U.S. Electricity Grid: At Risk

17GWs of hydropower capacity up for relicensing by 2035 risking the grid's ability to respond and recover

In addition to integrating variable wind and solar, zero-carbon **hydropower** is often crucial in responding to extreme grid events due to its agility, dispatchability and flexibility.

As the magnitude and frequency of extreme and stressful grid conditions increase, hydropower will continue to play a vital role in power system reliability and resilience.

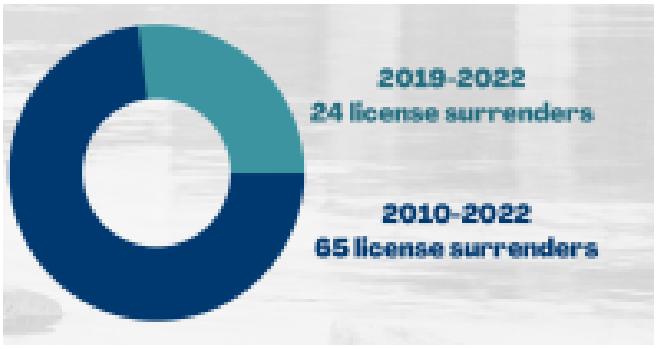
Currently, licenses for **459 hydropower facilities** representing **17 GWs will expire by 2035.**

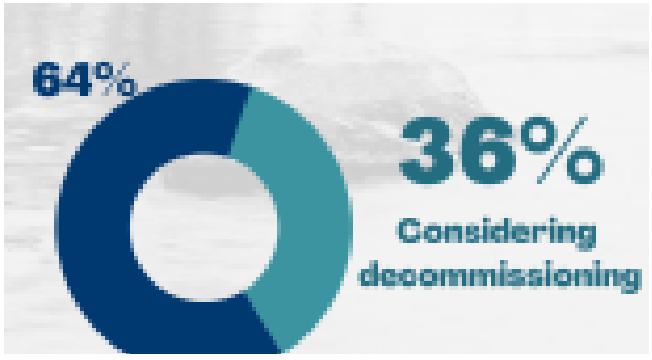
On average, relicensing a hydropower facility takes **7 years and the paperwork costs $3.5 million**, which does not include costs of new turbines, fish passage, or dam safety investments.

Half of the non-federal U.S. Hydropower fleet is up for relicensing.

HYDROPOWER LICENSING SURRENDER IS ACCELERATING AND WERE LOSING GROUND TO REACHING A ZERO CARBON GRID

From 2010-2022, the hydropower industry experienced **65 license surrenders**. In the last three years, there have been 2**4 surrenders**. suggesting an accelerating trend.





36.4% of hydropower owners said that they were **"actively considering" decommissioning** a facility, while only 13.6% of these owners had previously considered decommissioning.

NATIONAL HYDROPOWER ASSOCIATION

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GRID RELIABILITY SERVICES MATTER

Hydropower is flexible and dispatchable, and **outperforms** other energy resources when comparing essential grid reliability services such as: voltage support, inertial response, primary frequency response, spinning reserves.

And given hydropower's readily available conversion of stored energy water stored behind dams it provides **nearly half (40%) of the nation's black start capabilities**. Black start is what brings the grid brought back on line following a major disruption

Product	Nuclear	Run-of-River Hydro	Ponding Hydro	Pumped Storage	Coal	Combined Cycle	Combustion Turbine	Wind	Solar	Battery Storage	Demand Response	Energy Efficiency
Day-Ahead Energy	✓	✓	✓	✓	✓	✓	O	✓	✓	O	O	O
Real-Time Energy	O	✓	✓	✓	✓	✓	O	✓	✓	O	O	O
Clean Energy	✓	✓	✓	O	X	O	O	✓	✓	O	O	✓
Regulation	X	O	✓	✓	✓	✓	O	O	O	✓	O	X
Spinning Reserves	X	O	✓	✓	✓	✓	✓	X	X	✓	O	X
Non-Spinning Reserves	X	X	✓	✓	X	✓	✓	X	X	✓	O	X
Load-following	O	O	✓	✓	O	✓	✓	O	O	✓	O	X
Reactive Power	✓	✓	✓	✓	✓	✓	✓	O	O	✓	X	X
Black Start	X	✓	✓	✓	O	✓	✓	X	X	O	X	X
Resource Adequacy	✓	✓	✓	✓	✓	✓	✓	O	O	O	✓	✓

Technical Capability to Provide Product
✓ Well-Suited
O Neutral
X Poorly-Suited

CASE STUDIES: HYDROS TRUE VALUE TO THE GRID

While winter storm Elliot caused 46 GW of power to go offline in the PJM Interconnection in December 2022, **95% of hydropower generation remained reliable and available**

In 2020, a New England nuclear plant tripped offline, along with the loss of over 1,200 MW of power. Within seconds, the region's two pumped storage hydropower facilities **instantly generated power to help make up the shortfall**

As a heatwave in California brought fears of rolling blackouts in 2022, **hydropower increased generation to 5,000 MWs,** mitigating a potential grid disruption.

Alaska received more than **$200 million** to improve the Railbelt electrical grid (running from Homer to Fairbanks), stabilizing most of the population through **Bradley Lake Hydropower**.

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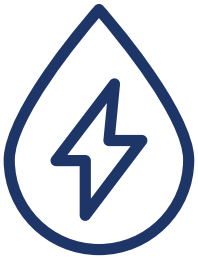
HYDROPOWER DOES MORE THAN GENERATE POWER

Hydro might be known for generating zero carbon power, but its essential grid reliability services are what really makes the grid work.

FLEXIBLE

Hydropower's flexibility allows it to rapidly ramp generation up and down in response to power imbalance. More than **80% of reporting hydropower capacity is capable of ramping from cold shutdown to full power within 10 minutes.**

FREQUNECY RESPONSE



During an extreme event, where multiple generating units are tripped, frequency response is critical to limit the range of frequency deviation within permissible ranges. **Hydropower facilities, collectively, contribute between 30–60% of response to help stabilize system frequency after outage events in the Western Interconnection,** even though, hydropower only constitutes between 20–25% of generation capacity in the WI grid.

BLACKSTART

The 2003 Northeast blackout turned into a massive grid stressor that affected more than **45 million people in eight states**. The hydropower plants in western New York were able to restart quickly and help stabilize the grid because hydropower is the sole generation type that can resume operations without relying on a kick start from an outside power source.

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