

CI 49036

HYD Avon 2 Controls Upgrades

REDACTED

August 5, 2025



NSEB APPROVAL SHEET

Project Title: HYD - Avon 2 Controls Upgrade

CI Number: 49036

Date: August 5, 2025

Expenditure Profile			Type of Filing	
Year	Budget Amount	Project Estimate	☒	Capital Project Authorization
2016	2,264	2,264	☐	Unforeseen and Unbudgeted (U&U)
2017	53,101	53,101	☐	Planned & Advanced (P&A)
2018	(21,903)	(21,903)	☒	Subsequent Approval Item
2019	(1,765)	(1,765)	☐	Authorization to Overspend (ATO)
2020	-	-	☐	Final Cost (FIN)
2021	-	-		
2022	-	-		
2023	1,245	1,245		
2024	7,382	8,313		
2025	391,178	644,142		
2026	64,791	388,065		
Total	\$496,293	\$1,073,463		

COMMENTS

This project was originally included in the 2025 ACE Plan as a carryover project, but would have more appropriately been listed as a project less than \$1,000,000.

Submitted on behalf of NOVA SCOTIA POWER INCORPORATED

Approved on behalf of NOVA SCOTIA ENERGY BOARD

Authorized Signatory
Dave Pickles
Chief Operating Officer

DATE
August 5, 2025

DATE

CI Number: 49036

Title: HYD Avon 2 Controls Upgrades

Start Date: 2016/06
In-Service Date: 2026/04
Final Cost Date: 2026/10
Function: Hydro
Forecast Amount: \$1,073,463

DESCRIPTION:

This project is for the upgrade and modernization of the control system for the hydro turbine and generator at the Avon 2 Hydro Station. The project includes the installation of new instrumentation, replacement of Programmable Logic Controllers (PLCs), network infrastructure, and data transfer to the NS Power Data Centre. These modifications allow control to start, stop, and synchronize the unit to the grid (remote and local), as well as a new ability for online monitoring of the unit for bearing temperature, vibration, run out, gate position, lake elevations, and output (MW, Volts, Amps) on a new graphic display. This upgraded system will also include the ability for data logging when the unit trips offline.

This project will result in an improved, robust communication system designed for dam and environmental monitoring, as well as turbine and generator condition monitoring and control. This initiative supports NS Power's risk-based investment strategy and strengthens asset condition assessments for Avon hydro assets.

The Avon 2 Generating Station is part of the Avon Hydro System and is a single powerhouse with one unit. The plant generates, on average, 9.39 GWh of renewable electricity annually.

Summary of Related CIs +/- 2 years

Pursuant to Section 11.2 of the CEJC, related CIs for Hydro projects include "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2025 CI C0048990 HYD AVO 2 Switchgear Replacement \$1,814,631
- 2025 CI C0058062 HYD AVO 2 Station Service Upgrade \$335,271

Depreciation Class: Hydraulic Production Plant – Avon River System

Estimated Life of the Asset: 25 years

Retirement Information:

- Categorization of Retirement: Accounting Policy 6420 - Retirement and Disposal of Capital Assets
- Percentage of Asset Pool: 2.48%

JUSTIFICATION:

Justification Criteria: Hydro

Why do this project?

The existing control system at Avon 2 Hydro Station is outdated and has reached the end of its operational life, making replacement parts increasingly difficult to source. Upgrading to a modern control system provides operators and engineers with detailed, real-time information to enhance troubleshooting, decision-making, and issue diagnosis. The newer technology will enable operations staff to quickly detect, address, and resolve problems before they escalate, reducing downtime and improving efficiency. Additionally, the simplified system display will offer better visibility for water management and generation dispatch, supporting optimized performance and resource utilization. This upgrade is essential to maintain reliability and enhance operational capabilities.

Why do this project now?

Completing this project now will lead to shorter delays in returning the unit to service when the current equipment fails, as replacement parts are discontinued by the supplier and unavailable without upgrading. This work ensures that operators and engineers gain immediate access to advanced tools for troubleshooting, decision-making, and issue diagnosis, reducing the likelihood of future operational disruptions. Acting now is a proactive step to safeguard reliability, efficiency, and cost-effectiveness.

This project will also be completed in parallel with a switchgear replacement to minimize overall outage time by completing the work within a single outage.

Why do this project this way?

NS Power is leveraging the proven approach used in previous controls upgrade projects at other hydro stations (CI 47163 Tusket Controls Upgrade and CI 47551 Sheet Harbour Controls Upgrade) to ensure consistency, reliability, and efficiency. By applying a familiar methodology, planning and execution can be streamlined, reducing the risk of unexpected issues. Additionally, lessons learned from those past projects have been carefully reviewed and incorporated into this project, enabling NS Power to address potential challenges proactively. This approach is expected to enhance both schedule adherence and cost efficiency, minimizing risks and ensuring a smoother implementation process.

Contingency Statement

Contingency for this project has been determined using a combination of internal subject matter expert (Professional Engineers) judgment and previous experience with hydro control projects CI 47551 and CI 47163, as well as the non-binding contingency guidelines. Consistent with the maturity matrix, this project is being filed as a Class 3 estimate with a contingency of 20 percent. Risks intended to be covered by this contingency include market volatility for contracted installation/commissioning, and additional refurbishments / replacements that may be required but not able to be assessed until after removal of the current assets associated with this work, including cabling and relay replacements. Any deviation from the established schedule may require the use of overtime, therefore utilizing contingency to ensure timely completion.

Reason for Variance

This project was included in the 2025 ACE Plan as a carryover project as it had preliminary engineering spend prior to 2025; however, it should have more appropriately been listed as a project less than \$1,000,000. The variance of approximately \$577,170 from the 2025 ACE Plan estimate of \$496,293 is primarily due to the original estimate being a high-level forecast developed prior to detailed project planning. NS Power has since refined the project scope, obtained actual vendor quotes, and included contingency appropriate to a Class 3 estimate. This update reflects a more accurate estimate of project requirements.

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Location: Hydro							
CI#: 49036-H766							
Title: HYD Avon Controls Upgrades							
Execution Year: 2025							
Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#s)	
Regular Labour							
Hydro River Staff - Construction	PD	219	\$ 437	\$ 95,733			
Engineering Staff	PD	208	\$ 472	\$ 98,220			
Sub-Total				\$ 193,953			
Overtime Labour							
Hydro River Staff - Construction	PD	0.1	\$ 874	\$ 96			
Sub-Total				\$ 96			
Term Labour							
Hydro River Staff - Construction	PD	35	\$ 437	\$ 15,345			
				\$ -			
Sub-Total				\$ 15,345			
Travel Expenses							
Site Visits	lot	1	\$ 3,170.40	\$ 3,170			
Sub-Total				\$ 3,170			
Materials							
Generator Protection and Revenue Meter	lot	1	\$ 10,907	\$ 10,907			
Digital Excitation Control System	lot	1	\$ 7,800	\$ 7,800.00			
HMI, Power Supply, relays, transfer switch	lot	1	\$ 17,022	\$ 17,021.70			
Control Cabinet	lot	1			Attachment 1		
Field Breaker Cabinet	lot	1			Attachment 2		
Pipeline Protection	lot	1	\$ 44,270	\$ 44,270			
Misc. Materials	lot	1	\$ 10,000	\$ 10,000			
Cable	lot	1	\$ 31,000	\$ 31,000			
Transformer	lot	1	\$ 13,500	\$ 13,500			
Sub-Total				\$ 331,704			
Contracts							
Installation Contract	lot	1	\$ 100,000	\$ 100,000		C0024484	
				\$ -			
Sub-Total				\$ 100,000			
Consulting							
Panel Design	lot	1	\$ 18,012	\$ 18,012			
Interconnection Design	lot	1	\$ 12,067	\$ 12,067			
HMI Design	lot	1	\$ 15,000	\$ 15,000			
				\$ -			
Sub-Total				\$ 45,079			
Meals							
Meals	lot	1	\$ 1,286	\$ 1,286			
				\$ -			
Sub-Total				\$ 1,286			
Other Goods and Services							
Contingency	%	20%	\$ 690,633	\$ 138,127			
Sub-Total				\$ 138,127			
Interest Capitalized							
AFUDC				\$ 37,922			
Sub-Total				\$ 37,922			
Administrative Overhead							
Administrative Overhead				\$ 194,309			
Contractor Admin Overhead				\$ 12,472			
Sub-Total				\$ 206,781			
Sub-Total (no AO, AFUDC)				\$ 828,760			
TOTAL (AO, AFUDC included)				\$ 1,073,463			
Original Cost				\$ 493,850			

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.

Note 2: Small differences in totals are attributable to rounding.



Instructions: Select option in Column B.
Columns C through G will auto-populate.

Document No: XXX-XX-XXXX-XXXX

Project Cost Estimate Input Checklist and Maturity Matrix						
Hydropower	Required fields:	Estimate Classification				
Project Name: HYD - Avon 2 Controls Upgrade	Started or Preliminary	Class 5	Class 4	Class 3	Class 2	Class 1
Maturity Level of Project Definition Deliverables	Defined or Complete					
General Project Data						
A. Scope						
Project Scope of Work Description	Defined (D)	P	P	D	D	D
Site Infrastructure (Access, Construction Power, Camp, etc.)	Defined (D)	NR	P	D	D	D
B. Capacity						
Facility Output / Production Profile	Defined (D)	P	P	D	D	D
Electrical Power Requirements (when not the primary capacity driver)	Defined (D)	NR	P	D	D	D
C. Project Location						
Plant and Associated Facilities	Not Applicable (NA)					
D. Requirements						
Codes and/or Standards	Defined (D)	NR	P	D	D	D
Communication Systems	Defined (D)	NR	P	D	D	D
Fire Protection and Life Safety	Not Applicable (NA)	NR				
Environmental Monitoring	Not Applicable (NA)	NR	NR			
E. Technology Selection						
Not Applicable						
F. Strategy						
Contracting/Sourcing	Defined (D)	NR	P	D	D	D
Escalation	Defined (D)	NR	P	D	D	D
G. Planning						
Regulatory Approval & Permitting	Defined (D)	P	P	D	D	D
Material Utilization (Borrow Sources)	Defined (D)	P	P	P/D	D	D
Logistics Plan	Preliminary (P)	P	P	P		
Work Breakdown Structure (WBS)	Preliminary (P)	P	P	P/D		
Decommissioning/Demolition Plan	Preliminary (P)	NR	P			
Integrated Project Plan	Preliminary (P)	NR	P			
Project Code of Accounts	Defined (D)	NR	P	D	D	D
Project Schedule	Preliminary (P)	NR	P			
Risk Register	Preliminary (P)	NR	P			
Stakeholder Consultation/Engagement/Management Plan	Not Applicable (NA)	NR				
Start-up & Commissioning Plan	Preliminary (P)	NR	P	P/D		
H. Studies						
Hydraulics	Not Applicable (NA)					
Topography & Bathymetry	Not Applicable (NA)					
Environmental Impact/Sustainability Assessment	Not Applicable (NA)	NR				
Environment/Existing Conditions	Not Applicable (NA)	NR				
Soils & Hydrology	Not Applicable (NA)	NR				
Geotechnical Investigation	Not Applicable (NA)	NR				
Technical Deliverables (Specifications and/or Drawings)						
Block Flow Diagrams	Not Applicable (NA)					
Hydraulic Design & Probable Maximum Flood (PMF)	Not Applicable (NA)					
Equipment Data Sheets	Complete (C)	NR/S	P	C	C	C
Equipment Lists: Electrical	Complete (C)	NR/S	P	C	C	C
Equipment Lists: Process/Utility/Mechanical	Complete (C)	NR/S	P	C	C	C
Design Specifications	Complete (C)	NR	S/P	C	C	C
Electrical One-Line Drawings	Preliminary (P)	NR	S/P			
General Equipment Arrangement Drawings	Preliminary (P)	NR	S/P			
Instrument List	Preliminary (P)	NR	S/P			
Construction Permits	Not Applicable (NA)	NR				
Civil/Site/Structural/Architectural Discipline Drawings	Not Applicable (NA)	NR				
Demolition Plans and Drawings	Preliminary (P)	NR	S/P	P		
Erosion Control Plan & Drawings	Not Applicable (NA)	NR				
Fire Protection & Life Safety Drawings & Details	Not Applicable (NA)	NR				
Mitigation Measures (Aquatic, Terrestrial, Heritage, etc.)	Not Applicable (NA)	NR				
Dam Design & Drawings	Not Applicable (NA)	NR				
De-silting Basins	Not Applicable (NA)	NR				
Gates & Cranes Design & Drawings	Not Applicable (NA)	NR				
Intake Design & Drawings	Not Applicable (NA)	NR				
Penstock Design & Drawings	Not Applicable (NA)	NR				
Powerhouse Design & Drawings	Not Applicable (NA)	NR				
Spillway Design & Drawings	Not Applicable (NA)	NR				
Turbine and Generator Design & Drawings	Not Applicable (NA)	NR				
Electrical Schedules	Preliminary (P)	NR	NR/S	P	P/C	
Instrument & Control Schedules	Preliminary (P)	NR	NR/S	P	P/C	
Instrument Data Sheets	Preliminary (P)	NR	NR/S	P	P/C	
Spare Parts Listings	Preliminary (P)	NR	NR	P	P/C	
Electrical Discipline Drawings	Preliminary (P)	NR	NR	S/P	P/C	
Facility Emergency Communication Plan & Drawings	Complete (C)	NR	NR	S/P	P/C	C
Information Systems/Telecommunication Drawings	Preliminary (P)	NR	NR	S/P	P/C	
Instrumentation/Control System Discipline Drawings	Preliminary (P)	NR	NR	S/P	P/C	
Mechanical Discipline Drawings	Not Applicable (NA)	NR	NR			
Auxiliary Electrical Design & Drawings	Preliminary (P)	NR	NR	S	P	
Auxiliary Mechanical Design & Drawings	Not Applicable (NA)	NR	NR			
Protection & Controls System Design & Drawings	Preliminary (P)	NR	NR	S	P	
Total # Deliverables for Class Estimate		6	26	29	25	16
% Defined/Complete towards Class Estimate		100%	100%	81%	69%	44%

Comments:

This project is being filed as a AACE Class 3 estimate. The defined deliverables for this project indicate that 81% of Class 3 deliverables are completed. AACE recommends applying between 10% and 30% contingency to estimates in this class. A contingency value of 20% was selected to account for specific risks such as market/pricing volatility of contractor and material costs. The contingency will also cover additional refurbishment costs which may arise once removal of the current system begins. Additional overtime work may also be required to complete the project within the outage window to be available for generation in Spring 2026.

Legend:

The maturity level is an approximation of the completion status of the deliverable. The completion is indicated by the following descriptors:

General Project Data:

- Not Required (NR): May not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- Preliminary (P): Project definition has begun and progressed to at least an intermediate level of completion. Review and approvals for its current status has occurred.
- Defined (D): Project definition is advanced, and reviews have been conducted. Development may be near completion with the exception of final approvals.

Technical Deliverables:

- Not Required (NR): Deliverable may not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- Started (S): Work on the deliverable has begun. Development is typically limited to sketches, rough outlines, or similar levels of early completion.
- Preliminary (P): Work on the deliverable is advanced. Interim, cross-functional reviews have usually been conducted. Development may be near completion except for final reviews and approvals.
- Complete (C): The deliverable has been reviewed and approved as appropriate.

Inclusions

For the purposes of this document, the term *hydropower industries* is assumed to include private and public utilities involved with the production of electrical power, exclusive of transmission and distribution, using natural gravitational force of falling or flowing water, excluding tidal forces, to drive a turbine that powers a generator.

The common thread among private and public utilities (for the purpose of estimate classification) is their reliance on user requirements, statement of objectives, design reports (i.e. geotechnical investigations, sourcing borrow materials and hydraulic design/modeling) and/or environmental data collection and studies as primary scope defining documents. These documents are key deliverables in determining the degree of project definition, and thus the extent and maturity of estimate input information.

Cost estimates for hydropower facilities are typically composed of key features such as:

- Reservoir area preparation (e.g., clearing, removal of structures and earthmoving).
- River management (e.g., cofferdams, diversion channels or tunnels, sediment management plans, environmental monitoring programs).
- Principal structures (e.g., dams, dykes, intakes, penstocks, powerhouse(s), low level outlet(s), power tunnel(s), de-silting basin(s), and spillway structure(s)).
- Permanent infrastructure (e.g., access roads, railroads, bridges, offices, warehouse and housing).
- Temporary infrastructure (e.g., construction camp, site access roads, airport, workshops, construction power etc).
- Environmental mitigation features (e.g. fish ladder(s), water bypass and creation of new fish or wildlife habitat).
- Owner's costs (e.g., stakeholder involvement, licensing, studies and investigations, administration and overhead, catering.).

Some, but not all, of these features are unique to the hydropower industries.

Typical hydropower facilities may include: turbines, generators, exciters, governors, transformers, gates for intake, spillway and draft tubes, and supporting electrical, mechanical, telecom, protection, and control systems. The water storage reservoir is typically required to support the operations of the hydropower facility.

PART 8 - PRICING AND TERMS

8.1 PRICING

Total firm fixed pricing to provide the quoted equipment is as follows. All pricing is shown in CAD currency.

PART 2	STANDARD ITEMS	
ITEM 2.1	CONTROL PANEL HARDWARE AND ENGINEERING	
ITEM 2.2	DYNAMIX 1444 VIBRATION MONITORING HARDWARE (OPTIONAL)	
ITEM 2.3	FACTORY ACCEPTANCE TEST	INCLUDED
ITEM 2.4	DOCUMENTATION	INCLUDED
TOTAL		

8.2 TERMS AND CONDITIONS

Delivery:	10-12 weeks after receipt of order (<i>Note 1</i>)
Crating:	Included
Shipping:	Included (DPU – 2819 Highway 14, Hants County, NS)
Taxes and Duties:	Extra (if applicable)
Country of Origin:	Control Hardware – USA System Engineering – Canada
Bid Validity:	90 days from proposal submission date
Terms of Payment:	2%/10 NET35
Payment Schedule:	Part 2: 30% - Contract award 30% - Drawings issued for manufacturing 40% - Successful FAT / Ready for shipment

Notes:

1. *Estimated lead time for the Electros witch hardware is 10 to 12 weeks. Delivery may be improved if the delivery of this hardware from the supplier improves.*
2. *This proposal is based on the attached: "FPS - Standard Equipment Supply terms and Conditions".*
3. *The contract price and schedule will be adjusted to account for any impact to FPS's costs, schedule or performance if the same are adversely affected by force majeure, change in law, conduct of buyer or the discovery of conditions at the site differing from conditions specifically identified in the contract documents. Change in law includes any enactment, issuance or change of any law, standard, regulation, rule, judgement, tax (including any new or an increase in an existing tax, duty or tariff or other charge of any nature), order, decree or interpretation of administration (including enforcement practises) of any of the foregoing by any federal, state, or local government authority or quasi-governmental authority.*



March 13, 2025

Nova Scotia Power
Avon 2 Hydro Station

Attn: Fred Porter

Via Email: fred.porter@nspower.ca

Re: Quote No. Q44648, Rev. 0 – Avon 2 Generator Field Breaker Panel

Dear Fred,

In response to your inquiry, Pennecon Technical Services ("PTS") is pleased to submit our proposal for Generator Field Breaker Panel as per the information provided.

PTS is committed to providing Nova Scotia Power with prompt, professional service that consistently meets and strives to exceed its requirements for safety, quality, price and schedule. This philosophy, in conjunction with our team approach to project implementation, has been the cornerstone of our success to date.

In this proposal, PTS is pleased to offer the following:

Option #1 w/ Eaton Circuit Breaker

- NEMA 12 Wall Mount Enclosure.
- Eaton HLD-DC Breaker 3P 600A Frame, LT300T Trip Unit, SNT4LP26K Shunt Trip, A1X5PK Aux Contacts, HN4R16 Rotary Handle/Mechanism/Shaft, TA602LD Terminal Lugs.
- Crompton 007 Series Digital/Analog DC Ammeter.
- Crompton 007 Series Digital/Analog DC Voltmeter.
- Rierdon Bourns 500 Watt 2 Ohm Discharge Resistors.
- GeneSIC S300Y Freewheeling Diode.
- Undervoltage Relay.
- Marathon Single Pole Power Blocks.
- DLO Wire with Long Barrel Compression Lugs.
- SIS Type Wire for all Control Wiring
- Fuse Blocks, Terminal Blocks, Din Rail etc.
- Approval/Fabrication and As-Built Drawings.
- QA Testing and Certification to CSA C22.2 No 286.

Price: [REDACTED]

Option #2 w/ ABB Breaker

- NEMA 12 Wall Mount Enclosure.



Pennecon Technical Services

- ABB XT5 Breaker 3P 600A Frame, Thermal Trip Unit, Shunt Trip, Aux Contacts, Rotary Handle/Mechanism/Shaft, Terminal Lugs.
- Crompton 007 Series Digital/Analog DC Ammeter.
- Crompton 007 Series Digital/Analog DC Voltmeter.
- Rierdon Bourns 500 Watt 2 Ohm Discharge Resistors.
- GeneSIC S300Y Freewheeling Diode.
- Undervoltage Relay.
- Marathon Single Pole Power Blocks.
- DLO Wire with Long Barrel Compression Lugs.
- SIS Type Wire for all Control Wiring
- Fuse Blocks, Terminal Blocks, Din Rail etc.
- Approval/Fabrication and As-Built Drawings.
- QA Testing and Certification to CSA C22.2 No 286.

Price

Price Validity: All prices are firm for 30 days and exclude HST

Payment Terms: Net 30 Days

Terms & Conditions: As per our General Terms attached and the notes below.

Delivery & Freight: Included

Lead Time: Eaton Option 14 to 24 Weeks, ABB Option 6 to 8 Weeks

Notes:

1. This quotation is premised upon client's acceptance of our General Terms and Conditions.
2. QA Testing and Certification is to CSA C22.2 No14 / CSA C22.2 No286 / UL508A.
3. In order for PTS to apply a certification mark, all customer supplied or specified components must be CSA or cUL certified, otherwise special certification may be required and will be at the customers expense.
4. Work to be completed during normal working hours (Monday-Friday 8:00am-4:30pm; excluding Holidays) unless otherwise noted.
5. Price does not include any parts or labour beyond our scope of work.
6. Any unscheduled delays due to weather, work site conditions, or any other event that occurs beyond our control will apply as an extra.
7. Quote remains valid for 30 days from date of issue. However, the impacts of potential incoming tariffs and market volatility cannot be reasonably determined at this time. This quote / proposal does not account for any potential adverse impact tariffs may have on Pennecon's pricing or delivery times. Price adjustments may occur at the time of shipment due to currency exchange rates, tariffs, or changes in regulations.
8. All quotes / proposals are listed in CAD unless otherwise stated. If the Canadian dollar fluctuates by +-5% against the USD at the time of shipment Pennecon reserves the right to adjust quoted prices"



We trust that this proposal will be acceptable. If you should require any additional information or further clarification, please contact the undersigned.

Sincerely,

A handwritten signature in black ink that reads "Justin Gray".

Justin Gray

Manager Power Systems - Maritimes

Pennecon Technical Services Ltd.

Email: justin.gray@pennecon.com / Mobile: (902) 719-8360