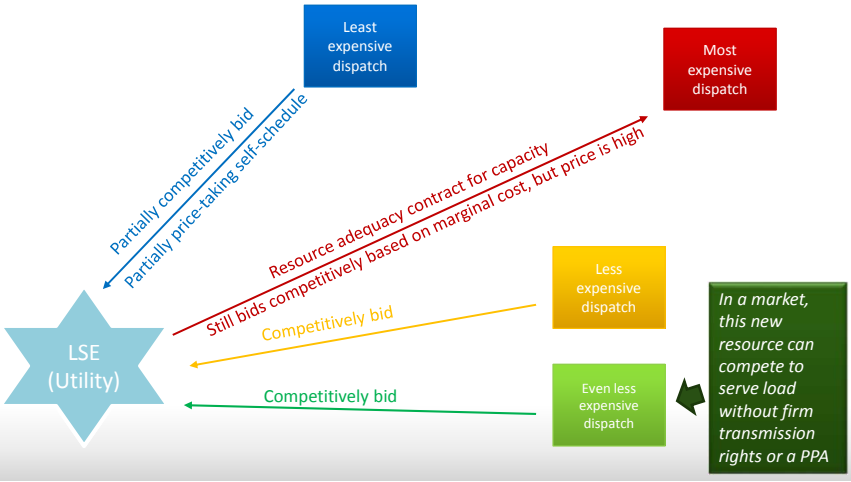
Planning as a centralized market but procuring as a bilateral market



Utility Function in Centralized Markets

- Utilities each still perform an IRP to ensure that they are individually resource adequate and meeting policy requirements
- Utilities may seek to procure or establish a contract for energy (contract for difference price hedge), resource adequacy capacity, or RECs depending on need
- ***BUT*, the market dispatches resources based on price and there are no transmission reservations prior to the day-ahead market's bid submission**
  - Holding a PPA or being a renewable resource can affect the resource's bidding, but does not create a priority in the CAISO's market scheduling except through the resource's bidding (or lack thereof in the case of a self-schedule)

Hypothetical dispatch in a centralized market with resource adequacy requirements



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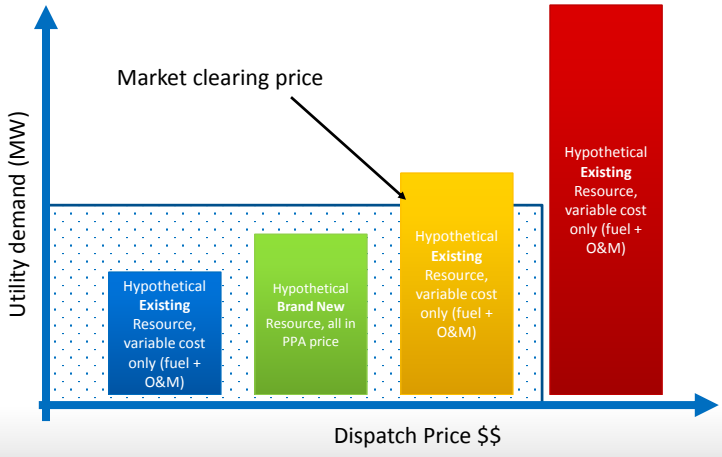
Planning as a centralized market but procuring as a bilateral market



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Things to note about centralized market dispatch example

- **All market participants have access to entire footprint**
- **Lowest cost resources in entire footprint are dispatched first**
  - Congestion pricing in market model makes sure dispatch respects system constraints (& provides transparent information for all market participants!)
- LSE did not get any preferential dispatch
- LSE did not own or contract for transmission
- Generator also did not own or contract for transmission
  - They needed an interconnection study ("Can I show up at point A"), but not a transmission service request ("Can I deliver from point A to B")
- Cost of transmission is not included in considering resource dispatch
  - As a note, the CAISO uses a "postage stamp" approach for every MWh regardless of source or sink. It is paid by the LSEs based on their total energy use.

LSE = Load Serving Entity, such as a utility

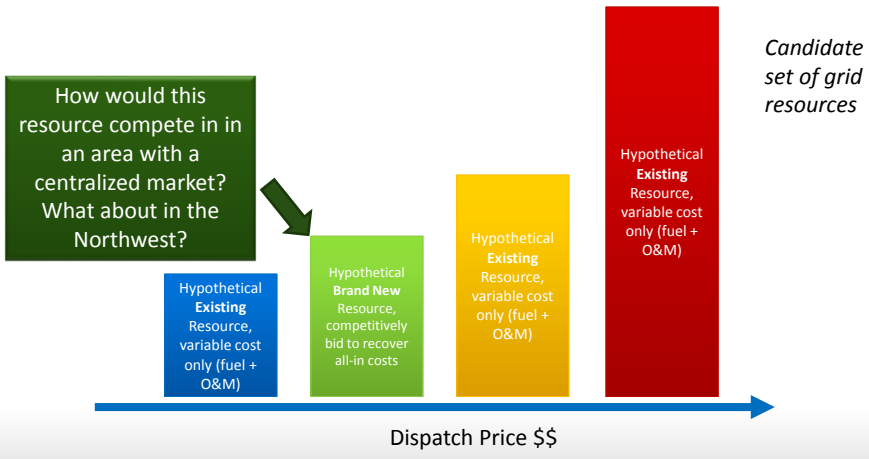
Resources in the Northwest

- As in a centralized market, resources in the Northwest also need to go through an interconnection request processed by queue order
  - In a centralized market, successfully moving through that would be enough to then begin commercial operation since the market dispatches generation across footprint to meet load
- In the Northwest, resources must also go through a parallel transmission service request with a specific POR and POD (contract path)

Transmission Service Requests

- BPA owns the vast majority of transmission in the Northwest
- They use a "Cluster Study" approach where projects in similar areas are grouped
- **But there's a problem:** Transmission providers can't make judgement calls on which projects will move forward
  - They must either process requests serially and assume everyone earlier in queue will come online
  - Or, if doing a cluster, they must assume all requestors will come online together
- **For a single 100 MW RFP, 1000's of MW of capacity could enter a queue and they would be studied as though they are all going to be built**
  - If there were 99 MW of ATC, the study would show upgrades not for 1 MW (to meet the 100 MW RFP), but for 1000+ MW (to meet the combined total request across parties) and no transmission service offers would be made

Planning as a centralized market but procuring as a bilateral market



Planning as a centralized market but procuring as a bilateral market (or "Connecting an IRP to an RFP")

- In a bilateral Northwest with limited commercial inventory, the simple answer is that resources with transmission typically are the ones which win RFPs
- In an extreme example, even a fictitious renewable resource offered at a PPA price of $5/MWh relying on non-firm transmission across a path with substantial physical capacity would have no certainty of being selected ahead of more expensive resources that had firm transmission

Conclusions (1/2)

- Planning models generally only consider physical transmission limits, not contractual encumbrance
- On the other hand, actual procurement normsin the region typically require long-term firm transmission contracts *in lieu* of testing physical deliverability through short-term transmission
- This can create misalignment between planning and procurement, and it could be the case that least-cost plans either can't be developed, or can only be developed with extremely expensive transmission expansion

Conclusions (2/2)

- The gap between what models see and what actually happens in procurement is largely a product of our bilateral market and the commercial products currently made available by transmission providers
  - We probably don't know how much this increases system costs, but we may be able to study it
- Not all areas in the country operate in this way and there are potential solutions including:
  - Centralized market
  - Conditional Firm
  - Term Firm (*e.g.* just Q1 and Q2 for next 20 years)
  - Resource choosing a POD of mid-C and utility choosing POR of mid-C