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Statement for the Record

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Full Committee Hearing to Examine Energy Storage Technologies

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Chairman Murkowski, Ranking Member Cantwell, and members of the Senate Energy and Natural Resources Committee: thank you for inviting me here today to testify on the tremendous value and potential of pumped storage hydropower.

I am the Head of Engineering at Voith Hydro, located in York, Pennsylvania. We are a 150-year old company, and we trace our roots in the United States back 140 years. Voith Hydro employs nearly 600 people in the United States, and all Voith divisions throughout the world employ nearly 20,000.

Both domestically and across the globe, we are a leading supplier of hydroelectric turbines, generators, automation, and other equipment. This is particularly true for pumped storage hydro generating equipment, where Voith has either supplied or modernized major generating components (i.e., pump/turbine or generator/motor) for about half of the pumped storage hydro facilities in the United States. These include projects like Bath County in Virginia, Raccoon Mountain in Tennessee, Castaic in California, Bad Creek in South Carolina, and Muddy Run in Pennsylvania. Voith Hydro has played a constant role in advancing the technology harnessing the world's largest developed source of renewable energy.

I am particularly excited about today's topic because pumped storage hydro is a highly-advanced – and in many ways, underutilized – form of energy. It is also the only proven form of large-scale energy storage, which gives utilities and grid operators the stability and reliability they need to deliver a constant flow of energy to their customers. Pumped storage hydro is also essential for the further deployment of other renewable energy resources such as wind and solar. Pumped storage hydro helps balance energy grids that are becoming increasingly reliant on more intermittent sources of energy.

According to the Department of Energy's 2016 Hydropower Vision Report, current pumped storage capacity in the United States is just under 22 gigawatts, and comprises 97% of utility-scale energy storage in the United States. Even though there are only 42 pumped storage facilities in the U.S. (compared to nearly 2,200 non-pumped storage hydropower plants), pumped storage accounts for over 20% of the installed hydro capacity in the United States. That statistic

alone shows the massive storage capacity that pumped storage hydro offers our nation to help with the transition to a more renewable energy-based economy.

The concept of pumped storage hydro is simple. During times when demand for energy is low, such as the middle of the night, water is pumped up to a higher elevation reservoir. This upper reservoir "stores" the energy used to pump the water up to the reservoir. That water remains there until demand for energy increases, at which point the water is released back through the turbines to generate energy. Pumped storage converts the potential energy of falling water into electricity that is deployed across the country, and it accomplishes this service with an overall efficiency of roughly 80%. Other energy storage methods cannot match this level of efficiency and sustainability.

The technology, engineering, and construction that goes into pumped storage is anything but simple. Each pumped storage unit is designed with the specific grid it is serving in mind to ensure the energy demand is met. That means other forms of energy serving the grid – such as nuclear, coal, natural gas, and other renewables – significantly affect the engineering and design of a pumped storage facility.

Though pumped storage is not a new technology, it is also not static. Over the last 100 years since Voith's first pumped storage unit was delivered, the technology has constantly improved. The evolution of pumped storage has gone from conventional pumped storage, which reacts to grid demands in minutes, to advanced conventional pumped storage, which reacts to the grid demands in seconds, to the current state-of-the-art variable speed, ternary, and full power frequency converter pumped storage facilities, which react to the grid demands in milliseconds.

Although pumped storage facilities are built to last for decades, the longer the facility has been operational, the less equipped it is with the most up-to-date technology that would allow these facilities to better account for a rapidly changing energy supply. These plants can also fall behind modern standards for efficiency; in those cases, operators are not extracting the full benefit of a pumped storage. A streamlined and robust licensing (and relicensing) process will make a huge impact to the utility grid value of these pumped storage facilities.

Like conventional and small hydropower technologies, pumped storage projects can take an incredibly long time to get licensed and ultimately built. The inherent cost of these large infrastructure projects, coupled with a licensing process that can take a decade or longer means many developers and utilities do not pursue pumped storage projects that would otherwise provide substantial benefits to their energy portfolios and, ultimately, the reliability of our nation's power grid.

With respect to licensing, I would like to thank Committee members for your work on the Energy Policy Modernization Act of 2016. That bill included provisions long-sought by our industry that would streamline the licensing process for hydropower, including designating the Federal Energy Regulatory Commission (FERC) as the lead agency throughout the licensing process. It would also give FERC the authority to set a schedule for this often cumbersome and timely process. Notably, this improved process would keep in place environmental safeguards,

but ensure projects do not languish and give their developers have some degree of regulatory certainty during the process.

Given that bill's fate at the end of last Congress, I am pleased to see Chairman Murkowski and Ranking Member Cantwell reintroduce similar legislation in the Energy and Natural Resources Act of 2017. Of particular interest to this hearing, that legislation contains Ranking Member Cantwell's proposal for a $50 million annual grid storage research, development, and demonstration program. That's a good and important first step.

Further, the Energy and Natural Resources Act requires FERC to establish an expedited review of the licensing process for new closed-loop pumped storage projects, identify project development and market compensation barriers for pumped storage, and encourages FERC to provide greater certainty with respect to the licensing timeline for low-impact pumped storage projects.

I hope both the Senate and the House reconsider this legislation and its provisions become law.

Outside of the regulatory landscape, perhaps the biggest challenge for pumped storage hydro is proper and accurate valuation. Nearly everyone agrees that energy storage is a priority, but there is considerably less agreement in how to account for that value in a way that has a true market impact. The lack of proper valuation with necessary context to the role storage plays on the energy grid is another hindrance to the development and deployment of pumped storage hydropower.

One way to solve this problem is through the tax code. Capacity additions, performance improvements, and life extension to existing pumped storage projects qualify under federal tax incentives for hydropower. However, these incentives expired in 2015. At a minimum, Congress should adopt an extension of the hydropower Investment Tax Credit (ITC), similar to the solar industry. Additionally, an investment tax credit for new pumped storage projects should also be adopted, along with eligibility for the Clean Renewable Energy Bonds (CREBs) program. I hope these provisions are considered in the tax reform effort currently being developed in Congress.

In addition, the research capabilities at the Department of Energy should not be ignored. The DOE's Water Power program needs continued funding. Pumped storage R&D support would fund activities such as the development, testing, and deployment of new turbine designs; the development of new small modular pumped storage projects; and the identification and quantification of the gaps in valuation of ancillary services and grid reliability in various federal and state policy.

In its recent Electricity Markets and Reliability Report (better known as the Grid Study), DOE acknowledged many of the issues outlined in my testimony. With respect to hydropower, the report said, "Encourage FERC to revisit the current licensing and relicensing process and minimize regulatory burden, particularly for small projects and pumped storage." It also commented on the need for storage, determining "A grid with higher levels of [variable renewable energy] and more dynamic customer loads will need more of the services that energy storage can provide by acting on both the supply and demand side, including energy, capacity,

energy management, backup power, load leveling, and [essential reliability services], over periods from seconds to hours or days."

Pumped storage projects are proven solutions for each of the energy service concerns identified in the Grid Study. I encourage this committee to work with DOE and stakeholders to address these well-established challenges.

Our European colleagues are already facing the reality of an energy grid comprised of mainly intermittent power sources. The older conventional storage facilities do not react fast enough to secure a reliable grid. As a result, they are rapidly advancing the deployment of cutting-edge equipment that reacts to grid faults in milliseconds (such as variable speed and ternary pumped storage units coupled with full power frequency converters). Many of these projects involve modernization and rehabilitation of existing conventional pumped storage facilities; however, several new facilities are also being built, particularly in areas prone to grid reliability issues.

In the United States, the challenge is clear. If we want more wind and solar power on our grid, or any other new form of energy, pumped storage *must* be expanded. In that same 2016 Hydropower Vision report I referenced earlier in my testimony, the DOE determined that pumped storage hydropower has the potential to grow by 36 gigawatts. In fact, pumped storage accounted for nearly 75% of the total hydropower increase envisioned by the report. But that can't happen without some of the policy changes I've outlined.

While I know this committee is primarily tasked with ensuring our country's energy needs are met and natural resources are utilized appropriately, I'd be remiss if I didn't at least mention the economic impacts of pumped storage. As with any large-scale infrastructure project, modernizing and retrofitting, and increasing the supply of pumped storage hydropower will be a serious economic boom, both in towns like York, Pennsylvania, and the communities where pumped storage projects are located. These projects benefit the people engineering the turbines and building the infrastructure, and the people who work for the over 2,000 companies in the national hydropower supply chain.

Thank you again for the opportunity to share my views, and I look forward to taking your questions.