September 6, 2022

U.S. Department of Energy
Grid Development Office
1000 Independence Ave., SW
Washington, DC 20585

RE: DE-FOA-0002762: Request for Information on Hydroelectric Incentive Programs

Submitted via: wptorfi@ee.doe.gov

To whom it may concern:

The National Electrical Manufacturers Association (NEMA) welcomes the opportunity to submit comments in response to the Grid Deployment Office's request for information (RFI) on hydroelectric incentive programs. We are the leading U.S. trade group representing nearly 325 electrical equipment and medical imaging manufacturers that make safe, reliable, and efficient products and systems. Our companies are at the forefront of helping the nation successfully transition to an electrified, connected, and cleaner economy. An assortment of our members manufacture almost all hardware products, advanced technologies, and integrated systems and controls used in grid construction and upgrade projects; this makes the electroindustry a critical part of any hydroelectric facility capital improvement venture.

Below are NEMA's considerations to the RFI's various questions:

C1.1.1 – Are there other terms, definitions, or alterations to the proposed definition of *capital improvement* that DOE should consider?

The RFI proposes the definition of capital improvement to be:

> *"The addition, improvement, modification, replacement, rearrangement, reinstallation, renovation, or alteration of tangible assets, such as real property, buildings (facilities), equipment, and intellectual property (including software) used in hydroelectric operations…"*

Generally, NEMA is pleased with this definition; however, we urge DOE to consider including or clarifying the following:

- **Ensure that 'software' within the term 'intellectual property' includes, or does not exclude, operational technologies (OT) and industrial control systems (ICS).** In addition to informational technology (IT), 'software' should be looked at holistically to incorporate IT, OT, and ICS; these elements should not be compartmentalized. OT and ICS include, but are not limited to, building management systems (BMS), power drive systems (PDS), and supervisory control and data acquisition (SCADA) systems.

NEMA encourages the inclusion of OT and ICS in the interpretation of 'software' to further the promotion of cybersecurity standard harmonization between product vendors and utility owners/operators, including those used in hydroelectric facilities. A facility's cyber resilience is optimized if all forms of software are integrated and operating using familiar code, networking definitions, and conformity assessments[1]. Any DOE policy definition should seek to boost such harmonization between products.

- **Incorporate building management processes**, like those recognized by DOE as part of its Better Buildings Challenge[2]. Employing product efficiency strategies and management processes can further optimize existing assets or tangible capital improvements, allowing hydroelectric facility owners flexibility in their upgrade applications. Improving operational efficiency by at least 3%, as required by Section 243, could be possible by the adoption of better processes and policies.

C1.1.2 – What benefits and/or limitations would result from requiring an eligible capital improvement to be exclusively within the FERC defined project boundary?

With the RFI's proposed definition of capital improvement, it states:

> *"…which are capitalized in accordance with generally accepted accounting principles within the Federal Energy Regulatory Commission (FERC) project boundary of a hydroelectric facility or the defined boundary pursuant to a permit or valid existing right-of-way granted prior to June 10, 1920."*

NEMA recognizes the need to provide a project boundary to determine scope, define eligibility, and measure results, among other aspects. However, for implementation of these BIL provisions, we urge that the DOE provide reasonable flexibility in applying the FERC project boundary as the limit. In incorporating technology to make a hydroelectric facility more resilient and efficient, a firm geographic border may be impractical or even counterproductive. DOE should consider the FERC boundary as a variable in the overall capital improvement project being proposed and decide accordingly.

A rationale for flexibility comes from the eligible technologies and systems contained within the definition of a capital improvement asset, per this RFI. Modern technologies which increase grid resiliency, facility efficiency, and worker safety may not be designed to be confined to a geographic boundary; in some cases, they are chosen because they go beyond such traditional limitations. The adoption of modern technological solutions or applications, particularly those which have been proven to meet or surpass the BIL's efficiency minimums, should not automatically be disqualified from an incentive consideration because it may operate or reside outside of the project boundary.

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[1] https://www.nema.org/standards/view/harmonized-cybersecurity-standards-and-conformity-assessment
[2] https://betterbuildingssolutioncenter.energy.gov/challenge

Consider the following as examples of technologies which may fall outside of a project boundary, but are practical and available solutions to achieve program design goals:

- **Battery Energy Storage**

  A hydroelectric facility's resilience depends on its ability to access and maintain secondary power when primary fails to ensure its operational components do not become a hazard to the facility itself, its workers, or the surrounding environment or community. Secondary power via battery energy storage is a practical solution. The load needs of a facility to ensure safe operations until primary source power is restored will determine the capacity of secondary storage needed. Where these batteries are situated is contingent upon multiple factors, including land availability, safety concerns, transformer location, and other logistical variables. Depending on these considerations, and others, placement of resilient battery storage may be necessary outside the FERC project boundary.

- **Microgrids**

  Grid resiliency relies heavily on the flexibility of electric generation facilities themselves; if their output is disrupted the consequences ripple throughout the grid. Microgrids allow hydroelectric facilities to mitigate high line failure rates and long maintenance downtimes. Microgrids can also be adaptable in their design, enabling them to be constructed in mountainous and other areas with remote and difficult geographies[3]. NEMA defines microgrids to have at least four key elements, which are described below to RFI question C3.B.1. These elements may vary in size and space, depending on the location of a hydroelectric facility. To help make microgrids a viable resiliency option, it may be necessary to place them outside the FERC project boundary.

- **Cybersecurity**

  Cyber threats against critical infrastructure are real and constant; hydroelectric facilities must consider cybersecurity in their resilience strategies. The OT and ICS which manage the physical operations and functionality of turbines, generator motors, load management systems, and other mandatory processes require unique and sophisticated software security programs. Almost always, these cybersecurity systems are tailored to meet the needs and demands of a specific facility. This specialization may require certain vendor requirements, including remote access to OT, ICS, and SCADA systems to continually audit, monitor, and upgrade/patch vulnerabilities. To provide quick service, this remote access may occur from distant facilities within other jurisdictions, well outside the FERC project boundary.

[3] https://www.sciencedirect.com/science/article/pii/S2352484720312877

C2.A.1 – What type of capital improvements are needed to improve operational efficiency at existing facilities by at least 3%?

NEMA realizes that a product or a facility cannot suddenly be made efficient; facility owners and operators must invest in and apply modern equipment and proper management processes to achieve efficiency goals. Incumbent and legacy power generation equipment, placed into service years ago, was designed primarily for longevity and to achieve output goals; efficiency was most likely not considered during their manufacture. Replacing these dated technologies with modern, efficient equipment, which has been proven to achieve greater levels of output, can reach and surpass these goals. Upgrades can include:

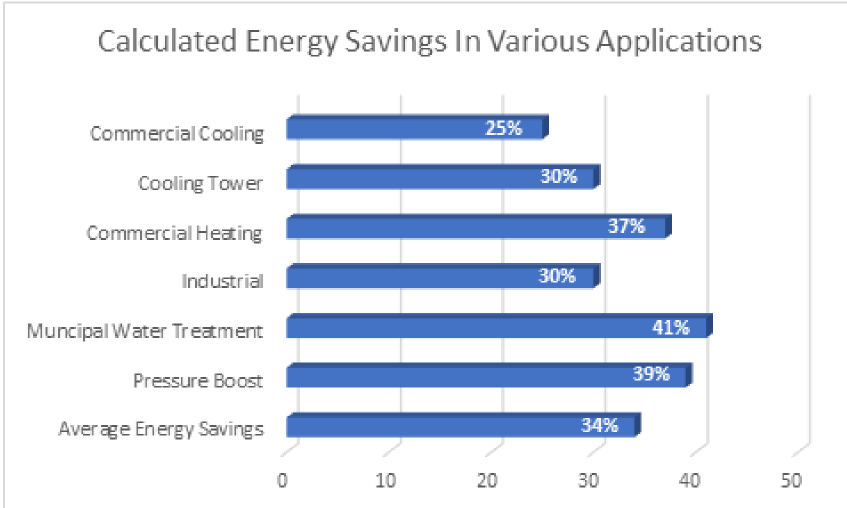
- **Power Drive Systems**

  A proven technology includes digitally controlled PDS. Legacy motor control systems, which rely on mechanical pullies, valves, and dampers, tend to increase electricity consumption as they age. PDS allow for greater efficiency, better integration with smart grids, 'peak demand' response control, and predictive maintenance. As all economic sectors continue to become more electrified and connected, broad adoption of PDS would reduce the need to construct additional power generation facilities to meet growing energy demand. Incorporation of such a technology in hydroelectric facilities could help provide resilience to the grid as load demand as the economy transitions to electrification.

  PDS technologies provide three immediate policy solutions: they are widely available; they offer energy savings for the grid; and they are scalable across a wide variety of economic sector applications. To illustrate this (see Figure 1), consider the recent research findings published in a Cadeo Group report suggesting that PDS can provide significant energy savings in most applications currently using legacy motor systems[4]. According to this research, more than one-third of all energy used to drive motors could be saved by retrofitting existing installations with PDS.

[4] https://neea.org/resources/power-drive-systems-energy-savings-and-non-energy-benefits-in-constant-variable-load-applications

(Figure 1)



- **Building Management Systems & Building Energy Modeling**

  A BMS (defined here to also include building automation systems, building automation and control systems, and intelligent building management systems) provides a holistic way of managing energy generation systems, sub-systems, and overall building energy to be efficient and resilient while keeping occupants safe, comfortable, and productive. They are integrated systems of hardware, software, and interfacing communications to automatically monitor and control building systems to optimize building energy performance. Use of these systems within a facility can, among many things, monitor and mitigate power reliability issues, enable actives responds to adverse events, and facilitate interactions with external systems.

  The use of a BMS in a hydroelectric facility can help facilitate greater operational efficiency in multiple ways. With proper modeling and the establishment of performance goals, they allow the facility itself to be more energy efficient, using data and technologies to smartly manage and operate energy consumption to ensure economical and resilient usage. Additionally, when a facility consumes energy more practically, this enables the operational equipment used in electricity generation to become more reliable.

  Even if a hydroelectric facility has been retrofitted or upgraded with modern, efficient technologies and equipment, they must be managed correctly and in unison to achieve the efficiency goals established by the facility's owner/operator or policymakers (including benchmarks required by this IIJA provision). Building energy modeling (BEM) techniques and tools are a necessary complement to a BMS; BEM use physics equations to evaluate a facility's performance. For example, while a building may be designed to be energy efficient, without a

BEM to properly manage its internal and operating systems, the structure's measured energy use could deviate by more than 25% from design projections[5].

The usage of BEM and BMS together can lead to a facility being substantially more energy efficient. According to model projections by Karpman Consulting, conservation measures using these systems have a higher contribution toward overall energy savings[6]. For instance, when a building implemented BMS technologies, the average contribution toward source energy savings was 29%.

C2.A.2 – How might DOE validate the efficiency improvements to ensure the capital improvements meet the 3% requirement?

Generation efficiency at hydroelectric facilities can be largely measured, and therefore validated, by comparing the head and flow. The amount of power that can be generated by a facility depends on the change in water levels between the hydro intake and discharge points; the more head, or water pressure, that engages with a turbine the more power it will generate. The more pressure against a rotating turbine and generator the lower the torque, which further translates into lower operating cost. Upgrading or retrofitting legacy turbines and generators can optimize head pressure, leading to greater outputs[7]. This can be very beneficial to facilities which are in regions experiencing severe drought or prolonged water storages. Facilities with more efficient equipment can help maximize electricity generation and output when head levels are reduced.

Flow is the annual mean rate of a facility's generation and a true benchmark to measuring operational efficiency. Since flow rates can vary day to day, a longitudinal approach is needed to determine average output over time and compare that data against the generation capabilities of equipment used, including any capital improvements. Once this information is known, operational efficiency goals can be more accurately established. Using BEM, BMS, and other ICS technologies can help further maximize outputs.

C2.A.4 – Should DOE consider other capital improvements that may improve overall facility efficiency?

Capital improvements to improve a facility's overall efficiency has multiple benefits, including reducing operational costs, improving occupant safety and comfort, and improving resiliency. As described above, implementing technologies (BEM, BMS, OT/ICS) and modern equipment (PDS, microgrids, battery power storage), as well as management strategies which amplify their effectiveness, help achieve these outcomes.

[5] https://www.nema.org/standards/view/specifying-building-management-systems-and-data-integrated-building-systems
[6] https://www.nema.org/standards/view/building-system-efficiency-modeling-improving-the-accuracy-of-building-energy-modeling
[7] https://www.renewablesfirst.co.uk/hydropower/hydropower-learning-centre/head-and-flow-detailed-review/

C3.B.1 – What types of grid resiliency improvements should receive the highest priority under Section 247?

As noted in comments to question C1.1.2, microgrids can serve as a critical component of a facility's resiliency. Microgrids provide energy reliability, especially to a facility's vital operational systems and equipment which could malfunction or become a hazard if suddenly cut off from power. Also, as power generation source, if a hydroelectric facility is unable to produce power, the ripple effects often stretch far beyond the initial impact zone. Regional outages inhibit the ability to protect communities from subsequent dangers and health concerns, including food refrigeration, sanitation, and shelter.

NEMA defines a microgrid to include four elements: local electricity generation; local load management; ability to automatically decouple from the grid and go into "island mode;" and ability to work cohesively with the local utility[8]. While microgrids can include diesel or propane generation, they can further integrate other features beyond these traditional fuels, including alternative energy sources like wind and solar, gas turbines and central plants providing combined heat and power, and battery energy storage. Using these alternatives, microgrids can more easily reroute power to detected load and fault conditions.

Microgrids are already used in myriad situations to provide resiliency for facilities which provide critical public services, including military installations and hospitals. The benefits of such a resilience tool can too be applied to enhance a hydroelectric facility.

Additionally, grid resiliency can be improved through better facility energy management, including the replacement or upgrade of existing analog motor systems with PDS. As noted above, a PDS provides substantial energy savings (more than 30% reduced energy use) and can be equipped with the capability to communicate with other energy delivery systems. This harmonization of systems and networks can maximize the uptime between PDS and other mission-critical operating components and equipment, creating efficiencies which reduce overall energy consumption.

NEMA once again appreciates the opportunity to provide these comments on how the electroindustry can help decarbonize the industrial sector. If there are questions regarding these comments, please do not hesitate to contact me.

Sincerely,

Spencer Pederson
Vice President, Public Affairs

[8] https://www.nema.org/storm-disaster-recovery/microgrids-and-energy-storage/energy-reliability-with-microgrids