

Feedback Form

Small Hydro Program Design, March 2022

Feedback Provided by:

Name: Alastair Wilson

Title: Technical Advisor

Organization: Gemini SRF Power Corp

Email: [REDACTED]

Date: 2022/04/19

To promote transparency, feedback submitted will be posted on the IESO webpage unless otherwise requested by the sender.

Following the (date) Small Hydro Program Design Outreach Session, the Independent Electricity System Operator (IESO) is seeking feedback from stakeholders on the following discussed items. Background information related to these feedback requests can be found in the presentation, which can be accessed from the [engagement web page](#).

Please submit feedback to engagement@ieso.ca by (date). If you wish to provide confidential feedback, please mark the document "Confidential". Otherwise, to promote transparency, feedback that is not marked "Confidential" will be posted on the engagement webpage.

Small Hydro Program – Engagement Approach

Topic	Feedback
<p>What questions or feedback do you have about the IESO’s engagement approach?</p>	<p>Although it is appreciated the proposed new Small Hydro Program is being developed meet a short target time deadline the approach can be characterizable as another IESO high level, top down, large group discussions approach that does not allow for individual contractual party discussions. A drawback of the approach as related by the team is that any previous facility specific information provided to IESO contract teams is not available to the Small Hydro program design team. Overall, by way of intention or lack of hydro experience there appears a appears to be a lack of appreciation that Ontario Small Hydro’s are forever assets irrespective of who owns and operates them. The Engagement teams use of principal terms, namely Competition, Fairness, & Transparency are not well defined or as they may relate to the specifics goals of the program to provide sustainable revenues and long-term security of pricing</p>

Small Hydro Program – Principles & Goals

Topic	Feedback
<p>What questions or feedback do you have on the design goals for the program?</p>	<p>The design goals are undefined other than seeming to support the primary goals of the IESO MRP to effectively cancel existing contracts with the singular objective of reducing reasonable generator revenues. The goals would also seem to be at odds with a Small Hydro program being designed “to provide value for ratepayers while providing a reasonable revenue stream for the facilities to continue operating.”</p>
<p>What questions or feedback do you have on the principles that the design is founded on? (Focus on value, promote competition, incent market-</p>	<p>The design foundation principles sound aspirational but they can be interpreted as but a singular focus of cutting generator revenues as if the current Small Hydro generation costs are</p>

Topic	Feedback
driven operations and allow for flexibility in future system operation).	out of line with best operation, maintenance practices and industry standards: [e.g. Value =reduce costs, Incent Market Operations =reduce energy revenues to average local system costs, Flexibility =reduce energy production in favor of capacity and dispatchable ramp /load change operations]. Underlying the concern with these expressed design principles is that run of the river Small Hydro plants are designed to essentially operate at best efficiency, within their specific site characteristics and most importantly the natural hydrology conditions of the site. The Ontario Small Hydro facilities are unsuited for operation that could be contemplated by the inappropriate application of these design principles. It is important to recognize that this is not a unique conclusion for Ontario; as many hydro jurisdictions worldwide have recognized that Small Hydro plants are not suitable flexible resources for integrating solar and wind facilities cost effectively

Small Hydro Program – Design Concepts

Topic	Feedback
What questions or feedback do you have relating to Design Concept #1: Capacity Payments	The IESO should provide specific examples of how a capacity payment approach could provide sufficient revenue to support continued operations [e.g., 5 MW plant, Capacity Factor 55% produces 24,090 MWhrs per year. Revenue @ \$69/MWhr =1.66 M\$/yr. ...A straight capacity payment equivalent = \$ 912/MW day. With an assumption that 40% could be market revenue earned the capacity payment would be \$600 /MW Day which is two to three times current capacity pricing] A capacity payment approach would also cause a reduction of Gross Revenue Payments of 12% which are computed against energy production because we will be forced to spill more water.

Topic	Feedback
<p>What questions or feedback do you have relating to Design Concept #2: Dispatchability</p>	<p>As was best expressed during the feedback sessions this design goal deserves a hard “NO” Dispatching of small plants is rarely feasible due to their dam configuration, river hydrology, and spill capability being managed by log operations. For plants located in community settings dispatch at night is usually prohibited to ensure public safety is not compromised by sudden changes in flow. More specifically as has been provided in feedback to the MRP team small hydro units are not designed to start stop frequently, or ramping due to the need to avoid rough zones. Supporting this finding is the extensive worldwide hydro utility Owners, OEM manufacturers, Research reports, [CEATI, NHA, NREL, EPRI,] outlining that the aggressive operational use of Small Hydro plants causes significant damage, failures, loss of life and added costs. Winter conditions of gates and logs icing prevent easy/timely spill management. A further issue is that frequent dispatching causes changes in dam stress loading especially when combined with the winter ice loads. In short, the Ontario small hydro facilities are not designed or fit for dispatchable purposes. As an example, each of the 4.6 MW SRF units 4.6 MW are restricted from operation below 1.7MW (cavitation) and between 3.2 to and 3.8 MW (rough zone avoidance). A mandated dispatch requirement to operate in these zones would require significant repair and spill compensation well above market rates</p>
<p>Is your facility currently dispatchable?</p>	<p>“NO” Gemini SRF is self-scheduling precisely as it is not dispatchable. As a typical single plant operator, a 24x7 control center with log operations staff on call is not in place to manage dispatching. The upper Mattagami River flow is fully controlled by OPG such that as SRF has no storage it generates run of the river as OPG dispatches flows. Additionally, the Town of Smooth Rock Falls water intake is</p>

Topic	Feedback
	<p>located 600 m upstream of the plant at a depth of 3m which requires the head pond to be maintained within 15cm to avoid causing backwash turbidity as would occur with pulsing of the head pond and non-compliance with the Mattagami River Water Management Plan. It is an offence to operate the facility in non-conformance with this Water Management Plan.</p>
<p>If your facility is currently not dispatchable, is there an interest in becoming dispatchable? What would be required to become dispatchable and what are the barriers (if any)?</p>	<p>“NO”. The Gemini SRF dam and power house built in 1919 was designed and is run as a run of the river facility. The river flows through the 2 units and the 19-sluice dam having but one sluice gate and 276 stop logs, are controlled such that the inflows do not cause the allowable head pond levels to be exceeded. Dispatching of the units would cause level non-compliance with the water levels mandated by the Water Management Plan unless the dam was to be modified to accommodate changes in unit and river inflows. At a minimum 2 new remote controlled heated head gates would need to be installed in the dam at a budgeted capital cost of approx. 3 M\$ plus the hire of additional control operators to provide 24x7 coverage such that the WMP allowable 15cm head pond variance could be maintained as the OPG controlled inflows are changed. Even with these dam upgrades, there would remain operational constraints due to OPG scheduling and environmental considerations which would restrict/prohibit IESO’s dispatch</p>
<p>What questions or feedback do you have relating to Design Concept #3: Tranching</p>	<p>Tranching has been discussed in terms of plant/unit size which as a general descriptive characterization has merit for those facilities less than 10 MW to set them aside from larger units. OPG has for many years “tranching” its small hydro plants into one operational group as distinct from larger plants to recognize their distinct operation and maintenance differences which require custom verse standardized approaches. [E.g. Unit size -5MW plant</p>

Topic	Feedback
	<p>dissimilar from 5x1unit plant, Age ,Head, Design, Type, KW/cms, Condition, Location, Civil infrastructure] A possible use of tranching might be to group plants within the context of their watershed location where the hydrological conditions and water management control are similar and interdependent to confirm their current operations [Trent Canal, Muskoka river, Upper Mattagami river, English River] .Tranching into groupings such as Connection type, Market participant, Ownership, Regional Location etc. does not seem relevant as distinct characteristics.</p>
<p>What characteristics would you consider to be defining features of your operations or facilities as it relates to potential criteria for contract payments?</p>	<p>Gemini SRF is a design-built run of the river plant (1919) that has operated exclusively as a run of the river plant having the following characteristics [No control of inflows (OPG) 15cm head range, No storage as within 2 hours head pond level drops below allowable minimum -shut down, Security of the Town of Smooth Rock Falls water intake depends on head level being maintained. We are embedded into the fabric of Smooth Rock Falls and need to be cognizant of our responsibilities to our neighbor's, i.e., we have overriding obligation to be good neighbors. As of 2018 the plant has been substantially refurbished with the install of 2 new units approved by IESO and Hydro One under an OPA HCI contract amendment. The plants power dam and equipment such as cranes, log lifters, main sluice gate, SCADA, have been replaced or rebuilt such that the plant can be run reliably and safely. When the current HCI contract term and price expires in 2030 the current outstanding amortization loan will have been retired but an ongoing sustaining stream of revenue will be required to support an ongoing maintenance and capital program as is the goal of the Small Hydro Program</p>
<p>What questions or feedback do you have relating to Design Concept #4: Investment?</p>	<p>The proposed contract terms are far too short to enable major sustaining, expansion or new</p>

Topic	Feedback
	<p>purpose build loans to be provided by vendors and insurers. OPG which typically carries out upgrades or station rebuilds secures IESO 40-year contracts. Lenders require certainty to support investment. SRF is/will not be fully amortized until 2030 and its current loan obligation which were approved by the IESO cannot be rescheduled with activating break fees. Furthermore, this program is being launched at the same time as the IESO's Market Renewal Program, which serves to cause a great deal of uncertainty with regard to future revenues and the operating regime for Smooth Rock Falls GS. This is a very important consideration for anyone contemplating an investment in our facility, or any facility for that matter.</p>
<p>Have you considered adding an on-site battery to your facility? If so, what stage of development are you in? Is there potential for Indigenous and/or community ownership?</p>	<p>We have considered alternatives set but as the plant's production and operation is the totally regulated by the IESO and Hydro One that no freedom to explore such opportunities as might exist such as direct sales to the local municipality is currently allowable. Batteries may be an interesting idea as the cost per MW, MWhr. Furthermore, it is unclear to us how we would be paid for this and whether there would be sufficient revenues to cover the capital investment and earn an adequate return on such an investment. An alternative investment that might be attractive is the charging service for EV vehicles or the production of Green hydrogen</p>
<p>Are you aware of your sustaining capital requirements over the next 5 y ears?</p>	<p>"YES", An ongoing sustaining 2022-2025 Capital and Maintenance budget is in place which has been approved by our lenders independent engineer as being adequate to endure the safe and reliable production of the plant</p>
<p>Have you considered any upgrades or capital projects at your facility? If so, what stage of</p>	<p>"YES", SRF was upgraded in 2017/2018 under an IESO HCI contract amendment replacing the original legacy 100year old units with new,</p>

Topic	Feedback
development are you in? Is there potential for Indigenous and/or community ownership?	increasing the average annual plant energy production by 10 % In addition to the main unit replacements an ongoing Capital and Maintenance program is in place to ensure the condition of the plant auxiliaries and supporting infrastructure is in good serviceable and safe condition.
What questions or feedback do you have relating to Design Concept #5: Contract Length ?	Contracts have to be longer than 10 years given current rates of return. Ontario Investors, Lenders, Regulatory Authorities are not comfortable with the risks of debt/equity failure due to IESO contract changes mid-stream, especially as no appeal lack of appeal process exists. It crucial to involve investors in this area of discussion. Private and Municipal hydro station owners do not have access to the IESO regulated long term loans or to government/OEB financing facilities
What questions or feedback do you have relating to a program review in 2026?	From previous IESO OPA generator experience it can be expected that changes will be required to address unforeseen problems, etc., However this approach increases the risk profile and further introduces uncertainty into the program. The alternative to this line of thought would be to focus on making the current program of existing contracts meet the intended provincial direction of securing long term financial surety for these assets

Small Hydro Program – Other Design Ideas

Topic	Feedback
Are there any other design ideas for the development of a Small Hydro Program that should be considered?	This is probably the most important question in that it infers that the current Small Hydro Program design concepts are the best to be implemented. Of concern is that no evidence has been provided as to other possible alternatives. Assuming the goal as stated by the IESO is to save ratepayers 80M\$ /yr for next 10

Topic	Feedback
	<p>years a few simpler ideas deserve consideration. The small hydro plants under IESO contract comprise but 3 % of energy produced by all Ontario generation. Against this background other simpler design options that can meet the cost reduction target and maintain investment certainty that could be evaluated :</p> <ol style="list-style-type: none"> 1. PRORATE TARGET COST savings across all generation – I.e. the IESO goal to save 80M\$..Hydro produces 26% of total 150 TWhs , on a prorated basis saving required against Hydro resources equates to 20M\$ per year which in turn would be an aske of small Hydro to reduce costs by 5%/yr over next 10 years – simple to implement & manage within the existing contracts and provides certainty of savings. A refinement for Hydro might be <10MW 4% ,10 to 50 MW 5% and >50MW 6% 2. BASE LOAD OPTION – Recognize that Ontario’s Small Hydro plants are all essentially legacy assets designed to produce base load energy; having essential secondary functions such as managing water flows at the local level. Delay any changes to current contracts for 10 years other than removing inflation and negative pricing requirements 3. AUDIT APPROACH – It is unclear that Ontario Small Hydro Plants are being operated and maintained in a higher cost than value manner. The financial criteria for operations is governed in the case of the majority by OPG -OEB with the balance being funded by the IESO under a variety of price contracts. Of the 100 such Small Hydro facilities a detailed technical financial audit sampling to assure cost effectiveness could be undertaken with recommendations to improve as found advisable. Some plants as part of their lenders due diligence are already operationally and financially audited in this manner. No one from the IESO has ever visited Smooth Rock Falls 4.TAKE OR PAY – In the event the IESO

Topic	Feedback
	<p>requires to spill water they could call on generators to do so as able by making payments plus for the spill to ensure the Small hydro plants are compensated for out of order costs on the basis of the flow spill energy conversion up to the energy revenue equivalent and additional operational and maintenance cost incurred. This is of significance as the IESO moves to locational marginal pricing under its MRP program. OPG plants are frequently to be seen spilling. It should be recognized that in some cases the cost of spilling is as high as generating energy as log operations and keeping the power station equipment energized and monitored as if it were producing is required</p> <p>5. WHAT NOT TO DO – Develop an even more complex contractual system than currently exist that tries to meet not only cost reduction goals but also meets the system ambition to force fit the Small Hydro plants into a generation mold that can provide capacity, dispatchability, flexibility, while at the same time meeting all the well-established safety, environmental and reliability goals. The management and administration structures of the small hydro plants are not equipped or trained to have an ongoing 24X7 operational interface with the IESO control center without adding resources</p>

Small Hydro Program – Challenges

Topic	Feedback
<p>Are there challenges that you foresee in transitioning to a new contract structure? What are these challenges?</p>	<p>The primary challenge of going forward, changing or cancelling the current contracts that would result in sudden energy revenues is the unacceptability by lenders that might cause them to call in existing loans and raise to future loans as might be arranged into higher more expensive risk categories which would in turn make cost reduction strategies more difficult.</p>

Topic	Feedback
<p>If you expect any challenges in transitioning to a new contract structure, do you have any suggestions on how the IESO can assist in the transition or reduce any anticipated barriers?</p>	<p>The first suggestion would be to confirm if the IESO is cancelling existing contracts and or putting in place an optional Small Hydro revenue program structure. Certainty is essential to ensure lenders do not lose confidence or call in existing loans</p> <p>Secondly, specific calculation examples of any new proposals should be developed both for the generators and for the financial community.</p> <p>Thirdly, it may be helpful if the IESO contracts to have a Small Hydro benchmarking study undertaken to provide cost context by one of their expert consultants e.g. (HATCH)</p>

General Comments/Feedback

Total hydro production in Ontario is approx. 36,400,000 MWhrs of which 80% is produced by OPG

There are a 77 IESO contracted small hydro <10 MW plants having a total capacity of 253.96 MW producing an average of 1,223,000 MWhrs per year +/- 10% representing but 3 % of energy production

This energy production is equivalent to the annual energy consumption of 240,000 e.v. cars of which there are currently 85,000 in Ontario with a projected number > 400,000 by 2030. As the majority of cars will be energy re-charging at night this further demonstrates the necessity to maintain or increase base load energy generation as we are no longer in a period of access nightly generation being sold at a loss.

Of the Small Hydro plants there are 21 between 5.0MW and 10 MW [2 OPG ,6 Private, 5 Municipal, 8 First Nation Partnered] Over 50 of the plant's sites have been in existence, producing reliable energy and multis ancillary benefits with operating and river control facilities for over 70 to 100 years

The investment, operation, and water control, environmental and safety management of Small Hydro plants is capital intensive and requires ongoing technically specialised repair of dams, generation equipment and auxiliaries all of which are monitored for regulatory compliance by the IESO, Hydro One, ESA, MOL, MNR, Fed FO etc. . Unlike the turn on off characteristic of solar and wind generation hydro plants cannot be turned on and off on a dime as the priority management of river flows prevails. They are proven forever 24X7 operational facilities until such time as the site is returned to its natural state back to the Ministry of Natural resources

Looking beyond the statistics and as the Minister specifically recognizes in his directive the many Small Hydro Plants throughout Ontario provide innumerable "benefits such as recreational opportunities, flood control, irrigation, tourism and facilitating local employment and economic development" As living legacy representing the foundation of Ontario's growth and prosperity, they

are of far to great a value to be lost to a contrived agnostic financially competitive energy bidding system.

Hydro plants must be operated in conformance with Water Management Plans to ensure public safety. Market signals are all well and good, but safety is paramount for us and for other hydro operators. We cannot overstress this. We cannot operate our plants solely because of market signals. This dispatchability quite problematic for us. This is why the majority of small hydro plants are self-scheduling.

In addition to the above general comments there are a number of considerations that need to be thought through before changing the relationship between the hydro generation industry and the IESO

COMPETITION

“Business competition is the contest between organizations that provide similar products or services or that target the same audience of consumers. Businesses compete to convert and retain customers, increase revenue and gain more market share.”

Does competition as strategy have value merits when a force fitted to the Ontario hydro industry. A program of agnostic price “competition” can be implemented but in reality, the IESO is the exclusive customer and price setter, the Government owned hydro assets of OPG are the totally dominant monolithic supplier, producing 90% of the energy as well as controlling the water sheds. Further the direct sales of power and wheeling are prohibited

The going forward issue that needs understanding is that by their very nature, individual Hydro resources produce at lower and or higher energy rates {PUEC, TUEC LUEC} E.g. double the head on a hydro plant and the KW/cms increases proportionally while the equipment, usually smaller in physical size, is less expensive to maintain on a KW/\$ basis ,hence lowering the LUEC

FAIRNESS Another consideration that needs to be addressed is that Hydro plants make annual payments of Gross Revenue Charges (water rental and tax 12%) which in effect is a fueling cost Solar & Wind generators pay no such charge.

MARKET DOMINANCE How can anyone competes with Gov OPG They control all the main water shed rivers, can internally cross subsidize costs, have access to longer low interest rate contracts, are self insuring and by their operations effectively create the market prices, have dominant role in MNR/MOE/ESA regulations e.g., dam safety. This is not to denigrate OPG but merely to recognise that it would be unreasonable to put Small Hydro plants into direct competition as they represent only 3% of production and are not able to appeal to the OEB for funding

LEGAL ISSUES

The IESO says there is no legal basis or appeal process to challenge forward going changes or cancelation to existing energy procurements contracts. We do not agree with this assertion at all and reserve all of our rights under the contract. This position will be challenged especially if reduced funding leads to public fatality or flooding damage etc. Clarification on this potential issue by the IESO would be helpful as it can have impacts on lenders and insurer contracts

CONTRACT TRANSPARENCY

The IESO hydro program team have confirmed they are not privy to existing Small Hydro contract details. The existing contracts [HESSA, HCI, RESOP, NUG, FIT, etc] contain many different terms having been approved by different authors OH,OPA,IESO. These contract terms should be made available such that the transparency is established and any new programs will be structured fairly

START STOP COSTS

The issue of requiring Hydro units to increase the number of starts stops, cycling, ramping have been raised with the IESO teams outlining that these types of aggressive operations can cause significant increases in wear, loss of reliability, loss of production and increases in long term costs. This especially true for small hydro legacy assets that were not designed for such purpose. The hydro industry world wide (Utilities, Hydro organisations (CEATI international, EPRI, NHA, NREL) as well as Original Equipment manufactures are of one confirming opinion. The IESO program teams have dismissed the reality of start stop costs with a the view that generators do not have to supply if they feel it may adversely impact their hydro asset condition and have declined to discuss any issues of compensation

REFERENCES

Influence of Starts and Stops on the Aging of Hydroelectric Generator Stators by Thermal Cycling: Empirical Study and Accelerated Lifetime Model

<https://hal.archives-ouvertes.fr/hal-03443019/document>

Studying Hydro Ramp rate hydrological restrictions Hydro Review BC Hydro
contact<https://www.hydroreview.com/world-regions/flow-management-studying-ramping-rate-restrictions/>

NERC Disturbance Control Standard specifies that regulating and supplemental reserves must be able to reach their full capacity within 10 minutes, but since capacities may differ dramatically, this definition will not describe the feasible MW increase within a minute. For instance, a 50 MW unit that meets the aforementioned standard will have a ramp rate of at least $50/10 = 5$ MW/min, but a 500 MW will have a ramp rate of at least 50 MW/min. A 5 MW unit increase a minute = 500KW /min which cannot be considered as good as 5 MW/min Or anywhere as be as good as 50 MW/min!

[https://www.researchgate.net/post/What is the typical MW minute ramping capability for each type of reserve](https://www.researchgate.net/post/What_is_the_typical_MW_minute_ramping_capability_for_each_type_of_reserve)

USBR RESEARCH Assigning costs of start stops and cycling <https://www.usbr.gov/research/st/bulletins/1880.pdf>

EPRI START STOP COSTS

[https://www.researchgate.net/publication/349714220 Start and Stop Costs for Hydro Power Plants A Critical Literature Review](https://www.researchgate.net/publication/349714220_Start_and_Stop_Costs_for_Hydro_Power_Plants_A_Critical_Literature_Review)

EPRI

http://www.hydroppi.com/uploads/3/4/5/6/34564986/hvi2018_flexible_operation_of_hydro_turbines_and_generators.pdf

Gemini- SRF Power Corp Hydro Generating Station





