Feedback Form

Long-Term 2 (LT2) RFP – April 4, 2024

Feedback Provided by:

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Date: 23 April 2024

To promote transparency, feedback submitted will be posted on the Long-Term RFP engagement page unless otherwise requested by the sender. If you wish to provide confidential feedback, please mark "Confidential".

Following the LT2 RFP April 4, 2024, engagement webinar, the Independent Electricity System Operator (IESO) is seeking feedback from stakeholders on the items discussed during the webinar. The webinar presentation and recording can be accessed from the engagement web page.

Please submit feedback to engagement@ieso.ca by April 23, 2024.

Enhanced Power Purchase Agreement (E-PPA) Revenue Model: Proposed Modifications

Topic	Feedback
Do you have any comments regarding use of monthly production factors for the calculation of deemed energy revenues?	NO
Do you have any comments regarding use of the Forecasted Weighted Average Price (FWAP)?	NO
Do you have any comments or suggestions on further mitigating perceived risks associated with VG participation in the DAM?	NO

LT2 RFP & Contract: Key Provisions

Topic	Feedback
Do you have any comments regarding the use of minimum production factors during proposal evaluation?	NO
Do you have any comments regarding the application of the non-performance charge?	NO
Do you have any comments regarding the treatment of outages under the LT2 Contract?	NO
Do you have any comments regarding the payback of Deemed Market Revenues greater than the Monthly Revenue Requirement?	NO

MT2 RFP

Topic	Feedback
Do you have any comments regarding the IESO's considerations on the MT2 RFP, including timing, eligibility, and the interplay between repowering and the MT2 and LT2 RFPs?	YES – SEE GENERAL COMMENTS BELOW:

Long Lead Time Resources

Topic	Feedback
Do you have any comments regarding the IESO's considerations on Long Lead Time Resources, including timing, eligibility, targets, and term?	YES – SEE GENERAL COMMENTS BELOW:

General Comments/Feedback

The Ontario Rivers Alliance (ORA) is a not-for-profit grassroots organization with a mission to protect, conserve and restore riverine ecosystems in Ontario. The ORA advocates for effective policy and legislation to ensure that development affecting Ontario rivers is environmentally and socially sustainable.

The ORA is providing feedback on the 4 April 2024 IESO Long Term 2 Request for Procurement (LT2 RFP) webinar. ORA has already provided extensive feedback as follows:

- 8 February 2023 – Hydroelectric and its Pathway to Decarbonization – ORA to the Minister of Energy, Ontario Power Generation and IESO
- 9 March 2023 – IESO - 2023 Annual Acquisition Report Feedback
- 14 May 2023 – ERO-019-6647, IESO Pathways to Decarbonization Study to the Minister of Energy – ORA to Minister of Energy
- 15 January 2024 – ORA Feedback on the IESO Long-Term 2 Engagement Workshop
- 7 March 2024 – ORA Feedback on the IESO Long-Term 2 Engagement Workshop

Engagement participants were informed of an overall need for 5 TWH of energy emerging at the end of the decade and growing through the 2030s. The LT2-RFP has an anticipated installed capacity target of around 2,000 MW of non-emitting energy resources to be procured and operational by 2030.

It was clearly stated in the 13 December 2023 engagement workshop and in the slide presentation that *"The LT2 RFP will be open to all non-emitting resources that can inject energy into the market, be fully operational by the milestone date for commercial operation (COD) and meet potential financial and experience requirements*."[1] Further, *"for the LT2 RFP, the IESO has been asked by the Ministry of Energy to review the role of existing assets and new non-emitting electricity resources that can be in-service by 2029 including wind, solar, hydroelectric, storage and bioenergy"*.[2]

ORA questions the IESO's rationale for applying the "non-emitting" label to hydroelectric when there are decades of independent third-party peer-reviewed studies, indicating that hydroelectric reservoirs generate significant and ongoing GHG emissions.

Unfortunately, the hydropower industry, as well as all levels of government, have ignored the extensive body of evidence compiled over the last few decades, indicating that hydroelectric reservoirs contribute approximately 5 to 7% of global GHG emissions that, individually, can rise to the level of a gas-fired facility. Instead, the industry and this government greenwash it with disinformation by labelling it as non-emitting, low-emitting, clean or renewable to mislead the public into believing it will cut GHG emissions when, in fact, it will be adding significantly to global emissions until the dam is removed.

It is willful blindness and, in ORA's opinion, fraudulent to greenwash hydroelectric and its reservoirs/ headponds so blatantly while ignoring the huge body of evidence to the contrary - especially when our children's futures are riding on effective climate action.

Greenwashing is not surprising when Ontario is so well invested in hydropower at 23% of the electricity mix, BC at 91%, Manitoba at 97%, Saskatchewan at 20%, New Brunswick at 21%, Quebec at 95%, and Canada at 59%. It's also not surprising that Canada and its provinces are not willing to admit that hydropower is a significant source of GHG emissions, especially since Canada has committed to cutting its emissions to 40-45% below 2005 levels by 2030.

Turning a blind eye to the many significant and ongoing environmental impacts of hydropower and spreading such disinformation brings to mind the tobacco and oil and gas industries in the 1960s and 1980s. The tobacco industry knew the dangers of smoking to human health, yet misled the public into believing it was safe. The oil and gas industry has known all along that fossil fuel emissions would lead civilization off a climate cliff, and yet withheld the information and failed to act. It is the responsibility of the government to be truthful and transparent, to take meaningful action to protect the future of its citizens and to act in the best interests of the global community.

Is this the legacy political leaders wish to leave their citizens, let alone their own children and grandchildren? ORA strongly objects to new hydroelectric being included as a "non-emitting" resource, eligible for the LT2-RFP, and recommends it be dropped from the electricity mix.

Recommendation 1: No new hydroelectric development in Ontario.
Recommendation 2: Hydroelectric facilities wear the appropriate label as a "significant" GHG emitter.
Recommendation 3: Any new or upgraded hydroelectric facilities be required to provide Financial Assurance by securing sufficient funds up-front with the province to cover future dam decommissioning.

What follows is ORA's supporting argument for why hydroelectric should not be included in any new RFPs and why it must be recognized as a significant GHG emitter. (Underlining is for emphasis only):

1. Hydropower is not a "Non-Emitting" Resource

The IESO has included hydropower as a "non-emitting" resource in the LT2 RFP, despite decades of third-party independent research reporting that hydroelectric reservoirs in boreal, temperate and tropical regions can be a significant and ongoing source of biogenic GHGs, including methane, which in some instances can reach the same emission rate as gas-fired facilities.[3]

In fact, the non-emitting and low-emitting labels are contrary to a 2004 Environment Canada report, stating,

> "*In contrast to the widespread assumption (e.g., in Intergovernmental Panel on Climate Change scenarios) that GHGs emitted from reservoirs are negligible, measurements made in boreal and tropical regions indicate they can be substantial.*[4]

In fact, in the first decade after a new hydropower generating station is built, it can contribute to more greenhouse gas emissions than burning coal through ongoing methane releases fueled by microbes feeding on flooded vegetation.[5]

Methane is a potent GHG with a heat-trapping capacity 28 to 34 times greater than carbon dioxide over a 100-year time scale, and measured over a 20-year time period, that ratio grows to 84 to 86 times.[6] Methane is generated in reservoirs by bacteria living in oxygen-starved environments. These microbes eat organic carbon from plants for energy, just like people and other animals, but instead of breathing out carbon dioxide, they breathe out methane.[7]

GHG emissions are fueled by rotting organic matter left behind when the reservoir is initially flooded, as well as the vegetation, litter, and organic matter that washes into the system regularly from rain events and seasonal flooding. Lakes and rivers can be a source or a sink for GHG emissions; however, when this organic matter and sediment continually accumulate behind the dam in the reservoir, it fuels emissions and guarantees the continued release of methane from the reservoir throughout the life of the dam.

Additionally, river networks with high nutrient and sediment loading from agricultural or wastewater effluent provide microbial communities with a more significant source of nutrients that can deplete sediment oxygen and fuel even more methane production. When water bodies become eutrophic, algal blooms can result in excessive nutrient loading, which further enriches reservoir sediments that fuel methane production.[8]

The effect of damming on methane emissions conducted in a central European impounded river revealed that the reservoir reaches are a major source of methane emissions and that areal emission rates far exceed previous estimates for temperate reservoirs. It showed that sediment accumulation correlates with methane production and subsequent ebullitive release rates. Results suggested that sedimentation-driven methane emissions from dammed river hot spot sites can potentially increase global freshwater emissions by up to 7%.[9]

This is bad news as we already have a serious methane problem. Indeed, Canada, along with 100 other countries, made a pledge to slash global human-caused methane emissions across economic sectors by at least 30% below 2020 levels by 2030. Hydroelectric reservoirs fall directly within the energy sector and should adhere to that pledge.

2. What the IPCC has to say about Hydroelectric:

The Intergovernmental Panel on Climate Change, in its 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories (NGHGI), has recognized and informed participating countries that flooded land emits GHGs in significant quantities and offers detailed guidance on how CO_2 and CH_4 coming from reservoirs for hydroelectric energy production should be reported:

"Flooded Land is defined as water bodies where human activities have caused changes in the amount of surface area covered by water, typically through water level regulation. Examples of Flooded Land include reservoirs for the production of hydroelectricity, irrigation, and navigation."[10]

"Flooded Land emits CO_2, CH_4 and N_2O in significant quantities, depending on a variety of characteristics such as age, land use prior to flooding, climate, upstream catchment characteristics and management practices. Emissions vary spatially and over time."[11]

The range of Flooded Land considered in this chapter are listed in Table 7.7."[12]

TABLE 7.7 (NEW)
TYPES OF FLOODED LAND, THEIR HUMAN USES AND GREENHOUSE GAS EMISSIONS CONSIDERED IN THIS CHAPTER

Flooded Land types	Human Uses	Greenhouse gas emissions for which guidance is provided in this Chapter
Reservoirs (including open water, drawdown zones, and degassing/downstream areas)	Hydroelectric Energy Production, Flood Control, Water Supply, Agriculture, Recreation, Navigation, Aquaculture	CO_2, CH_4
Canals	Water Supply, Navigation	CH_4
Ditches	Agriculture (e.g. irrigation, drainage, and livestock watering)	CH_4
Ponds (Freshwater or Saline)	Agriculture, aquaculture, recreation	CH_4

Emissions of CH_4 from Flooded Land are primarily the result of CH_4 production induced by anoxic conditions in the sediment (see Annex 7.1).

Methane can be emitted from small lakes or reservoirs via diffusive, ebullitive, and downstream emissions. Downstream CH_4 emissions are subdivided into degassing emissions (see Glossary) and diffusive emissions, which occur downstream from the flooded land. Methane emissions are generally higher in waterbodies with high organic matter loading and/or high internal biomass production, and low oxygen status. Due to their high emission rates and large numbers, small ponds of area < 0.1 ha have been estimated to generate 40 percent of diffusive CH_4 emissions from open waters globally (Holgerson & Raymond 2016). Whilst emissions from natural ponds can (at least in part) be considered natural, those from small constructed waterbodies are the result of anthropogenic activity.[13]

Fugitive emissions from hydroelectric operations are anthropogenic in nature as they result from human activity:

"This volume [Volume 2-Energy] provides methodologies for the estimation of fugitive emissions of CO_2, CH_4 and N_2O. Fugitive emissions tend to be diffuse and may be difficult to monitor directly. Methodologies for estimating fugitive emissions from the Energy Sector are very different from those used for fossil fuel combustion. However, if these emissions can be measured, they should be reported in source category 1.B.3 "Other emissions from energy production".[14]

Hydroelectric GHG emissions can be detected, measured and reported with high efficiency and accuracy using a drone housed with laser spectrometer technology[15] or GHGSat technology[16], both are extremely sensitive at parts-per-billion levels. Therefore, hydroelectric operations must be identified in all related communications as a potentially "significant" source of GHG emissions and be required to monitor, measure and publicly report those emissions.

The zone of influence of the entire hydroelectric operation is a major factor to be considered:

"Dams for hydroelectric generation *and flood control can create riparian wetlands upstream and influence existing riparian wetlands by altering the frequency and duration of flood pulses, which impacts sediment deposition and nutrient loading to wetlands (Brinson and Malvárez, 2002; Noe and Hupp, 2005, Nilsson and Berggren, 2000)."*[17]

"Flooded Lands are defined in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Wetlands) as water bodies where human activities have caused changes in the amount of surface area covered by water, typically through water level regulation. Here, we also consider:

i) waterbodies where human activities have changed the hydrology of existing natural waterbodies thereby altering water residence times and/or sedimentation rates, in turn causing changes to the natural flux of greenhouse gases (See A7.1.1); and
ii) waterbodies that have been created by excavation, such as canals, ditches and ponds. Flooded Lands include waterbodies with seasonally variable degrees of inundation but would be expected to retain some inundated area throughout the year under normal conditions."[18]

Retention time and operating strategy are other key considerations that could involve other lakes, streams and wetlands:

"Reservoirs are designed to store water over time scales ranging from hours to several years. Their use can serve single (e.g. water supply) or multiple purposes, and reservoir operation may vary depending on different user needs (Table 7.7). Hydropower reservoirs can be divided in three categories: storage, run-of-the-river and pumped storage reservoirs. These categories generally describe the relationship between storage volume, inflow and water residence times, but in reality, reservoirs exist on a spectrum. Natural lakes may also be used as reservoirs, often by damming to expand their volume and surface area.

Flooded land is exposed to natural or anthropogenic regulation of water levels, creating a drawdown zone. Greenhouse gas emissions from the drawdown zones are considered significant and similar per unit area to the emissions from the water surface (e.g. (Yang et al. 2012), (Deshmukh et al. 2018)) and are therefore included when estimating greenhouse gas emissions from Flooded Land. Lakes converted into reservoirs without substantial changes in water surface area or water residence times are not considered to be managed Flooded Land, in accordance with the 2006 IPCC Guidelines. Reservoirs are classified according to the length of time they have been flooded:

(i) Flooded Land Remaining Flooded Land – includes reservoirs that were converted to Flooded Land more than 20 years ago.
(ii) Land Converted to Flooded Land – includes reservoirs that were flooded less than or equal to 20 years ago." [19]

The IPCC also reports that "*in reservoirs, high levels of CH_4 emissions can occur in the first 20 years following flooding (see Annex 7.1)".*[20] Although the initial GHG emissions will reduce slightly after the first 20-year surge, methane emissions continue to be generated in the reservoir and have been shown to increase as the climate continues to warm.

This indicates that new hydropower projects will cause a sharp increase in methane emissions as we seek to slow the climate crisis. Whereas healthy undammed rivers are more resilient and will play a critical role in moderating and mitigating climate.[21],[22]

3. Other notable studies on GHG emissions coming from hydroelectric operations:

A recent study out of Quebec quantified the long-term historical and future evolution of GHG emissions from 1900 to 2060, examining the cumulative global surface area of 9,195 reservoirs in four different climate zones (boreal, temperate, subtropical, and tropical) around the world. The study reported:

> *"reservoir-induced radiative forcing continues to rise due to ongoing increases in reservoir methane emissions, which accounted for 5.2% of global anthropogenic methane emissions in 2020. We estimate that, in the future, methane ebullition and degassing flux will make up >75% of the reservoir-induced radiative forcing, making these flux pathways key targets for improved understanding and mitigation.*
>
> *While CO_2 and CH_4 diffusion are modelled as decreasing with reservoir age, ebullition and degassing remain constant, such that these two latter emission pathways grow increasingly important with time. Thus, while CO_2 diffusion was the dominant flux pathway in the twentieth century, C–CH_4 emissions, mainly via ebullition and degassing, are expected to surpass C–CO_2 around 2032 and account for 75% of reservoir C emissions by 2060. In addition, the higher greenhouse warming potential of CH_4, relative to CO_2, amplifies the climate impact of CH_4 emissions. Furthermore, estimated fluxes do not account for future global temperature increases or water eutrophication changes, both of which would probably stimulate CH_4 emissions more strongly than CO_2. Methane emissions, and especially CH_4 ebullition and degassing are expected to dominate future reservoir C-GHG release (39% and 32% in 2060, respectively; (Fig. 2 - below), implying that mitigation efforts aimed at reducing CH_4 fluxes via pathways could be quite effective."*[23]

Another pivotal study back in 2000 reported that although carbon dioxide and methane diffusion will decrease within the first 20 or more years of a new reservoir being created, the ebullition and degassing of methane will persist, and increase over time. Measurements made at hydroelectric facilities in boreal and temperate regions indicate that GHG emissions can be substantial.[24]

A Swiss study of a temperate hydropower reservoir indicates that "*the total methane emissions coming from Lake Wohlen, was on average > 150 mg CH_4 m^{-2} d^{-1}, which is the highest ever documented for a midlatitude reservoir. The substantial temperature-dependent methane emissions discovered in this 90-year-old reservoir indicate that temperate water bodies in older headponds can be an important but overlooked methane source"*.[25]

Proponents often boast that hydroelectric facilities can remain in service for 100 years or more. That may be attractive to an investor, but it means the facility will continue to emit carbon, methane and nitrous oxide for 100 years or more. However, as temperatures rise, so will emissions and stream degradation.

For instance, OPG recently announced its plans to reconstruct the Kakabeka Falls Generating Station which is already 117 years old. So, it will soon contribute another century's worth of carbon and methane when it is vital that we cut emissions.

You can turn off a gas-fired facility when a cleaner form of electricity comes along; however, a hydroelectric reservoir will continue to emit methane until the dam is removed. You cannot just turn off emissions coming from its reservoir when biomass keeps building up behind the dam.

Upfront dam decommissioning funds for hydroelectric facilities are not required by the province, and dam removal has proven to be cost-prohibitive in most instances, as it can add up into the $millions.

Consequently, hydroelectric reservoirs cannot be considered "non-emitting," "low-emitting," "clean" or even renewable, and should never be allowed to sell Clean Electricity Credits unless the GHG emissions are monitored, measured, and the data reported publicly to demonstrate they are non-emitting.

It is also important to consider that creating a hydroelectric reservoir on a previously untamed riverine ecosystem can transform a healthy ecosystem from a GHG sink into a relatively significant source of emissions into the atmosphere.[26]

4. Greenwashing of Hydropower:

Unfortunately, Hydro Quebec has been very effective in muddying the waters over the last 3 decades by downplaying the quantity and duration of reservoir GHG emissions through the commissioning of a number of questionable studies that excluded key pathways of methane emissions, from its study results and has a website that seriously misleads the public by omitting these and other key factors regarding the accumulation of methylmercury in fish tissue.[27]

The best way to sum up the problem is to cite a 2011 Montreal Gazette article, where Dr. Eric Duchemin, Institute of Environmental Sciences, University of Quebec, and an IPCC scientist, appointed by the Government of Canada, stated,

> *"(Hydro-Quebec) has the tendency to minimize the importance of the emissions from its reservoirs… You transform the forest, the river, the valley into a huge immovable zone where you have enormous amounts of micro bacteria where a huge amount of methane is emitted that was not emitted before."* What's more, Duchemin said, reservoirs continue to emit greenhouse gases for decades because they are the depositories for all the gaseous biomass in the reservoir watershed. Eric Duchemin, PhD, Environmental Sciences.[28]

Hydro Quebec was also invested in the development of the G-Res Tool, which again fails to include many key components responsible for GHG emissions coming from reservoirs. Of course, it is a very popular tool used by many hydropower proponents around the world to downplay their emissions.

5. Hydropower's Clean and Renewable Reputation:

A very high environmental and socio-economic price has been paid in the past in terms of losses to valued natural resources due to the installation of dams and waterpower facilities. The socio-economic costs of these losses are generally ignored[29,30] and rarely revealed to the public.

The collateral environmental damage caused by dams and waterpower facilities has been well documented for decades, including the loss or serious decline in migratory fish species (waterpower facilities are key factors in the listing of some iconic fish species as species at risk in Ontario and elsewhere)[31,32], declining biodiversity[33], impaired water quality (including elevation of mercury concentrations in fish tissue)[34],[35], and are critical threats to imperilled aquatic species.[36]

Significant ecological damage from waterpower has been ongoing for many decades in Ontario and other locations worldwide.[37] In fact, in Ontario dams are considered to be a major factor in the extirpation of Ontario's Atlantic Salmon stock[38], one of the most important causes of significant anthropogenic mortalities and decline of Ontario's American Eel[39], and a key threat to Ontario's declining Lake Sturgeon populations.[40,41,42]

In addition, the hydropower industry has also been extremely negligent in protecting fish species, as there are a total of 224 hydroelectric facilities in Ontario, including 66 owned by Ontario Power Generation, and only 2 are fitted with operating fishways.

6. Methylation of Mercury in Fish Tissue:

Several studies have shown that the same process through which microbes break down submerged plants and organic material to release GHGs also leads to the methylation of mercury present in the system. As highlighted by the ELARP study on Lake 979 and the surrounding wetland system, the construction of a reservoir leads to dramatic increases by 10 to 20 times, in both GHG and methylmercury production. [43]

Mercury is present as a natural component of soil in its inorganic form (Hg) in trace amounts through natural processes.[44] However, in its organic and methylated form, it is one of the most potent environmental neurotoxins in the world. After the construction of a dam, the methylmercury (MeHg) formed via microbial breakdown persists in riverine soils for decades due to its high affinity for organic matter.[45],[46]

Studies have shown that while MeHg is only produced in reservoirs in the first 10 years after its construction, the levels of this compound can remain elevated in the water for several decades afterwards because of its adherence to the sediment.[47],[48],[49]

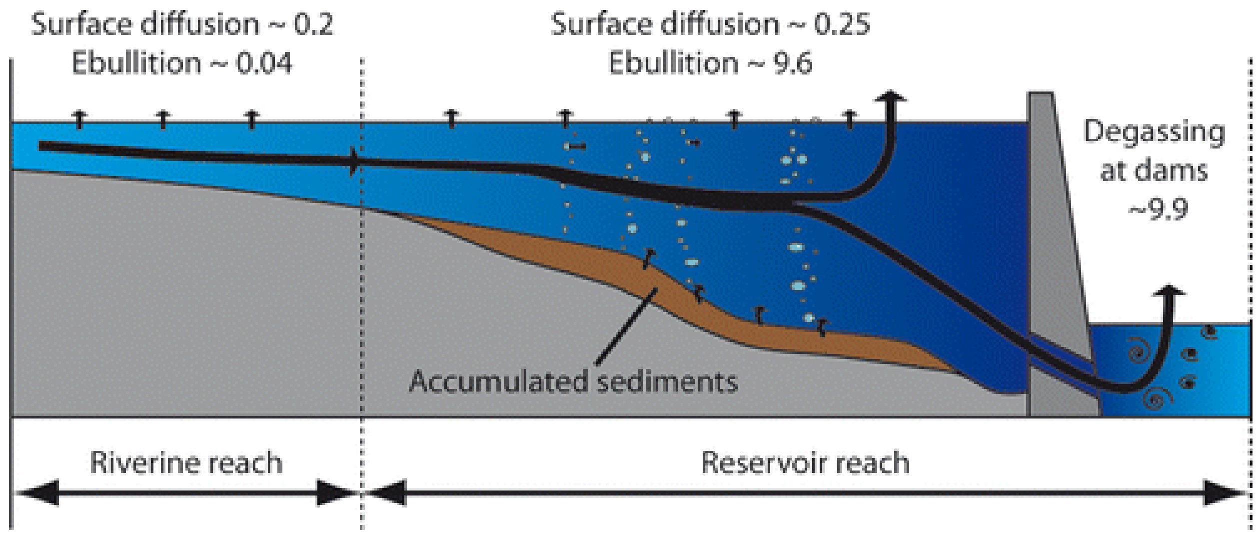
One of the central mechanisms behind MeHg's toxicity lies in its ability to concentrate in organisms rather than being excreted, which leads to its magnification as we go up the aquatic food chain.[50] Multiple studies have shown that large predatory fish such as Northern Pike near newly constructed dams and reservoirs contain MeHg levels 3 to 9 times higher than the maximum acceptable level in fish for sale in Canada.[50,51] Furthermore, it can take several decades for the MeHg levels to return to normal in the muscles of these fish, assuming there are no further instances of flooding.

Methylmercury contamination of fish tissue poses a serious risk to those who rely on fish as a main staple in their diet. Once absorbed into the bloodstream, MeHg is carried to the brain and spinal cord where it wreaks havoc on the nervous system. More specifically, it interferes with the formation and maintenance of nerve cells, as well as the release and reuptake of neurotransmitters. This disruption affects brain function and development, sensory processes, and behaviour.[52]

New reservoir flooding accelerates the bioaccumulation of methylmercury in fish tissue, and these effects can persist for decades.[53],[54] This can remove fish as a primary source of food from Indigenous and other stakeholder communities.

7. Small Hydropower is Not A Solution

Small hydro, usually considered to be under 10 MW, is often thought to be clean and carry fewer impacts. This is understood in most circles to mean that it does no harm to the environment and does not emit GHGs. However, an article by the American Chemical Society has noted: "*With the "clean" reputation of large hydroelectric dams already in question, scientists are reporting that millions of smaller dams on rivers around the world make an important contribution to the greenhouse gases linked to global climate change*." [55]



The article references a study by Maeck et al. (2013), reporting that "*there are millions of small dams worldwide that receive and trap high loads of organic carbon and can therefore potentially emit significant amounts of methane to the atmosphere. We evaluated the effect of damming on methane emissions in a central European impounded river. Direct comparison of riverine and reservoir reaches, where sedimentation in the latter is increased due to trapping by dams, revealed that the reservoir reaches are the major source of methane emissions (0.23 mmol CH4 m-2 d-1 vs 19.7 mmol CH4 m-2 d-1, respectively) and that areal emission rates far exceed previous estimates for temperate reservoirs or rivers. We show that sediment accumulation correlates with methane production and subsequent ebullitive release rates and may therefore be an excellent proxy for estimating methane emissions from small reservoirs. Our results suggest that sedimentation-driven methane emissions from dammed river hot spots can potentially increase global freshwater emissions by up to 7%*." [56]

With smaller dams, storage becomes increasingly important. Reservoirs silting up or becoming overloaded with nutrients are common problems. They are at least as serious where shallower water bodies are created. The shallower a water body, the more vulnerable it is to thermal warming and the more eutrophic it can become. Likewise, methane generation occurs largely where water and sediment meet. This means that a shallower water body is likely to release more methane per unit area than a deeper water body. Shallow reservoirs are not unlike paddy fields and biomass generation, which are known to contribute substantially to methane emissions.[57]

The IPCC also reports that "*hydropower plants without or with small storage may be susceptible to climate variability, especially droughts, when the amount of water may not be sufficient to generate electricity (Premalatha et al. 2014) (Section 6.5).*[58]

Many small hydroelectric facilities rely on harmful peaking/cycling operating strategies to maximize power generation during peak demand hours. The hourly and/or daily water level fluctuations and repetitive wetting and drying effects over vast areas of the reservoir amplify the volume of GHGs released into the atmosphere.

For instance, a 2021 study revealed that "*reservoir drawdown areas, where sediment is exposed to the atmosphere due to water level fluctuations, are hot spots for carbon dioxide emissions.* Researchers used monthly data based on satellite imagery and considered the size of water surface areas from around 6,800 dams worldwide between 1985 and 2015. For these 30 years, the scientists were thus able to determine exactly when, where, and for how long the dams were not completely filled and how large the dry areas were. On average, 15% of the total reservoir surface was not covered by water. Scientists used this figure to further calculate the carbon release from these areas. *"Our calculations* *show that carbon emissions from dams had been significantly underestimated. On a global average, they release twice as much carbon as they store. Their image as a net carbon store in the global carbon cycle must be reconsidered*." [59]

In summary, the studies indicate that a small hydropower facility relying on reservoir drawdowns or water level fluctuations can be just as bad if not worse than larger dams for GHG emissions.

8. Run-of-River Hydropower

Other than closed-looped Pumped Storage Hydro, the only lower-impact type of hydroelectric power generation is run-of-river, but a true run-of-river has no water storage capacity. In fact, building a true run-of-river facility is often not cost-effective on smaller rivers because of the high construction cost and the small and intermittent amount of power generated as a result of low and unreliable flows. The IESO reported run of river efficiency to be as low as 15 to 30% of Installed Capacity.[60]

To further highlight this point, a 2014 analysis was conducted by the IESO to determine the best means of electricity connection to remote First Nation communities and to enable forecasted growth of the Ring of Fire mining operations in northern Ontario. The analysis concluded that "*Northern hydroelectric generation is an energy-limited resource known to have significantly reduced output and availability during drought conditions of the river system supplying these generating units.*[61] In fact, the recommendation of their report was to not build any new hydroelectric facilities but primarily to build new transmission lines.

The daily, seasonal, and annual variations of run-of-river or small hydro operations are intermittent and unreliable. This is because generation peaks during the high flows of spring when power is in low demand and produces at its lowest during the hot summer months when consumption and demand are most heightened. During the low flow season of summer or during drought conditions, many true run-of-river and even some peaking (storage) facilities, especially on smaller rivers, cannot operate efficiently and must be shut down.

Run-of-river dams are vulnerable to water shortages, and this will only increase as temperatures continue to rise.[62] Sediment and leaf litter are trapped behind the dam and will release GHG emissions at the turbine intake, spillway, and outflow downstream of the dam.

A cost/benefit analysis should be required to determine whether these types of projects are environmentally and/or economically sustainable and whether they should even qualify for certification and CECs.

9. Conclusion:

Hydroelectric facilities will last for 100 years or more, so it is essential that full life-cycle costs associated with any new projects are carefully assessed in terms of sustainability, including GHG emissions, impacts to ecosystem services, fisheries, water quality and water quantity, as well as the eventual decommissioning of the facility. Decommissioning can involve millions of dollars and is likely to be necessary sooner than expected. Rivers will be severely impacted as climate change progresses, and it is already happening in many regions of North America where rivers are drying up or not having enough flow to spin the turbines

It is crucial to consider that future environmental and socio-economic costs and uses of hydropower will rely on water availability and must be accurately understood to inform decision-makers in these uncertain times. The authors of a new study say that although observations in the St. Lawrence Basin had previously suggested snowpack trends were small, study results show that human-caused climate change was responsible for a seven percent drop in March snowpack per decade over 40 years. It also reports that there is an average -8°C threshold; with more days at or near freezing, these regions will start to see accelerating snow loss. With average temperatures below -8°C, the snowpack remains relatively consistent.[63]

Growing water insecurity will threaten global economic growth and political stability. "*The World's water systems face formidable threats due to unsustainable management and climate change… The demand for water is expected to increase by 50% by 2030, but water supplies physically cannot grow in parallel. Water stress can be the backdrop for increasing conflicts, political instability and migration pressure.'*[64]

The role of hydropower in helping to provide power system balance and stability will also be affected by climate-related events, which have reduced water availability in many regions over the last few years, straining power grids and raising questions about the resilience of electricity systems. [65]

There have been numerous reports of extended droughts causing reduced hydroelectric generation, and municipalities and cities having to rely on natural gas, coal and diesel to fill the gap. For instance, Doug Prendergast, a spokesperson for the NWT Power Corporation, reported that a combination of diesel and hydro had been providing power to Yellowknife, Ndılǫ, Dettah and Behchokǫ̀ since the fall of 2022. While roughly 95 to 98 percent of electricity in the North Slave typically comes from hydro, up to the end of November, around 45 percent of power was being generated by diesel. Over the next several months, as demand for electricity increases in Yellowknife and the other communities supported by Snare, he expected that percentage will change somewhat, and the percentage of diesel generation will increase. "*It is obviously a challenging situation,*" Prendergast said. "*Now this looks like it could extend into a third year so, obviously, we'll be hoping for lots of snow in the area of the Snare basin."* [66]

Manitoba Hydro boasts it has one of the cleanest grids in the country, but because of growing drought conditions, it is banking on fossil fuels long into the future. It has used more natural gas-fueled electricity in the last 12 months than it has in a decade. It's a foreshadowing of the uncertain future hydropower faces. "*From 2013 to 2023, the utility has run its natural gas generators for an average 54 gigawatt-hours of power; this year, the province has used 122 GWh, according to data provided by Manitoba Hydro. The drought conditions took a toll on the province's hydroelectric reserves this year, prompting the utility to import electricity as well as running its backup thermal generators*."[67]

Hydroelectric must be recognized for its significant and ongoing GHG emissions that will have long-lasting implications on our ability to achieve our GHG emission reduction goals. Its reservoirs are much worse contributors to world GHG emissions than previously thought, as *"carbon emissions from dams have been significantly underestimated. On a global average, they release twice as much carbon as they store. Their image as a net carbon store in the global carbon cycle must be reconsidered*."[68]

It is also important to consider that creating a hydroelectric reservoir on a previously untamed riverine ecosystem can transform a healthy ecosystem from a GHG sink into a relatively large source of methane emissions.[69] However, removing a dam from a river can quickly turn a GHG emitter into a GHG sink.

To ensure climate-resilient riverine ecosystems, the Ministry of Energy should ensure there are no new hydropower developments included in the IESO's RFP for the Long-term Energy Plan. Ontario should also start incentivizing the removal of the hundreds of old and unsafe dams that will continue to generate GHG emissions until they are removed.

Thank you for this opportunity to comment!

Respectfully,

Linda Heron
Chair, Ontario Rivers Alliance
(705) 866-1677

Cc: The Honourable Todd Smith, Minister of Energy – MinisterEnergy@Ontario.ca

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