4.3 Key Uncertainties for the Value of the Lower Snake River Dams

This study explicitly captures the following key drivers of the LSR dams power service replacement needs:

- Replacing the **GHG-free energy**, **firm capacity**, **operating reserves**, and **operational flexibility** of the dams

Uncertainty of the LSR dam value is considered under:

- **Clean energy policy**: replacement of carbon-free power becomes increasingly critical to reach a zero-emissions electricity grid
- **Load growth**: replacement energy and capacity needs may change with increased electrification and peak higher winter space heating needs
- **Technology availability**: replacement is more expensive with fewer emerging technology resource options
- **Timing**: replacement was focused on breaching in 2032, but a 2024 sensitivity was also considered

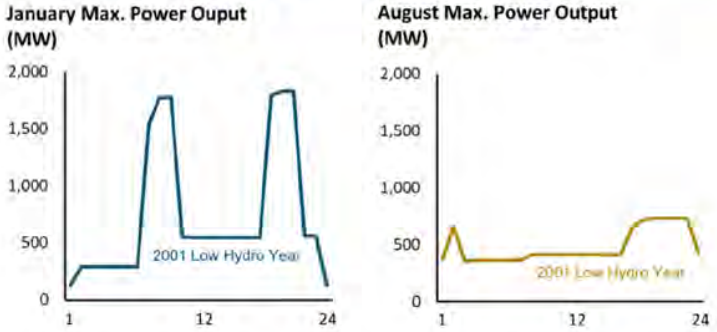
Additional uncertainties regarding the value of the dams are as follows:

- **Annual energy output**: E3's existing RESOLVE model data uses historical hydro years 2001, 2005, and 2011 as representative of the regional long-term average low/mid/high hydro year conditions. The data for the Columbia River System dams was adjusted to reflect the Preferred Alternative operations defined in the CRSO EIS. However, for the LSR dams, these selected historical hydro years resulted in ~~this leads to~~ a relatively low output of ~700 average MW, whereas the dams may generate ~900 average MW on average across the full historicala range of hydro conditions. ~~– according to BPA data post EIS spill constraints.~~ Therefore, E3's analysis likely underestimates the energy value of the dams and costs for replacing that extra GHG-free energy.
- **Firm capacity counting**: as resource adequacy is found to be a key driver of future resource needs, the firm capacity contributions of the LSR dams is a key driver of their value.
    - E3 uses a regional hydro capacity value estimate for the LSR dams in this study. More detailed follow-on ELCC studies could be done to confirm the LSR dams' capacity value, though proper and coordinated dispatch of the Northwest hydro fleet would be necessary to develop an accurate and fair value of the LSR dams within the context of the overall hydro fleet.
    - This study validated the assumed 2.28 GW of firm capacity from the dams by considering BPA modeled LSR dams dispatch under 2001 conditions using the CRSO EIS spill constraint adjusted model. Maximum January output (plus 100-250 MW of operating reserves) was 1.9-2.1 GW (~56-60% of total capacity), slightly less but close to the 65% regional hydro value the study assumes.

Comment [EAJ29]: If this acronym hasn't been used then "Columbia River System Operations Environmental Impact Statement"

Comment [AB30]: Eve/BPA to review and confirm

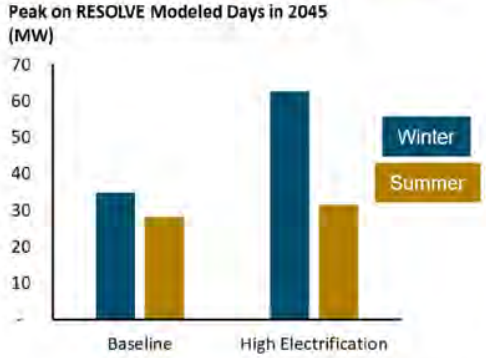
Figure 19. BPA-Modeled LSR Dam Output During the 2001 Low Hydro Year with CRSO EIS Preferred Alternative operations



Comment [EAJ31]: Might be worth adding if someone looks at chart without reading the detail in the text

- The other capacity value uncertainty is whether the Northwest will remain winter reliability challenged or whether reliability events will shift to the summer due to climate impacts on load patterns and hydro output. If reliability challenges did shift to the summer, the LSR dam firm capacity contribution would be significantly lower than assumed. However, E3 believes it is reasonable to assume under high electrification scenarios that the region will remain winter challenged due to peak space heating needs, as shown in figure below.

Figure 20. Winter vs. Summer Peak Loads



- To address the capacity value uncertainty, E3 estimates that a 1.5 GW firm capacity value (43%) for the dams would lower the NPV replacement costs by 9-20% and a 1.0 GW firm capacity value (29%) would lower the NPV replacement costs by 14-33%.

+ **Replacement resource capacity contributions**: if Northwest reliability challenges dramatically shift into the summer, this would also impact the capacity value of replacement resources. Directionally, this would likely lower the value of wind and increase the value of solar and energy storage. It is expected that additional solar and storage would be part of the regional

capacity additions in lieu of wind and dual fuel natural gas + hydrogen plants. However, it is unclear whether the marginal capacity LSR dams replacement resources would change since the region would likely saturate solar and battery storage capacity value in cases with the dams not breached, even if it took longer for the capacity value of those resources to saturate. E3 MAY ADD FURTHER NOTES HERE.

+ **Replacement of transmission grid services:** this study does not focus on the transmission grid reliability services provided by the LSR dams. These services likely can be replaced by a combination of the new resources selected by RESOLVE and additional local transmission system investments. A qualitative summary of the transmission grid reliability services of the dams is summarized in the appendix of this report.

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Comment [AB32]: @Angineh Zohrabian to update if we have more info