# Ear TO THE RIVER

## **FINAL REPORT**

Hydropower Industry Research **of** Owners **for** Owners

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"Improve the market structure to recognize hydro and all of its attributes, and improve the access to lowcost financing. Lastly, improve the regulatory environment...climate and perception are the biggest challenges we face in the hydropower industry."

- Participant



The "Ear to the River" survey is a new annual survey of the North American hydroelectric industry that was developed through a partnership between the Ontario Waterpower Association, the Hydropower Foundation, and Kleinschmidt Associates in 2021. The need for this survey was that most of the information currently available about the hydro industry is based on public information such as FERC filings. Though this information is helpful in understanding where the industry is currently, it doesn't necessarily help the industry know where it is going. The intent of the "Ear to the River" annual survey of the industry is to help hydro owners understand what other owners are doing and thinking across North America. It also intended to help lobbying efforts by providing data on how various policies could impact the role hydro plays in transitioning to a clean energy future as well as help vendors and suppliers understand opportunities in this thriving clean energy industry.

Partners and industry advisors worked to develop the focus of the survey, which for the inaugural edition focused primarily on future markets for hydropower. A professional survey firm, GreatBlue Research, conducted and managed the survey effort. GreatBlue also conducted personal interviews with several hydropower owners to add qualitative context to the results. The survey ran until mid-November 2021 and the final results are presented herein. All respondents and individual responses are confidential and results have been presented by industry segment and geographic region.





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## **Survey Demographics**

## **Survey Participant Overview**



River

#### **Organization Type**

"By continuing to provide affordable, reliable renewable energy-More importantly to position itself as a critical partner to other new sources of generation such as wind and solar and show how there is complementarity in the generation profiles, I think that would help a lot."

- Participant

## **Key Findings**

The industry expects many changes over the next 3 years. Owners expect to see an increase in value for hydro due to it's role in balancing other renewables. Owners also expect greater ancillary services market participation and continued investment in existing projects, primarily in generators, turbines, and gates. Additional key findings are listed to the right.

## **Key Findings at a Glance**



Increase in direct power purchase agreements



Increase in bundling and colocating with other renewables



Strong concern over low energy prices



Support for investment tax credits



Strongly increased use of batteries to firm hydro assets



Increase in greenfield pumped storage development



Increase in incentive program participation, where possible



Increase in decommissioning activity, primarily due to project economics

## **Key Findings - Executive Summary**

#### **Direct Purchase Power Agreements**

Participation in direct power purchase agreements with corporations, ISOs/ IESO, government entities, universities and municipalities, and RTOs is expected to increase over the next 3 years, with the largest increases among corporations, universities and municipalities.

### **Ancillary Service Markets**

While more than one-half of all survey participants (53.3%) are currently involved in ancillary service markets, four-fifths (80.0%) expect to be involved within the next 3 years. Recognition of hydropower's ability to balance more intermittent renewables, such as wind and solar, is expected to increase (26.7% believe it is currently being recognized while 81.8% expect it to be in the future).

#### Bundling

The frequency of organizations bundling hydropower with other renewables or battery storage to deliver firm power contracts is expected to more than double over the next 3 years (23.3% currently bundle hydropower while 60.0% expect to within the next 3 years).

#### **Co-Locating**

Within the next 3 years there will be significant increases in co-locating activities such as deploying batteries as an energy storage solution, planning additional renewable energy or battery storage at their facility, and co-locating hydrogen production facilities to produce hydrogen from hydroelectricity. Respondents from the United States were more likely to deploy batteries in the future than co-locate other renewable energy.

#### **Micro-Grid Applications**

While the frequency of hydropower owners utilizing hydropower based micro-grid applications will increase over the next 3 years, this increase is not expected to be substantial.

#### Decommissioning

Over a third of U.S. hydropower owners surveyed are "actively considering" decommissioning a facility while only 13.6% of these owners had previously considered decommissioning. Survey participants from Canada (37.5% and 62.5%, respectively) and those with 3 or more hydropower assets (28.6% and 57.1%, respectively) were more likely to have previously or be actively considering decommissioning any facilities. Economics was indicated by all survey participants as the primary factor for considering decommissioning - environmental considerations and dam safety were also prominent factors.

### **Pumped Storage**

Roughly one-quarter of survey participants from the United States and Canada anticipate developing pumped storage / greenfield developments within the next 3 years. Many have also recently made facility enhancements at existing pumped storage projects such as adding new units or upgrading capacity.

#### **Renewable Energy Incentives**

Survey respondents indicated high levels of support and participation for renewable / clean energy credit sales, production tax credit, investment tax credit, bond programs, and the EPAct 2005 Section 242 production incentive, with participation for each expecting to increase within the next 3 years.

#### **Tax Credits**

Survey respondents indicated high levels of support and participation for renewable / clean energy credit sales, production tax credit, investment tax credit, bond programs, and the EPAct 2005 Section 242 production incentive, with participation for each expecting to increase within the next 3 years.

#### The Future of Hydropower

The top concerns for hydropower owners over the next 3 years centered on low energy prices, high capital costs (for new development), dam / public safety requirements and potential for additional costs, and the lengthy and expensive process for licensing and / or re-licensing. Generator rewinds and turbine overhauls are primarily the facility changes or upgrades being prioritized over the next 3 years.

Ear to the River March 2022

### **Direct Power Purchase** Agreements

### **Ouestion:**

"Are you currently participating in, or within the next 3 years do you expect to participate in, any direct power purchase agreements with..."



Survey participants indicated being *more likely to participate in the* future in direct power agreements with each of these five (5) types of organizations than currently.

Survey participants were most likely to:

*currently* participate in direct power purchase 46.7% agreements



*in the future* participate in direct power purchase agreements

with corporations, followed by ISOs/IESO's

46.7% currently

50% in the future

### **Direct Power Purchase Agreements** (Owners with more than 3 facilities)

### **Ouestion:**

"Are you currently participating in, or within the next 3 years do you expect to participate in, any direct power purchase agreements with..."

Number of Hydropower Facilities	3 or more			
	Current	Future		
Corporations	52.4%	81.0%		
ISOs/IESOs	61.9%	66.7%		
Government Entities	47.6%	52.4%		
Universities and Municipalities	38.1%	61.9%		
RTOs	14.3%	33.3%		

Survey participants with more than 3 facilities were more likely to participate in **direct power purchase agreements** in the future than they are now. Direct power purchase agreements with corporations are expected to be the most common type.

> "Currently, fifty-five percent of our assets are merchant owned-selling into market at whatever price we can get instead of a contract." - Survey Participant



### **Ancillary Markets & Regional Marketplace**

#### **Ouestion:**

"Are you currently involved in, or within the next 3 years do you expect to be involved in any energy, capacity, and/or ancillary service markets?"

100% More than one-half of all survey 80% participants 53.3% 60% are currently involved in energy, capacity, and/or ancillary service markets, while four-fifths expect 40% to be involved in ancillary service markets within the next **3** years. 20%



Type of Organization					
	Current	Future			
Investor owned electric utility	60.0%	100.0%			
Municipally owned electric utility	42.9%	71.4%			
Rural co-operative electric utility	25.0%	75.0%			
Independent hydropower producer	72.7%	81.8%			

Independent hydropower producers (72.7%) and investor owned electric utilities (60.0%) have the highest current and future involvement in energy, capacity, and/or ancillary service markets.

### **Ancillary Markets & Regional Marketplace**

### **Question:**

"In your region's electricity marketplace, is hydropower's ability to balance more intermittent renewables, such as wind and solar, recognized and compensated for?"



While only one-quarter of all survey participants (26.7%) reported that hydropower's ability to balance more intermittent renewables is recognized and compensated for in their region's electricity marketplace, more than four-fifths (81.8%) indicated they expect their region's electricity marketplace will recognize and compensate for this at some point in the future.

Type of Organization	Investor- Owned Electric Utility	Municipally- Owned Electric Utility	Rural Co-Op Electric Utility	Independent Hydropower Producer
In your region's electricity marketplace, is hy- dropower's ability to balance more intermittent renewables, such as wind and solar, recognized and compensated for? ("Yes")	40.0%	28.6%	25.0%	9.1%
Do you expect that at some point in the future, your region's electricity marketplace will recog- nize and compensate for hydropower's ability to balance more intermittent renewables, such as wind and solar? ("Yes")	100.0%	80.0%	66.7%	80.0%

Investor owned electric utilities (40.0%), were the organizations most likely to indicate that hydropower's ability to balance intermittent renewables is recognized and compensated for in their region's electricity marketplace. All sectors expect more compensation in the future.

### **SURVEY QUESTIONS**



"Do you expect that at some point in the future, your region's electricity marketplace will recognize and compensate for hydropower's ability to balance more intermittent renewables, such as wind and solar?"

### Bundling

#### **Question - overall:**

"Are you currently, or within the next 3 years do you expect to, bundle hydropower with other renewables or battery storage to deliver firm power contracts?"



While less than one-quarter of all survey participants (23.3%) reported they currently bundle hydropower with other renewables or battery storage to deliver firm power contracts, three-fifths (60.0%) indicated they expect to do this within the next 3 years.

#### **Question - by type of organization:**

"Are you currently, or within the next 3 years do you expect to, bundle hydropower with other renewables or battery storage to deliver firm power contracts?"

Type of Organization	Investor- Owned Electric Utility	Municipally- Owned Electric Utility	Rural Co-Op Electric Utility	Independent Hydropower Producer
Current	20.0%	42.9%	0.0%	18.2
Future	20.0%	85.7%	50.7%	72.7%

Municipally owned electric utilities reported being the **most likely to bundle** hydropower with other renewables or battery storage to deliver firm power contracts both currently **(42.9%)** and within the next **3 years (85.7%)**. While **18.2%** of independent hydropower producers are currently **bundling** hydropower with other renewables or battery storage, more than seven-out-often **(72.7%)** indicated they expect to do this within the next **3 years.** 

### Bundling

### **Question - by country:**

"Are you currently, or within the next 3 years do you expect to, bundle hydropower with other renewables or battery storage to deliver firm power contracts?"

While roughly a quarter of survey participants from both the United States and Canada **currently bundle** hydropower with other renewables or battery storage to deliver firm power contracts, an increased frequency of those from the United States expect to do so within the next **3 years (68.2%)**.

One participant stated they bundled "run of the river" with battery storage, but cannot explore the potential of bundling with other renewables until it is time to renew their contract with their customers.





	United States	Canada
Current	22.7%	25.1%
Future	68.2%	37.5%

### **Co-Locating**

### **Question:**

"Are you currently, or within the next 3 years do you expect to..."

Deploy batteries as an energy storage solution

Plan physical co-location of additional renewable energy or battery storage at your hydro facility(ies)

> Develop pumped storage / greenfield developments as an energy storage solution

Co-locate hydrogen production facilities to produce hydrogen from hydroelectricity



Approximately a quarter (26.7%) of survey participants currently deploy **batteries** as an energy storage solution while almost three quarters (73.3%) expect to do so within the next 3 years. While only one-in-ten respondents (10.0%) currently plan physical co-location of additional **renewable energy or battery storage** at their facility(ies), more than one-half (56.7%) expect to do so within the next **3 years**. No survey participant is currently involved in co-locating **hydrogen production facilities** to produce hydrogen from hydroelectricity but one third (33.3%) expect to do so within the next **3 years**.

"Looking to build a hydroplant where we have the reservoir and resources; 10 miles away we're looking at installing grid-scale solar. They're not on the same piece of land, but they're very specifically going to be co-designed to operate together in the community." - Participant



### **Co-Locating**

Country	United States		ates Canada	
	Current	Future	Current	Future
Deploy batteries	22.7%	81.8%	37.5%	50.0%
Plan physical co- location of additional renewable energy	4.5%	59.1%	25.0%	50.0%
Develop pumped storage / greenfield developments	18.2%	27.3%	0.0%	25.0%
Co-locate hydrogen production facilities	0.0%	31.8%	0.0%	37.5%

Use of **batteries** at hydro sites is expected to grow throughout North America. Respondents from the United States were more likely to deploy batteries in the future than co-locate other renewable energy.



### **SURVEY QUESTIONS**

Roughly one-quarter of survey participants from the United States (27.3%) and Canada (25.0%) anticipate developing **pumped storage / greenfield developments** within the next **3 years**, while approximately a third anticipate co-locating hydrogen production facilities to produce hydrogen from hydroelectricity in the future.

### **Investments in Pumped Storage**

### **Question:**

"Have you made any existing facility enhancements with respect to pumped storage projects such as adding new units or upgrading capacity?"

One-in-six survey participants (16.7%) indicated they have made **existing** facility enhancements with respect to pumped storage projects such as adding new units or upgrading capacity, while more than three-quarters (76.7%) have not made any of these facility enhancements.





### **Micro-Grid Applications**

#### **Question:**

"Are you currently utilizing, or within the next 3 years do you expect to utilize, any hydropower based micro-grid applications?"

One-out-of-six survey participants (16.7%) currently utilizes hydropower based micro-grid applications, while slightly more than one-quarter (26.7%) expect to do so within the next 3 years.







### Decommissioning

#### **Question:**

"Have you previously, or are you actively considering, decommissioning any facilities?"



One-fifth of survey participants (20.0%) have previously considered **decommissioning** any of their facilities, while more than two-fifths (43.3%) are actively considering doing so in the future.

Survey participants from Canada (**37.5%** and **62.5%**, respectively) and those with 3 or more hydropower assets (28.6% and 57.1%, respectively) were more likely to have previously or be actively considering decommissioning any facilities.

**Investor owned** electric utilities were most likely to have previously considered decommissioning any facilities (40.0%), while municipally owned electric utilities (71.4%) were most likely to be actively considering decommissioning.



"Previously, no. Actively decommissioning, there may be one or two that we may do. It's mostly economics, the facility no longer lends itself to be economically viable. That could be for a million reasons—relicensing terms and other kinds of things." - Participant

### Decommissioning

#### **Question:**

"What are the primary factors for considering decommissioning a facility?"

All survey participants (100.0%) indicated that economics were a primary factor when considering decommissioning a facility, while slightly less than one-half reported environmental considerations (46.2%) or dam safety (46.2%) to be considerations when decommissioning a facility.

"Currently, in the process of decommissioning. It is a really small plant that no longer serves any use to us." - Participant

Reasons for Decommissioning	Economics	Environmental considerations	Dam safety
Country	%	%	%
United States	100.0%	62.5%	37.5%
Canada	100.0%	20.0%	60.0%
Type of Organization	%	%	%
Investor owned electric utility	100.0%	50.0%	50.0%
Municipally owned electric utility	100.0%	40.0%	40.0%
Rural co-operative electric utility	100.0%	0.0%	0.0%
Independent hydropower producer	100.0%	60.0%	60.0%

While respondents from the United States were more likely to indicate that environmental considerations (62.5%) are a factor when considering decommissioning, respondents from Canada placed increased consideration on dam safety (60.0%).



### **SURVEY QUESTIONS**



Reasons given by in-depth survey participants centered on economics, stating that the facilities would cost more to relicense and modernize than the value of energy they would output.

### **Renewable Energy Incentives**

#### **Question:**

"Are you currently participating in, or within the next 3 years do you expect to participate in..."



While more participants currently participate in **production tax credits (33.3%)** as opposed to investment tax credits **(30.0%)**, an increased frequency anticipate participating in **investment tax credits** in the future **(46.7%)** compared to production tax credits **(43.3%)**.

Survey participants were most likely to both currently (53.3%) and in the future (76.7%) participate in renewable / clean energy credit sales.





### **Renewable Energy Incentives**

Country	United States		Canada	
	Current	Future	Current	Future
Renewable / clean energy credit sales	68.2%	81.8%	12.5%	62.5%

Survey participants from the United States were most likely to have currently (68.2%) or plan to participate in the future (81.8%) in renewable / clean energy credit sales than respondents from Canada.



### **SURVEY QUESTIONS**

All of the in-depth interview participants indicated they would take advantage of Production **Tax Credits** and Investment Tax Credits, if these were passed in new legislation

### **Tax Credits**

#### **Question:**

"The National Hydropower Association is working towards legislation to renew the Investment Tax Credit which allows hydropower developers to receive a 30% tax credit for new development. How aware are you of this current legislative effort?"

More than three-quarters of United States survey participants, 77.3%, indicated being either "very aware" (31.8%) or "somewhat aware" (45.5%) of the National Hydropower Association's legislative efforts to renew the Investment Tax Credit which allows hydropower developers to receive a 30% tax credit for new development.



#### **Question:**

"If this legislation regarding the Investment Tax Credit was passed, how beneficial do you believe it would be toward generating future investments in hydropower?"



More than four-fifths of United States survey participants, **86.4%**, indicated the passing of legislation regarding the renewal of the Investment Tax Credit is either "very beneficial" (40.9%) or "somewhat beneficial" (45.5%) toward generating future investment in hydropower.

## The Future of Hydropower



wind and solar, but I would say it's the opposite for hydropower. There are barriers, on."

- Participant

Ear to the River







### The Future of Hydropower

#### **Question:**

"Over the next 3 years, how concerned is your organization about..."

Survey participants indicated their organization is most concerned (either "very" or "somewhat") over the next 3 years with **low energy** prices (93.3%), followed by high capital costs (for new development) (86.7%), dam / public safety requirements and potential for additional costs (83.3%) and lengthy and expensive process for **licensing** and / or relicensing (83.3%).

Dam / public safey requirements and potential for additional costs

Lengthy and expensive regulatory process for licensing and / or relicensing

#### **Question:**

"Over the next 3 years, how concerned is your organization about..."

Survey participants from Canada indicated higher levels of concern (either "very" or "somewhat") for five (5) of six (6) characteristics effecting the future of hydropower, as compared to respondents from the United States. Those respondents from the United States reported increased levels of concern for high capital **costs** when compared to respondents from Canada.

	United States	Canada
Low Energy Prices	90.0%	100.0%
High Capital Costs	95.5%	62.5%
Dam/Public Safety Requirements	77.3%	100.0%
Lengthy and Expensive Regulatory Process for Licensing	77.3%	100.0%
Druoght, Floods, or Extreme Weath- er Events	77.3%	87.5%
PPAs Expiring	50.0%	87.5%





### The Future of Hydropower

While **high levels of concern** were generally reported for each characteristic effecting the future of hydropower, rural co-operative and municipally owned electric utilities expressed slightly less concern over the listed issues than investor owned electric utilities and independent hydropower producers.

Type of Organization	Investor- Owned Electric Utility	Municipally- Owned Electric Utility	Rural Co-Op Electric Utility	Independent Hydropower Producer
Low Energy Prices	100.0%	85.7%	75.0%	100.0%
High Capital Costs	80.0%	100.0%	75.0%	81.8%
Dam/Public Safety Requirements	100.0%	100.0%	50.0%	81.8%
Lengthy and Expensive Regulatory Process for Licensing	80.0%	85.7%	75.0%	90.0%
Druoght, Floods, or Extreme Weather Events	100.0%	85.7%	25.0%	90.9%
PPAs Expiring	40.0%	28.6%	50.0%	100.0%

Survey participants from Canada were more likely to be planning to make **facility changes** or **upgrades** over the next **3 years** as compared to respondents from the United States, specifically for generator rewinds (**75.0%**), turbine overhauls (**75.0%**), gate replacements (**50.0%**) and penstock replacement (**37.5%**).

	United States	Canada
Generator Rewinds	59.1%	75.0%
Turbine Overhauls	59.1%	75.0%
Gate Replacements	45.5%	50.0%
Penstock Replacement	18.2%	37.5%
Other	27.3%	0.0%
N/A - None of the Above	18.2%	12.5%

### **Question:**

*"Is your organization planning any of the following facility changes or upgrades over the next 3 years? Select all that apply."* 



When anticipating facility changes or **upgrades** over the next 3 years, almost two thirds of all survey respondents, **63.3%**, indicated their organization is planning **generator rewinds** or **turbine overhauls**, while almost half **(46.7%)** are planning **gate replacements** over the next **3 years**.

Type of Organization	Investor- Owned Electric Utility	Municipally- Owned Electric Utility	Rural Co-Op Electric Utility	Independent Hydropower Producer	Government Agency
Generator Rewinds	80.0%	71.4%	0.0%	72.7%	100.0%
Turbine Overhauls	60.0%	85.7%	25.0%	63.6%	100.0%
Gate Replacements	80.0%	42.9%	0.0%	54.5%	100.0%
Penstock Replacement	20.0%	28.6%	0.0%	36.4%	0.0%
Other	0.0%	42.9%	0.0%	18.2%	100.0%
N/A - None of the Above	0.0%	0.0%	75.0%	9.1%	0.0%

Respondents from rural co-operative electric utilities were least likely to be planning to make **facility changes** or **upgrades** over the next **3 years**. Investor owned electric utilities were more likely to be planning generator rewinds or gate replacements, while municipally owned electric utilities were more likely to be planning turbine overhauls.

### Ear to the River March 2022 SURVEY QUESTIONS

### The Future of Hydropower Additional Insights



More than one-third of survey respondents with 2 or fewer hydropower assets (37.5%), are not planning on making any facility changes or upgrades over the next 3 years. Survey respondents with 3 or more assets were more likely to be planning turbine overhauls (85.7%), generator rewinds (76.2%), gate replacements (66.7%) or penstock replacement (33.3%).

Number of Hydropower Facilities	2 or Fewer	3 or More
Generator Rewinds	37.5%	76.2%
Furbine Overhauls	12.5%	85.7%
Gate Replacements	0.0%	66.7%
Penstock Replacement	0.0%	33.3%
Dther	37.5%	14.3%
N/A - None of the Above	37.5%	4.8%

### **Biggest Threats/Challenges**



CI



### How Can the Industry Grow in Clean Energy Future?



Equal Footing on Incentives with Other Renewables



Lobbying for Recognition of Key Role Hydro Plays





In-depth interview participants indicated that, overall, the biggest threat facing the hydropower industry is that other renewable energy resources are more publicly visible whereas hydropower, in both the public and federal viewpoint, is not always considered a renewable resource.



These participants indicated that if all renewable energy entities worked together cohesively, that the public perspective surrounding hydropower will change to be more positive.



Additionally, in-depth interview participants indicated that hydropower has significant costs and regulations associated with owning and operating facilities, and that these costs could become less burdensome if the hydropower industry was recognized and compensated for within the renewable energy marketplace.



Climate Change



Regulatory Burdens



Perception Relative to Other Renewables





Quicker and Less Expensive Licensing Process

## Closing

This was the first annual "Ear to the River" survey. The participation from industry was excellent, with over 11 GW of hydro generation represented. We are very thankful and appreciative of all the project owners who took the time to complete the survey and who agreed to be interviewed. The results provide many insights into major trends that are expected to impact the industry over the next several years.

In future years we are hoping to see even greater participation and be able to provide more detailed analysis within key segments of the industry. Planning for the 2022 survey effort has now started. Please let us know if you have specific questions for the industry we're listening.

### **Giving Back**

To promote the survey, as well as hydropower education and the need for a hydro workforce in the future, we donated 50 hydropower science kits to STEM programs at the following schools. Many of the schools were recommended by survey participants.

Badin Elementary - Badin, NC Christ the King - Haddonfield, NJ Hanford High School - Richland, WA Hood River Valley High School - Hood River, OR Hunter College Elementary School - NYC, NY Jean de la Mennais - La Prairie, Quebec Pleasant Park Public School - Ottawa, Ontario River Oak Christian Academy - Jefferson City, MO University of Wisconsin - Madison, WI Valdez Middle School - Valdez, AK Curve Lake First Nation School - Peterborough, Ontario



Hiawatha First Nation Child Care Center - Peterborough, Ontario

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