2019 Integrated Resource Plan (IRP)
Post-filing Public Input Meeting
November 12, 2019




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Agenda

November 12

- 12:30pm-2:00pm pacific – Post-Filing IRP Discussion
- 2:00pm-2:15pm – Break
- 2:15pm-4:00pm pacific – Transmission Modeling Workshop

2019 IRP
Post-filing IRP Discussion




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2019 IRP Timeline

- Following an 18-month public-input process, PacifiCorp filed its 2019 IRP in its six states – October 18, 2019
  - 2019 IRP data discs and supplemental information filed – October 25, 2019
  - 2019 IRP second supplement and data disc replacement files filed – November 8, 2019
- On October 30, 2019 – the Public Utility Commission of Oregon issued its procedural schedule, Docket LC-70.
- On November 6, 2019 – the Public Utility Commission of Utah issued its procedural schedule, Docket 19-035-02.
- On November 7, 2019 – the Washington Utilities and Transportation Commission approved staff's petition to not take action on the 2019 IRP (Docket UE-180259) and to focus on completion of the clean energy legislation implementation rulemaking and IRP rulemaking to inform the 2021 IRP.
- On November 7, 2019 – the Public Service Commission of Wyoming opened an investigation into the 2019 IRP, Docket 20000-552-EA-19.
- The Public Utility Commission of Idaho has not yet taken action on the 2019 IRP, Docket PAC-E-19-16.

2019 IRP
Transmission Modeling Workshop




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Overview of Transmission Improvements

- Endogenous Method
  - For the 2019 IRP, PacifiCorp developed a method to endogenously associate estimated transmission costs with expansion resources in System Optimizer.
  - The method has three applications:
    - Estimated Incremental Transmission
      - Incremental capacity additions are tied to the new resources that require the capacity.
      - System Optimizer is able to use the added transmission capacity.
      - Out-of-model cost reconciliation related to transmission upgrades is no longer required.
    - Estimated Interconnection Upgrades
      - Upgrades increasing interconnection without adding incremental transmission capacity are accurately associated with enabled resources.
    - Estimated Recovered Transmission
      - Recapture firm transmission that could become unavailable with retirements. The model is able to consider cost savings of retaining these rights.
  - The method is inherently conservative due to topology and modeling limitations.
- PacifiCorp transmission provides these cost estimates based on a high-level evaluation of the existing system, which has not changed as an input to this endogenous modeling approach.
- The costs associated with the interconnection service or transmission service of a particular resource are only known once a request is submitted, queued, and then studied by PacifiCorp transmission.

Common Features of Prior and New Transmission Modeling

- Proxy resources are available to System Optimizer
  - Proxy resources align with the supply-side table (SST).
  - The SST reflects updated information from project experience, industry vendors, public meeting comments and studies.
  - Costs and performance vary by location.

- IRP Topology
  - For model performance and clarity, the IRP topology includes aggregated load and resource bubbles, connected by aggregated transmission paths.

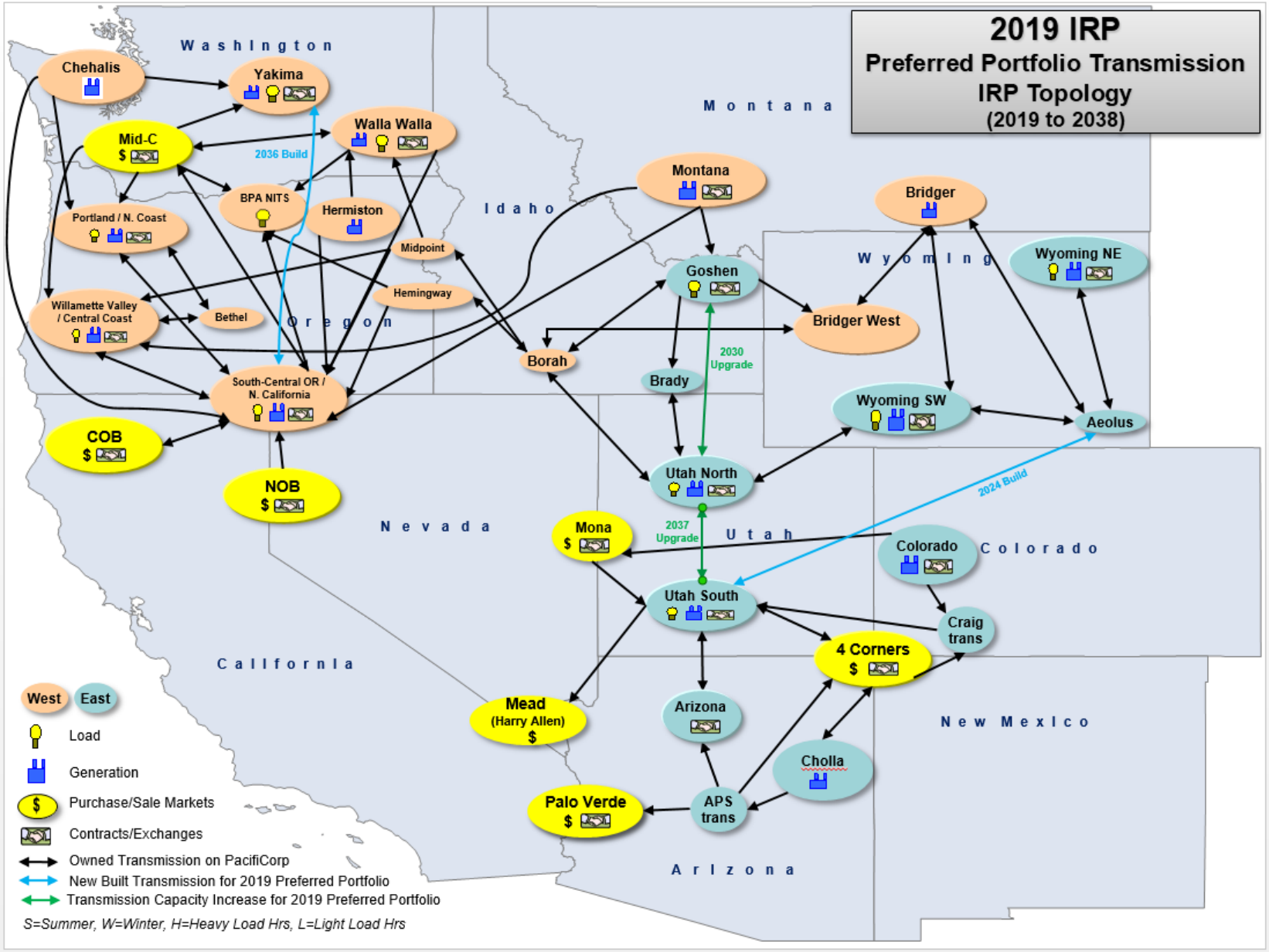
- The next two slides show the incremental transmission options and the IRP topology for reference.

Incremental Transmission Options

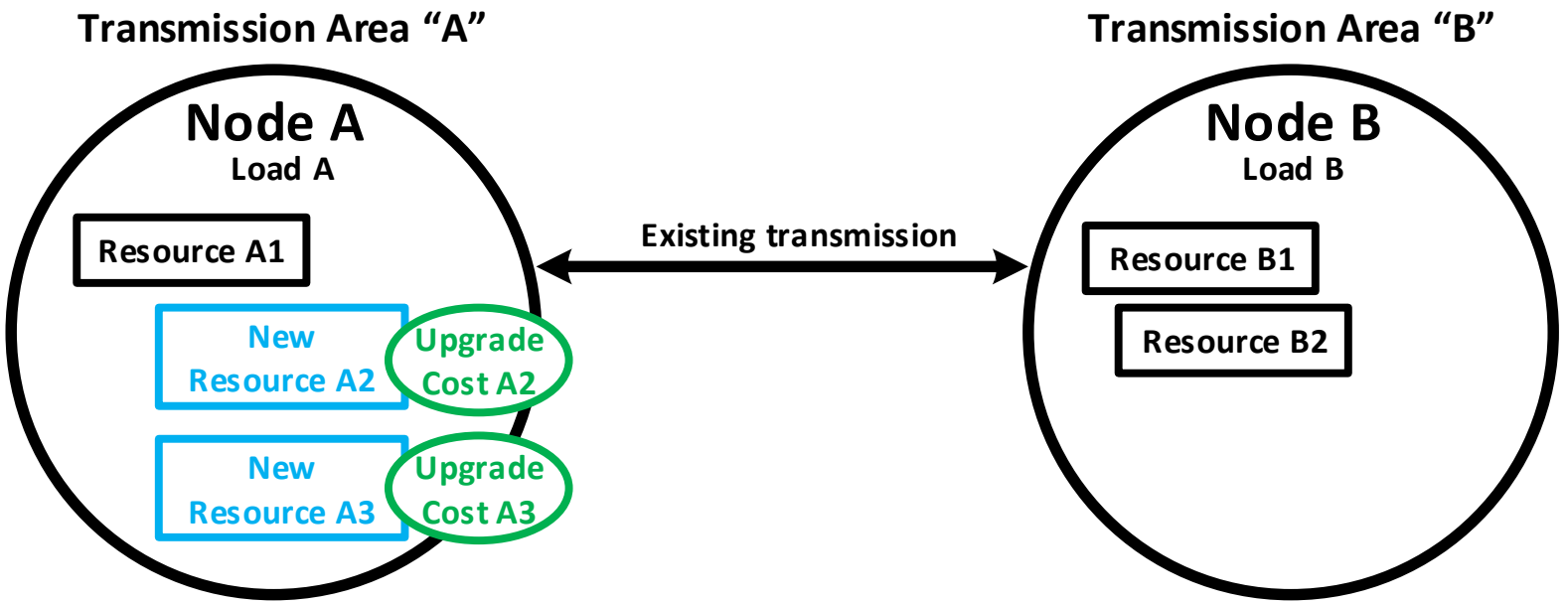
IRP Bubble	Added Resource MW		IRP Year	Description of Integration	Affected Topology Path(s)		
	Min	Max			Incremental Capacity (if any)	From Bubble	To Bubble
Portland/N. Coast	1	130	2024	Portland area local reinforcement	-	-	-
	131	580	2030	Portland area (Troutdale) to Albany area 230 kV transmission	450	Portland	Willamette
Willamette	1	615	2024	Albany area local reinforcement	-	-	-
	616	1115	2030	Albany area to Roseburg area 500 kV transmission	1500	Willamette	South-Central OR
Yakima	1	405	2024	Yakima area local reinforcement	-	-	-
	406	835	2030	Yakima area to Bend area 230 kV transmission	450	Yakima	South-Central OR
Walla Walla	1	100	2030	Walla Walla area to Yakima lower valley transmission	200	Walla Walla	Yakima
South-Central OR/ N. California	1	500	2024	Medford area 500-230 kV and 230 kV reinforcement	-	-	-
	501	975	2025	Medford area 500-230 kV and 230 kV reinforcement	-	-	-
Bridger	1	650	2026	Energy Gateway segment D.2 (Anticline-Populus 500 kV transmission line)	650	Bridger	Bridger W. /Populus
Goshen	1	450	2023	Southern Idaho reinforcement	-	-	-
	451	1100	2029	Southern Idaho reinforcement	800	Goshen	Utah North
Wyoming NE	1	460	2023	Energy Gateway segment D.1 (Windstar - Shirley Basin 230 kV line)	-	-	-
Wyoming SW	1	100	2024	Southwest Wyoming area reinforcement	-	-	-
	101	500	2026	Separation of double circuit 230 kV lines, Southwest Wyoming/northern Utah area	-	-	-
Aeolus	1	1920	2024	Energy Gateway segment F (Aeolus-Clover 500 kV transmission line)	1700	Aeolus	Utah South
Utah North	1	300	2021	Northern Utah 345 kV reinforcement	-	-	-
	301	900	2024	Northern Utah 345 kV reinforcement	-	Utah North	Utah North
Utah South	1	300	2021	Utah Valley area 345-138 kV and 138 kV local reinforcement	-	-	-
	301	800	2027	Utah Valley area local 138 kV reinforcement	-	-	-

* “Added Resource MW” is synonymous with “Max Interconnection” used in some reporting; likewise “Incremental capacity” is synonymous with TTC. TTC = Total Transfer Capability.

IRP Topology Reference Map

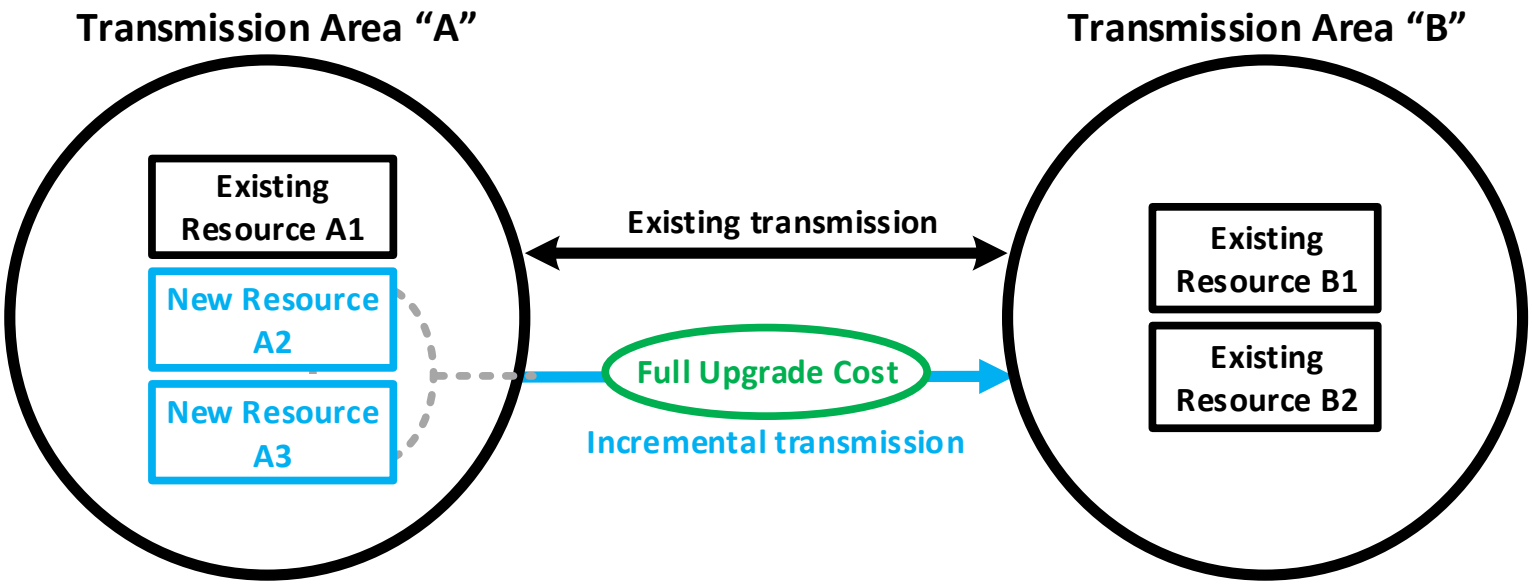


Prior IRP Modeling



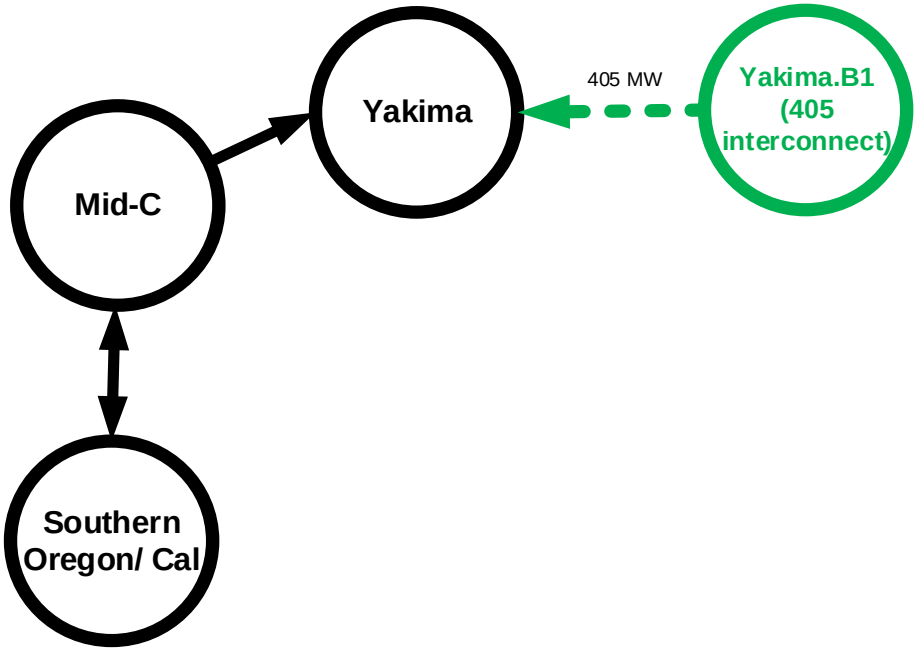
- Incremental transmission was not previously modeled because System Optimizer (SO) is designed around independent "betterments", which could be built without required network resources. Without explicit resource build limits, SO would also allow resources to be built without required upgrades.
- The earlier solution to these limitations was to assign a nameplate maximum to resource builds, and to add $/MW capacity cost to the resources to pay for transmission, based on an estimate of how much the model was likely to build.
- SO lacked the ability to use new incremental transmission, and would misestimate transmission costs.
- Costs were then trued-up in post-model transmission integration, in consultation with PacifiCorp transmission.
- Significant transmission projects such as Gateway were evaluated through robust sensitivities.

2019 IRP Modeling



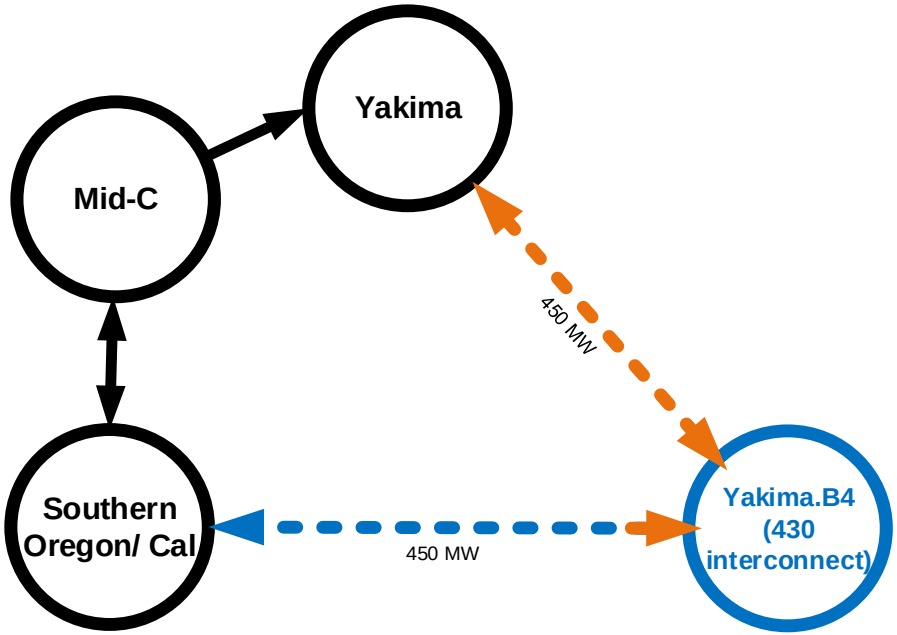
- The 2019 IRP incremental transmission modeling now accurately captures estimated transmission upgrade costs, and makes estimated new transmission available to the new resources that will use it.
- The new modeling cannot handle simultaneous multiple path additions for a single project, and so unique resource transmission configurations are still modeled as distinct studies if needed.
- In the following slides, object modeling examples illustrate how endogenous transmission capability has been made possible.

Modeling Object View of Yakima Transmission Interconnection Upgrade



- **Black** components represent the existing IRP topology.
- **Green** components represent the option to add 405 MW of local interconnection capability in Yakima, but no incremental Total Transfer Capability (TTC). The solid green Yakima.B1 bubble is included every case at no cost, but has no impact unless the dotted green transmission line is built (Year end 2023 capital cost $2.7m in the preferred portfolio).
- The System Optimizer (SO model) won't pay the transmission upgrade capital cost unless there are offsetting benefits, which can only come from adding new resources to Yakma.B1. These resources contribute energy and capacity to the black Yakima topology bubble exactly as if the resources were built there.
- Note: The green components are "logical objects" used to achieve endogenous transmission modeling and accurate costs. Such objects are purely math structures, not actual locations or transmission lines.

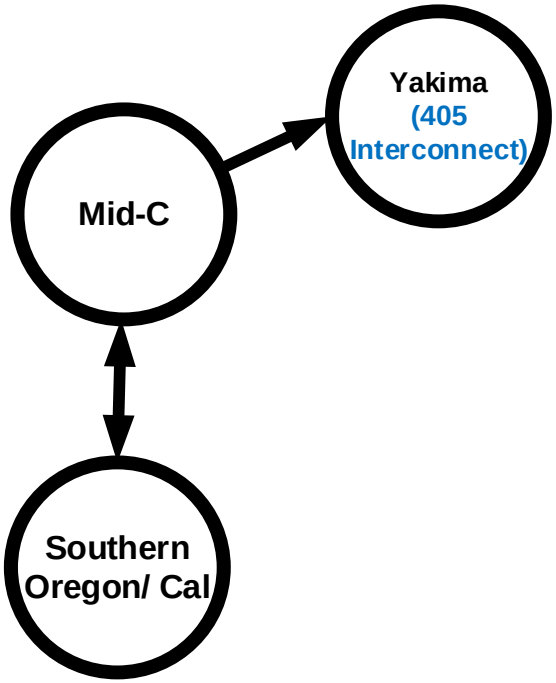
Modeling Object View of Yakima Incremental TTC



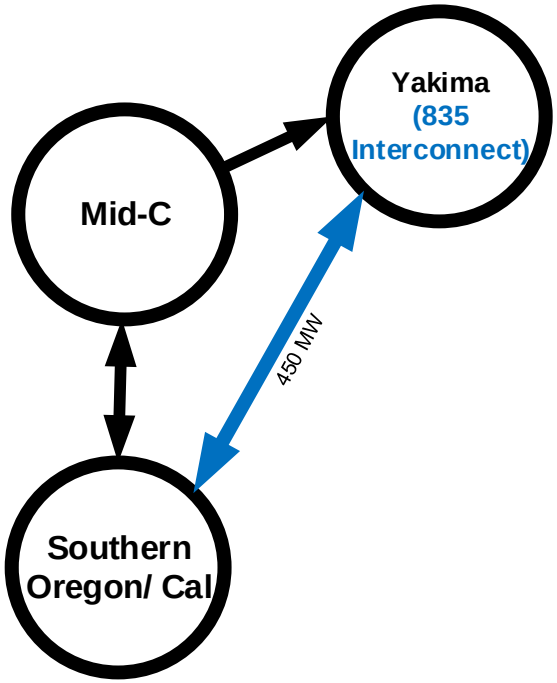
- **Blue** components represent the option to add 450 MW TTC between Yakima and Southern Oregon where no path previously existed.
- The solid blue Yakima.B4 bubble is included every case at no cost, but has no impact unless the dotted blue transmission lines are built.
- The model won't pay the transmission capital cost unless there are offsetting benefits, which can only come from adding new resources to Yakma.B4. These resources contribute energy and capacity to topology bubbles for Yakima and Southern Oregon.
- Note the conservative assumption that SO must find sufficient value in the Yakima.B4 to Southern Oregon path to justify the incremental option. SO does not see the path from Yakima.B4 to Yakima.
- After SO has selected the Yakima.B4 incremental option, the modeling is improved in preparation for the Planning and Risk (PaR) model. The **orange** arrows represent the addition of transmission back into the Yakima.B4 bubble. This gives PaR the ability to use the new transmission capacity for existing resources, which are located in the black bubbles.

Resolved Effects of Yakima Transmission Option Modeling

Years 2024-2035

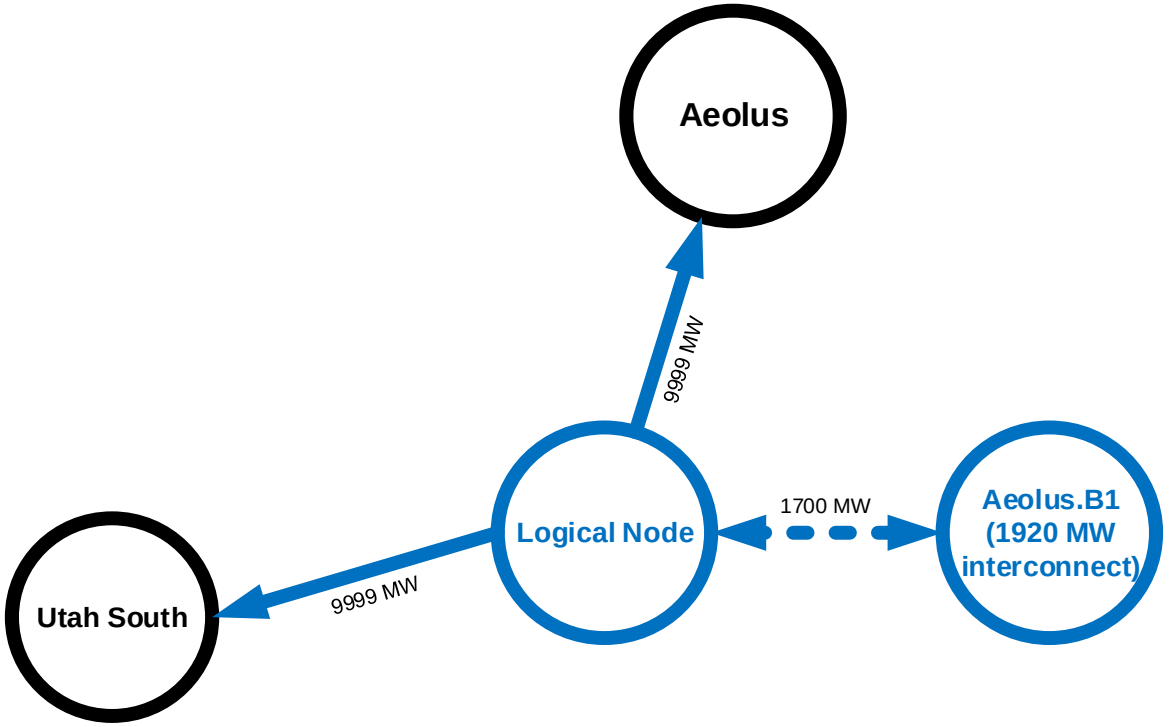


Years 2036 and forward



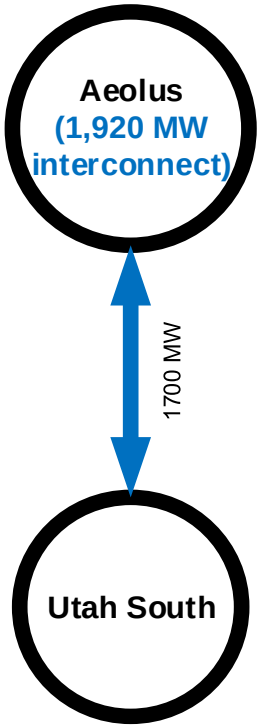
- In 2024 (year end 2023) in the preferred portfolio, SO elected to add the local interconnection upgrade at Yakima. The model concurrently selected 395 MW of solar+storage at Yakima.
- These new resources are available to serve Yakima load and reduce Mid-C purchases in years 2024 and forward, with other potential dispatch impacts radiating out from Mid-C and Chehalis.
- In 2036 (year end 2035), SO elected to add the 450 MW incremental TTC upgrade, which also adds another 430 MW of interconnection capacity at Yakima for a total interconnection increase of 835 MW.

Modeling Object View of Gateway South Incremental TTC



- **Blue** components represent the option to add 1700 MW TTC between Aeolus and Utah South where no path previously existed. The solid blue components are included in every case at no cost, but have no impact unless the dotted blue transmission line is built.
- The model won't pay the transmission capital cost unless there are offsetting benefits, which can only come from adding new resources to Aeolus.B1. These resources contribute energy and capacity to topology bubbles Aeolus and Utah South.
- The use of the Logical Node allows SO to see the value of new resources at Utah South and Aeolus at the same time, which is an advantage over the Yakima approach. However, this modeling adds complexity and artificially limits the effective capacity coming from the new resources in some periods.

Resolved Effects of Gateway South Transmission Option Modeling



- In 2024 (year end 2023), SO elected to add the Gateway South 1700 MW incremental TTC upgrade, which also adds 1,920 MW of interconnection capability at Aeolus.
- The model concurrently added 1,920 MW of new Wyoming wind.

Transmission Information and Outcomes in the IRP

- In the IRP Document:
  - Volume I, Chapter 4 (Transmission): Discussion of specific transmission projects, reliability standards, system constraints, etc.
  - Volume I, Chapter 6 (Resource Options), pages 168-169: Summary of materials in this workshop.
  - Volume II, Appendix M (Case Study Fact Sheets): Case-by-case summary of incremental transmission additions plus transmission and resource maps.
- On the Confidential Data Disk, System Optimizer Portfolio Summary
  - "Portfolio Sum" tab
    - The second table of this tab shows a summary of selected incremental transmission, including the year and added capacity.
  - "TieBuild" tab
    - The table reports the year, project, topology bubbles, capacity and capital cost for all potential upgrades.
    - Filter the "Capital Cost" to exclude zeroes, which will result in a filtered list of the selected options.
    - This view shows both incremental additions and transmission "recovered" after retirements.

Transmission Planning

- PacifiCorp transmission planning considered known transmission capacity and limitations of WECC rated paths and internal paths to provide inputs to the IRP model for baseline transmission capacity between IRP bubbles and the estimated amount of new generation that could be added in various locations.
- Transmission planning also provided a list of estimated incremental transmission capacity additions that the IRP model could select when the model selected generation resource additions within an IRP bubble that exceeded the baseline transmission capacity of that bubble. Incremental transmission capacity selection options were based on the following information:
- Planned network system improvements (projects included in proposed budget, local transmission plan and/or regional transmission plan)
- Completed generator interconnection studies
  - megawatt size
  - location
  - system improvements identified
- Estimated cost for construction based on voltage class, line mileage and substation integration requirements.

Interconnection Queue Reform Overview

- PacifiCorp transmission initiated a public stakeholder process in June 2019 to evaluate whether to seek FERC approval to reform the way it processes queued interconnection requests.
- Currently PacifiCorp transmission processes queued requests using FERC's standard "first-come, first-served" or serial-queue order methodology under which requests are queued and studied based on queue position alone.
- Using this methodology has led to queue backlog: the interconnection queue currently has approximately 234 pending interconnection requests for over 40,000 MW of capacity.
- PacifiCorp transmission is evaluating moving to a "***first-ready***, first-served" methodology under which requests would be required to demonstrate readiness before entering the queue or being studied.
- PacifiCorp transmission is reviewing the latest round of recently submitted written stakeholder comments and is currently aiming to file with FERC by the end of 2019.

Additional Information

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Additional Information

- 2019 IRP:
  - www.pacificorp.com/energy/integrated-resource-plan.html
- Public Input Meeting Presentation and Materials:
  - www.pacificorp.com/energy/integrated-resource-plan/public-input-process.html
- 2019 IRP Stakeholder Feedback Forms:
  - www.pacificorp.com/energy/integrated-resource-plan/comments.html
- IRP Email / Distribution List Contact Information:
  - IRP@PacifiCorp.com