CONNECTICUT'S HYDROPOWER ASSETS

2024 Report from the Task Force to Study Hydropower

April 1, 2024

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I. Executive Summary

Background

Special Act No. 23-8 became law on June 28, 2023, and established a Task Force to Study the State's Hydropower Assets. The taskforce was mandated to study existing hydropower assets in the state and review the benefits of such assets and submit a report on its findings and recommendations. Small and large hydropower producers, an environmental representative, state agencies (the Department of Energy and Environmental Protection (DEEP) and Public Utilities Regulating Authority (PURA)), and the CT Green Bank (a quasi-public agency) held public meetings with administrative support from Energy & Technology Committee staff between October 2023 and March 2024 to develop this report.

Benefits of Hydropower

Hydropower, or hydroelectric power, is one of the oldest and largest sources of renewable energy, which uses the natural flow of moving water to generate electricity. In addition to being a clean energy source that emits no carbon dioxide, it is a base load generator with a long design life (50-100 years) that tends to have higher capacity factors compared to wind and solar. Hydropower can also provide ancillary services like frequency regulation, grid stability and reserve capacity. Non-power benefits include property tax support, recreational opportunities, public dam safety and job creation.

Drawbacks and Environmental Impacts of Hydropower

In addition to their numerous benefits, hydropower dams can have significant environmental and social impacts. Dams can profoundly alter local river environments, impede the movement of fish and other aquatic species (eel, mussels, etc.), interrupt natural flows and sediment transport, accumulate pollutants within the impounded sediments, impact water quality and quantity, submerge critical habitats, contribute to shoreline erosion, and can create significant safety concerns. The report identifies eight areas where hydropower can mitigate and reduce these impacts such as supporting ecological flow, water quality, providing effective fish passage and protection, ecosystem services and watershed health.

Existing Environment and Challenges

There are 25 operating hydropower projects in Connecticut with a total installed generating a total nameplate capacity of 152 MW. The average installed capacity of these facilities is 5.9 MW, the median 0.5 MW. Assuming an industry average capacity factor of 40%, these facilities provide approximately 533,000 MWH per year of clean renewable energy to the electric grid. Hydropower operators in Connecticut are faced with a variety of challenges. Without a program for existing assets, they face low energy compensation rates with electricity valued at the real-time locational marginal pricing (LMP). There are also restrictions to the current Renewable Portfolio Standard (RPS) whereby it does not allow projects installed before 2003 to be considered as a Class I. Hydropower is a heavily regulated electric sector with extensive permitting and regulatory requirements. Additionally, hydropower faces costs to maintain and upgrade existing generating equipment as well as install and operate environmental enhancements (i.e., fish passage facilities).

Policy Considerations

Although DEEP and PURA are active members of this Task Force, these agencies have regulatory and administrative responsibilities associated with hydropower that make them unable to endorse the following policy considerations without the potential for conflicts of interest. That said, these agencies have supported the Task Force putting forth policy considerations that reflect potential remedies to the existing challenges to hydropower described above.

Save the Sound participated actively in the Hydropower Task Force and provided feedback throughout but does not want to have its involvement suggest that there is implicit or explicit support for the policy considerations contained in the final Task Force report. Save the Sound supports improved innovation, efficiencies, and environmental protections at existing hydropower facilities, but does not support incentivizing the conversion of existing dams to hydropower, unless they currently serve another valuable purpose that ensures their long-term maintenance and viability, such as water supply or flood control.

Each policy consideration summarized below includes a brief statement of pros and cons, as needed, to reflect the various perspectives of Task Force members. In general, the following policy considerations encourage support for hydropower production as a source of local and regional renewable energy that must be balanced with ensuring healthy rivers, environmental mitigation, and community benefits. The following policy considerations support hydropower that: i) meets state and federal requirements, including applicable site-specific standards for water qualify, flow, and fish passage; ii) is limited to existing dams; and iii) is not located in dams identified as candidates for removal.

- **Standard Service Rate Compensation for Connecticut Hydropower Projects:** would enable existing hydropower assets less than 10 MWs that comply and remain in compliance with environmental requirements to enter 30-year contracts with a utility and be compensated at a standard rather than wholesale rate.

- **DEEP solicitation of hydro power:** would authorize DEEP to procure in-state hydropower resources up to 20 MW in aggregate. Facilities shall meet environmental guidelines at the time of submission or submit a proposal to comply with those requirements.

- **Changes to the Class I definition**: would modify the Class I definition under CT CGS Sec 16-1 (a)(20)(X) to allow for existing instantaneous run of the river hydropower assets that comply with the following criteria to qualify as Class I resources: 1) generating capacity of no more than 10 MW; 2) interconnected to the electric distribution company or municipality; 3) positive benefits to the state's economic development; 4) demonstrates consistency with the policy goals outlined in the Comprehensive Energy Strategy adopted pursuant to section 16a-3d; 5) not based on a new dam or a dam identified by the Commissioner of Energy and Environmental Protection as a candidate for removal, and 6) meets applicable state and federal requirements, including state dam safety requirements and site-specific standards for water quality, flow and fish passage.

- **Program Considerations for the Non Residential Renewable Energy Solutions (NRES) for Incremental Run of the River Hydro Projects** Proposed consideration would amend the NRES program or create another program specific to hydropower that: i) extends up to a 30-year Tariff term (instead of 20 years) based on the typical Federal Energy Regulatory Commission (FERC) license term and the inherent longevity of hydropower equipment and civil works; and ii) allows for projects to be sized based on hydro potential at the site instead of historical load at the meter.

Conclusions

The policy considerations above are intended to enable and encourage existing and new hydropower projects to respect natural river flows, fish migration, and water quality. They also could provide steady and predictable cash flows for existing hydropower facilities needed to facilitate adequate project financing. For those facilities that need to undergo improvements to improve efficiency, FERC licensing or relicensing, or comply with environmental requirements, steady cash flows and longer-term commitments would allow projects to seek public and private financing from entities like the CT Green Bank as well as commercial or community banks to make and sustain improvements.

II. Benefits of Hydropower

Introduction

Hydropower is unique among renewable generation technologies and offers a variety of both power and non-power benefits. Many of the existing generation assets have been operating for decades and are in need of modernization and life-extension investments including FERC relicensing. The absence of appropriate market recognition for the multiple benefits these assets provide poses a real risk of significant loss of these benefits to the state. In the absence of actions to address life extension challenges, the existing renewable production baseline will erode negatively impacting contributions from new capacity additions. Further, replacement of the existing renewable baseline will require new programs to be implemented in the future to encourage new investments which will come at a higher cost than maintaining the existing fleet.

Key considerations relative to the benefits of hydropower include:

Power Benefits:

1. *Renewable and Sustainable:* Hydropower is a renewable energy source, meaning it harnesses the natural flow of water to generate electricity without depleting finite resources.

2. *Production Efficiency:* hydropower tends to have higher conversion efficiencies and capacity factors compared to wind and solar power, along with greater operational flexibility. In simple terms, each MW of installed hydropower capacity would require replacement with 2.7 MW of solar, or 1.2 MW of wind capacity to produce the same volume of renewable energy[1].

3. *Zero Carbon Emissions:* The generation of electricity from hydropower produces zero carbon emissions, helping to mitigate climate change and reduce the environmental impact of electricity generation.

4. *Longevity:* Design life often ranges from 50 to 100 years or more; several of Connecticut's hydropower projects have been in continuous service for over 100 years.

5. *Flexible and Reliable:* Some hydropower plants can quickly adjust their output to match changes in electricity demand, providing flexibility to the energy grid. This capability makes hydropower an excellent complement to intermittent renewable energy sources like wind and solar, helping to stabilize the grid and ensure a reliable power supply.

Non-Power Benefits:

1. *Job Creation and Economic Development:* The construction, maintenance and operation of hydropower plants create jobs and stimulate economic growth at the local and regional scale. From engineering and construction to maintenance and operations, hydropower projects generate employment opportunities across a range of skill levels, contributing to economic development. Further, the areas around hydropower projects are frequently utilized for recreational activities associated with the hydropower facility that can generate meaningful economic benefits.

2. *Public and Dam Safety;* Safety is key to the effectiveness of a dam. Dam failures can be devastating for the dam owners, to the dam's intended purpose and, especially, for downstream populations and property. Property damage can range in the thousands to billions of dollars; no price can be put on the loss of life. The Federal Energy Regulatory Commission (FERC) regulates both the construction and operational phase of a licensed or exempted project; dam safety is a critical part of the FERC's hydropower program and receives top priority. FERC dam safety engineers review and approve the designs, plans, and specifications of dams, powerhouses, and other structures prior to construction and routinely complete detailed inspections throughout operations. Additionally, FERC regulated hydropower projects are required to prepare and regularly update public safety plans. For hydro dams that are not regulated by FERC, CT DEEP Dam Safety regulates the dam and requires that dam owners conduct periodic inspections (frequency is hazard classification specific), maintenance, and prepare and regularly update public safety plans dependent on hazard classification.

3. *Natural Resource Management:* Dams can play a role in managing natural resources by creating man-made wetland areas that help filter water, control floods, and provide habitats for diverse flora and fauna. Dams can also allow operators to manage water flows and create favorable conditions for wildlife. By regulating the release of water downstream, some dams attempt to mimic natural flow patterns and enhance the health of rivers and associated ecosystems. In many instances fish passage facilities are constructed, operated, and maintained by hydropower owners that attempt to provide safe and timely passage for migratory fish. Impoundment habitat created by dams creates warmwater lacustrine habitat for fisheries such as largemouth bass, carp and in some cases rare, threatened and endangered species (e.g. the banded sunfish).

4. Recreational Opportunities: Some hydroelectric dams can provide recreational opportunities for fishing, boating, swimming, bird watching, etc. This is due to the increased ponded habitat for waterfowl, fish, and water sports. These activities can support local economies by increasing tourism. Hydropower owners and operators embrace the importance of providing safe public access for recreational activities. The National Hydropower Association (NHA) notes that, "recreation is perhaps hydropower's most visible and publicly driven benefit… These activities also contribute significantly to local and regional economies and greatly improve the quality of life for those who take advantage of these recreational opportunities."

5. *Trash Collection*: Many hydro facilities collect and remove tons of trash annually from Connecticut's river including man-made materials and other debris; removed inorganic materials are sorted into multiple large dumpsters, organics are typically returned to the river to mimic the natural organic material transport function of the system. Many hydropower projects are manned on a daily basis. As a result, plant operators are intimately familiar with the river systems where they spend 1,000's of hours each year not only in operational capacity, but as stewards of these resources. Removing trash and debris is only part of this important function.

6. Historic Preservation: In addition to supplying energy for the industrialization of civilizations, many hydroelectric projects, which were built in the past as the most modern and technological engineering/architectural structures of their time, are currently considered as industrial heritage. Such structures and the territories they create in their surroundings

constitute components of cultural heritage. Innovative construction systems and engineering techniques implemented at hydroelectric facilities of the past centuries and machinery installed within them constitute a significant phase in the history of technology. Functioning hydroelectric facilities enable the sustainable maintenance and monitoring of the sites, while providing the transfer of the industrial heritage to the future generations.

The following section provides additional detail specific to Connecticut's hydropower's power benefits in both a historical and forward-looking context.

Energy and Power Benefits

There's been a long history of using water flowing in rivers and streams to produce mechanical energy; hydropower is the first-ever source of energy that was used in the production of electricity. In performing this electrical generation function, hydropower offers numerous benefits to the energy grid, making it a valuable source of renewable energy. In the simplest terms hydropower projects can produce the following power-related products:

- **Energy –** Hydropower projects generate electrical energy by converting the kinetic energy of flowing water into electrical energy with turbines and generators. Electrical energy is a fundamental component of modern society and is used for a wide range of purposes. In some instances, the energy derived from renewable resources creates an environmental attribute, commonly known as a renewable energy certificate (REC) associated with each MWH of generation; REC's can be traded in regional RPS compliance markets providing an important source of revenue to asset owners and investors.

- **Power & Capacity –** Capacity – also measured in kW and MW -- refers to the maximum amount of electricity that a power plant, substation, or transmission line can produce or carry under specific conditions. In the electrical grid, power and capacity are closely monitored and managed to ensure reliable and efficient system operation. Power must be carefully balanced between generation and consumption to maintain grid stability and avoid blackouts or brownouts. Hydropower plays an important role in meeting the demand to provide reliable service to customers.

- **Ancillary Services –** Hydropower plants can provide various ancillary services that contribute to the stability and reliability of the electrical grid. The specific ancillary services provided by hydropower can depend on the design and capabilities of the hydropower facility. Ancillary services are essential for balancing supply and demand, maintaining system stability, and ensuring the efficient operation of the grid, examples include:

    - *Grid Stability During Contingencies:* Hydropower plants can play a key role in grid stability during contingencies, such as sudden load changes or equipment failures
    - *Frequency Regulation:* Hydropower plants can respond rapidly to changes in electrical demand or generation, helping to maintain the system frequency within acceptable limits.
    - *Spinning Reserve*: Hydropower plants, particularly those with reservoirs, can quickly adjust their output to provide spinning reserve and help balance the system.

- *Load Following:* Some hydropower plants can adjust their output to match varying electrical demands throughout the day. This load-following capability helps to stabilize the grid by aligning generation with consumption.
- *Black Start Capability:* In case of a widespread blackout where the entire grid loses power, synchronous hydropower generators can restart and re-energize the system. This is known as black start capability and is crucial for grid restoration.
- *Voltage Support:* Hydropower plants can contribute to maintaining stable voltage levels on the electric grid. By adjusting their output hydropower facilities can provide reactive power support, helping to regulate voltage and enhance the overall stability of the electrical system.
- *Reserve Capacity and storage:* In addition to spinning reserve, hydropower plants can offer non-spinning reserve capacity, which involves having additional generation capacity that can be brought online with a short lead time to respond to unforeseen changes in demand or supply. Additionally, pumped hydro storage facilities provide the bulk of existing energy storage capacity and throughput capability in New England.

III. Drawbacks and Environmental Impacts of Hydropower

Environmental Impacts

Low-carbon and flexible energy is a crucial part of climate change mitigation. At the same time, hydropower dams can have significant environmental and social impacts. Dams can profoundly alter local river environments, block upstream and downstream movement of fish and other aquatic species (eel, mussels, etc.), interrupt natural flows and sediment transport, accumulate pollutants within impoundments, impact water quality, disrupt natural temperature regimes, submerge critical habitats, and can create significant safety concerns.

These key considerations relative to the impacts of hydropower dams are described as follows:

1. *Disruption of Aquatic Connectivity:* Both large and small hydropower dams fragment riverine corridors, blocking or hindering upstream and downstream movement of fish and other aquatic species (eel, mussels, etc.). The river channel itself and the river's floodplain are fragmented by dams. These impacts can be significant for many aquatic species and may also impact terrestrial wildlife passage. This significantly impacts the ability of many species to migrate either due to life cycle requirements, habitat disturbances, or changing climate. While fish passage facilities are often required to mitigate the impacts of hydro dams on fish migration and aquatic connectivity, recent studies have shown that the vast majority of fishway structures do not effectively mitigate the effects of dams (Bunt et al. 2012) and thus many fish passage facilities fall far short of providing safe, timely and effective passage at dams (Brown et al. 2012; Noonan et al. 2012).

2. *Fish Kills:* Many fish are killed at hydropower dams by impingement on intake screens and blade strikes due to the turbines. These impacts can be reduced with properly designed exclusion screens and when fish friendly turbines are installed. However, fish can also be killed when proper downstream passage is not provided, for example when fish are left to spill over the spillway onto a hard apron or jagged stone. If water quality is significantly reduced in the impoundment and harmful algae blooms are present, fish can pass upstream in a fishway only to be killed within the dam's reservoir. In addition, long reservoirs can disrupt the flow cues that anadromous fish utilize to migrate upstream and significantly increase predation of the fish from avian predators.

3. *Impacts on Flow Regime*: Hydropower dams can alter the natural distribution, timing and quantity of streamflow. By altering the pattern of downstream flow (i.e. intensity, timing and frequency), they change sediment and nutrient regimes and can alter water temperature and chemistry. Terrestrial ecosystems in reservoir areas are replaced by lacustrine, littoral and sublittoral habitats and pelagic mass-water circulations replace riverine flow patterns (WCD report 2000). The impacts of hydro dams also include the effects of water diversion on riverine systems, which can vary significantly depending on the dam in question and the length of the diversion. The altered pattern of natural flows and changes in quantity of downstream flow can alter river channel-floodplain interactions downstream. Some pumped storage hydro facilities can actually reverse the direction that a river flows and disrupt natural ecological cues for aquatic species. Alteration of natural flow patterns caused by many hydro dams can limit the river's ability to "flush" out the river and form the river channel and floodplain. These cyclical "flushing" events help ensure diversity of species and complexity of habitat.

4. *Disruption of Sediment Transport:* Hydropower dams disrupt the natural sediment transport processes in rivers. Sediment transport in the river is blocked by the dam and sediment builds up within the reservoir behind the dam, while creating sediment starved conditions below the dam that lead to channel bed degradation, channel narrowing and bank erosion, and in some cases erosion of lands on private properties. This disruption of sediment processes can disconnect a river from its natural floodplain downstream or submerge riverine floodplains upstream of a dam. These impacts are compounded by multiple dams along a river. The decrease in sediment supply downstream means that natural processes like deposition of sediment on floodplains, creation of deltas, and creation of coastal beaches are all negatively impacted by dams. Natural self-sustaining processes are critical to riverine health.

5. *Accumulation of Pollutants*: Hydro dams often accumulate sediments within the reservoir and due to the industrial history of Connecticut, these impounded sediments can often accumulate pollutants, thus the reservoir becomes a potential hot spot and if the dam were to breach these sediments could be released in an uncontrolled manner impacting public health and safety as well as the downstream environment.

6. *Reduced Water Quality*: Water quality is often reduced within the reservoir behind a hydropower dam and those reduced water quality conditions are then released downstream. In certain cases, the slower water within a reservoir combined with a hydro dam's operation has led to harmful algae blooms within the reservoir.

7. *Disruption of Natural Temperature Regimes*: Reservoirs behind hydro dams alter the natural temperature regimes in river systems both within the upstream reservoir and then downstream of the dam as the water is released. The reservoirs change a swifter flowing river condition with diverse patterns of circulation into a slow moving and often stratified water body. Shallow impoundments behind small hydro dams can often increase the river's temperature upstream and downstream. The highly stratified reservoirs of larger hydro dams can either increase water temperatures downstream when releasing flows from a surface release or decrease temperatures when releasing water from a low-level outlet (depending on the season). In either instance, the natural temperature regime of the river is modified, and native aquatic organisms must either adapt, perish, or relocate.

8. *Loss of Riparian Habitat*: Hydro dams block not only sediment but often debris and nutrients as well. Excluding these critical building blocks of riverine habitat from reaching downstream locations, while upstream riverine habitat is submerged by the reservoir itself. Dams are often built in high gradient reaches of the river, prime spawning habitat for many cold-water fish species. In addition to many high gradient riffles and rapids, many waterfalls have been submerged under dams and their impoundments.

9. *Impacts on Species Diversity*: An increased number of invasive species are often found in the reservoirs created by dams, while native species are often displaced, decreased in abundance or in some cases eradicated. The hydropower dam reservoirs flood terrestrial ecosystems, killing terrestrial plants and displacing animals. As many species prefer valley bottoms, large scale impoundment may eliminate unique wildlife habitats and extinguish entire populations of endangered species (Nilsson and Dynesius, 1994). Loss of some ecosystems may benefit some species (e.g. waterfowl and fish that favor deep water), but others may suffer significant loss of population, or even extinction (WCD report). While many species may benefit from the creation of open water habitat, there are more species that depend on marshes, floodplains, and riverine habitats that are negatively impacted by dams (WCD report).

10. *Public Safety Risks and Potential for Dam Breach*: Although FERC and the state of CT require hydro operators to maintain their dams in safe condition, this is not always the case, as is evident from the significant safety concerns at the Kinneytown Dam hydro facility. In addition, even a well-maintained dam can fail depending on the flows it experiences during a significant flood event. All dams are designed to pass certain regulated flood events, but when a flooding event occurs in excess of the design event, the potential increases for an uncontrolled dam breach. An uncontrolled dam breach can have effects on downstream ecosystems, the river channel, and the floodplain, as well as damage downstream property and put human life at risk. In addition, since many dams have deposits of sediment behind them of unknown quality, there is also the risk of contamination of downstream systems if a dam with contaminated sediment were to fail. Many people are unaware that they live within the breach inundation zone of a dam, since it is not a FERC, state, or federal requirement to inform the population that lives within a dam's breach inundation zone. Community planning efforts often do not include issues relating to dams, their condition, their location, and their area of potential impact, therefore many local planning decisions can be made that further increase the threat to the public. Dams can also provide an attractive nuisance that can draw the public in, especially into hydraulic rollers at the base of low head dams.

11. *Impacts on Recreation Opportunities and Economic Development*: Dams fragment river systems and eliminate or significantly disrupt certain types of riverine recreation such as boating (i.e. canoeing, kayaking, and white-water boating), tubing, and angling for migratory and cold-water fish species. These activities contribute significantly to local and regional economies and greatly improve the quality of life for those who take advantage of these recreational opportunities.

12. *Impacts to Historic and Archeologic Resources*: While maintaining a hydro dam may preserve a symbol of our industrial heritage, dams were often constructed on bedrock outcrops and riverine pinch points that were once sacred fishing locations for Native Americans. Dams blocked historic fish runs and, in some cases, submerged historic and archeological sites beneath their reservoirs. When we discuss history and archaeology, we must remember to consider the full history of a site.

13. *Increased Risk of Flooding*: Many hydropower dams are not operated as flood control dams and therefore have little to no ability to attenuate floods. Dams that do not attenuate floods have the opposite effect on flooding -- they increase flooding upstream of the dam where water surface elevations are raised due to the impoundment. Some dams also create significant down cutting of the channel downstream of the dam, due to the sediment transport disruptions thereby disconnecting the river from its natural floodplain decreasing natural attenuation of flood flows.

14. *Long-Term Maintenance Obligations*: Dams are manmade structures that disrupt the natural self-sustaining processes of a river and eventually need to be completely rebuilt or removed, since maintenance alone will not extend their design lives indefinitely. The burden of this dam maintenance cost is passed on to future generations, even once the economic benefits are no longer adequate to cover the costs. While a hydro dam is generating power, typically no portion of the economic gain is set aside to address the end-of-life cycle for the dam.

15. Connecticut currently has nearly 5,000 dams listed in the state's dam safety inventory impacting almost all flowing waterbodies across the state. The vast majority of these dams do not have hydropower facilities associated with them and the cost associated with rehabilitation is significant.

A 2023 report released by the Association of State Dam Safety Officials estimates the cost to rehabilitate the nation's non-federal dams at 157.5 billion.[8] The report broke down costs in each state for dams rated less than satisfactory. Connecticut's statistics are as follows:

- Total number of dams rated less than satisfactory: 830
- Estimated cost of rehab for total dams: $1.05 Billion
- Total number of high hazard potential dams rated less than satisfactory: 267
- Estimated cost of rehab for high hazard potential dams: $330 Million

16. *Short-Term Construction and Maintenance Impacts:* When a hydro dam is built or repaired, that construction project alone can have an impact on the river system and watershed in which the dam is located. The construction of access roads, increased turbidity while the work is under way, temporary water diversions to control water during construction, and other actions that take place during construction and/or maintenance can have direct or indirect impacts on rivers.

IV. CT Hydropower Existing Environment

Existing Environment

Connecticut's 25 operating hydroelectric facilities provide up to 152 MWs of generating capacity. There are an additional 7 projects with a combined 6 MW of potential additional capacity that have been abandoned or are in the process of decommissioning. Tabulated below is a summary of the operating and decommissioned hydropower assets in Connecticut.

OPERATING PROJECTS:

PROJECT NAME	NAMEPLATE CAPACITY (KW)	OPERATIONAL STATUS
SHEPAUG	42,600	Operating
ROCKY RIVER	30,000	Operating
STEVENSON	28,900	Operating
FALLS VILLAGE	9,000	Operating
RAINBOW	8,000	Operating
DERBY	7,800	Operating
BULLS BRIDGE	7,200	Operating
WYRE-WYND	2,780	Operating
GREENVILLE/TENTH STREET	2,200	Operating
QUINEBAUG-FIVE MILE	2,181	Operating
TUNNEL	2,100	Operating
SCOTLAND	2,000	Operating
TAFTVILLE	2,000	Operating
UPPER COLLINSVILLE	1,000	Operating
CARGILL FALLS	875	Operating
OCCUM	800	Operating
M.S.C.	512	Operating
PUTNAM	500	Operating
MANSFIELD HOLLOW	500	Operating
MECHANICSVILLE	325	Operating
GAILLARD	300	Operating
HANOVER POND DAM	220	Operating
ROCKY GLEN	110	Operating
DAYVILLE POND	100	Operating
STILL RIVER	37	Operating
TOTAL	**152,040 KW**	

PROJECTS THAT HAVE BEEN DECOMMISSIONED OR ARE NOT OPERATING:

CONGDON	60	Decommissioned
GLEN FALLS	250	Decommissioned
WILLIMANTIC #2	770	Not operating
WILLIMANTIC #1	770	Not operating

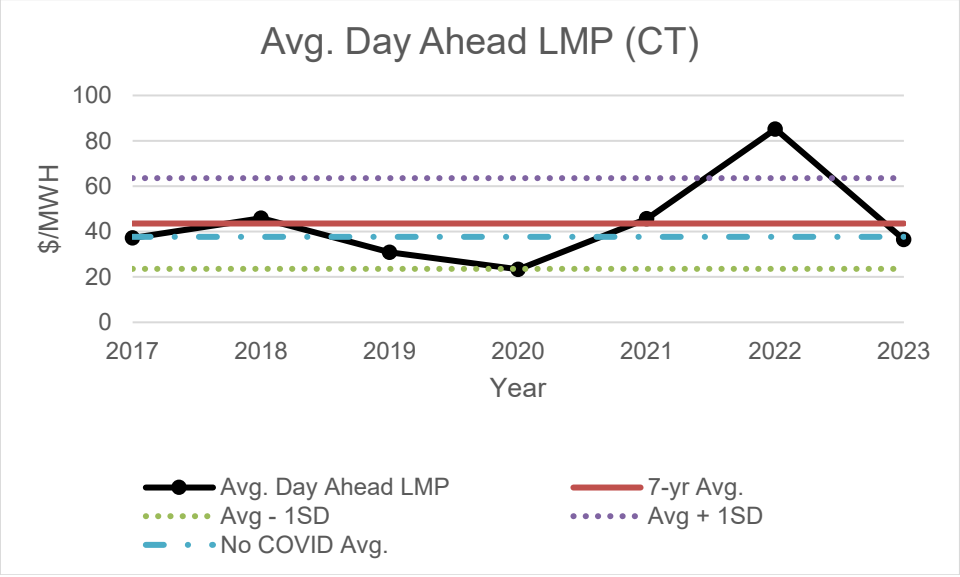
ROBERTSVILLE	600	Not operating
BANTAM	300	Not operating
COLEBROOK	3,000	Decommissioned
TOTAL	**5,750 kW**	

The above list excludes 2,360 kW Kinneytown because it is slated for dam removal.

Energy Markets

Many hydropower facilities interconnected within Connecticut and throughout the New England region, especially those that began operations before the 1990s, participate directly in the ISO New England (ISO-NE) wholesale electricity markets, including wholesale energy and capacity markets. Hydropower stations participate as "price-takers' in the ISO-NE Day-Ahead and Real-Time Energy Markets, which are designed to produce a single clearing price (Locational Marginal Price or, LMP) on an hourly basis in the Day-Ahead Energy Market and every 5 minutes in the Real-Time balancing market (RT-LMP). Current electricity market conditions are challenging for hydropower operators. For many hydropower generators located in Connecticut that cannot afford the expense and complexity required to register as an ISO-NE Market Participant, energy compensation is specifically tied to the Real-Time LMP and accessed via Rate 980.[1]

With natural gas-fired power plants supplying more than 50% of generation in New England, energy pricing in the region is largely dependent on the market cost of natural gas.[2] Including the exceptional market impacts from the steep inclines in natural gas pricing experienced during the coronavirus pandemic (which appear to be returning to pre-pandemic levels), the most recent seven-year LMP rate history averaged $43.56/MWh. Removing the period impacted by the coronavirus (2020-2022), average day ahead LMP rates (2017-2019 and 2023) were **$37.69/MWH**. These data illustrate the volatility in the market expressed by a nearly 46% standard deviation in day ahead rates from 2017-2023 (see figure below).



[1] https://www.eversource.com/content/docs/default-source/rates-tariffs/rate-980-non-firm-power-purchase.pdf
[2] https://www.iso-ne.com/about/key-stats/resource-mix/

A low and volatile energy rate environment challenges asset owners with making investment decisions which address maintenance, operations, dam safety, regulatory matters, environmental enhancements and upgrades to existing hydropower facilities. When coupled with the absence of an in-state RPS program that values existing hydropower resources, these conditions not only constrain new investments but threaten the long-term viability of this existing asset class within Connecticut.

Hydropower in Regional Energy Policies

All the New England states, except Connecticut, include tariff mechanisms that incorporate the value of renewable energy as well as avoided transmission and distribution costs. Examples include the Net Energy Billing program in Maine[3], the Group Net Metering program in New Hampshire[4], Virtual Net Metering in Rhode Island[5] and Vermont[6] and the Small Hydro Tariff in Massachusetts[7].

Hydropower plays an important role in the regional energy supply mix providing approximately 10% of the generation supply to the ISO-NE control area; an additional 10% of the supply mix is imported from large hydropower projects located in Quebec, Canada[8]. Additional hydropower imported from Canada is critical to meeting the aggressive clean energy goals of several U.S. states, including Connecticut. U.S. Senators Richard Blumenthal and Chris Murphy joined with several of their counterparts around New England to support a transmission line project that would bring hydropower from Canada into New England via underwater cable beneath Lake Champlain[9]. The $1.6 billion project is seen as a way to improve energy reliability in New England, particularly in Connecticut, Massachusetts and Rhode Island where demand for electricity is the highest.

In recognition of the vital role played by hydropower in meeting the regions energy needs, several New England states have established programs for the development and retention of hydropower assets; program specifics and eligibility vary by state. Program design is often intended to provide a stable revenue stream for the energy component to renewable resources like small-scale hydropower that more fully encompasses the value of small-scale renewable energy not otherwise compensated through exposure to volatile wholesale energy markets. Tabulated below is a summary of programs in the northeastern states that include hydropower as an eligible resource.

Program	CT	MA	RI	NH	VT	ME	NY	Structure/Value Notes
Virtual Net Metering	No	Yes	Yes	Yes	Yes	Yes	No	Eligibility Variable/Near Full Retail Rate
Standard Offer	No	No	Yes	No	Yes	No	No	Avoided Cost Calculation
RPS - New Projects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Eligibility/Value Variable
RPS - Existing Projects	No	Yes	Yes	Yes	Yes	Yes	Yes	Eligibility/Value Variable
Small Hydro Tariff	No	Yes	No	No	No	No	No	Asset Specific

[3] https://www.maine.gov/mpuc/regulated-utilities/electricity/neb
[4] https://www.energy.nh.gov/renewable-energy/net-metering-and-group-net-metering/group-net-metering
[5] https://energy.ri.gov/renewable-energy/wind/net-metering
[6] https://puc.vermont.gov/electric/net-metering
[7] https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section139A
[8] https://www.iso-ne.com/about/key-stats/resource-mix/
[9] https://www.murphy.senate.gov/newsroom/in-the-news/blumenthal-murphy-back-project-to-bring-more-canadian-hydropower-into-new-england

Long-Term Contracts	No	No	Yes	No	Yes	No	Yes	Eligibility/Value Variable
Program Sub-Total	**1**	**4**	**5**	**3**	**5**	**3**	**3**	

These data illustrate that Connecticut does not provide as many programs designed to incentivize investments in existing hydropower resources relative to our neighboring Northeastern states.

Connecticut's renewable portfolio standard (RPS) was established in 1998 and has been revised several times since then. The RPS requires that increasing amounts of electricity sold in the state be generated from renewable resources reaching 44% of electricity sales by 2030. Connecticut's governor issued an executive order for 100% of the state's electricity supply to be generated by renewable resources by 2040. Meeting Connecticut's renewable energy targets will not only require the deployment of new capacity, but the maintenance of the existing fleet of hydropower facilities which currently contribute to the baseline percentage of renewable generation.

To encourage the use of renewable resources, Connecticut requires both of its investor-owned utilities to offer programs encouraging the deployment of renewable energy resources within the state. As of the drafting of this analysis there is only one RPS program that includes "new" hydropower as an eligible resource; there is limited potential to develop new hydropower resources within the state and the existing exclusionary language makes Connecticut's hydropower RPS program, and its associated economic benefits, inaccessible to most of the existing in-state fleet.

Hydropower is an eligible technology in the various New England state Renewable Portfolio Standards (RPS), allowing many generators a supplemental revenue stream from Renewable Energy Credits (RECs) that may be sold to electric distribution companies and other load serving entities to meet statutorily required minimum renewable energy purchasing obligations. However, hydropower eligibility differs by state and may depend on resource size, vintage and even project location. Connecticut currently does not provide for existing hydro projects that began operation before 7/1/2003 unless a project is run-of-river and receives a new FERC license after January 1, 2018. A general overview of hydropower eligibility within New England RECs markets includes:

- *Connecticut Class I* – run-of-river hydropower 60MW or less with a commercial operations date of July 1, 2003, or later, or a run-of-river hydropower facility that received a new FERC license after January 1, 2018.
- *Massachusetts Class I* – hydropower 30MW or less certified by the Low Impact Hydro Institute with a commercial operations date of January 1, 1998, or later.
- *Massachusetts Class II* – hydropower 7.5MW or less certified by the Low Impact Hydro Institute with a commercial operations date of December 31, 1997, or earlier.
- *Rhode Island New* – hydropower 30MW or less with a commercial operations date of January 1, 1998, or later.
- *Rhode Island Existing* – hydropower 30MW or less with a commercial operations date of December 31, 1997, or earlier.
- *New Hampshire Class IV* – hydropower 5MW or less with a commercial operations date of January 1, 2006, or earlier, and complies with certain environmental protection criteria; and hydroelectric facilities up to 1 MW that are interconnected to the New Hampshire distribution grid.
- *Maine Class I/IA* **–** hydropower 100MW or less with a commercial operations date after September 1, 2005, or existing hydropower 100MW that underwent significant capital investment after September 1, 2019.

- *Maine Class II* – hydropower 100MW or less with a commercial operations date before September 1, 2005.
- *Vermont Tier I* – existing hydropower (no vintage, size or location restrictions).

Federal Incentives for Hydropower

The following federal incentives and programs are available for Hydropower projects. A brief description is provided along with links to the websites that contain information about the programs.

Hydroelectric Production Incentives (Section 242: Energy Policy Act of 2005)
Supports qualified hydropower development by providing payments for electricity generated and sold from dams and other water infrastructure that add or expand hydroelectric power generating capabilities through the installation of new generating capacity or are constructed in an area with inadequate electric service. This program provides 10 years of production-based incentive for facilities that began producing hydroelectric energy on or after October 1, 2005, or are located in inadequate service areas. Since none of CT is considered an inadequate service area, this program is only applicable to newer projects and/or generating units that began after 2005. The program requires an annual application; more information is available here: https://www.energy.gov/gdo/section-242-hydroelectric-production-incentive-program

Hydroelectric Efficiency Improvement Incentives (Section 243: E. P. Act of 2005)
Focuses on increasing efficiency by funding qualified capital improvements that improve an existing hydroelectric facility's efficiency by at least 3%. This competitive program has allocated all available funding; future funding and the availability of the program is currently unknown. More information is available here: https://www.energy.gov/gdo/section-243-hydroelectric-efficiency-improvement-incentives-program

Maintaining & Enhancing Hydroelectricity Incentives (Section 247: E. P. Act of 2005)
Invests $554 million to enhance existing hydropower facilities for capital improvements directly related to grid resiliency, dam safety, and environmental improvements. Competitive process with the last round of applications received in October 2023. Future funding and program accessibility is uncertain. More information on this competitive program is available here: https://www.energy.gov/gdo/section-247-maintaining-and-enhancing-hydroelectricity-incentives

V. Challenges

Hydropower operators in Connecticut, the agencies that regulate them, and environmental organizations that watchdog relicensing and regulation are faced with a variety of challenges, including but not limited to:

Inadequate Energy Market Valuation

There are no existing state programs which value energy delivered by existing hydropower assets above low and volatile LMP rates. As noted earlier, many hydropower facilities interconnected within Connecticut and participate directly in the ISO New England (ISO-NE) wholesale electricity markets, including wholesale energy and capacity markets. Current electricity market conditions are challenging for small hydropower operators. For many small hydropower generators located in Connecticut that cannot afford the expense and complexity required to register as an ISO-NE Market Participant, energy compensation is specifically tied to the Real-Time LMP.

Without an economically viable alternative, some owners elect to export energy from their projects to out-of-state end users. These arrangements require owners to engage with out of state energy buyers, negotiate power purchase agreements and administer complex commercial terms. For example, in 2022 thirteen Massachusetts-based municipal public power entities announced the purchase over 110 GWh per year of hydroelectric energy and RECs produced by two of FirstLight's Connecticut hydropower facilities; the 43 MW Shepaug Generating Station in Southbury, and the 28.9 MW Stevenson Generating Station in Monroe[10]. Similar arrangements[11,12] are made by a minority of Connecticut hydropower owners in order to access market value necessary to maintain viable operations, meaning that Connecticut is not capturing the value provided by its own hydropower fleet.

Restrictions on RPS Market Participation

Connecticut's RPS currently does not provide for existing hydro projects that began operation before 2003 unless a project is run-of-river and receives a new FERC license after January 1, 2018. The majority of Connecticut's existing hydropower fleet does not meet these criteria. Without an economically viable alternative, some owners elect to export RECs from projects that qualify to participate in out-of-state compliance markets. The environmental and non-power benefits are largely retained locally. However, the State's utilities must purchase RECs from out of state resources to satisfy growing RPS obligations thereby exporting significant economic value.

Stevenson Station was recently qualified as a Class I (in Maine) renewable energy facility; Shepaug Station is a Maine Class II renewable energy facility, these projects do not currently qualify as resources in the CT RPS however are contracted to deliver these RECs to out of state buyers (see above). Several other Connecticut hydropower projects are qualified RPS resources in neighboring states (Quinebaug and Five Mile Pond, Putnam Hydropower, and the MSC Project), which also export RECs to out of state RPS compliance markets.

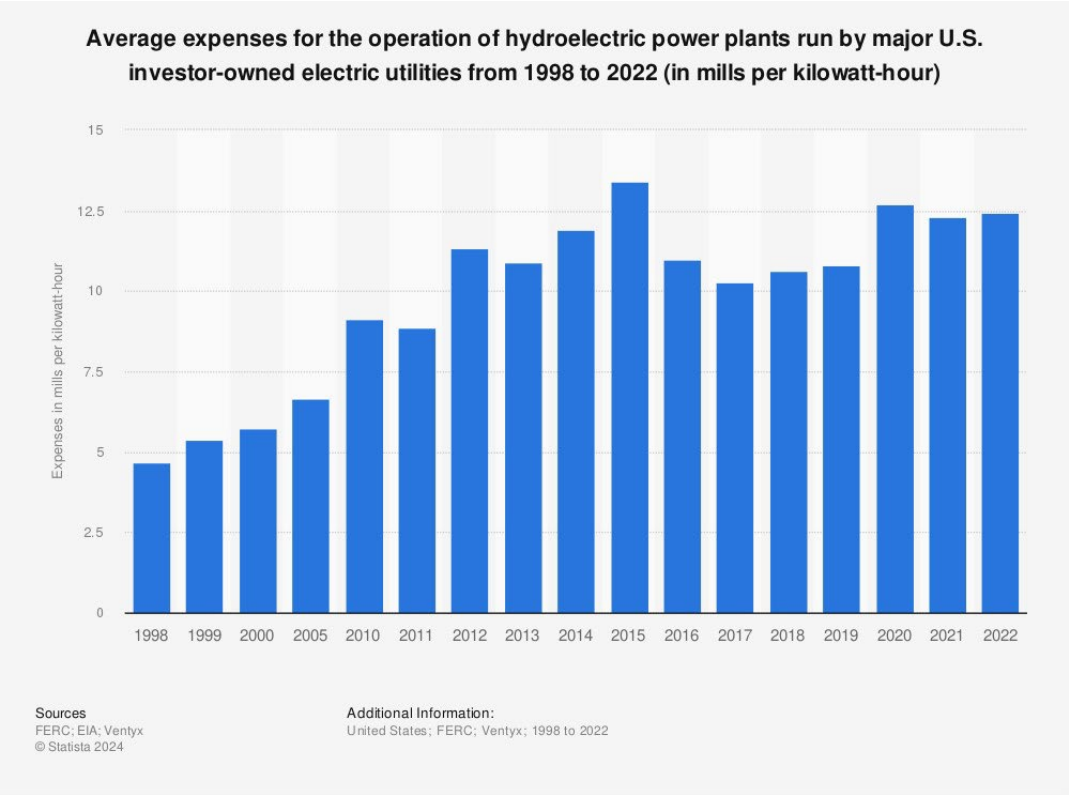
[10] https://www.hydroreview.com/business-finance/business/firstlight-power-and-energy-new-england-expand-hydroelectric-ppa/#gref

[11] https://www.businesswire.com/news/home/20231205507899/en/FirstLight-and-Massachusetts-Municipal-Wholesale-Electric-Company-Enter-Power-Purchase-Agreement-to-Deliver-Clean-Power-to-14-Massachusetts-Municipalities

[12] https://www.rmld.com/financial-statements/files/cy-2022-budget-capital-and-operating

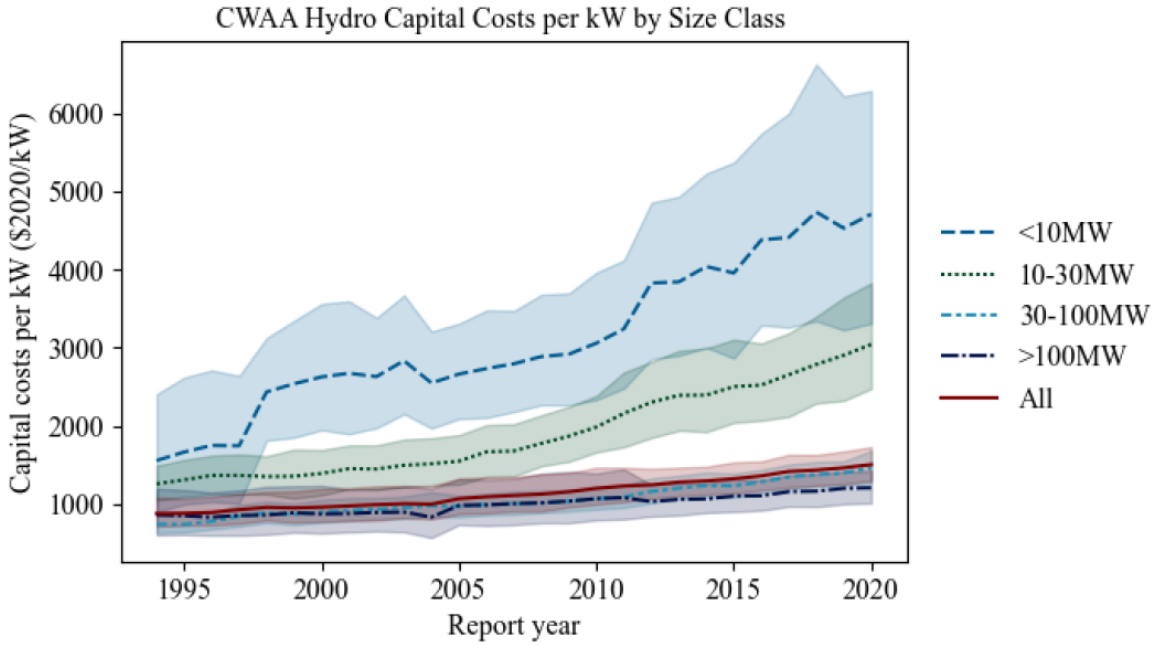
Increasing Operational and Capital Expenditure Costs

The expense of operating and maintaining generating facilities and their appurtenant features is significant. Hydropower cost data is necessary for investment and decision-making by plant owners, project developers, technology developers, and regulators in the industry. The cost of fuel (water) is zero, however, major civil infrastructure (i.e., dams, powerhouses, etc.) and equipment (turbines and generators) require periodic investments to ensure safe, reliable and efficient operation. According to Statistica[13], operating expenses for conventional and pumped storage hydroelectric power plants run by major United States investor-owned electric utilities totaled 12.44 mills per kilowatt-hour in 2022. That same year, operating expenses for fossil steam power plants amounted to 43.88 mills per kilowatt-hour, nearly 3.5 times more expensive. Despite the lower comparable operating costs of hydropower, the industry has seen a significant increase in expenses over the past two decades (see below).



Additionally, the cost to maintain and upgrade existing generating equipment and install and operate environmental enhancements (i.e., fish passage facilities) include initial capital investments in the millions. A recent survey completed by the Oak Ridge National Laboratory[14] provides insights into the trend of increasing capital cost across the U.S. hydropower fleet. This survey revealed an economy of scale relationship between installed capacity and cost (see figure below).

[13] https://www.statista.com/statistics/195828/us-hydroelectric-power-plant-operating-expense-since-1998/
[14] https://info.ornl.gov/sites/publications/Files/Pub169067.pdf



Capacity Weighted Average Annual (CWAA) Capital Cost per kw Installed. The median installed capacity of Connecticut's hydropower fleet is approximately 500 kw. Source: Oak Ridge National Laboratory

Significant Regulatory Obligations and Costs

Hydropower is a heavily regulated energy production industry in the U.S. Many owners must go through an extensive permitting and regulatory process to license or relicense new or ongoing projects. FERC licenses are issued for 30-to-50-year terms. Throughout Connecticut several hydropower assets are at the end of their term and are preparing for or undergoing the arduous FERC relicensing process, which is an expensive and time-consuming affair. The FERC process is designed to help protect local water quality, wildlife species and habitats, cultural resources, and recreation, while maintaining hydropower operations. However, the process also increases the costs and risks associated with operating hydroelectric plants. The regulatory review process for hydropower includes comprehensive evaluation of resources subject to various jurisdictions and statutory authorities[15]. Under the Federal Power Act (FPA), prior to FERC issuing a license, a project must comply with the following processes and obtain the following certifications, approvals, permits, and authorizations from the relevant authority with jurisdiction:

- 401 Water Quality Certification
- Endangered Species Act Section 7 Consultation Process
- Essential Fish Habitat Consultation Process
- Coastal Zone Management Act Consistency Determination
- National Environmental Policy Act (NEPA) of 1969 Environmental Review Process
- National Historic Preservation Act Section 106 Consultation Process
- Wild and Scenic River Section 7 Consultation (if applicable)

In addition, to mitigate potential impacts to resources and ensure that hydropower projects are consistent with agency land and resource management plans, the FPA authorizes federal agencies with jurisdiction

[15] https://www.nrel.gov/docs/fy22osti/79242.pdf

to issue mandatory conditions and federal agencies, state agencies, and Native American tribes with jurisdiction to issue recommendations for inclusion in a FERC license. The following agency license conditions and/or recommendations may be issued in addition to or in lieu of certain permits, authorizations, or other approvals:

- *FPA Section 4(e) Mandatory Conditions:* Federal agencies with jurisdiction over federal reservations (i.e., Bureau of Indian Affairs [BIA], U.S Bureau of Reclamation [BOR], USFWS, National Park Service [NPS], Bureau of Land Management [BLM], and USFS [U.S. Forest Service]) may prescribe mandatory Section 4(e) conditions for inclusion as conditions to a FERC license to ensure that the project will not interfere or be inconsistent with the purpose of any reservation and ensure adequate protection and utilization of the reservation (16 U.S.C. § 797(e)). In addition, Section 4(e), as amended by the ECPA, requires FERC to give "equal consideration to the purposes of energy conservation; the protection, mitigation of damages to, and enhancement of, fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality" (16 U.S.C. § 797(e) as amended). This "equal consideration" clause requires FERC to balance developmental and non-developmental values when deciding on licensing a non-federal hydropower project. The licensee or any other party to the FERC licensing proceeding may also file alternative mandatory 4(e) conditions with the relevant land management agency (16 U.S.C. § 823d(a)).

- *FPA Section 10(a) Recommendations:* Federal agencies (i.e., BIA, BOR, BLM, USFWS, NPS, USACE, NOAA Fisheries, and USFS) and state resource agencies exercising administration over flood control, navigation, irrigation recreation, cultural, and other relevant resources of the state in which the project is located as well as Indian tribes affected by the project may provide Section 10(a) license recommendations for inclusion as conditions to a FERC license to ensure that a hydropower project will be best adapted to a comprehensive plan for improving or developing a waterway for the use or benefit of interstate or foreign commerce; the improvement and use of water power development; and the adequate protection, mitigation and enhancement (PME) of fish and wildlife and for other public uses (16 U.S.C. § 803(a)(1); (2)(B)).

- *FPA Section 10(j) Recommendations:* USFWS, NOAA Fisheries, and state fish and wildlife agencies may provide Section 10(j) license recommendations for inclusion as conditions to a FERC license to adequately and equitably protect, mitigate damages to, and enhance fish and wildlife (including related spawning grounds and habitat) affected by the development, operation, or management of the project (16 U.S.C. § 803(j)(1); 16 U.S.C. § 661 et seq.).

- *FPA Section 18 Mandatory Fishway Prescriptions:* USFWS and NOAA Fisheries may prescribe Section 18 mandatory fishway prescriptions for inclusion as a condition to a FERC license during the operation and maintenance of a hydropower project (16 U.S.C. § 811). Section 18 fishway prescriptions are limited to: physical structures, facilities, or devices necessary to maintain all life stages of such fish; and project operations and measures related to structures, facilities, or devices, which are necessary to ensure the effectiveness of such structures, facilities, or devices for such fish (Energy Policy Act 1992 § 1701(b)). The licensee or any other party to the FERC licensing proceeding may also file alternative Section 18 fishway prescriptions with NOAA Fisheries and/or USFWS (16 U.S.C. § 823d(b)).

Navigating the process requires significant investments of capital and time and frequently results in incorporating new conditions to enhance environmental performance which may also result in reduced generation.

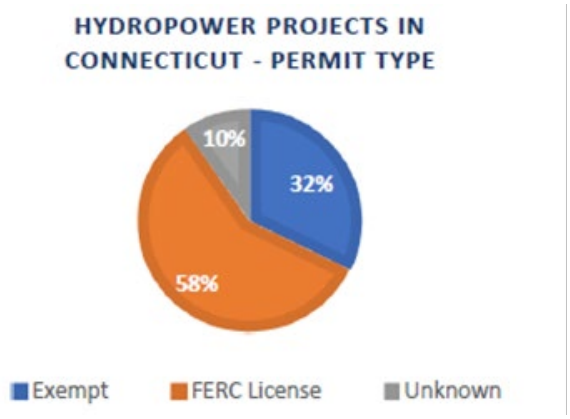
FERC Regulatory Framework Not Inherently Protecting Environment

There are misconceptions that FERC licensing and state regulation of dams guarantees regulatory consistency and oversight of hydropower facilities and protection of riverine ecosystems.

1. Understanding types of permits for FERC regulation

According to the Oak Ridge National Laboratory databased of hydropower projects, 18 of the 29 hydropower developments in Connecticut have a full license from FERC, eight are exempt from the FERC relicensing process and 4 are not regulated by FERC (non-jurisdictional). New hydropower projects up to 10 MW, which operating in a run-of-river mode and for which the developer can demonstrate ownership rights to all lands necessary to develop, operate and maintain the project, and are built at an existing dam are eligible for an exemption from FERC licensing. Projects granted an exemption must first successfully complete the full licensing review process after which they are exempt from the requirements of Part I of the Federal Power Act requiring periodic regulatory reviews (relicensing). Exemptions have no expiration date, and yet these exempt dams all have the same environmental and social impacts of fully licensed dams.

Out of all the hydropower projects in Connecticut, 58% hold traditional FERC licenses, 32% hold FERC exemptions from licensing, and 10% do not fall under FERC jurisdiction.[9]



Since an exemption does not expire, there is little opportunity or regulatory teeth for stakeholders to engage with FERC and a dam owner in order to negotiate a potential change in operations to address documented harm to the environment and recreation. The Naugatuck River Revival Group spent decades documenting serious environmental issues below Kinneytown Dam, which holds an active FERC exemption. Despite well-documented environmental impacts, it took the threat of a lawsuit by Save the Sound and the Naugatuck Valley Council of Governments to even get the dam operator's attention.

2. Environmental mitigation measures are not automatic

FERC jurisdiction does not automatically mean that environmental mitigation measures are in place to minimize the impact on rivers. Environmental flow releases, effective fish passage, and addressing temperature alteration and the decrease in dissolved oxygen concentrations are all necessary to minimize the impact that hydroelectric dams have on our rivers.

What FERC must consider in the process according to regulation is not always what happens in practice.

According to regulation: When deciding whether to issue a license, FERC must consider not only the power generation potential of a river, but also to give equal consideration to energy conservation, protection of fish and wildlife, protection of recreational opportunities, and preservation of general environmental quality. This "equal consideration" mandate requires FERC to consult with federal, state and local resource agencies, including fish, wildlife, recreation and land management agencies, in order to assess more accurately the impact of a hydro dam on the surrounding environment.

In practice: Federal, state and local resource agencies often do not have the resources to ensure that equal consideration is upheld.

A key finding of a 2021 technical report titled *An Examination of the Hydropower Licensing and Federal Authorization Process*[11] produced by the National Renewable Energy Laboratory and Oak Ridge National Laboratory follows:

> ***Length and Complexity of the Licensing Process Is Challenging for All Stakeholder Sectors, Including Regulatory Agencies.***
> *The average length of an original (5.0 + 2.9 years) or relicense (7.6 + 3.3 years) process constitutes a relatively long-term time and monetary investment by all sectors of the hydropower community. Responses to email solicitations and phone interviews with stakeholders from all sectors point to turnover and limited bandwidth among state and federal agency staff and NGOs as primary sources of these challenges. Specifically, these responses indicated that new or inexperienced staff taking over in the middle of a licensing/authorization process; agencies not having adequate staff resources to complete work in a timely fashion; and NGOs, especially those with a local focus, not having adequate staff bandwidth or technical expertise to stay engaged throughout the licensing process.*

Organizations like the Connecticut River Conservancy, Save the Sound, The Nature Conservancy, and Trout Unlimited have put significant resources into intervening in the FERC process. Engaging in the process is not trivial. Without legal and expert representation, it is challenging for the average person to take part on behalf of their rivers and/or public health. American Whitewater has participated in about 100 FERC relicensing processes across the country. They estimate that complex relicensing requires approximately 2,000 hours of dedicated attention per year. With more narrowly focused interests, the amount of time is less. For comparison, a full-time, 40 hours per week employee works 2,080 hours per year. Even federal and state water quality certificates do not guarantee effective environmental protections for downstream flow and aquatic habitat.

While the cost of relicensing is built into hydropower project operational costs, NGOs must seek private funding for staff time and experts and individual members of the public rarely have the resources to participate in a meaningful way. In addition, the environmental impact studies conducted by licensees' consultants during the relicensing process can be prone to bias or perceived as biased because the consultants developing the studies are hired by the licensees.

VI. Hydropower Best Practices

In light of the significant environmental impacts hydropower facilities may have on rivers, it is important to ensure that any incentives for hydropower are used to remediate rather than exacerbate existing impacts to river systems (such as those referenced above and in the LIHI criteria and goal statements), and to ensure that dams that may be candidates for removal are not artificially sustained through incentives.

Because of the many well-researched environmental impacts of dams and hydropower on rivers, there national nonprofit organizations like the Low Impact Hydropower Institute (LIHI) which independently certify those hydropower facilities that take actions to mitigate and reduce their impacts. LIHI identifies 8 primary environmental, cultural, and recreational criteria and goal statements (more available at Criteria & Standards | Low Impact Hydropower) that are evaluated to determine whether a hydropower facility can be certified as "low impact" or not:

1) Ecological flow regimes that support healthy habitats

Goal: Flow regimes in riverine reaches that are affected by the facility support habitat and other conditions suitable for healthy fish and wildlife resources.

2) Water quality supportive of fish and wildlife resources and human use

Goal: Water quality is protected in water bodies directly affected by the facility, including downstream reaches, bypassed reaches, and impoundments above dams and diversions.

3) Safe, timely and effective upstream fish passage

Goal: Safe, timely and effective upstream passage of migratory fish so that they can successfully complete their life cycles and maintain healthy populations in areas affected by the facility.

4) Safe, timely and effective downstream fish passage

Goal: Safe, timely and effective downstream passage of migratory fish. For riverine (resident) fish, the facility minimizes loss of fish from reservoirs and upstream river reaches affected by facility operations. Migratory species can successfully complete their life cycles and maintain healthy populations in the areas affected by the facility.

5) Protection, mitigation and enhancement of the soils, vegetation, and ecosystem functions in the watershed

Goal: Sufficient action has been taken to protect, mitigate and enhance the condition of soils, vegetation and ecosystem functions on shoreline and watershed lands associated with the facility.

6) Protection of threatened and endangered species

Goal: The facility does not negatively impact federal or state listed species. Facilities shall not have caused or contributed in a demonstrable way to the extirpation of a listed species. However, a facility that is making significant efforts to reintroduce an extirpated species may pass this criterion.

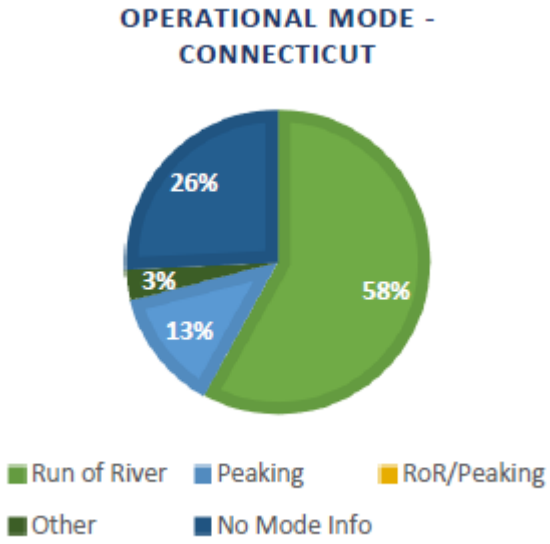
7) Protection of impacts on cultural and historic resources

Goal: The facility does not unnecessarily impact cultural or historic resources that are associated with the facility's lands and waters, including resources important to local indigenous populations, such as Native Americans.

8) Recreation access is provided without fee or charge

Goal: Recreation activities on lands and waters controlled by the facility are accommodated, and facility provides recreational access to its associated land and waters without fee or charge.

Operating a hydroelectric facility as an instantaneous “run of river” most closely mimics natural, environmental flows and minimizes downstream flow fluctuations that cause erosion and decrease aquatic biodiversity. It is a baseline for minimizing environmental impacts - yet only 58% of hydropower capacity in Connecticut are run of river[7], and a portion of the hydroelectric dams that claim to be run of river, actually operate on a 24-hr peaking basis. A large percentage of projects have no information on mode of operation. To ensure a common understanding of “run of river,” clarifying language has been proposed in policy considerations such as “instantaneous” or “continuous” run of river.



VII. Policy Considerations

Although DEEP and PURA are active members of this Task Force, these agencies have regulatory and administrative responsibilities associated with hydropower that make them unable to endorse the following policy considerations without the potential for conflicts of interest. That said, these agencies have supported the Task Force putting forward policy considerations that reflect potential remedies to the existing challenges to hydropower described above. Each policy consideration summarized below includes a brief statement of pros and cons, as needed, to reflect the various perspectives of Task Force members. In general, the following policy considerations encourage incentives for hydropower production as a source of local and regional renewable energy that must be balanced with ensuring healthy rivers, environmental mitigation, and potential community benefits.

The following policy considerations support hydropower that: i) meets state and federal requirements, including applicable site-specific standards for water qualify, flow, and fish passage; ii) is limited to existing dams; and iii) is not located in dams identified as candidates for removal. **These policy considerations are not presented below in an order meant to suggest the priority of one consideration over others.**

A. Standard Service Rate Compensation for Connecticut Hydropower Projects

The proposed consideration is modeled after Rhode Island's program which allows hydropower assets to be compensated at the Last Resort Service Tariff: https://www.rienergy.com/media/ri-energy/pdfs/billing-and-payments/tariffs/6b._qf_tariff_ripuc_2256_09-01-22.pdf

Eligibility & Authority:

The electric distribution company, interconnecting utility, or municipal utility (IU) shall enter into a purchase agreement for the electrical output from an existing dam which includes a 10 MW or less instantaneous run of the river hydropower facility which meets the eligibility criteria provided below:

a. Is not based on a new dam or a dam identified by the Commissioner of the Department of Energy and Environmental Protection as a candidate for removal, and meets applicable state and federal requirements, including state dam safety requirements, site-specific standards for water quality, flow, and fish passage, or has submitted such plans to the regulator to be implemented upon receipt of the tariff;
b. Is or will be interconnected with an IU;
c. Has a generating capacity not more than 10 MW;
d. Provides positive impacts to the state's economic development;
e. Demonstrates consistency with the policy goals outlined in the Comprehensive Energy Strategy adopted pursuant to section 16a-3d.

Any eligible facility that desires to sell electricity under this tariff must provide the IU with sufficient prior written notice. At the time of notification, the qualifying facility shall provide the IU with the following information:

a. The name and address of the applicant and location of the qualifying facility.
b. A brief description of the qualifying facility, including a statement indicating whether such facility is a small power production facility or a cogeneration facility.
c. The primary energy source used or to be used by the qualifying facility.

d. The power production capacity and average annual kWh of the qualifying facility and the maximum net energy to be delivered to the IU's facilities at any clock hour.
e. The owners of the qualifying facility, including the percentage of ownership by any electric utility or by any public utility holding company, or by any entity owned by either.
f. The expected contract commencement date.
g. The anticipated method of delivering power to the IU.
h. Other documentation to prove the facility complies with eligibility requirements.

Structure:
Following the notification outlined above, the qualifying facility and the IU shall execute a standard purchase power agreement for no more than 30 years, setting forth the terms of the sale, which shall be executed no later than thirty (30) days prior to the contract commencement date.

Products:
Energy - the IU will pay rates described below for each kilowatt-hour generated in excess of the facility requirements and delivered to the IU's bulk power or distribution system.

Capacity and/or Reserves - the IU shall make payments to a qualifying facility for capacity and/or reserves-related products if the sale is recognized by NEPOOL or ISO-NE as a capacity and/or reserves-related product sale. The IU shall pay rates equal to the payments received for the sale of any capacity and/or reserves-related products associated with such qualifying facility output to ISO power exchange.

Rate:

Retail distribution delivery service by the IU to the qualifying facility shall be governed by the tariffs, rates, terms, conditions, and policies for retail delivery service which are on file with the Connecticut Public Utilities Regulatory Authority. The selection of the appropriate retail rate will be equal to the qualifying facility's rate class at its service meter.

Capacity payments, where applicable, would be compensated at rates equal to the IU's sale price in the ISO-NE system (pass through).

Other Requirements:

1. The qualifying facility shall furnish and install the necessary meter socket and wiring in accordance with the IU's Standards for Connecting Distributed Generation.
2. The qualifying facility shall install equipment approved by the IU which prevents the flow of electricity into the IU's system when the IU's supply is out of service, unless the qualifying facility's generation equipment can be controlled by the IU's supply.
3. The qualifying facility's equipment must be compatible with the character of service supplied by the IU at the qualifying facility's location.
4. The qualifying facility shall be required to install metering pursuant to the requirements contained in the IU's Standards for Connecting Distributed Generation.
5. The qualifying facility shall enter into or have an interconnection agreement and follow all other procedures outlined in the IU's Standards for Connecting Distributed Generation, as amended and superseded from time to time.
6. The qualifying facility shall reimburse the IU for any equipment and the estimated total cost of construction (excluding costs which are required for system improvements or for sales to the qualifying facility, such as the cost of a standard metering installation, in accordance with the IU's

Terms and Conditions) which are necessary to meter purchases under this rate and to interconnect the qualifying facility to the IU's distribution or transmission system in accordance with the IU's Standards for Connecting Distributed Generation. The IU will install, own, and maintain the equipment.

7. The qualifying facility shall save and hold harmless the IU from all claims for damage to the qualifying facility's equipment or injury to any person arising out of the qualifying facility's use of generating equipment in parallel with the IU's system; provided that nothing in this paragraph shall relieve the IU from liability for damage or injury caused by its own fault or neglect.

Summary of Pros/Cons for this policy consideration:

Pros:

- Would provide a rate of energy compensation option to help sustain hydropower producers that meet criteria to be an eligible facility.
- May encourage hydropower producers to make investments and/or operational modifications to improve environmental performance as required in the eligibility criteria
- May encourage addition of incremental efficiency improvements or capacity from existing assets
- Would be administratively simpler than other options because it is based on an existing rate and can be less discretionary (straightforward to determine whether a facility qualifies).
- Controls ratepayer impacts by utilizing a variable rate, as determined by IUs and approved by PURA, which reflects current market conditions for energy as compared to a fixed (bid) rate.
- This Policy Consideration is the method preferred by several hydropower producers due to simplicity and hydropower not being determined through a time-consuming bid process.

Cons:

- Some benefits from Standard Service Rate may go to sustaining hydropower that already exist versus acquiring incremental increases in renewable energy capacity needed to meet zero carbon energy generation goals.
- May require additional requirements designed to track long term compliance of the eligibility criteria after a facility is accepted into the program.
- An energy supply rate that applies to all qualifying facilities and is not based on a competitive procurement process may not be in the best interest of ratepayers unless future energy rates are overestimated.

B. CT Hydropower DEEP Procurement/Solicitation

Draft language to consider a legislatively mandated procurement of in state hydropower resources. The proposed language would be a new section 16a-3q. Note that language is based off existing Sec. 16a-3h of the statutes which call for a solicitation re: run-of-the-river hydropower, landfill methane gas, biomass, fuel cell, offshore wind, anaerobic digestion or energy storage systems.

Sec. [NEW]. Pilot solicitation instantaneous run-of-the-river hydropower. On or after [date], the Commissioner of Energy and Environmental Protection, in consultation with the procurement manager identified in subsection (l) of section 16-2, the Office of Consumer Counsel and the Attorney General, shall solicit proposals, in one solicitation or multiple solicitations, from providers of instantaneous run-of-the-river hydropower that is interconnected with an electric distribution company or municipal utility. On an exception basis, hydropower facilities will be considered where modification of natural flow(s) provides an ecological benefit. In making any selection of such proposals to award long term contracts, the commissioner shall consider factors, including, but not limited to (1) whether the proposal is in the

interest of ratepayers, including, but not limited to, the delivered price of the proposed resources in terms of energy, capacity and/or environmental attributes, (2) the emissions profile of a relevant facility, (3) any investments made or expected to be made by a relevant facility to improve the emissions profile or environmental performance such as but not limited to water quality, flow, or fish passage of such facility, (4) any positive impacts on the state's economic development, (6) whether the proposal demonstrates consistency with the policy goals outlined in the Comprehensive Energy Strategy adopted pursuant to section 16a-3d, (7) whether the proposal promotes electric distribution system reliability and other electric distribution system benefits, including, but not limited to, microgrids, or function as a load reducing resource as defined by ISO NE (8) the proposal shall not be based on a new dam or a dam identified by the Commissioner of Energy and Environmental Protection as a candidate for removal, and (9) the proposal shall, at the time of submission or within a reasonable timeframe as defined by DEEP through a public process as a condition for selection, meet applicable state and federal requirements, including state dam safety requirements and applicable site-specific standards for water quality, flow, and fish passage. The commissioner may select for up to 20 MW in aggregate and the solicitation shall be issued promptly but, in any case, no later than December 31, 2025. If applicable, certificates issued by the New England Power Pool Generation Information System for any Class I renewable energy sources procured under this section may be: (A) Sold in the New England Power Pool Generation Information System renewable energy credit market to be used by any electric supplier or electric distribution company to meet the requirements of section 16-245a, provided the revenues from such sale are credited to all customers of the contracting electric distribution company; or (B) retained by the electric distribution company to meet the requirements of section 16-245a. In considering whether to sell or retain such certificates, the company shall select the option that is in the best interest of such company's ratepayers. Any such agreement shall be subject to review and approval by the Public Utilities Regulatory Authority, which review shall be completed not later than sixty days after the date on which such agreement is filed with the authority. The net costs of any such agreement, including costs incurred by the electric distribution companies under the agreement and reasonable costs incurred by the electric distribution companies in connection with the agreement, shall be recovered through a fully reconciling component of electric rates for all customers of electric distribution companies. All reasonable costs incurred by the Department of Energy and Environmental Protection associated with the commissioner's solicitation and review of proposals pursuant to this section shall be recoverable through the non-by passable federally mandated congestion charges, as defined in section 16-1.

Summary of Pros/Cons of this policy consideration:

Pros:

- Allows for competitive solicitation while also taking into consideration non-monetary benefits and impacts of hydropower projects.
- Allows project that do not currently meet applicable state and federal requirements (including state dam safety requirements and applicable site-specific standards for water quality, flow, and fish passage) to obtain a fixed long-term contract that allows them to pay for improvements so they can comply with requirements.
- A competitive process with an aggregate award cap may be helpful to protect ratepayer interest in achieving affordable energy rates.
- Fixed rate contracts with a credit-worthy party would expand financing strategies associated with any necessary investments.

Cons:

- It is only one solicitation, if a project is not awarded, there is no recurring solicitation or option for a facility to try to obtain better compensation.

- Hydropower suppliers prefer a standard rate over a competitive process (like a solicitation) to enable assurances to proceed with long-term commitments, investments, and associated financing with minimal administrative costs.
- Having a fixed rate that doesn't adjust with inflation or other market fluctuations may be a challenge for hydropower suppliers and could result in bids that factor in this risk/uncertainty.
- There are many costs and impacts associated with addressing existing dams, and there are additional costs and impacts that would be associated with rehabilitation, repowering, and/or removal of dams. All of these costs must be weighed against the benefits of a hydropower project when evaluating the feasibility of projects. Procurements should be structured in such a way that equitable rates should only be applied to feasible, existing projects not currently considered for removal that meet environmental mitigation standards or will help projects to meet mitigation standards. Equitable rate structures should not be structured to incentivize development of unpowered dams.

C. CT CLASS I RPS QUALIFICATION

Consider the following new additions (underlined) to CT Class I hydropower definition at CT CGS Sec 16-1 (a)(20)(X):

Section 16-1. Subsection (a)(20) of the general statutes is repealed and the following is substituted in lieu thereof (Effective from passage):

"Class I renewable energy source" means (A) electricity derived from (i) solar power, (ii) wind power, (iii) a fuel cell, (iv) geothermal, (v) landfill methane gas, anaerobic digestion or other biogas derived from biological sources, (vi) thermal electric direct energy conversion from a certified Class I renewable energy source, (vii) ocean thermal power, (viii) wave or tidal power, (ix) low emission advanced renewable energy conversion technologies, including, but not limited to, zero emission low grade heat power generation systems based on organic oil free rankine, kalina or other similar nonsteam cycles that use waste heat from an industrial or commercial process that does not generate electricity, (x) (I) an instantaneous run-of-the-river hydropower facility that began operation after July 1, 2003, has a generating capacity of not more than ~~[sixty]~~ thirty megawatts, is not based on a new dam or a dam identified by the Commissioner of Energy and Environmental Protection as a candidate for removal, and meets applicable state and federal requirements, including applicable state dam safety requirements and applicable site-specific standards for water quality, flow, and fish passage, ~~[or]~~ (II) an instantaneous run-of-the-river hydropower facility with a generating capacity of not more than thirty megawatts that received a new license after January 1, 2018 under the Federal Energy Regulatory Commission rules pursuant to 18 CFR 16, as amended from time to time, is not based on a new dam or a dam identified by the Commissioner of Energy and Environmental Protection as a candidate for removal, and meets applicable state and federal requirements, including applicable state dam safety requirements and applicable site-specific standards for water quality, flow, and fish passage, or (III) an instantaneous run-of-the-river hydropower facility that: 1) has a generating capacity of no more than ten megawatts, 2) is interconnected to the electric distribution company or municipality, 3) provides positive impacts on the state's economic development, 4) demonstrates consistency with the policy goals outlined in the Comprehensive Energy Strategy adopted pursuant to section 16a-3d, 5) is not based on a new dam or a dam identified by the Commissioner of Energy and Environmental Protection as a candidate for removal, and 6) meets applicable state and federal requirements, including applicable state or federal dam safety requirements and applicable site-specific standards for water quality, flow, and fish passage, (xi) a biomass facility that uses sustainable biomass fuel and has an average emission rate of equal to or less than .075 pounds of nitrogen oxides per million BTU of heat input for the previous calendar quarter, except that energy derived from a biomass facility with a capacity of less than five hundred kilowatts that

began construction before July 1, 2003, may be considered a Class I renewable energy source, or (xii) a nuclear power generating facility constructed on or after October 1, 2023, or (B) any electrical generation, including distributed generation, generated from a Class I renewable energy source, provided, on and after January 1, 2014, any megawatt hours of electricity from a renewable energy source described under this subparagraph that are claimed or counted by a load-serving entity, province or state toward compliance with renewable portfolio standards or renewable energy policy goals in another province or state, other than the state of Connecticut, shall not be eligible for compliance with the renewable portfolio standards established pursuant to section 16-245a;

Summary of Pros/Cons of this policy consideration:
Pros:

- Allows existing hydropower projects that came online before July 1, 2003 that are generating clean energy and meeting environmental performance criteria to be classified as Class I and therefore able to sell RECs to improve compensation.
- Provides a slight shift in REC revenue going to CT businesses rather than out-of-state businesses.
- May encourage hydropower facilities to make investments and/or operational modifications which improve production and environmental performance in order to become eligible to participate in the Class I market.
- Increases the availability of Class I RECs available to IUs to meet their compliance obligations and may provide a ratepayer benefit by avoiding making Alternative Compliance Payments.

Con:

- Increases the number of eligible Class I resources, thereby leading to an increased supply of RECs which could slightly reduce the value/cost of each REC.

D. Program Considerations for the Non-Residential Renewable Energy Solutions (NRES) for Incremental Run of the River Hydro Projects

Background:

Under the NRES Program:

- Projects less than or equal to 200kW are awarded tariff agreements on a first-come, first-served basis at a fixed price as determined by PURA.
- Projects greater than 200kW up to and including 5,000kW are awarded tariff agreements through a competitive solicitation process. Bidding will take place in an online bid portal during the RFP window.
- Two incentive options:
    - *Buy All*: export all power that system produces to the electric grid without first supplying power to onsite meter. Receive compensation from utility for both energy and RECs at a set rate for 20-year term
    - *Netting:* Similar to net metering, power supply from the system will be used for the building and only excess power will be exported to the grid. Power produced by system, but not consumed within the month, is "netted" at the same rate customer would pay Eversource for electricity. Receive compensation for RECs at a set rate for 20 years
- Below are 2024 published price caps

2024 Price Caps and Tariff Rates

	Buy-All Price Cap ($/MWh)
Small Zero Emission Tariff Rate	$199.82
Medium Zero Emission Price Cap	$188.90
Large Zero Emission Price Cap	$145.97
Low Emission Price Cap	$159.00

System Sizing Requirements and Eligibility Criteria for NRES program (excerpts from section 3 of the program manual) along with commentary or applicability for run of the river projects:

- 3.2.1. The total generation of Customer Projects that are not Rooftop Projects cannot exceed the highest consecutive 12 months of kWh load of the Customer, net of any existing generation, over the five years prior to the date of Bid submission plus eligible adjustments to load for electrification or removal of onsite generation. The highest consecutive 12 months of kWh load shall be measured by the Customer's individual electric meter or a set of electric meters at a Project Site, when such meters are already combined for billing purposes at the time of Bid submission, as determined by the EDC providing service to the Customer.
    - Limits size of project based on the historical load behind the meter
- 3.3.1 Eligible Zero Emission and Low Emission Projects shall be less than or equal to five (5) MW (AC) in size and qualify as a Class I renewable energy source under Conn. Gen. Stat. Section 16-1(a)(20), as amended by Section 1 of Public Act 22- 14.
    - Incremental hydro power projects qualify under the Class I definition. Per the Class I definition – project must not be based on a new dam or a dam identified by the Commissioner of Energy and Environmental Protection as a candidate for removal, and meets applicable state and federal requirements, including applicable state dam safety requirements and applicable site-specific standards for water quality, flow, and fish passage
- 3.3.7. Projects must receive Approval to Energize after the solicitation to which the Customer is responding. For facilities constructed prior to the solicitation to which the Customer is responding, which have been uprated with new production equipment (e.g., new solar panels, turbines) installed after the solicitation to which the Customer is responding, the new incremental production equipment may be eligible to the extent that it meets all of the eligibility criteria and is separately metered and compensated pursuant to the rules set forth in this Program Manual.
    - Per the NRES program rules only projects that energize after a bid is presented to the NRES program are eligible. It allows for incremental production if there is new production equipment

<u>Issues for Hydropower projects in the NRES Program:</u>

- 20-year term does not match the typical FERC license term and inherent longevity of hydro equipment
- Does not allow hydro flow to be maximized due to the historical load requirements
- Incremental hydro power needs to be separately metered

Proposal:

- Extend to a 30-year Tariff term (instead of 20 years) based on the typical FERC license term and the inherent longevity of hydropower equipment and civil works.
- Allow for projects to be sized based on hydro potential at the site instead of historical load at the meter, similar to the legislation that was approved last year to allow for rooftop solar to be maximized based on roof size.
- Allow incremental production equipment associated with hydropower to not be separately metered given complexities and realities of hydro power assets.

References:

Legislation that was approved last year to allow rooftop solar to be maximized based on the roof size. Section 4: https://cga.ct.gov/2022/ACT/PA/PDF/2022PA-00014-R00SB-00176-PA.PDF

NRES Program Manual: https://www.eversource.com/content/docs/default-source/save-money-energy/nres-year-3-program-manual.pdf?sfvrsn=cc29a16f_1

Summary of Pros/Cons of this policy consideration:

Pro:

- Allows new hydropower or incremental generation to participate in an existing program that is competitive in nature, while addressing some of the challenges preventing hydropower from currently participating.

Con:

- The NRES program's intent is for on side load to generate power close to where it is consumed. While rooftop solar projects are allowed to be sized regardless of the historical load, these are expected to match a good portion of the load. This is not true of hydropower assets that usually have minimal load. This could set a precedent for other technologies to participate in the NRES program without having to worry about the onsite load.
- Hydropower suppliers prefer a standard rate over a competitive process (like NRES) to enable assurances to proceed with commitments, investments, and financing and to accommodate time delays associated with FERC licensing.

VIII. Conclusion

Hydropower, or hydroelectric power, is a clean baseload energy source that emits no carbon dioxide. In addition to their numerous benefits, hydropower dams can have significant impacts altering river environments. Hydropower operators in Connecticut are faced with a variety of economic challenges which constrain investment decisions related to operational improvements, including those associated with environmental enhancements, modernization and life extension.

Without a program for existing assets, they face low energy compensation rates with electricity valued at the real-time locational marginal pricing (LMP). In addition, they face restrictions of CT's RPS qualifications, specifically the Class I level, cost associated with FERC licensing, and the cost of installing/operating environmental and dam safety enhancements.

The policy considerations outlined in this report encourage equitable compensation for energy rates and Class I RPS qualification for hydropower production as a source of local and regional renewable energy. The policy considerations are intended to balance activities that ensure healthy rivers, environmental mitigation, and potential community benefits. The considerations are therefore designed to support hydropower that: i) meets state and federal requirements, including applicable site-specific standards for water qualify, flow, and fish passage; ii) is limited to existing dams; and iii) is not located in dams identified as candidates for removal. Lastly, innovation at existing facilities should be encouraged to both improve energy generation efficiencies, capture opportunities for additional value, and better mitigate environmental impacts. Collectively, these policy considerations would be expected to enable and encourage existing and new hydropower projects to respect natural river flows, fish migration, and water quality. They also would be expected to provide steady and predictable cash flows for existing hydropower facilities needed to facilitate adequate public and private financing from entities like the Connecticut Green Bank as well as commercial or community banks to make and sustain improvements.

IX. Appendix

A. List of Task Force Appointees

Appointed Hydropower Task Force Members (in alphabetical order):

Duncan Broatch, Chairperson, CT Small Power Producers Assoc.

Marissa Gillett, Chair, Public Utilities Regulatory Authority (PURA)

Leonard Greene, (Task Force Chair), Vice President of External Affairs, FirstLight Power

Eric Hammerling, Director, Environmental Review & Strategic Initiatives, CT Department of Energy & Environmental Protection (DEEP)

Mariana Trief, Associate Director, Investments, Connecticut Green Bank

Laura Wildman, Vice President of Ecological Restoration, Save the Sound

Steven Zuretti, Senior Director, Origination and Policy, Brookfield Renewable

Co-Appointees:

Steve Cadwallader, PURA

Quat Nguyen, PURA

Contributors:

Alicea Charamut, Rivers Alliance of Connecticut

Jon Petrillo, VP Business Development, Gravity Renewables, Inc.

B. PURA Testimony on SB 382

STATE OF CONNECTICUT
PUBLIC UTILITIES REGULATORY AUTHORITY

Energy and Technology Committee — Public Hearing, March 14, 2024

Testimony submitted and presented by: *Marissa P. Gillett, Chairman*
PURA Position: *Informational*

Raised S.B. No. 382 – An Act Concerning Solicitation of Run-of-the-River Hydropower and Other Class I Renewable Energy Resources

Thank you for the opportunity to present testimony regarding **An Act Concerning Solicitation of Run-of-the-River Hydropower and Other Class I Renewable Energy Resources, Raised Senate Bill No. 382**. The Public Utilities Regulatory Authority (PURA or the Authority) welcomes the opportunity to offer the following ***informational testimony***.

PURA understands that the current language in S.B. 382 is meant to serve as a placeholder for policies offered for consideration by the Hydropower Task Force (Task Force), of which PURA is a member, in its final report scheduled to be submitted no later than April 1, 2024 (Report). At this time, PURA takes no position on the various policy considerations expected in the final report; however, we stand ready to implement and administer any such policy(cies) that the General Assembly may adopt.

Background and Considerations

The following four policy scenarios are currently under consideration by the Task Force for inclusion in the Report:

1) Modify the Non-Residential Renewable Energy Solutions (NRES) Program so that it is open to new and/or incremental hydropower projects that are 5 MW or less;
2) Authorize/require DEEP to solicit hydropower contracts up to 20 MW in aggregate;
3) Authorize/require the electric distribution companies to purchase power from hydropower projects that are 10 MW or less at a certain specified rate; and
4) Change the definition of Class I resources to include existing hydropower projects that are 10 MW or less.

None of the above four scenarios definitively ensures that all hydropower resources receive the necessary compensation to remain operational since in some scenarios (DEEP solicitation) projects would be offered payment based on the bids submitted under a competitive procurement and not all eligible projects would be selected (20 MW aggregate cap). Conversely, if the MW cap is removed from the DEEP solicitation policy scenario or raised to ensure all eligible hydropower resources receive a contract, projects are unlikely to submit competitive bids. If this change is made to the DEEP solicitation policy scenario, PURA suggests that hydropower projects be required to open their books to the DEEP procurement team to allow DEEP to evaluate the competitiveness of the bids submitted.

Connecticut's Hydropower Assets

The Last Resort Service and Class I resource scenario (labeled the "RECs-Only" scenario below) has a 10 MW or less project size cap and would offer compensation at a rate anchored to the market, which may or may not be sufficient for hydropower resources to continue operating. However, as such prices mirror market rates, the risk to ratepayers of paying more than the market value for the services these resources provide is lower under these scenarios and, in the RECs-Only scenario, is minimized.

The NRES Program scenario may allow for sufficient compensation to ensure hydropower resources are able to remain financially solvent as the NRES Program scenario has a price, megawatt (MW) caps for different project size categories, and an overall project cap of 5 MW. Thus, resources are not guaranteed to be selected under the NRES Program.[1] The Authority also notes that several existing in-state hydropower resources exceed the 5 MW project statutory limit for the NRES Program, which would require a change to General Statutes §16-244z to address. Other changes to General Statutes §16-244z would also be required; for example, existing resources would need to be allowed to participate (rather than the program focused on encouraging incremental, new resources).

A high-level summary of compensation available under the above four policy scenarios under consideration for hydropower resources is shown in the below table:

<table>
<tr><th rowspan="2">Compensation Category</th><th colspan="4">Policy Scenarios</th></tr>
<tr><th>Modify NRES</th><th>DEEP Solicitation</th><th>Last Resort Service</th><th>RECs-Only</th></tr>
<tr><td>Energy</td><td rowspan="2">¢11.36-19.98/kWh[2]</td><td rowspan="2">Uncertain
(est. ~¢15/kWh)</td><td>~¢10-20/kWh
(Avg. ~¢15/kWh)[3]</td><td>¢3.5-5/kWh[4]</td></tr>
<tr><td>Renewable Energy Certificates (RECs)</td><td>¢4/kWh[5]</td><td>¢4/kWh[5]</td></tr>
<tr><td>Capacity[6]</td><td>N/A[7]</td><td>~¢0.5/kWh[8]</td><td>N/A[9]</td><td>~¢0.5/kWh[10]</td></tr>
<tr><td>Total</td><td>¢11.36-19.98/kWh</td><td>Est. ¢15.5/kWh</td><td>¢14-24/kWh</td><td>¢8-9.5/kWh</td></tr>
</table>

[1] This consideration would not exist if the NRES Program MW cap was eliminated. However, the ratepayer cost associated with this policy scenario would increase if the MW cap was eliminated as projects would be compensated at the bid price cap instead of their bid price.

[2] NRES projects receive combined compensation for energy and RECs. The pricing provided is based on the historical low NRES selected bid price and Year 3 Price Cap. See February 27, 2024 HB 5231 Testimony and the November 8, 2023 Decision in Docket No. 23-08-03.

[3] The estimated compensation range is based on rates for Last Resort Service customers of The United Illuminating Company (UI) and The Connecticut Power and Light Company d/b/a Eversource Energy (Eversource) from 2021 to present, omitting outliers from late 2022 and 2023. The estimated average compensation rate is based the on June 2021 to June 2024 blended Last Resort Service rate for Eversource customers.

[4] The estimated compensation range is based on average ISO-New England Locational Marginal Prices for energy in Connecticut for 2021 and 2023. 2022 was omitted due to the anomalously high prices attributable to global macroeconomic factors.

[5] Assuming that all hydropower resources are made eligible as a Class I resource and the REC market continues to clear near the Alternative Compliance Payment (ACP) rate.

[6] The Authority understands that not all hydropower projects are eligible for compensation through the ISO-New England Forward Capacity Market.

[7] NRES projects are treated as load reducers and are ineligible to participate in the Forward Capacity Market.

[8] Assuming a $/kW-month rate between $2-$4 consistent with the last six Forward Capacity Auctions (FCA 14 – FCA 18), not accounting for capacity accreditation or performance payments or penalties.

[9] As Last Resort Service is a full requirements product, which includes capacity, the Authority assumed that the state would retain the capacity rights for projects under this scenario.

[10] Assuming a $/kW-month rate between $2-$4 consistent with the last six Forward Capacity Auctions (FCA 14 – FCA 18), not accounting for capacity accreditation or performance payments or penalties.

The Authority provides an approximate ratepayer impact analysis of the four policy scenarios currently under consideration below. The intention of this analysis is to provide an initial, high-level comparison of the potential ratepayer impacts of each option based on the *currently proposed* scenarios. This analysis is not intended to affirmatively quantify the magnitude of ratepayer impacts of the Committee's preferred path forward, as any final statutory language, which could include additional or alternative limitations on resource participation, would need to be accounted for in any analysis. In short, the actual ratepayer impacts will depend on what options are offered in statute, which projects are eligible under the final language, and confirmation of what inputs and assumptions are accurate.

Compensation Category	Policy Scenarios			
	Modify NRES	DEEP Solicitation	Last Resort Service	RECs-Only
Compensation Rate	¢11.36-19.98/kWh	Est. ¢15.5/kWh	¢14-24/kWh	¢8-9.5/kWh
Low-End Est. of Electric Benefits[11]	~¢4-5.5/kWh			
High-End Net Ratepayer Cost Est.	¢5.86-15.98/kWh	¢10.0-11.5/kWh	¢8.5-20/kWh	¢2.5-5.5/kWh
Estimated Total Incremental Cost[12]	$3.8-10.4 million	$7.0-8.1 million	$15.1-35.5 million	$4.4-9.8 million[13]
Average Residential Bill Impact / Month[14]	$0.11-0.29	$0.20-0.23	$0.42-0.99	$0.12-0.27
# Projects Retained	19	1 to 20[15]	23	23
MW Retained	18.616	20.000	50.616	50.616

Additionally, the above analysis is not intended, nor does it serve, as an apples-to-apples comparison of the ratepayer impacts of the different policy scenarios as each scenario results in a different number and MW of hydropower projects being retained, as shown in the above table.

Last, and importantly, a complete and robust ratepayer impact analysis on all four scenarios would require additional time, including several iterations on the above analysis and discussions with stakeholders on the assumptions and calculations used. In conducting such analysis, the Authority would benefit from detailed cost and revenue stream information from each of the in-state hydropower resources, as the ratepayer impacts of the competitive solicitation cannot be quantified accurately without such information.

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[11] Combined $/kWh rate for energy and capacity compensation provided under the "RECs-Only" scenario in the above table.

[12] Assuming total annual hydropower generation compensated under each scenario of 65,230 MWh, 70,080 MWh, 177,358 MWh, and 177,358 MWh, respectively.

[13] It is not clear to what degree allowing additional Class I RECs would constitute added costs to ratepayers. This calculation assumes that it displaces ACP amounts, which are flowed back to ratepayers, and does not simply reduce the market price of RECs.

[14] Assuming annual retail electric sales of roughly 25 million MWh and typical monthly residential electricity usage of 700 kWh.

[15] Since this scenario has an aggregate cap and not a project cap, one large project could fill the aggregate cap or as many as 20 smaller projects.

Conclusion

The Authority applauds the use of a diverse task force to provide policy considerations to the General Assembly. This approach ensures that key considerations regarding hydropower projects are sufficiently vetted and that a variety of policy considerations are provided. PURA respectfully requests that the Committee carefully review the report before deciding what policy(cies), if any, to enact.