Addressing the Lower Snake River Dams' Peaking Capacity

NW Energy Coalition – April 2022

The lower Snake River (LSR) dams provide value to the Northwest energy system. But how much value during times of peak energy usage? Specifically, how much do the LSR dams contribute to sustained peaking capacity for the Bonneville Power Administration's customers during grid emergencies, a cold snap, or a heat wave?

A high-level look at the data shows that the LSR dams:

1. Provide maximum sustained peaking capacity during times when the Northwest grid already has an abundance of hydropower.
2. Can provide limited multi-hour peaking capacity during times when peaking capacity is most needed, particularly mid-winter and late summer.

The LSR dams provide maximum sustained peaking capacity when the Northwest grid already has an abundance of hydropower.

It is not unusual to hear statements that the LSR dams provide maximum generation for many hours over multiple days of a winter cold snap, summer heat wave, or grid emergency. For example, the claim has been made that the LSR dams can produce over 2,650 megawatts (MW) for 10 hours per day for 5 consecutive weekdays. Through simple multiplication, 2,650 MW for 10 hours over 5 days equals 132,500 MWh. For demonstrative purposes, Figure 1 is a thought experiment to evaluate the above statement. Figure 1 shows average weekly generation – an average of all 168 hours of the week – of the LSR dams across 2012-2021. Our region's energy system's demand peaks during summer and winter months, so we'll use those periods to distinguish broad trends.

Summer Peaking

Peak energy demand in the Northwest often occurs as a heat wave forces residents to turn up air conditioning, most commonly in late summer. As seen in Figure 1, even with the generous average of all 168 hours of the week rather than a 50-hour period, the generation profile exceeds the peaking capacity of 132,500 MWh only during February through June, a time period when heat waves are less likely, grid demand is lower as the winter heating season ends and summer cooling season is yet to begin, and there is already an abundance of power on the grid due to spring runoff. Figure 1 shows that late summer has the lowest generation, due to little precipitation and low river flows. Climate change will only exacerbate late summer's low generation as drought reduces precipitation and river flow. However, late summer is also forecasted to have increasing energy demand in our region, as climate change drives longer and more frequent heat waves across the region. With the effects of climate change, we can expect LSR dam energy generation to become less valuable.

Winter Peaking

The Northwest energy system most commonly sees peak energy demand in the winter as residents turn up their heating systems. Winter cold snaps in the Northwest are likely to occur in December or January. Again, in Figure 1, the generation profile exceeds the peaking capacity of 132,500 MWh only during February through June, a time period when winter cold snaps are less likely, grid demand is lower in the spring as the winter heating season ends, and there is already an abundance of power on the grid due to spring runoff. December and January are periods of low generation for the LSR dams due to low river flow as precipitation falls as snow. As climate change worsens, this trend may change as more precipitation in winter falls as rain rather than snow. However, climate change also causes more interannual variation, further complicating the ability to forecast future winter sustained peaking capacity.

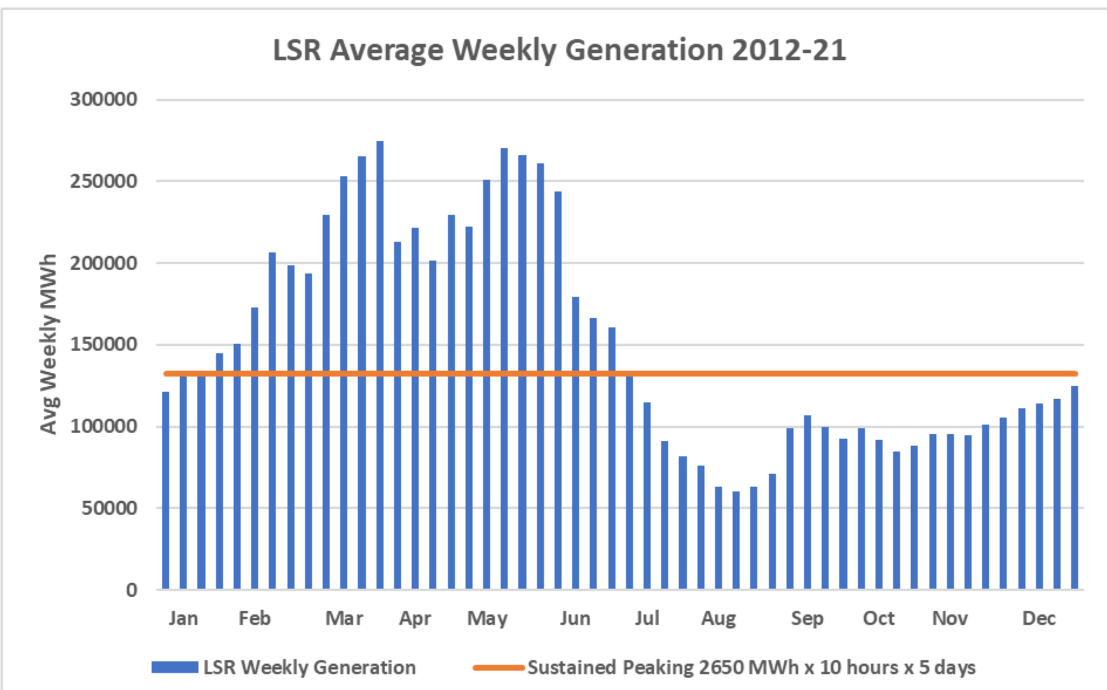

Figure 1: Average weekly generation (MWh) of LSR dams across the years 2012-2021 in comparison to the claim of sustained peaking capacity (2650 MWh x 10 hours x 5 days). Data source: US Army Corps of Engineers.

As we note below, the LSR dams do have important peaking capacity abilities. However, the operational data shows that the LSR dams cannot provide the multi-day, multi-hour sustained peaking capacity that is attributed to them, due to the river simply not having enough water.

Furthermore, the LSR dams will help our region's energy system address peak capacity during its period of greatest energy need, summer, less and less as climate change worsens.

The LSR dams provide limited multi-hour peaking capacity during times when peaking capacity is most needed, particularly mid-winter and late summer.

As explained above, peaking capacity is most needed in winter and summer months, when energy demand is high and weather extremes are most frequent. In late December 2021, the Northwest experienced a cold period during which energy demand was high. Figure 2 shows how dam operators switched to running the generators close to zero megawatts for a couple hours after midnight, and then ramped generation up during the day. Despite having over 3000 MW of nameplate generating capacity, the dams mostly peaked around 1200 MW (with two days over 1400 MW). While operating the LSR dams like this can provide flexibility, fish managers are concerned about the resulting impacts to salmon and steelhead moving between LSR reservoirs.

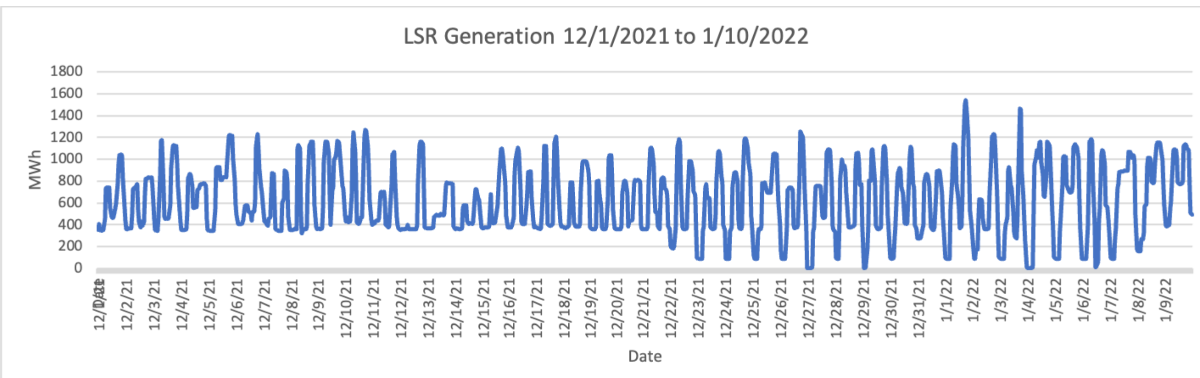

Figure 2: LSR dam generation in MWh from December 21, 2021 to January 10, 2022. Data source: US Army Corps of Engineers.

Figure 3, a close up of a couple of days from Figure 2, shows a more precise pattern. Dam operators slowed or even shut down generation, allowing water to pool behind the dams, and then increased generation to match energy demand peaks in the morning and evening.

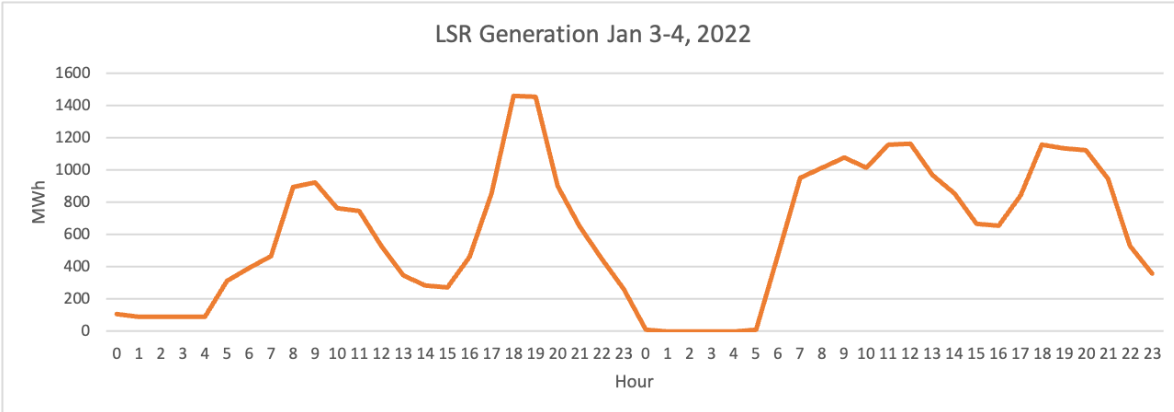

Figure 3: Hourly LSR dam generation in MWh during a period of January 3 and January 4, 2022. Data source: US Army Corps of Engineers.

Figures 2 and 3 show that the LSR dams do allow dam operators the ability to increase and decrease generation according to peak demands. However, in this instance of high winter power demand, that ability is closer to 1,000 MW for several hours – nowhere near 2,650 MW for 10 hours over 5 days.

In the late summer months – our fastest growing reliability stress period – there is even less of an ability to increase and decrease generation according to peak demands. Figure 4 shows LSR dam generation across two hot days in August 2021, at a time when river flows are at their lowest. The dams were able to increase generation by only about 200 MW for several hours.

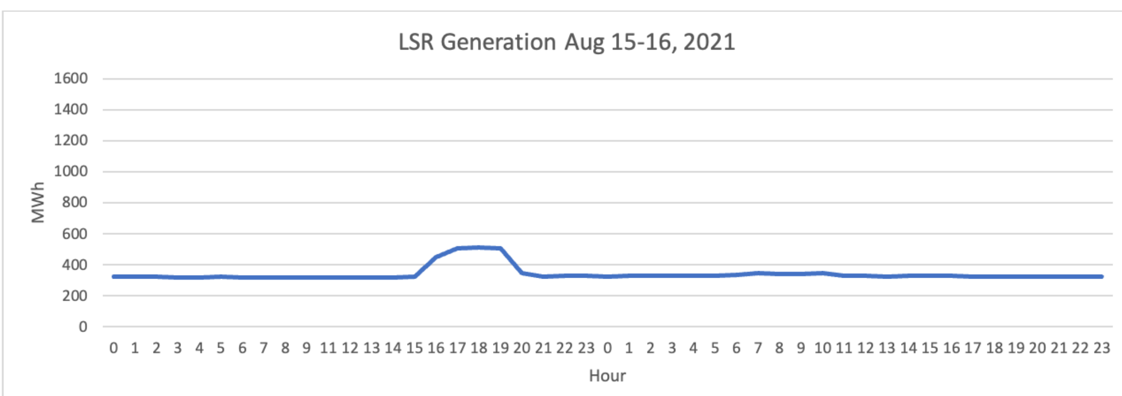

Figure 4: Hourly LSR dam generation in MWh during a period of August 15 and August 16, 2021. Data source: US Army Corps of Engineers.

As shown in the NW Energy Coalition's recent paper, "Smart Planning Will Drive Replacing the Power from Lower Snake River Dams," strategic and smart planning can identify a clean resource portfolio that may better suit the energy services that the Northwest grid requires: "hybrid projects that combine renewable resources with storage are specifically designed to increase reliability and provide a power resource that better fits utility load. The storage can be used to precisely time when the renewable energy goes onto the grid when it is most valuable."

An energy portfolio that includes hybrid renewable projects (wind/solar/storage), energy efficiency, demand response, standalone storage, and distributed generation (solar and wind) could result in high generation when demand is highest in the summer (when the sun is shining) and the winter (when the wind is blowing). As climate change worsens, it is expected that LSR dam output will become even more variable and perhaps less coincident with times of high summer and winter demand.

Furthermore, a portfolio that includes customer side resources such as energy efficiency, distributed generation and storage, and demand response will help flatten demand peaks and protect the reliability of the system. Customer side resources must be part of any clean resource portfolio.

Conclusion

The LSR dams have a limited ability to shift generation to times of peak energy demand. The LSR dams provide sustained peaking capacity during times when the grid already has an abundance of power. They provide limited multi-hour peaking capacity during times when peaking capacity is most needed, particularly mid-winter and late summer. As energy demand peaks continue to shift towards summer and away from winter, the region may be better served with a clean resource portfolio to meet periods of sustained peaking.

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