NOVA SCOTIA POWER INC.

TRANSMISSION & DISTRIBUTION ENGINEERING DEPARTMENT

FACILITIES STUDY INFRA-STRUCTURE REPORT FOR IR#542 – MINAS TIDAL

Addition of 5.58MW of Tidal Generation at 90N-FORCE Substation

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Rev. 0: 2018-11-22

Facilities Study Report

Project: Addition of 5.58MW Tidal Generation at 90N–FORCE Substation

Date: 2018-11-22 Rev. No.: 0

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1.0 INTRODUCTION:

In accordance with Section 8.3 of the Standard Generator Interconnection Procedures, the Transmission Provider is required to utilize existing studies to the extent practicable in performing new Facilities Studies. As such, Sections 2 – 8 of this report make extensive use of the Facilities Studies that were performed for IR #516 and IR #517.

IR #516 and IR #517 were two tidal Interconnection Requests studied simultaneously in 2015 that utilized the 90N-FORCE substation to connect to the NSPI transmission system. These IR's subsequently provided the funds to install the required NSPI System Network Upgrades (NU), and the Transmission Providers Interconnection Facilities (TPIF) between the NSPI transmission system and 90N-FORCE.

While no additional NSPI infrastructure will be required for IR #542 beyond what was installed for IR #516 and IR #517, a capital contribution towards the cost of the shared TPIF will be required from IR #542 in the amount of $470,442 plus $70,566 (HST), for a total of $541,008. This amount includes a 1/3 share of the remaining site commissioning costs that are estimated at $10,000 including HST.

Sections 2-8 of this report are essentially a re-statement of the Facilities Study that was completed for tidal projects IR #516 and IR #517 in 2015. They document the requirements that were necessary to provide for the establishment of the 69 kV system interconnection at 37N-Parrsboro to supply the FORCE Substation (90N) located on the West Bay Rd. just outside the Town of Parrsboro (approx. 10km from NSPI's 37N-Parrsboro Substation. The final cost associated with the work to complete the NU and the TPIF for IR #516 and IR #517 are included to demonstrate the appropriate capital contribution requirement for IR #542.

The original Facilities Study for IR #516 and IR #517 was performed by R.L. Johnson, P.Eng, in June of 2015.

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1.1 Interconnection Request (IR) #542

This Interconnection Facilities Report is based on the Revised Standard Generator Interconnection Procedures as approved by the UARB on June 10, 2016. The interconnection service is designated Network Resource Interconnection Service (NRIS).

IR #542 is a 5.58MW Interconnection Request for In-stream Tidal generation to be installed at the Fundy Ocean Research Centre for Energy (FORCE) Berth 'A'. The facility consists of 15 tidal generators each producing 372kW at 690V. Generation is subsequently stepped up to 13.8kV and connected to the 90N-FORCE substation via a subsea cable. Connection to the NSPI transmission system is accomplished via the 90N-FORCE 13.8kV-69kV substation, a facility owned and operated by FORCE but controlled by NSPI under a Facilities Operating Agreement.

The defined Point of Interconnection (POI) for IR #542 is the existing 69kV bus at Nova Scotia Power's 37N-Parrsboro Substation. The Point of Change in Ownership between NSPI and FORCE is at the line terminal structure at 90N.

The existing transmission line between the 37N-Parrsboro Substation and the 90N-FORCE Substation (L-5582) has been built to 138kV standards but is currently operating at 69kV.

The one line diagram, as provided by the Interconnection Customer (IC), for the interconnection to Nova Scotia Power's transmission system is shown in Appendix A along with the FORCE Berth layout drawing.

1.2 IR #516 and IR #517

At present, there are two IR's ahead of IR #542 in the Queue that also have Berths at the 90N-FORCE substation: IR #516 and IR #517. These two requests were processed in 2015 and were responsible for establishing the 69kV supply to FORCE.

The 69kV facilities required for IR #516 and IR #517 were built in 2016 and 2017

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and construction funds were provided in advance by these interconnection Customers based on good faith best estimates and the scope of work defined in each of their Facility Study Reports. The associated construction work has since been completed and the project has been final costed. Approximately $10,000 of commissioning work remains to be completed after generation is installed.

In accordance with Section 9.9.2 of the Standard Generator Interconnection and Operating Agreement (GIP Appendix 6), IR #542 will be responsible to provide a capital contribution for the shared portion of the TPIF associated with this work. Section 9.9.2 refers to third party usage and states:

> If required by Applicable Laws and Regulations or if the Parties mutually agree, such agreement not to be unreasonably withheld, to allow one or more third parties to use the Transmission Provider's Interconnection Facilities, or any part thereof, Interconnection Customer will be entitled to compensation for the capital expenses it incurred in connection with the Interconnection Facilities based upon the pro rata use of the Interconnection Facilities by Transmission Provider, all third party users, and Interconnection Customer, in accordance with Applicable Laws and Regulations or upon some other mutually-agreed upon methodology. In addition, cost responsibility for ongoing costs, including operation and maintenance costs associated with the Interconnection Facilities, will be allocated between Interconnection Customer and any third party users based upon the pro rata use of the Interconnection Facilities by Transmission Provider, all third party users, and Interconnection Customer, in accordance with Applicable Laws and Regulations or upon some other mutually agreed upon methodology. If the issue of such compensation or allocation cannot be resolved through such negotiations, it shall be submitted to the Board for resolution.

As IR #542 is the third project to share the TPIF, it must provide a capital contribution equal to 1/3 of the total TPIF costs to NSPI. 1/2 of this payment will be forwarded to IR #516, and the remaining 1/2 will be forwarded to IR #517. In addition, IR #542 will be responsible for its share of all ongoing maintenance and operations costs associated with the TPIF. Should the number of third party users change, the cost responsibility will also change in proportion to the number of third party users. In the event additional projects are added at FORCE, IR

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#542 will receive a refund for their portion of shared line usage.

Note that Sections 2-8 of this report are essentially a re-statement of information provided in the original Facilities Study for IR #516 and IR #517 performed by R.L. Johnson, P.Eng, in June of 2015. Final configuration of equipment and final costing has been inserted where appropriate.

2.0 SUMMARY:

This section provides an explanation of ownership and project costs for:

- Transmission Provider Interconnection Facilities (TPIF)
- Network Upgrades (NU).

2.1 Ownership:

Ownership, maintenance and other commercial operating arrangements will be covered separately in more detail in the Generator Interconnection and Operating Agreement between Nova Scotia Power, FORCE, and the Interconnection Customer.

For the purposes of this Facilities Study, the Point of Change of Ownership will be the line terminal side of the 90N-FORCE Substation as shown on the single line diagram attached in Appendix A.

The communications between Nova Scotia Power and FORCE is via a licensed 900MHz radio utilizing a 75ft composite pole, antenna and associated radio and tele-protection equipment and a 48V DC Supply located in the 90N-FORCE Substation but owned by NSPI.

Nova Scotia Power also owns the revenue metering system located in the FORCE Substation. This includes **dedicated** set of revenue metering class potential and current transformers (i.e. functionality not shared with any other purpose) certified by Measurement Canada for 3 element metering, the revenue meter, and all associated wiring Including the wiring to the communication cabinet in the Customer's control building.

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2.2 **Estimated Costs:**

The original estimated cost for Nova Scotia Power's work to provide a 69 kV interconnection at 37N-Parrsborro was $1,728,832.00 (HST excluded). The estimated cost of TPIF and NU were divided equally between Interconnection Requests IR#516 and IR#517 as follows.

TPIF Estimate:	$1,454,332 (HST excluded)
Network Upgrades Estimate:	$ 274,500 (HST excluded)
TPIF Estimate for each IR:	$ 727,166 (HST excluded)
NU Estimate for each IR:	$ 137,250 (HST excluded)
Total:	**$1,728,832 (HST excluded)**

The detailed cost estimate provided in Appendix E: Project Cost Estimate (Nova Scotia Power Portion) was based on the scope of work outlined in Section 4.0 of this Facilities Study Report. Strict accounting of costs during the project insured an accurate split between TPIF costs and Network Upgrade costs.

The deposit supplied via FORCE on behalf of IR #516 and IR #517 to cover the estimated TPIF and NU costs was $1,759,882 + $228,275 HST = **$ 2,023,864**.

(Note that the deposit provided was based on a revised estimate prior to the execution of the Generator Interconnection and Operating Agreement)

2.3 **Actual Final Costs:**

The final cost for Nova Scotia Power's work to provide the 69 kV interconnection at 37N-Parrsborro was as follows:

TPIF Actual Costs:	$1,402,630 (HST excluded)
NU Actual Costs:	$ 268,182 (HST excluded)
Total Actual Cost:	**$1,670,812 (HST excluded)**

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According to the GIA, Each of the three IR's is responsible for 1/3 of the TPIF costs:

TPIF (516/517/542): **$ 467,544 (Plus HST) each**

In addition, IR #542 will be responsible for 1/3 of the remaining commissioning testing, which is estimated at $8,696 plus HST. As such, a capital contribution totaling ($467,544 + $2,899) + $70,565 (HST) = **$541,008** is required from IR #542 for the shared usage of the TPIF infrastructure.

Nova Scotia Power will not permit the connection of IR #542 to the grid prior to receipt of the executed GIA and secured funding from the Interconnection Customer in accordance with Article 11.5 of the Generation Interconnection Agreement.

3.0 DESIGN:

Nova Scotia Power was responsible for the engineering and drawing production for all aspects of the scope of work at 37N-Parrsboro described in **Section 4.0** of this report. This included the 69 kV additions; the protection and control design; the telecommunications systems between Parrsboro and FORCE, Parrsboro and Maccan, & Springhill and RAL; the new SCADA RTU at 37N-Parrsboro; and the review of Protection and Control design at the 90N-FORCE substation affecting the interconnection with NSPI's transmission system.

FORCE was responsible for the engineering design of the 90N-FORCE interconnection substation.

The Interconnection Customer is responsible for design of all aspects of the generating facility on the Interconnection Customer's side of the Point of Change of Ownership shown in Appendix A – Single Line Diagram of Interconnection Substation.