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British Columbia Hydro and Power Authority

Application for a Certificate of Public Convenience and Necessity for the Lower Mainland Reactive Power Reinforcement Project

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Decision
and Order G-20-24

January 24, 2024

Before:
A. K. Fung, KC, Panel Chair
A. C. Dennier, Commissioner

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Executive summary

On November 22, 2022, British Columbia Hydro and Power Authority (BC Hydro) filed an application with the British Columbia Utilities Commission (BCUC) seeking a Certificate of Public Convenience and Necessity (CPCN) for the Lower Mainland Reactive Power Reinforcement project (Application). BC Hydro proposes to install reactive power compensation equipment at the Meridian, Ingledow, McLellan and Clayburn substations to manage reactive power on BC Hydro's transmission system. In addition, BC Hydro proposes to cease operations at the Burrard Synchronous Condenser Station (BSY) as the equipment and buildings in BSY are old, deteriorating and expensive to maintain and operate (together, the Project). BC Hydro states the Project is required to maintain the transfer capability of the Interior to Lower Mainland Transmission System, to maintain voltage control for the Metro Vancouver Regional Transmission System and to relieve voltage constraints to support load growth in the Central Fraser Valley Regional Transmission System.

Following a public review process, the Panel finds that BC Hydro has established the need to manage reactive power on its transmission system upon the terms stated above.

However, the Panel does not accept BC Hydro's methodology for assessing the feasible alternatives due to the largely qualitative nature of its structured decision-making process and the lack of clear cost differentiation between the different alternatives. The Panel considers BC Hydro's assessment of the Project to be incomplete as submitted as it is missing significant scope of work associated with the decommissioning and remediation of the entire BSY site. The Panel finds BC Hydro's comparison of the present value between the feasible alternatives to be incomplete because it does not include all applicable Project scope in the cost estimate of each alternative, and furthermore, does not properly account for the overlapping cost ranges associated with the Class 5 cost estimates for the various alternatives which render the financial analysis suspect.

The Panel considers that, for the effective review of the merits of the Project, BC Hydro must submit the full scope of work for the preferred alternative including the full scope of decommissioning and remediation of BSY, the associated Project costs at a Class 3 estimate, and the resulting rate impact. By not including the scope of work associated with decommissioning and remediation of BSY, BC Hydro's evaluation of the full scope and cost of the Project is incomplete, and the rate impact of the Project cannot be fully or satisfactorily assessed by BC Hydro or the BCUC.

For these reasons, the Panel finds that the evidence adduced in this proceeding does not demonstrate that the Lower Mainland Reactive Power Reinforcement Project is in the public interest and accordingly denies the granting of a CPCN for this Project as unwarranted.

However, the Panel encourages BC Hydro to continue its efforts to develop, and, in due course, reapply as required for approval of one or more projects that address the need to manage reactive power on the BC Hydro transmission system. Alternatively, BC Hydro is at liberty to file another CPCN application for the Project which addresses the deficiencies identified in this decision for BCUC review and approval. In the meantime, the Panel directs BC Hydro to file, within 90 days of this decision, its interim contingency plan to manage the need for reactive power on its transmission system.

1.0 Introduction

On November 22, 2022, British Columbia Hydro and Power Authority (BC Hydro) filed an application with the British Columbia Utilities Commission (BCUC) pursuant to sections 45 and 46 of the *Utilities Commission Act* (UCA) seeking a Certificate of Public Convenience and Necessity (CPCN) for the Lower Mainland Reactive Power Reinforcement Project (Project) (Application).[1]

BC Hydro states the Project is needed to manage reactive power[2] on BC Hydro's transmission system. BC Hydro identifies that the Project is required to maintain the transfer capability of the Interior to Lower Mainland Transmission System, maintain voltage control for the Metro Vancouver Regional Transmission System and relieve voltage constraints to support load growth in the Central Fraser Valley Regional Transmission system. BC Hydro further states that it currently relies on the Burrard Synchronous Condenser Station (BSY) to manage the production and absorption of reactive power, and thereby manage voltage levels on the transmission system.[3]

BC Hydro submits that the equipment and buildings in BSY are old, deteriorating and expensive to maintain and operate. As such, BC Hydro proposes to stop using the BSY to manage reactive power on BC Hydro's transmission system and to instead install reactive power compensation equipment at the Meridian, Ingledow, McLellan and Clayburn substations. These reactive power resources include a combination of shunt capacitor banks (to supply reactive power) and shunt reactors (to absorb reactive power).[4]

The Project is expected to be in-service by October 2026[5] and has an estimated cost range of $85.8 million to $129.5 million.[6] The Project is designed to support the anticipated load growth in the Central Fraser Valley after 2026, to fully replace the capacitive output of BSY by 2031, and immediately replace BSY's ability to absorb reactive power.[7]

1.1 Approvals Sought

BC Hydro seeks approval of a CPCN for the Project, pursuant to sections 45 and 46 of the UCA. The Project includes the installation of the following reactive power compensation equipment[8]

- Two shunt reactors at Meridian substation;
- Two shunt capacitor banks at Ingledow substation;

[1] Exhibit B-1, p. 1-1.
[2] In brief, "active power" is the power that does useful work (e.g., in the case of a purely resistive load like a lightbulb, the creation of light (and heat)). However, for other loads, such as motors, electrical energy cannot be directly converted into useful work (e.g., rotation of the motor) because a magnetic field needs to be created before the motor can rotate. The portion of the power used to create the magnetic field in this example is known as "reactive power." The production and absorption of reactive power impacts voltage levels and voltage stability on BC Hydro's system. Therefore, it is necessary for BC Hydro to manage both the production and absorption of reactive power to maintain voltage levels and stability.
[3] Exhibit B-1, p. 1-1.
[4] Ibid., p. 1-2.
[5] Ibid., p. 4-40.
[6] Ibid., p. 1-7.
[7] Ibid., p. 2-21.
[8] Ibid., p. 1-2.

- One shunt capacitor bank at McLellan substation;
- One shunt capacitor bank at Clayburn substation; and
- Ancillary equipment at Meridian, Ingledow, McLellan and Clayburn substations.

The Project also includes work to stop using BSY to manage reactive power on BC Hydro's transmission system.[9] If the CPCN is granted, BC Hydro proposes to file various Project compliance reports.[10]

BC Hydro requests that certain information in the Application and several appendices be held confidential due to the commercially sensitive nature of the information, in accordance with Part IV of the BCUC's Rules of Practice and Procedure.[11]

1.2 Regulatory Process

On December 15, 2022, the BCUC established a regulatory timetable for the review of the Application, which included public notification and intervener registration.[12]

On January 16, 2023, the BCUC established a further regulatory timetable, including a BC Hydro workshop and a round of information requests (IRs) to BC Hydro.[13] The BCUC subsequently established further and amended regulatory timetables, which included among other things, a second round of IRs, various extensions, and final and reply arguments.[14]

Three parties registered as interveners and participated actively in the proceeding:

- British Columbia Old Age Pensioners' Organization et al. (BCOAPO);
- Commercial Energy Consumers Association of British Columbia (the CEC); and
- The Residential Consumer Intervener Association (RCIA).

1.3 Legislative and Regulatory Framework

Sections 45 and 46 of the UCA set out the legislative framework for the BCUC review of CPCN applications. Section 45(1) of the UCA states that except as otherwise provided, after September 11, 1980, a person must not begin the construction or operation of a public utility plant or system, or an extension of either, without first obtaining from the BCUC a certificate that public convenience and necessity require or will require the construction or operation of the plant or system.[15]

Section 46(3) of the UCA states that the BCUC may issue or refuse to issue a CPCN or may issue a CPCN for the construction or operation of only a part of the proposed facility, line, plant, system or extension, and may attach terms and conditions to the CPCN.

[9] Exhibit B-1, p. 1-2.
[10] Exhibit B-14, BCOAPO IR 2.52.1, Attachment 1.
[11] BCUC Order G-72-23.
[12] Order G-363-22, dated December 16, 2022.
[13] Order G-8-23, dated January 16, 2023.
[14] Order G-127-23, dated June 2, 2023; Order G-173-23, dated July 4, 2023; Order G-208-23, dated August 4, 2023.
[15] *Utilities Commission Act*, RSBC 1996, c. 473, Section 45(1).

Neither the UCA nor the BCUC's CPCN Guidelines[16] provide a definition of public convenience and necessity.

The BCUC has previously relied upon *Memorial Gardens Assn. (Can.) Ltd. v. Colwood Cemetery Co.*, as the leading case on the definition of public convenience and necessity and it quoted from that case as follows in FortisBC Inc.'s CPCN for the Advanced Metering Infrastructure Project Decision:

> Abbott J. for the majority, after commenting that it would "be both impracticable and undesirable to attempt a precise definition of general application of what constitutes public convenience and necessity" and that "the meaning in a given case should be ascertained by reference to the context and to the objects and purposes of the statute in which it is found," describes the determination of public convenience and necessity as follows:
>
> > As the Court held in the Union Gas case the question whether public convenience and necessity requires a certain action is not one of fact. It is predominantly the formulation of an opinion. Facts must, of course, be established to justify a decision by the Commission but that decision is one which cannot be made without a substantial exercise of administration discretion. In delegating this administration discretion to the Commission the Legislature has delegated to that body the responsibility of deciding in the public interest, the need and desirability of additional cemetery facilities, and in reaching that decision the degree of need and of desirability is left to the discretion of the Commission.[17]

1.3.1 Contaminated Sites Regulation

The *Contaminated Site Regulation* (CSR)[18] is a set of provincial regulations issued under the *Environmental Management Act*.[19] BC Hydro states it will trigger regulatory requirements under the CSR for a parcel of land in BSY if operations stop on that parcel for a period of 12 months or longer. CSR requirements will not, however, be triggered if a future user commences operations within the 12-month period.[20]

1.4 Structure of Decision

The structure of this Decision largely follows that of the CPCN Application and the BCUC's CPCN Guidelines:

- Section 2.0 addresses the Project need and its justification;
- Section 3.0 addresses the alternatives that BC Hydro considered as capable of meeting Project objectives. This section also describes the Project alternatives evaluation and selection of the preferred alternative for the Project.
- Section 4.0 addresses the Project description, costs, accounting and rate impact;
- Section 5.0 sets out the overall Panel CPCN determination; and

[16] https://docs.bcuc.com/documents/Guidelines/2015/DOC_25326_G-20-15_BCUC-2015-CPCN-Guidelines.pdf
[17] FortisBC Inc. Certificate of Public Convenience and Necessity for the Advanced Metering Infrastructure Project, Decision and Order C-7-13 dated July 23, 2013, Memorial Gardens Assn. (Can.) Ltd. v. Colwood Cemetery Co., [1958] S.C.R. 353, 1958 CanLII 82 (Memorial Gardens) pp. 7-8; Memorial Gardens, p. 357.
[18] B.C. Reg. 375/96
[19] SBC 2003 c.53
[20] Exhibit B-12, BCUC IR 2.39.3.

- Section 6.0 addresses BC Hydro's confidentiality requests and outlines the Panel's determination in this regard.

2.0 Project Need and Justification

As already noted, BC Hydro states the Project need is to manage reactive power on its transmission system and identifies the following three key Project drivers:[21]

(a) Maintain the transfer capability of the Interior to Lower Mainland Transmission System;

(b) Maintain voltage control for the Metro Vancouver Regional Transmission System; and

(c) Relieve voltage constraints to support load growth in the Central Fraser Valley Regional Transmission System.

BC Hydro further identifies the current state and future of BSY as key drivers to the initiation of the Project.[22] BC Hydro explains that BSY is more than 60 years old, and its equipment and structures are deteriorating, thus requiring significant investment to continue safe and reliable operation.[23]

BC Hydro further explains that the cost required to continue to invest in, operate and maintain the BSY equipment is no longer economic compared to other alternatives.[24] BC Hydro states that the Project will resolve system risks driven by the deteriorating condition of BSY and expected load growth in the Central Fraser Valley area.[25]

In the following subsections, we provide an overview of the need for reactive power and describe each of BC Hydro's three key drivers for the Project in the context of reactive power compensation requirements for the Interior to Lower Mainland Transmission System, Metro Vancouver Regional Transmission System and Central Fraser Valley Regional Transmission System. We then review the current state of the BSY facility and the long-term reactive power needs of BC Hydro's transmission system.

2.1 Transfer Capacity of the Interior to Lower Mainland Transmission System

The Interior to Lower Mainland portion of BC Hydro's 500 kilovolt (kV) bulk electric system is a critical component of BC Hydro's transmission grid and delivers electricity generated in the interior of British Columbia, where a large portion of BC Hydro's generation resources are located, to the load centres in the Lower Mainland and Vancouver Island, where approximately 70 percent of customer load is located. Figure 1 below shows the location of the Interior to Lower Mainland portion of BC Hydro's 500 kV transmission system.

[21] Exhibit B-1, p.2-1.
[22] Exhibit B-12, BCUC IR 2.33.1.
[23] Exhibit B-1, p.2-19.
[24] ExhibitB-7, BCUC IR 1.3.3.1.
[25] Exhibit B-9, RCIA 1.6.1.

Figure 1: BC Hydro Interior to Lower Mainland 500 kV Transmission System Map[26]

BC Hydro explains that its electric systems require reactive power to operate. Reactive power provides for the transfer of active power through the system to electrical equipment via electric and magnetic fields.[27] Further, reactive power must be available in sufficient quantities so the transmission system can meet system performance requirements. North American Electric Reliability Corporation reliability standards, adopted by the BCUC, require BC Hydro to plan and operate the system such that system stability is maintained under a range of possible disturbances.[28]

BC Hydro states that customer loads and certain equipment consume reactive power. To maintain voltage stability during peak loads, greater amounts of reactive power are required. During such conditions, a disturbance such as loss of a transmission line can cause a drop in voltage which could become uncontrollable, leading to a widespread outage.[29]

BC Hydro states that the Interior to Lower Mainland system is currently a voltage stability constrained system. When customer load in the Lower Mainland and Vancouver Island regions grows, more reactive power will need to be provided to maintain that voltage stability and comply with Mandatory Reliability Standards.[30] BC Hydro states that the Interior to Lower Mainland transmission system relies on +400 Mega Volt-Amps Reactive (MVAr) of reactive power compensation from BSY to maintain voltage stability and increase transfer capability limits.

[26] Exhibit B-1, p. 2-4.
[27] Exhibit B-4, Slide 7; Workshop Transcript Volume 1 Revised, pp. 15-19.
[28] Exhibit B-1, p. 2-5; BCUC Order R-27-18A NERC standard TPL-001-4.
[29] Ibid., pp. 2-5 – 2-6.
[30] Ibid.

BC Hydro explains that if it is unable to replace the capacity of BSY to supply sufficient reactive power to the Interior to Lower Mainland System, the transfer capability to serve load and maintain voltage stability would be reduced.[31] With none of the BSY synchronous condensers operating, the transfer capability of the Interior to Lower Mainland Transmission System is limited to approximately 6,200 megawatts (MW).[32]

2.2 Voltage Control in the Metro Vancouver Regional Transmission System

BC Hydro's 230 kV transmission system in the Lower Mainland is subject to high voltages during light load periods due to excess reactive power, which can result in significant equipment damage. During light load periods or low customer demand, for example during the early morning hours of a spring or summer holiday weekend, transmission lines can produce reactive power. Excess production of reactive power during light load periods can generate high voltages on the transmission system.[33] Both utility equipment and customer equipment are designed to operate within certain voltage ratings. Prolonged operation of equipment at voltages outside specified ratings could adversely affect their performance and possibly cause damage. As a result, specified maximum voltage limits should not be exceeded.[34]

BC Hydro states that it manages light load conditions using specific operating procedures coupled with synchronous condensers at BSY to absorb reactive power. BSY provides a total reactive output of -200 MVAr at full capacity (with all four condenser units in operation).[35] BSY enables BC Hydro's 230 kV system voltage levels to be up to 4 kV lower than they would be without BSY.[36] (Section 2.4 of this decision provides a further overview of the facilities at BSY). Over the past 20 years, BC Hydro has also been using operating procedures, such as switching out 500 kV transmission lines, if necessary, to mitigate the impacts of very light loads on the transmission system under extreme scenarios due to reliability risks. Under these circumstances, system operators take steps to deploy available reactive resources to maintain equipment within operating limits.[37]

BC Hydro has identified circumstances in the past when all available reactive power resources are deployed, but system voltages remain high.[38] BC Hydro identified three instances in 2022 when transmission lines were taken out of service as a result of light load conditions on the Metro Vancouver system in order to control system voltage.[39] BC Hydro's general operating practice prescribes the switching out of transmission lines to control system voltages when there are insufficient reactive resources to maintain the system voltage at an acceptable level.[40]

BC Hydro states that if the Project is approved and completed, it will meet the system requirements for reactive power during light load operating conditions within the planning horizon of 2022 to 2041.[41]

[31] Exhibit B-1, p. 2-6.
[32] Ibid., Appendix E-1, p.18.
[33] Ibid., pp. 2-8 – 2-9.
[34] Ibid., p. 2-9.
[35] Ibid., p. 2-11.
[36] Ibid., p. 2-9.
[37] Exhibit B-9, RCIA IR 1.2.7; Exhibit B-14, BCOAPO IR 2.32.1.
[38] Exhibit B-14, BCOAPO IR 2.32.1.
[39] Ibid., BCOAPO IR 2.32.2.
[40] Ibid., BCOAPO, IR 2.31.1.2.
[41] Exhibit B-12, BCUC IR 2.35.9.

2.3 Load Growth in the Central Fraser Valley Regional Transmission System

The Central Fraser Valley Regional Transmission System primarily consists of a single series of 230 kV transmission lines between Ingledow and Rosedale substations. Five substations serving a total of 253,000 customers are connected to the Central Fraser Valley system between these points: Fleetwood, McLellan, Mount Lehman, Clayburn, and Atchelitz.[42]

BC Hydro states its customer load in the Central Fraser Valley is growing.[43] BC Hydro states that the Central Fraser Valley area has undergone significant recent development,[44] and load in the region is expected to increase at an average rate of approximately 1.5 percent per year over the next 20 years. Further, BC Hydro explains the 230 kV Central Fraser Valley Regional Transmission system is a voltage constrained system because the demand for reactive power from the region will exceed the supply of reactive power from the transmission system under certain critical outage conditions.[45]

BC Hydro uses a fixed power factor[46] of 0.95 lagging for transmission system planning.[47] BC Hydro states that transmission loads in the Central Fraser Valley Region have had a steady power factor ratio of 0.95 for the last 20 years.[48] BC Hydro explains that as the power factor approaches 1 there is less need to provide reactive power compensation to the system.[49] BC Hydro states that it measures both reactive and active power flows in real-time on the transmission system to calculate power factor.[50] BC Hydro explains that it sets the power factor for planning purposes for distribution loads in the Central Fraser Valley Region annually.[51]

BC Hydro notes that it has observed an improvement (increase) in the measured average power factor from 0.95 lagging to 0.984 lagging between 2017 and 2021 in the Central Fraser Valley Region.[52] BC Hydro attributes the improvement in power factor to continued increase in use of capacitive devices such as light-emitting diode lighting, electronic devices, and inverter-based technologies.[53] BC Hydro further explains that additional reactive power, above and beyond this Project, would be required if the annual power factor was changed back to 0.95. However, BC Hydro considers such a change in power factor to be unlikely.[54]

BC Hydro undertook the Central Fraser Valley Transmission System Assessment (Central Fraser Valley Assessment) to determine the reactive power requirements in the Central Fraser Valley over a 20-year period from 2022 to 2041. Based on the reference forecast scenario, the Central Fraser Valley Assessment concluded that one 230 kV, 125 MVAr capacitor bank will be required in 2026 to provide additional reactive power, with

[42] Exhibit B1, pp.2-22, 2-23.
[43] Exhibit B-1, p.2-24.
[44] Exhibit B-1, Appendix E-2, p.6.
[45] There are two contingencies driving the need for system reinforcement in the Central Fraser Valley system:
- Loss of the two 500/230 kV transformers at Clayburn Substation; and
- Loss of transmission line 2L74 from Ingledow to Fleetwood.

[46] BC Hydro describes power factor as the ratio of active power to apparent power (Exhibit B-8, BCUC IR 1.21.2).
[47] Workshop Volume 1 Revised, p.43.
[48] Exhibit B-12, BCUC IR 2.43.4.
[49] Workshop Transcript Volume 1 Revised, pp. 49-50.
[50] Exhibit B-7, BCUC IR 1.21.2.
[51] Ibid., BCUC IR 1.21.3.
[52] Ibid., BCUC IR 1.21.3.1.
[53] Exhibit B-12, BCUC IR 2.43.3.
[54] Exhibit B-7, BCUC IR 1.21.5.

additional capacitive resources needed by 2033.[55] BC Hydro states that if the Project is implemented, the next major transmission system upgrade under a reference forecast scenario may be required in 2041.[56]

Positions of the Parties

RCIA does not dispute the need of the Project and does not contest BC Hydro's need for adequate reactive power resources in the Lower Mainland. RCIA submits that BC Hydro's Application "does not go far enough." RCIA submits that should the load growth forecast by BC Hydro in the Lower Mainland, Vancouver Island and Central Fraser Valley regions materialize, additional reactive resources may be needed.[57]

RCIA submits that the evidence supports the Project need as described by BC Hydro.[58]

The CEC understands and accepts the need for transfer capability to the Lower Mainland.[59] The CEC submits it recognizes the critical nature of voltage stability under light load conditions and the importance of reactive power management.[60] The CEC further supports BC Hydro's analysis of the requirements and the equipment required to support the Metro Vancouver Regional Transmission System.[61] The CEC accepts BC Hydro's analysis of the need for additional reactive power resources and the equipment required to support the growing Central Fraser Valley load.[62]

BCOAPO supports BC Hydro's stated need for reactive power compensation. BCOAPO considers that BC Hydro has adequately demonstrated that while the BSY units are not immediately required to provide reactive power to support the Interior to Lower Mainland Transmission System in its supply of domestic load and firm exports, they will be needed in the near to medium term, as early as 2025.[63] Additionally, BCOAPO submits BC Hydro has adequately demonstrated the need for the BSY units, or their equivalent, to support Metro Vancouver during low load periods in the short to medium term.[64] In BCOAPO's view, BC Hydro has adequately demonstrated the need for additional reactive resources to support the anticipated load growth in Central Fraser Valley.[65]

However, BCOAPO submits that BC Hydro should improve its ability to forecast off-peak and low load requirements before it can appropriately identify longer term requirements for reactive power to serve low load periods.[66]

In reply, BC Hydro explains that the studies establishing the need to absorb reactive power in Metro Vancouver were based on the 10th percentile summer light load levels. The studies show that if BC Hydro stops operation of BSY, BSY's ability to absorb reactive power will need to be immediately replaced in order to maintain voltage control of the regional transmission system.[67]

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[55] Exhibit B-1, pp. 2-26, 2-27.
[56] Exhibit B-7, BCUC IR 1.6.6.
[57] RCIA Final Argument, pdf pp. 10-11.
[58] Ibid., pdf p. 11.
[59] CEC Final Argument, p. 4.
[60] Ibid., p. 5.
[61] Ibid., pp. 5, 14.
[62] Ibid., p. 15.
[63] BCOAPO Final Argument, p. 6.
[64] Ibid., p. 8.
[65] Ibid., p. 11.
[66] Ibid., p. 7.
[67] BC Hydro Reply Argument, pp. 5-6.

Panel Determination

The Panel finds that BC Hydro has established the need to manage reactive power on its transmission system to maintain the transfer capability of the Interior to Lower Mainland Transmission System, to maintain voltage control for the Metro Vancouver Regional Transmission System, and to relieve voltage constraints to support load growth in the Central Fraser Valley Regional Transmission System. None of the interveners disputes this need.

With respect to the need to maintain the transfer capability of the Interior to Lower Mainland Transmission System, BC Hydro has demonstrated that to reliably supply load centres in the Lower Mainland and Vancouver Island, sufficient reactive power is required to maintain the existing transfer capability of the Interior to Lower Mainland system and to allow BC Hydro to maximize utilization of the existing 500 kV transmission system. BC Hydro has further demonstrated that if it is not able to supply sufficient reactive power to the Interior to Lower Mainland Transmission System, the Interior to Lower Mainland system transfer capability would need to be reduced to keep the system at a point where BC Hydro is able to maintain voltage stability. This reduction of transfer capability would result in reduced capability to serve load.

With respect to the need to maintain voltage control for the Metro Vancouver Regional Transmission System, BC Hydro has demonstrated that its transmission system is designed and operated to meet certain system performance criteria for a wide range of system conditions, ranging from the peak period of a heavy load day to extremely light load periods. During periods of low customer demand, BC Hydro's load consumes less reactive power and therefore excessive reactive power must be absorbed in order to avoid high voltage conditions. BC Hydro's evidence shows that its equipment such as 230 kV underground cable circuits as well as other voltage-sensitive substation equipment must be operated within their maximum continuous voltage ratings because prolonged operation of this equipment at voltages outside these ratings could adversely affect their performance and possibly cause equipment damage and reduce their life span. The Panel is satisfied that BC Hydro's system needs to absorb reactive power during low load conditions to avoid high voltage conditions that could damage critical transmission equipment.

With respect to the need to relieve voltage constraints to support load growth in the Central Fraser Valley Regional Transmission System, the Panel accepts BC Hydro's assessment that the Central Fraser Valley load is expected to experience a 20-year average load growth of approximately 1.5 percent annually. The Panel agrees with BC Hydro's assessment that it is beginning to experience voltage constraints in the Central Fraser Valley 230 kV system due to the load growth in the Central Fraser Valley over the last several years and that additional capacitive resources beyond what is currently supplied by the BSY condensers will be required by 2026. The Panel further accepts BC Hydro's assessment that additional reactive power resources beyond those proposed in the Application are not anticipated until 2041.

2.4 Overview of the BSY Station

BC Hydro currently relies on the BSY, together with other assets, to manage the production and absorption of reactive power, and thereby manage voltage levels on the transmission system.[68] The BSY facility is located on Thermal Plant Road in Port Moody, on the north side of the Burrard Inlet and west of the Imperial Oil Ioco Terminal. [69] An aerial view of the BSY site is shown below.

[68] Exhibit B-1, p. 2-1.
[69] Ibid., Appendix M, p. 29.

Figure 2: BSY Aerial View[70]

The BSY facility commenced operations in 1962[71] and was previously known as the Burrard Thermal Generating Station (BGS) from 1962 to 2016.[72] During this period, the BGS facility operated as a six-unit 900 MW natural gas fired thermal generation plant.[73] In 2010, the government of British Columbia published energy objectives under the *Clean Energy Act*, prohibiting BC Hydro from using BGS as a planned generation resource and restricting operations to emergency generation and reactive power support.[74]

In 2013, BC Hydro conducted a strategic review which indicated that conversion of the generating units to synchronous condenser mode would alleviate costs and facility associated risks. The review further concluded that only three synchronous condenser units would be needed to meet the transmission system needs over a 10-year time frame.[75] In 2016, the BCUC granted BC Hydro approval to cease operating those portions of the BSY that were not required for transmission support service.[76] BC Hydro converted the BGS site into the BSY on April 1, 2016.[77] In the same year, BC Hydro developed a Facility Asset Plan, which concluded that significant investments in BSY would be required to sustain long-term operations at BSY beyond 2025.[78]

[70] Exhibit B-1, p. 5-41.
[71] Ibid., Appendix E-1, p. 11.
[72] Ibid., Appendix D-2, p. 7.
[73] Exhibit B-7, BCUC IR 1.2.2, Attachment 1, p. 5.
[74] Ibid., BCUC IR 1.2.1.
[75] Exhibit B-1, BCUC IR 1.2.1.
[76] Order G-198-16, dated December 29, 2016.
[77] Exhibit B-7, BCUC IR 1.2.1.
[78] Ibid., BCUC IR 1.2.3.

Of the six original generating units, Units 5 and 6 are not able to operate in synchronous condenser mode and have been disconnected.[79] BC Hydro confirms Units 5 and 6 can no longer be returned to operation without significant intervention.[80] The remaining four synchronous condensing units, Units 1 to 4, when operating at full capacity, provide a total capacitive output of +400 MVAr and reactive output of -200 MVAr.[81]

Components of each synchronous condenser unit at BSY include:[82]

- A stator/rotor;
- An excitation system;
- Hydrogen cooling systems and gas handling systems;
- Protection and control systems;
- A power transformer; and
- Associated switchgear.

In 2016, Unit 2 experienced a rotor failure and was removed from service due to a grounding issue. Unit 2 is used as a source for spare parts as required.[83] Units 1, 3, and 4 are in operation and are expected to continue to support BC Hydro's firm capacity for the next two years.[84]

2.4.1 Condition Assessment of BSY Synchronous Condenser Units

BC Hydro conducted a condition assessment of Unit 1 in the summer of 2022 for its mechanical, electrical, and protection and control components.[85] BC Hydro states that it has not completed an assessment of all components for each of the remaining three synchronous condenser units. Given that all synchronous condenser units are similar with respect to design, number of operating hours and maintenance histories, BC Hydro considers the condition of Unit 1 as indicative of the condition of the remaining three synchronous condenser units[86] and summarizes the assessment results for each component of its BSY synchronous condenser fleet in Table 1 below.

[79] Exhibit B-1, p.2-10, footnote 36; Appendix D-2, p. 8.
[80] Exhibit B-7, BCUC IR 1.2.1.
[81] Exhibit B-1, pp.2-11-2-12.
[82] Ibid.
[83] Ibid., Appendix D-2, p. 8.
[84] BC Hydro Final Argument, p. 18, footnote 70.
[85] Exhibit B-1, pp. 2-13, 2-14.
[86] Exhibit B-7, BCUC IR 1.3.5.

Table 1: Condition Assessment Results for Components of Synchronous Condenser Units 1 to 4[87]

	Unit 1	Unit 2	Unit 3	Unit 4
Stator/Rotor	Fair/Poor	Offline due to rotor concerns	Not Assessed	Not Assessed
Exciter	Poor	Poor	Poor	Poor
Hydrogen related systems	Fair	Not Assessed	Not Assessed	Not Assessed
Protection and Control Systems	Poor	Poor	Poor	Poor
Power Transformers	Poor	Poor	Poor	Poor
Switchgear	Not assessed	Not Assessed	Not Assessed	Not Assessed

Each of the four units is identified as deteriorating in condition based on operating experience, inspection reports, operating hours since last overhaul, and historical performance.

BC Hydro further states that detailed inspection and testing were completed for each component noted as "not assessed" in the health assessment summary presented above. Further, certain equipment, such as the power transformers and exciters, has also been assessed for the entire station.[88]

BC Hydro acknowledges that condition assessments do not provide the life expectancy of the unit but rather, the remaining possible operating life before a major overhaul, refurbishment, or replacement is required. BC Hydro states that a unit's service life can be extended by a significant amount of time if there are no economic feasibility constraints for the Project.[89] BC Hydro estimates a cost of $5 to $6 million for continued BSY operation and maintenance each year.[90]

2.4.2 BSY Operational Risks

In addition to the three key Project drivers, BC Hydro states the Project is needed to address the following risks:

- Safety Risks: the BSY facility requires continuous onsite operation by 25 personnel. Employees at the BSY experience increased exposure to safety hazards. BC Hydro states personnel safety risks can be alleviated with the installation of proposed reactive power compensation equipment, which require occasional onsite inspections over the Project service life.[91]
- Reliability Risks: BSY currently manages a significant amount of total reactive power in the Lower Mainland. The Project allows BC Hydro to manage reactive power from four substations, thus improving operational flexibility of the BC Hydro transmission system.[92]

[87] Exhibit B-9, BCOAPO IR 1.7.1.
[88] Exhibit B-7, BCUC IR 1.7.1.
[89] Ibid., BCUC IR 1.3.1.
[90] Exhibit B-1, p. 2-20.
[91] Exhibit B-4, pp. 23-24.
[92] Ibid.

- Environmental Risks: the Project scope will include activities to reduce environmental related risks, such as removal of hazardous chemicals from the BSY and development of updated fire safety plans and fire detection in the retained BSY buildings.[93]

2.4.3 Interior to Lower Mainland 500 kV Transmission System Assessment Study

In 2016, BC Hydro completed a review (2016 Review) of its investment strategies for the BSY facility over the next 10 years.[94] Following this review, BC Hydro initiated the Interior to Lower Mainland 500 kV Transmission System Assessment Study (Transmission System Study) in 2021 to identify and assess the alternatives available for a functionally equivalent substitute for BSY.[95] Once the BSY facility is retired, BC Hydro states it would need to replace BSY's ability to supply reactive power at some time in the future, depending on future load conditions and resource plans.[96] The Transmission System Study considered substitutes of BSY that are economically feasible and provide the equivalent full reactive power output of BSY (+400 MVAr/-200 MVAr). The Transmission System Study confirmed the timing of the need for replacement of capacitive and reactive support following retirement of BSY vary under different scenarios. BC Hydro will need to replace the full capacitive supply from BSY (i.e., +400 MVAr) by 2031 to support the transfer capacity on the Interior to Lower Mainland system under its Base Case scenario.[97] Under other scenarios, the need to replace BSY's full ability to provide reactive power is advanced.[98]

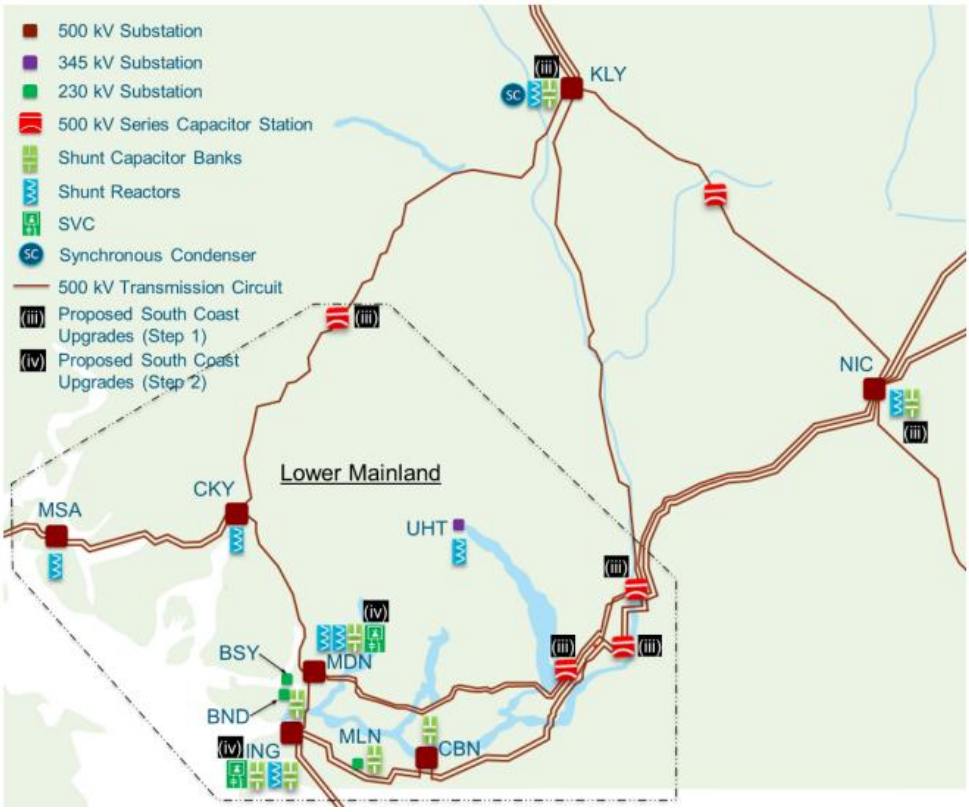
To meet the light load operating conditions of the Metro Vancouver Regional Transmission system, BC Hydro would need to immediately replace the full reactive power output of BSY (by 2026) following the retirement of the BSY facility.[99] BC Hydro states that additional reactive power support would also be required by 2026 to support the load growth in the Central Fraser Valley area.[100]

2.5 Future Reactive Power Compensation Requirements

BC Hydro states the Project is based on domestic load forecasts and firm transmission requirements[101] and clarifies that this Project does not compromise its current import and export capabilities.[102] BC Hydro states the Project is aligned with its 2021 Integrated Resource Plan (2021 IRP), which maps out the plan to meet the long-term reactive power compensation requirements of the South Coast region. After the Project is complete, additional projects called Step 1 and Step 2 will be required in the future as load grows in the region.[103]
BC Hydro provides the location and type of its existing reactive power resources and proposed transmission reinforcements for the South Coast region in Figure 3 below.

[93] Exhibit B-4, p. 29.
[94] Exhibit B-7, BCUC IR 1.2.2, Attachment 1, p. 20.
[95] Exhibit B-1, Appendix E-1. p.6
[96] the need dates for an equivalent BSY substitute in the Transmission System study are contingent upon BC Hydro's plan to stop BSY operations in fall, 2025.
[97] Exhibit B-9, BCOAPO IR 1.6.1.
[98] Exhibit B-1, p. 1-4.
[99] Ibid., p. 2-20.
[100] Ibid., Appendix E-1, p. 39.
[101] Ibid., p. 2-5.
[102] Exhibit B-12, BCUC IR 2.37.1.
[103] BC Hydro 2021 IRP proceeding, Exhibit B-1, p. 6-28.

Figure 3: Transmission Reinforcements in the South Coast Region[104]



BC Hydro provides estimated in-service dates of 2034 and 2040 for incremental upgrades to transmission lines serving the South Coast region under Step 1 and Step 2 respectively.[105] Step 1 and Step 2 would not be in service in time to replace BSY's full reactive power output after operations cease in 2025.[106] BC Hydro clarifies that the Project focuses on the replacement of the reactive power supplied by BSY until the next major system reinforcement would be required.[107] BC Hydro states that it expects to address all the future system reinforcement needs, including the scope of Step 1 and Step 2 upgrades in its 2025 Long-Term Transmission Plan.[108] BC Hydro states that the Step 1 and Step 2 projects assume that the Project has been approved and put into operation.[109] BC Hydro explains that it decoupled the Project from its Long-Term Transmission Plan as the results of its 2016 review recognized the need for significant investments to operate BSY beyond 2025 and because the reactive power capacity planned under its Long-Term transmission plan would not be installed in time for BC Hydro to avoid the need for these significant investments.[110]

In the short-term, BC Hydro states the Project will continue to meet the three key Project drivers, even with the new higher load forecasts provided in the 2021 IRP proceeding.[111] Further, BC Hydro states that its higher system peak load forecast and base resource plan, filed in updates to the 2021 IRP proceeding will not impact

[104] Exhibit B-12, BCUC IR 2.35.10.
[105] Ibid., BCUC IR 2.35.4.
[106] Ibid., BCUC IR 2.35.1.
[107] Ibid., BCUC IR 2.35.2.
[108] Ibid., BCUC IR 2.36.4.
[109] Exhibit B-1, p. 1-23.
[110] Exhibit B-12, BCUC IR 2.35.1.
[111] Ibid., BCUC IR 2.36.4.

the reactive power requirements during off-peak or light load operating conditions for the Metro Vancouver Regional Transmission System.[112]

BC Hydro states that the Project will satisfy the reactive support needs of the Central Fraser Valley system until approximately 2041 under a Reference load forecast scenario,[113] and until 2034 for the Interior to Lower Mainland transmission system under a Base Case scenario.[114]

Positions of the Parties

RCIA agrees with BC Hydro that additional reactive resources may be needed should its load growth forecast materialize in the Lower Mainland, Vancouver Island and Central Fraser Valley regions.[115]

RCIA submits there is a concern that due to the deteriorating condition of BSY, BC Hydro may cease to comply with Mandatory Reliability Standards in the future unless the condition of BSY is mitigated or the facility is replaced with other reactive power resources.[116]

BCOAPO submits that BC Hydro has acted prudently in questioning whether the system needs, which are currently addressed by BSY, can be more economically and appropriately addressed using alternative means.[117] BCOAPO notes the anticipated timing for the required refurbishments of BSY units between 2026 and 2029 and accepts BC Hydro's explanation as to why a separate project was required.[118] Furthermore, in the interest of efficiency, BCOAPO submits it is appropriate to consider the needs of the Central Fraser Valley system in conjunction with how best to supply the future reactive power support currently provided by BSY.[119]

The CEC submits that BC Hydro has adequately justified the need for relieving the current issues with reactive power and the replacement of BSY to support the power transfer capability of the transmission system for the Central Fraser Valley and Metro Vancouver Regional Area.[120]

The CEC accepts that changes to the load forecast will not diminish the need for the Project, but that future load forecasts may require additional reactive power resources.[121] In the CEC's view, projects for additional reactive power resources will be essential as BSY is reaching the end of its service life.[122]

The CEC further finds BC Hydro's condition assessments of the equipment and the costs to maintain it to be very well-documented.[123] The CEC considers it inappropriate for BC Hydro to continue to rely on BSY as a primary reactive power resource.[124] While the CEC accepts that BSY synchronous condenser units should be considered

[112] Exhibit B-14, BCOAPO IR 2.32.2.1.
[113] Exhibit B-7, BCUC IR 1.6.7.
[114] Exhibit B-12, BCUC IR 2.35.9.
[115] RCIA Final Argument, pdf p. 11.
[116] Ibid.
[117] BCOAPO Final Argument, p. 9.
[118] Ibid.
[119] Ibid., p.11.
[120] CEC Final Argument, p. 15.
[121] Ibid., p. 11.
[122] Ibid., p. 6.
[123] Ibid., p. 4.
[124] Ibid., p. 13.

at or near end of life, it suggests that having one or more units as a contingency backup resource may provide value and support deferral of remediation costs.[125] In reply, BC Hydro submits that, if the Project is approved, there is no need to continue any form of synchronous operations at BSY as the CEC suggests since the Project scope fully satisfies the need for reactive power. Further, BC Hydro submits that even if the remaining BSY units were used to provide contingency, continuing operation would result in substantial costs.[126]

Additionally, the CEC submits that the potential for export can and should be a relevant objective for the Project.[127] In the CEC's view, BC Hydro's ability to maximize its export capabilities will economically benefit its customers. The CEC recommends that the BCUC direct BC Hydro to file a post-approval report on its ability to maximize benefits from exports and Powerex trading. [128] The CEC also submits that BC Hydro should optimize its export and trading capabilities in future planning and projects.[129]

In reply to the CEC, BC Hydro submits that the Project and its objectives are consistent with BC Hydro's obligations under the Open Access Transmission Tariff (OATT). BC Hydro states that including the potential for exports that rely on non-firm transmission service as an objective of the Project would be inconsistent with BC Hydro's responsibilities under the OATT. BC Hydro also confirms that the Project is based on domestic load forecasts and firm transmission requirements and will not have a significant impact on BC Hydro's current import and export capabilities.[130]

Panel Determination

The Panel is satisfied with BC Hydro's methodology for evaluating the equipment health of BSY, which BC Hydro submitted it has used to perform condition assessments of other synchronous condenser units on its system.

The Panel accepts BC Hydro's evaluation and interveners' position that the BSY synchronous condenser units are near their end of life and that components have been evaluated as "Fair" or "Poor". The Panel sees no reason to disagree with BC Hydro's conclusion that the synchronous condenser units would need to be refurbished some time between 2026 and 2029 to sustain their function and continue to meet operational requirements.

The Panel accepts the Transmission System Study performed by BC Hydro that concluded that if BSY ceases to operate, BC Hydro would need to immediately replace BSY's ability to absorb reactive power to continue to be able to maintain voltage control for the Metro Vancouver Regional Transmission System. The Panel is satisfied that under the Base Case scenario, BC Hydro would need to replace BSY's ability to supply reactive power to maintain the transfer capability of the Interior to Lower Mainland Transmission System by 2031.

BC Hydro explains that the Project is a bridge between the near to mid-term reactive power compensation needs and the long-term reactive power compensation needs. The Panel notes that BC Hydro anticipates that a long-term Interior to Lower Mainland Transmission Plan would be available in 2025 reflecting updated load forecasts based on anticipated load growth in the region.

[125] CEC Final Argument, p. 12.
[126] BC Hydro Reply Argument, p. 12.
[127] CEC Final Argument, p. 8.
[128] Ibid., p. 10.
[129] Ibid.
[130] BC Hydro Reply Argument, pp. 6-7.

The Panel further agrees with the interveners that if BC Hydro's load growth forecast materializes, additional reactive resources may be needed. The Panel notes that the Project addresses only an interim need. The Panel encourages BC Hydro to plan for projects that can fulfill the long-term needs of the system to reduce the risk that interim projects may not be part of an optimal long-term solution.

As for the CEC's recommendation, the Panel disagrees with its request to direct BC Hydro to provide a post-CPCN-approval report on its ability to maximize benefits from electricity exports and optimize export capabilities. The Panel notes that BC Hydro is obliged to plan its Transmission System based on firm point-to-point transmission service under the OATT. The Panel agrees with BC Hydro's submission that target completion for projects should be based on domestic load forecasts and firm transmission requirements, and not on BC Hydro's ability to import and/or export non-firm power via its unregulated subsidiary. While the Panel agrees with the CEC that it would be valuable for BC Hydro's customers to receive economic benefits from excess power exports, the Panel considers this request to be outside of the scope of the Application and therefore declines making such direction to BC Hydro.

3.0 Description and Evaluation of Project Alternatives

BC Hydro initially identified six alternatives for the Project.[131]

1) Do nothing;
2) Retrofit the existing BSY Hydrogen-Cooled Synchronous Condensers to Air Cooling;
3) Construct a new 500 kV Transmission Line between Kelly Lake substation and Cheekye substation;
4) Substation Alternative;
5) Burrard Alternative; and
6) Hybrid Alternative.

BC Hydro initially considered all of these alternatives. However, for the reasons discussed below, it subsequently screened out the "do nothing," the "retrofit existing BSY hydrogen-cooled synchronous condensers to air cooling" and the "construct a new transmission line" alternatives in the conceptual stage of the assessment of Project alternatives.[132]

3.1 Alternatives Considered Not Feasible

Do Nothing Alternative

This alternative involves operating BSY without making any capital investments to replace or refurbish BSY assets and removing any malfunctioning or unsafe equipment from service. This approach was deemed not feasible as removal of synchronous condenser units would reduce BC Hydro's ability to manage reactive power and result in non-compliance with applicable standards.[133]

[131] Exhibit B-1, p. 3-1.
[132] Ibid., p. 3-5.
[133] Ibid.

Retrofitting the Existing BSY Synchronous Condensers from Hydrogen to Air Cooling

BC Hydro considered retrofitting the synchronous condenser units with air cooling as it would reduce the hazards of using hydrogen as a cooling medium. However, BC Hydro states it rejected this alternative because air is a less efficient cooling medium than hydrogen and could potentially reduce the existing capacity of BSY.[134] Further, BC Hydro cites the lack of operational history for synchronous condenser units under air cooling conditions and explains that it is unable to further verify the dependable capacity of air-cooling synchronous condenser units.[135]

Constructing a new 500 kV Transmission Line between Kelly Lake Substation and Cheekye Substation Alternative

BC Hydro considered the alternative of constructing a new 500 kV transmission line from Kelly Lake substation to Cheekye substation. The new transmission line would deliver power to Lower Mainland and Vancouver Island load centers. BC Hydro screened out this alternative as not feasible because the estimated cost of this alternative exceeds $600 million and because of the significant length of time required to implement this alternative.[136]

Through intervener IRs, several other alternatives were raised. Three of these are addressed below:

- "Run-to-fail" strategy with six operational BSY synchronous condenser units – this alternative refurbishes Unit 2 and converts Units 5 and 6 to synchronous condense mode to provide short-term reactive power. According to BC Hydro, this strategy may increase operating costs and pose challenges in planning for replacements, making this option imprudent and subject to heightened reliability, safety, and operational stability risks.[137]
- Converting BSY synchronous condenser units to generators – BC Hydro did not consider this option due to the *Clean Energy Act*, which prohibits reliance on the Burrard Generating Station without specific regulatory authorization. As no such authorization exists under the *Clean Energy Act*, this option was not explored.[138]
- Distribution connected shunt capacitors – BC Hydro states it has considered the application of lower voltage switched capacitors in Lower Mainland Distribution substations.[139] BC Hydro states distribution-connected capacitors are cheaper on a per MVAr basis.[140] BC Hydro provided a list of pros and cons for distribution and transmission-connected shunt capacitors, with more unfavourable items for distribution-connected shunt capacitors and more favourable points for transmission-connected shunt capacitors.[141]

[134] Exhibit B-1, p. 3-5.
[135] Exhibit B-9, CEC IR 1.8.7, RCIA IR 1.21.1.
[136] Exhibit B-1, p. 3-5.
[137] Exhibit B-9, RCIA IR 1.20.2.
[138] Exhibit B-12, BCUC IR 2.36.6.
[139] Exhibit B-9, RCIA IR 1.2.9.
[140] Exhibit B-14, BCOAPO IR 2.43.1.
[141] Exhibit B-9, RCIA IR 1.2.11.

3.2 Description of Feasible Alternatives

BC Hydro identified three feasible alternatives for the Project and evaluated them through its Structured Decision-Making (SDM) process. The three alternatives were: Substation, Burrard and Hybrid (Feasible Alternatives).[142] BC Hydro evaluated two options under the Substation Alternative: Meridian and Ingledow.[143] The Burrard Alternative also included two options: Refurbish and Replace.[144] Based on the results of its evaluation, BC Hydro selected the Meridian Option of the Substation Alternative as its preferred alternative to meet the Project needs (Preferred Alternative). This Project alternative includes scope of work to stop operations at BSY and install reactive power compensation equipment at different substations.

3.2.1 Substation Alternative: Meridian Option and Ingledow Option

BC Hydro states that it would install shunt capacitors and shunt reactors at various substations to replace BSY's capability and meet the reactive power requirements of the Central Fraser Valley system. As mentioned, the Substation Alternative considers two options to install equipment at different substations to manage reactive power in the Lower Mainland:

- The Meridian Option would include the installation of two +125 MVAr shunt capacitors on the 230 kV bus at Ingledow substation and two -132 MVAr shunt reactor banks on the 230 kV bus at Meridian substation. This option also includes the installation of a +125 MVAr shunt capacitor at Clayburn Substation and at McLellan Substation to meet the growing demand in the Central Fraser Valley area.
- The Ingledow Option would include installation of one +250 MVAr shunt capacitor on the 500 kV bus at Ingledow substation. Similar to the Meridian option, the Ingledow option also includes the installation of two -132 MVAr shunt reactors on the 230 kV bus at Meridian Substation, one +125 MVAr shunt capacitor at Clayburn substation and one +125 MVAr shunt capacitor at McLellan substation.

Only for the purposes of the SDM analysis, the Present Value (PV) of both options under the Substation Alternative[145] also includes costs to stop using BSY and to complete the following additional scopes of work:[146]

a) Design and construct a new switchyard control building; and

b) Remove unused assets at BSY and remediating the BSY site beginning in 2026.

BC Hydro states it included the cost of the additional scope items for the purposes of the SDM analysis but excluded them from the Project. According to BC Hydro, these further scopes of work will be carried out under separate projects.[147]

BC Hydro provides scope breakdown and cost estimates for decommissioning and remediation of operating and non-operating areas at BSY on a confidential basis. The total cost to decommission and remediate the operating area is publicly available and reviewed in Section 3.4.1 of this Decision.

[142] Exhibit B-1, p. 3-6.
[143] Ibid., p. 3-8.
[144] Ibid., p. 3-9.
[145] Ibid., p.3-8.
[146] Ibid., p.3-9.
[147] Ibid.

3.2.2 Burrard Alternative

Under the Burrard Alternative, BC Hydro would continue to run BSY until 2065 and install the necessary shunt capacitors to meet the reactive power requirements for the Central Fraser Valley. The Burrard Alternative includes two options so that BSY can reliably continue to provide reactive power to the transmission system until 2065:[148]

- The Refurbish Option would refurbish the four existing hydrogen-cooled BSY synchronous condensers. The ancillary systems and equipment required to operate BSY safely and reliably would also be refurbished or replaced as required.
- The Replacement Option would replace the four existing synchronous condensers with new, air-cooled synchronous condensers sized to match the capacity of the existing hydrogen-cooled units. The ancillary systems and equipment required to operate BSY safely and reliably would also be refurbished or replaced as required.

Similar to the Substation and Hybrid Alternatives, both options of the Burrard Alternative also include the installation of one +125 MVAr shunt capacitor at Clayburn and McLellan substations to meet Central Fraser Valley needs.[149]

Under the Burrard Alternative, BC Hydro explains that there would be no need to construct a new switchyard control building nor to decommission and remediate BSY since BSY would continue to operate until 2065.[150]

3.2.3 Hybrid Alternative

Under the Hybrid Alternative, BC Hydro would continue to make minimal investments necessary to safely and reliably operate BSY until 2035. By 2035, the necessary shunt capacitors and shunt reactors would be installed at Clayburn, Ingledow, Meridian, and McLellan substations to replace BSY's capabiltiy to manage reactive power on the transmission system. Similar to the scope of work for the Burrard and Substation Alternatives, the Hybrid Alternative also includes the installation of +125 MVAr shunt capacitors at Clayburn and McLellan substations.[151]

Only for the purposes of the SDM analysis, BC Hydro also includes costs of the following additional scope activities in the PV of the Hybrid Alternative:[152]

a) Design and construct a new switchyard control building; and

b) Remove unused assets at BSY and remediate the BSY site beginning in 2036.

BC Hydro chose a target date of 2035 to cease operations at BSY as part of the Hybrid Alternative to explore a middle ground between the Substation and Burrard Alternatives. BC Hydro explains that "using a 10-year timeframe (which is equivalent to a single long-term planning cycle) allowed a meaningful shift in the BSY

[148] Exhibit B-1, p. 3-9.
[149] Ibid.
[150] Ibid., p. 3-10.
[151] Exhibit B-2, p. 3-10.
[152] Exhibit B-1, p. 3-11.

investment timeframe to be explored requiring some level of additional risk management investment to maintain safe and reliable operations but not to the same extent as under the Burrard Alternative." [153]

3.3 Selection of Preferred Alternative for the Project

Based on the SDM analysis of the Feasible Alternatives (Substation, Hybrid, and Burrard Alternatives), BC Hydro proposes to select the Meridian Option of the Substation Alternative as its Preferred Alternative.[154]

BC Hydro provides the results of its SDM analysis in the following consequence table. The table illustrates the relative rankings of each Feasible Alternative compared to the Preferred Alternative (Substation Meridian Option) which is established as a reference point. In comparison to the Substation Meridian Option, green in the consequence table represents a superior ranking, red signifies a lower ranking and no colour suggests an equal ranking. BC Hydro does not assign quantitative weightings to the objectives, criteria, or outcomes in the consequence table[155] as shown in Table 2 below.

Table 2: Consequence Table: Alternative Analysis Results[156]

Worse	Better	Similar	Point of Comparison

Objectives	Criteria	Measure	Substation Alternative Meridian Option	Substation Alternative Ingledow Option	Burrard Alternative Refurbish Option[78]	Hybrid Alternative
Minimize Total Costs	Present Value of Total Cost	(PV)$-million	120.8	123.5	390.0	212.5
Maximize System Operational Flexibility	System Dynamic Response	High/Med/Low	Low	Low	Med	Med
	System Voltage Control	High/Med/Low	Med	Low	High	High
	Flexibility for System Maintenance or Forced Outage	High/Med/Low	Med	Low	High	Med
	Planned Outage Availability to Accommodate Construction	High/Med/Low	High	Med	High	High
	Opportunity for Future System Expansion	High/Med/Low	High	Med	Low	Med
Maximize System Reliability	Post Single Contingency Impacts – Remaining MVAr	MVAr	375	250	525	525 (before 2035) /375 (after 2035)
	Equipment Availability	High/Med/Low	High	High	Low	Low
	Stress on Equipment from High Voltage Equipment Switching	High/Med/Low	Med	High	Low	Med
	Impact on the 500 kV Transmission System	High/Med/Low	Low	Med	Low	Low
Minimize Risks to Occupation Health and Safety	Hazards During Construction	High/Med/Low	Low	Med	Low	Low
	Safety During Operation	High/Med/Low	Low	Low	High	Med
Minimize Impacts to Stakeholders	Impacts to Neighbors Resulting from Construction	High/Med/Low	Med	Low	Low	Med
	Interest in BSY Site Redevelopment	High/Med/Low	High	High	Low	Med
Minimize Environmental Impacts	Land Disturbance and Site Remediation	High/Med/Low	Low	Low	High	Med
Minimize Impacts to First Nations	Impacts to First Nations	High/Med/Low	Low	Low	Low	Low

BC Hydro explains that the consequence table excludes the Burrard Replacement Option due to relatively higher cost and safety risks compared to the Burrard Refurbish Option. BC Hydro considers the two Burrard options equal in all other respects. Therefore, only the Burrard Refurbish Option, deemed the superior choice, is included in the consequence table.[157]

[153] Exhibit B-7, BCUC IR 1.18.1.
[154] Exhibit B-1, p. 3-12.
[155] Exhibit B-7, BCUC 1.18.3.
[156] Exhibit B-1, p. 3-14, Table 3-3.
[157] Ibid., p. 3-7, footnote 69.

BC Hydro explains that it used the above consequence table to underscore the inherent trade-offs associated with selecting one viable alternative over another, then deliberated on these trade-offs by applying professional judgement to ultimately determine its Preferred Alternative.[158] BC Hydro submits that while the Burrard and Hybrid Alternatives both offer increased operational flexibility and system reliability relative to the Substation Alternative, the Substation Alternative ranked higher because it is cost-effective and has reduced safety risks and lower environmental impacts.[159] Further, BC Hydro states that while the Meridian and Ingledow options of the Substation Alternative are nearly identical in cost, the Meridian option emerged as the Preferred Alternative because it is anticipated to exceed the Ingledow option in performance with respect to controlling system voltage, mitigating post-single contingency impacts, and facilitating outage management for construction purposes.[160]

If the Burrard Alternative were the preferred alternative for the Project, it would provide a total of 650 MVAr of reactive power compensation on the system or an additional +150 MVAr (positive reactive power) more than the Substation Alternative. This additional +150 MVAr would increase the transfer capability of Interior to Lower Mainland by 75 MW[161] and likely defer the required in-service dates of projects planned under Step 1 and Step 2 upgrades by approximately one year. BC Hydro assumes that if it were to select the Burrard Alternative, there would be no changes to its required planning allowance of $780 million for Step 1 upgrades and $200 million for Step 2 upgrades under the base resource plan.[162]

3.4 Cost Comparison of Project Alternatives

BC Hydro provided cost estimates for each feasible alternative at a conceptual-level. The cost estimates conform to Association for the Advancement of Cost Engineering (AACE) Class 5 requirements and have an accuracy range of +100%/-35%). According to BC Hydro, it was appropriate to rely on Class 5 estimates to calculate the PV for the Substation, Burrard and Hybrid Alternatives. Due to the substantial cost differences between the alternatives[163] BC Hydro considers it is not necessary to proceed with further development of the design and planning for the decommissioning and remediation of BSY to generate a Class 4 estimate as contemplated under the CPCN Guidelines.[164]

The PV of the total costs for each alternative, broken down by different scopes of work, is provided in Table 3-4 of the Application and reproduced below. As shown in Table 3 below, the Meridian Option of the Substation Alternative has the lowest PV of total costs across all Feasible Alternatives.

[158] Exhibit B-7, BCUC IR 1.18.2.
[159] Exhibit B-1, p. 3-12.
[160] Ibid., p. 3-13.
[161] Exhibit B-7, BCUC IR 1.18.4.
[162] Exhibit B-12, BCUC IR 2.35.8.
[163] Exhibit B-3, Attachment 10, p. 47.
[164] Exhibit B-7, BCUC 1.12.2.

Table 3: PV of Costs for Each Alternative[165]

Present Value[80] ($-millions)	Substation Alternative		Burrard Alternative	Hybrid Alternative
	Meridian Option	Ingledow Option		
Substations Direct Capital Cost and Operations and Maintenance Cost	50.2	52.9	16.9	38.0
BSY Direct Capital Cost	0	0	233.3	62.5
BSY Cost to Remove Assets and Remediate Site and Switchyard Control Building Replacement	73.0	73.0	0	54.6
BSY Operations and Maintenance Cost and Property Taxes	(2.4)	(2.4)	139.8	57.4
Total	120.8	123.5	390.0	212.5

As previously discussed in Section 3.2 of this Decision, only for SDM analysis purposes, BC Hydro included in the PV for the Substation and Hybrid Alternatives the costs to decommission assets at BSY, remediate the BSY site and replace the switchyard control building. BC Hydro explains these costs are included because they would be necessary under any scenario that involves stopping operations at BSY, whether it occurs in 2025 with the Substation Alternative or in 2035 with the Hybrid Alternative. Since BSY is projected to remain in operation until 2065 under the Burrard Alternative, there would be no requirement to eliminate unused BSY assets or construct a new control building for the BSY switchyard. As a result, these aspects of the Project are excluded in the PV analysis for the Burrard Alternative.[166]

3.4.1 Cost Estimate to Remove Assets, Remediate Site and Replace Switchyard Control Building

To support the analysis of the PV cost of the Feasible Alternatives and to address the uncertainty surrounding the scope and timing of decommissioning and remediation activities, BC Hydro retained Wood Canada Limited (Wood) to prepare a conceptual-level cost estimate for decommissioning and remediating both the operating and non-operating areas of the BSY site under a "high cost scenario."[167] The accuracy range of this estimate is assessed at +100%/-35%, as per AACE Class 5 classification.[168] The $73 million cost shown in Table 3 under line item "Remove Assets and Remediate Site and Switchyard Control Building Replacement" represents the Class 5 estimate of the scope of work applicable to the BSY operating area under the "high cost" scenario and is excluded from the Project scope.[169]

BC Hydro explains that Wood used the follow assumptions to provide a "high cost" estimate:[170]

- All equipment removed;
- All structures removed to below grade;
- Soil and groundwater remediation to meet CSR Industrial Land Use and Aquatic standards;

[165] Exhibit B-1, Table 3-4, p. 3-17.
[166] Ibid., p. 3-10.
[167] Exhibit B-3, Attachment 10, p. 6.
[168] Exhibit B-12, BCUC IR 2.40.4.
[169]; Exhibit B-1, p. 3-17, Table 3-4; Exhibit B-4, pp. 40, 49; Exhibit B-7, BCUC IR 1.12.2.
[170] Exhibit B-12, BCUC IR 2.40.4.

- Worst case scenario for contaminated soil assumed; and
- All the above work would be undertaken as soon as practical after BSY stops operating, representing the high-end of the PV cost.

BC Hydro distinguishes between the operating and non-operating areas of BSY. Operating areas are currently utilized for synchronous condenser unit operations. Non-operating areas are no longer in use, and BC Hydro states that decommissioning activities for these areas can commence independently of the cessation of synchronous condenser unit operation.[171]

Regarding the costs for decommissioning and remediating the non-operating areas of BSY, BC Hydro decided not to factor them into the PV analysis of the alternatives. The rationale behind this exclusion by BC Hydro is that such costs are common to all alternatives and could be incurred at any point, given the cessation of operations in these areas.[172] Despite this, BC Hydro has chosen to refrain from initiating the removal of unused assets and the remediation of non-operational areas of BSY due to the substantial cost involved and the lack of sufficient information regarding the future utilization of the site.[173]

BC Hydro states that the costs associated with the removal of unused BSY assets and the remediation of the BSY site remain uncertain because they are contingent upon the future use of the site. The determination of which BSY infrastructure will be retained (or removed) depends on the specific needs and requirements of future users of the BSY site.[174]

BC Hydro states that apart from considerations related to site infrastructure retention and future use, factors like the degree of environmental remediation and changes in the status of leases from the Vancouver Fraser Port Authority (e.g., expiration or termination) could influence the costs and timelines associated with additional scopes of work.[175] BC Hydro explains that if operations at BSY cease for 12 months, regulatory requirements under the CSR will be triggered. Ceasing operations under the small parcel, which includes the gas control station, is likely if synchronous condensers at BSY are no longer operational. In the event of ceasing operations on the small parcel, BC Hydro must submit a Site Disclosure Statement within six months, triggering environmental investigations and potential remediation based on contamination levels and regulatory standards.[176]

Positions of the Parties

The CEC submits that it is satisfied with the BC Hydro analysis to remove the alternatives considered not feasible, with the exception that the CEC recommends an additional sub-option of the Hybrid Alternative for minimal continuance of functions at BSY and deferral of removal, remediation and restoration costs.[177] The CEC submits that additional cost savings can be achieved if BC Hydro optimizes the timing of removal, remediation and restoration works at BSY. In the CEC's view, BC Hydro could potentially realize savings of approximately $25

[171] Workshop Transcript Volume 1 Revised, p. 79.
[172] BC Hydro Final Argument, p. 47.
[173] Workshop Transcript Volume 1 Revised, p. 83.
[174] BC Hydro Final Argument, p. 45.
[175] Exhibit B-7, BCUC IR 1.10.4.
[176] Ibid., BCUC IR 1.11.2.
[177] CEC Final Argument, p. 19.

million (difference in cost for decommissioning, remediation, and control building relocation between the Hybrid Alternative and the Substation Meridian option) if the remediation of BSY is deferred to a time when the future use of site is fully known.[178] The CEC recommends that the BCUC direct BC Hydro to consider a separate sub-option under the Hybrid Alternative where costs for decommissioning and remediation are deferred until work to repurpose and redevelop the BSY site is fully defined. Alternatively, the CEC recommends that the Project be approved based on the Meridian Option, subject to a compliance directive that re-examines the existing remediation plan.[179] The CEC believes that decommissioning and remediation make up a substantial portion of the Class 5 cost estimate and that BC Hydro has options to manage the deferral of remediation expenditures to the benefit of ratepayers.[180]

In reply, BC Hydro submits that it appears that the CEC is suggesting that the Project scope be approved subject to the addition of one or more BSY units being kept in a contingency run to fail state. BC Hydro submits that if the Project is approved, there is no need to continue any form of operation of BSY units as the Project scope fully satisfies the need for reactive power.[181] BC Hydro notes that the CEC has not provided any support for its suggested $25 million in savings, as the lower decommissioning and remediation costs for the Hybrid Alternative are only achievable by making additional capital investments of $62.5 million into the BSY site.[182] BC Hydro also submits that it was not given the opportunity to address the costs of a Hybrid sub-option and notes that given the need to continue to operate and maintain BSY under this option, the total costs would be expected to be substantial.[183] BC Hydro argues there is no basis to the CEC's suggestions for BC Hydro to continue synchronous condenser unit operations at BSY or to take additional measures to attempt to defer decommissioning and remediation costs.[184]

The CEC agrees that the consequence table, provided in Table 2 above, clearly demonstrates the superiority of BC Hydro's preferred alternative, but notes that BC Hydro did not apply any weightings, thresholds, ranges or other quantitative measures.[185] The CEC recommends BC Hydro further develop its SDM methodology to include weighting and relative values of the criteria against each other.[186] The CEC submits that analysis of the costs as presented by BC Hydro lead to an "easy conclusion" that the Meridian Option of the Substation Alternatives is the best alternative. However, the CEC notes that this Project is "41.5% about reactive power reinforcement and 58.5% about removals and remediations." The CEC recommends that a more fulsome review of the removal and remediation issues is needed to confirm what work might be deferred to effect savings.[187]

In reply, BC Hydro submits that it disagrees with the CEC on the need for additional quantification to improve the comparison of Feasible Alternatives. BC Hydro argues that the quantification of the PV of total costs along with the 'high/medium/low' measures for other criteria was enough to make the decision on the Preferred Alternative. BC Hydro submits it will continue to provide quantifiable measures wherever possible and will aim to provide context for qualitative measures. BC Hydro further submits measures and weightings are only

[178] Ibid., pp. 26-28.
[179] Ibid., pp. 19, 30.
[180] Ibid., pp. 23,27.
[181] BC Hydro Reply Argument, p. 12.
[182] Ibid., p.15.
[183] Ibid.
[184] Ibid., p. 16.
[185] CEC Final Argument, p. 21.
[186] Ibid., p. 20.
[187] Ibid., p. 23.

applicable if a decision is complicated enough to not yield answers otherwise. BC Hydro notes the CEC's agreement that the consequence table (see Table 2 above) demonstrates the superiority of the Preferred Alternative.[188]

RCIA submits BC Hydro's feasibility assessment to screen out alternatives appears appropriate and reasonable due to potential financial and operational risks.[189]

RCIA submits that BC Hydro acknowledges that the Meridian Option of the Substation Alternative, is functionally inferior to the Burrard Alternative. RCIA summarizes the technological limitations of the shunt compensation equipment compared to the synchronous condenser as follows:[190]

1. System Dynamic Response: shunt compensation equipment controls reactive power in large discrete blocks which lack real-time control and have slower dynamic response.
2. System Voltage Control: as the system voltage falls below its nominal operating range, the ability of switched shunt capacitors to support system voltage decreases.
3. Post Single Contingency Impacts: over-penetration of shunt capacitors introduces operational challenges such as increased risk of voltage collapse under severe contingencies like loss of the US interties during high imports.

RCIA submits that the Meridian Option of the Substation Alternative is "an economically acceptable functional compromise **if and only if** the resulting scope and cost of the BSY decommissioning and site remediation are shown to be immaterial" in comparison to the overall Project scope and cost.[191] RCIA believes the key issue is whether the Project, as presently proposed, is the most cost-effective option.[192]

In reply, BC Hydro states it has addressed RCIA's submissions about "required" site remediation and continues to acknowledge uncertainty in the scope and cost of any potential site remediation. BC Hydro submits that RCIA does not identify any evidence that casts doubt on Wood's decommissioning and remediation estimate or on BC Hydro's SDM process, which considers the potential scope and costs associated with the future use of the BSY site.[193]

BCOAPO submits that the alternative of distribution-connected shunt capacitors should have been included in BC Hydro's structured analysis, particularly considering the Central Fraser Valley system needs. BCOAPO notes that while transmission-connected shunt devices have a number of operational advantages, distribution-connected shunt capacitors are cheaper on a cost per MVAr basis.[194]

In reply, BC Hydro submits that although distribution-connected shunt capacitors are less expensive on an equipment-only basis, they are not less expensive overall. Further, BC Hydro submits that transmission-

[188] BC Hydro Reply Argument, p. 9.
[189] RCIA Final Argument, pdf p. 12.
[190] Ibid., pdf pp. 13-14.
[191] Ibid., p. 14.
[192] Ibid., pdf p. 11.
[193] BC Hydro Reply Argument, p. 21.
[194] BCOAPO Final Argument, p. 13.

connected shunt capacitors have numerous benefits. BC Hydro notes that BCOAPO had the opportunity to ask further IRs about this selection but chose not to do so.[195]

Regarding BC Hydro's selection of the Meridian Option of the Substation Alternative, BCOAPO notes the cost of the Hybrid Alternative is almost twice that of the Preferred Alternative, while the cost of the Burrard alternative is more than three times that of the Preferred Alternative. BCOAPO further notes BC Hydro's view that all alternatives meet operating requirements, and that the cost savings of the Preferred Alternative "overwhelmed any minor relative benefits of the Burrard Alternative."[196] BCOAPO submits it is unlikely that updated cost estimates from Class 5 to Class 3 for the feasible alternatives would change the rankings. Regarding the remediation costs, BC Hydro has noted that the relative rankings would not be impacted even if remediation costs are 300 percent of the estimated costs.[197] BCOAPO submits that the additional 150 MVAr of reactive compensation under the Burrard alternative does not justify the additional cost.[198] BCOAPO submits it agrees with BC Hydro's selection of the Meridian Option of the Substation Alternative as the Preferred Alternative.[199]

BCOAPO submits that BC Hydro's decision to exclude the work and costs related to the decommissioning and remediation of the BSY site from the scope and costs of the Project is appropriate, based on the information known or knowable at this time.[200] BCOAPO also notes that the impact of the Project on remediation requirements is limited to, at most, the small land parcel and the leased land of BSY. However, even with respect to these land parcels, given the uncertainty as to whether remediation will be required, BCOAPO considers it would be inappropriate to include the work and cost for remediation as part of the current Project.[201]

Panel Determination

The Panel accepts BC Hydro's evaluation and interveners' position that unfeasible alternatives were appropriately screened out when selecting the Feasible Alternatives for more detailed analysis. BC Hydro appropriately rejected the following alternatives as unfeasible:

- Do nothing alternative;
- Retrofitting the existing BSY synchronous condensers from hydrogen to air cooling; and
- Constructing a new 500 kV transmission line between Kelly Lake substation and Cheekye substation.

However, the Panel does not accept BC Hydro's methodology for assessing the Feasible Alternatives because BC Hydro's application of its SDM process was largely qualitative in nature and did not clearly differentiate between the different alternatives.

BC Hydro submits that to evaluate the three Feasible Alternatives for the Project, BC Hydro identified a set of seven objectives which considered the need for the Project. Each objective was further subdivided into one or more underlying criteria to a total of sixteen criteria. Each Feasible Alternative was assessed against each individual criterion using a simple scale (or measure, e.g., High/Medium/Low). One criterion was purely financial

[195] BC Hydro Reply Argument, pp. 10-11.
[196] BCOAPO Final Argument, p. 23.
[197] Ibid., p.24.
[198] Ibid., p. 25.
[199] Ibid., p. 26.
[200] Ibid., p.20.
[201] Ibid., pp.19-20.

(minimize total cost) and the remaining criteria represented non-financial attributes. BC Hydro's Application did not provide relative weights for each criterion or each objective, and therefore, there was no evidence that one criterion was more or less important than another.

In the Panel's view, by opting for a simple scale to evaluate each Feasible Alternative against each individual criterion, not providing numerical scores, nor using relative weights, BC Hydro's application of its SDM process was largely qualitative in nature. The Burrard Alternative was superior in 10 out of 15 non-financial criteria and the Meridian Alternative was superior in 9 out of 15 non-financial criteria. Therefore, the Panel considers that a clear Preferred Alternative was not selected based on the non-financial criteria set out in BC Hydro's SDM process. Contrary to BC Hydro's submission, the Panel finds that the application of weights should have been used in BC Hydro's SDM process since the decision to determine the Preferred Alternative is complicated enough to not yield easy answers to the trade-off methods.

Nonetheless, BC Hydro selected the Meridian Option of the Substation Alternative as the Preferred Alternative based on BC Hydro's assessment of that option as the lowest cost alternative that minimizes overall safety risks and environmental impacts. By doing so, it appears that BC Hydro attributed a greater weight to the financial criterion than to increased operational flexibility and system reliability objectives. This is reinforced by the fact that BC Hydro rated both the Burrard and Hybrid Alternatives higher than the Meridian Option of the Substation Alternative in terms of operational flexibility and system reliability, but nonetheless chose not to adopt either of the former alternatives as its Preferred Alternative.

The Panel disagrees with BC Hydro's submission that for the Project, the quantification of the PV of total costs along with "High/Medium/Low" measures for the non-financial criteria, was enough to justify its decision on the Preferred Alternative. The Panel does not accept BC Hydro's SDM process used in this Application and finds it to be inappropriate in this instance. The Panel agrees with the CEC's submission that BC Hydro should further develop its SDM to provide quantitative values and better facilitate the weighting and relative values of the criteria versus each other and to the Project as a whole. Overall, the Panel finds that BC Hydro's evidence and its application of the SDM process do not adequately support the selection of the Substation Alternative (Meridian Option) as the best alternative.

The Panel considers that BC Hydro's selection of the Preferred Alternative seems to rely principally on the PV of the least expensive alternative, as the Burrard Alternative ranked higher than the Substation Alternative in its assessment of the non-financial criteria. The Panel finds BC Hydro's comparison of the PV between alternatives to be incomplete because it did not include all applicable Project scope in the cost estimate of each alternative, and it did not account for the wide cost accuracy range of the Class 5 cost estimates. For these reasons, the Panel does not accept BC Hydro's selection of the Preferred Alternative based solely on BC Hydro's assessment of the least-cost alternative.

Furthermore, although BC Hydro submits that the Substation Alternative was the least cost amongst its Feasible Alternatives, its evaluation of the alternatives only accounted for the cost of the implementation of each alternative and the costs associated with decommissioning and remediation costs of the operating plant at BSY. Most notably, BC Hydro's evaluation of alternatives did not consider the cost of decommissioning and remediation of the non-operating plant at BSY.

The Panel considers that for the comparison of the Feasible Alternatives, the scope of work should include the decommissioning and remediation activities of the BSY site, because this work has a material impact on the cost consideration of the Feasible Alternatives. For the comparison of the Feasible Alternatives, BC Hydro included the costs to remove the unused BSY assets and remediate the BSY site as it relates to the operating plant. The Panel finds that BC Hydro's failure to include the decommissioning and remediation costs of the non-operating areas at BSY resulted in an incomplete assessment of the Feasible Alternatives with respect to the total cost of the Project. The Panel considers that, for the effective scrutiny of the alternatives, the BCUC should have a view of the full costs of implementing the alternatives, and these costs include the full decommissioning and remediation of the entire BSY site if the site were to stop operating.

BC Hydro submits that conceptual-level cost estimates (namely, AACE Class 5, accuracy range of +100%/-35%) were applied in the comparison of the PV of the Feasible Alternatives. However, in its evaluation, BC Hydro did not include the accuracy range of the conceptual-level cost estimates. The Panel notes that once the additional scope of decommissioning and remediation of non-operating areas at BSY (the costs for which were filed confidentially by BC Hydro) is added to each Feasible Alternative, the resulting Class 5 cost estimate ranges overlap. Therefore, based on the wide Class 5 cost range of the Feasible Alternatives, the Panel is not persuaded that BC Hydro appropriately selected the best alternative.

The Panel notes that the BCUC's CPCN Guidelines state that cost estimates used in the economic comparison of Feasible Alternatives should have at least a Class 4 degree of accuracy. The Panel acknowledges that in the past, the BCUC has accepted economic comparisons based on Class 5 cost estimates when the preferred alternative was clearly superior to other alternatives based on the results of BC Hydro's SDM analysis and its economic assessment. In this case, however, the Panel is not persuaded by the choice of Preferred Alternative based on the overlapping Class 5 estimate ranges, especially when BC Hydro's SDM assessment of the financial and non-financial criteria was unpersuasive to say the least.

In short, the Panel is not satisfied that BC Hydro's Preferred Alternative, namely, the Substation Alternative (Meridian Option), is the best alternative to meet the need to manage reactive power on its transmission system.

Specifically, the Panel considers that to differentiate between the evaluated Feasible Alternatives more clearly, BC Hydro needs to conduct a quantitative assessment of the different alternatives based on weighted selection criteria, combined with Class 4 cost estimates for each alternative as contemplated under the BCUC's CPCN Guidelines, for the full scope of work (i.e., including decommissioning and remediation of the entire BSY site in this instance).

4.0 Project Description

4.1 Project Scope

The Project scope includes the replacement of reactive power facilities at BSY with the following high-voltage reactive power compensation equipment:[202]

- Two shunt capacitor banks (+125 MVAr each, +250 MVAr in total) at the Ingledow substation;

[202] Exhibit B-1, p. 1-6.

- One shunt capacitor bank (+125 MVAr) at McLellan substation;
- One shunt capacitor bank (+125 MVAr) at Clayburn substation; and
- Two shunt reactors (-132 MVAr each, -264 MVAr in total) at Meridian substation.

Based on the scope outlined above, the Project will install total capacitive power of +500 MVAr from shunt capacitor equipment and total reactive power of -264 MVAr from shunt reactor equipment. BC Hydro states it determined the locations of the proposed shunt reactor and shunt capacitors in the Transmission System Study and Central Fraser Valley Assessment during the conceptual design stage based on four factors:[203]

1. The known system configuration;
2. The long-range load forecast used for study purposes;
3. BC Hydro's Base Resource Plan; and
4. Mandatory Reliability Standards (MRS) compliance requirements.

While BC Hydro states that locations of the shunt capacitor banks are finalized from a design perspective,[204] significant changes to its load forecast could trigger the need for a refreshed assessment for the Central Fraser Valley Transmission System.[205] BC Hydro defines significant change as a new reference case forecast that exceeds all sensitivity scenarios in the Central Fraser Valley Assessment. BC Hydro states that such a situation is unlikely to occur.[206]

To facilitate the installation of shunt reactor and shunt capacitor banks, the following installations will also need to be completed:[207]

- Bus work at the Meridian, Ingledow, McLellan and Clayburn substations;
- Circuit breakers at Meridian, Ingledow, McLellan and Clayburn substations;
- Manual disconnect switch(es) at Clayburn substation;
- Motor operated disconnect switches;
- Surge arrestor(s) at Clayburn and Meridian substations; and
- Capacitor voltage transformer(s) at Clayburn, Ingledow and Meridian substations.

In addition to the scope of work summarized above, additional P&C, electrical and civil works will also need to be completed as part of the Project.[208] A summary of these construction works including key Project activities at each of the substations is provided in Chapter 4 of the Application and outlined in the table prepared by BCUC Staff below.

[203] Exhibit B-7, BCUC IR 1.21.10.
[204] Ibid., BCUC IR 1.21.7.
[205] Ibid., BCUC IR 1.21.1.1.
[206] Exhibit B-12, BCUC IR 2.36.1.
[207] Exhibit B-1, p. 4-5, Table 4-1; p.4-8, Table 4-2; p. 4-11, Table 4-11; p. 4-14, Table 4-14.
[208] Exhibit B-1, p.4-2.

Table 4: Summary of Construction Scope Activities at Substations[209]

Project Activity	Summary of Project Activity
Access Road	The existing Ingledow access road will be re-routed to facilitate the new equipment installation.
Control Room Flooring	Floor tiles containing asbestos will be replaced at each substation.
Drainage	The existing McLellan drainage system will be modified to accommodate the re-graded site. The existing Meridian perimeter ditch will be re-aligned and the disposal field within site expansion will be removed.
Firewall	A pre-fabricated three-hour fire-rated firewall system will be installed to mitigate fire risk at both Clayburn and Meridian.
Foundations	Foundations will be installed at each site to support new equipment.
Grounding	New ground grid will be installed at Meridian. The existing ground grid will be extended at Ingledow.
Lightning Protection	Shield wires and lightning poles will be installed at all substations.
Oil Containment System	A new oil containment system will be installed for the two new shunt reactors at Meridian.
Protection and Control	New standard protection and control panels will be installed at Clayburn, Ingledow and McLellan. New bus and reactor protection panels will be installed at Meridian. Reactive power control schemes will be modified as required.
Security	One existing security camera pole will be relocated at Meridian.
Site Grading	Site grading and excavation work will be completed at each substation as necessary.
Spare Equipment	Additional 5% of shunt capacitor units will be stored at Clayburn, Ingledow and McLellan.
Steel Structures	New steel structures will be installed for the new equipment at Clayburn and McLellan.
Supervisory Control and Data Acquisition System	Updates and additions to the existing supervisory control and data acquisition system will take place at Clayburn, McLellan and Meridian.
Telecommunications	Additions and modifications to the telecommunications system at Clayburn, McLellan and Ingledow.

As already noted, the Project scope will include specific work at BSY to stop operations, make the site safe, and mitigate immediate environmental risks for a two-year period after stopping operations.[210]

Key Project activities to stop operations to manage reactive power at BSY include:[211]

- Removing hazardous chemicals and materials from site;
- Preparation of a Stage 1 Preliminary Site Investigation Report to support submittal of a Site Disclosure Statement to the BC Ministry of Environment and Climate Change Strategy;

[209] Exhibit B-1, pp. 4-7, 4-10, 4-13, 4-17.
[210] Ibid., p. 4-17.
[211] Ibid., p. 4-19.

- Disconnecting/disposing of computers and other programmable devices as per MRS cybersecurity requirements;
- Disconnecting the main power supply to the BSY site; and
- Developing new fire safety plans and updating fire detection in the retained buildings.

Please see Section 4.3 for the Panel's discussion of the impact of the scope and cost information exclusions from the Project.

4.2 Project Cost and Rate Impact

4.2.1 Capital Cost Estimate

The Project has a total cost range of $85.8 million to $129.5 million. This cost range is based on an expected cost[212] of $102.46 million (Expected Cost) and an authorized cost of $129.55 million (Authorized Cost).[213] The Expected Cost estimate is based on preliminary design and conforms to AACE International Class 3 cost estimate requirements with an estimated accuracy range of +21% to -16%.[214]

The Project cost range includes actual costs to date and forecast direct construction costs, indirect construction costs, contingency and reserves, escalation, interest during construction and capital overhead.

A summary of the total estimated Project costs is provided in Table 4-7 of the Application and reproduced in Table 5 below with redacted confidential information.

[212] The Expected Cost is defined as the estimated cost at a P50 confidence level, as defined in AACE International Recommended Practice 10S 90, which indicates "an expected 50% probability that the final result will be less than (i.e. more favorable) or equal to the P50 value."
[213] The Authorized Cost is equivalent to the estimated cost at the P90 confidence level plus any Special Reserves. A P90 confidence level indicates an expected 90% probability that the final result will be less than or equal to the P90 value.
[214] Exhibit B-1, p. 4-33.

Table 5: Project Cost Range and Breakdown[215]

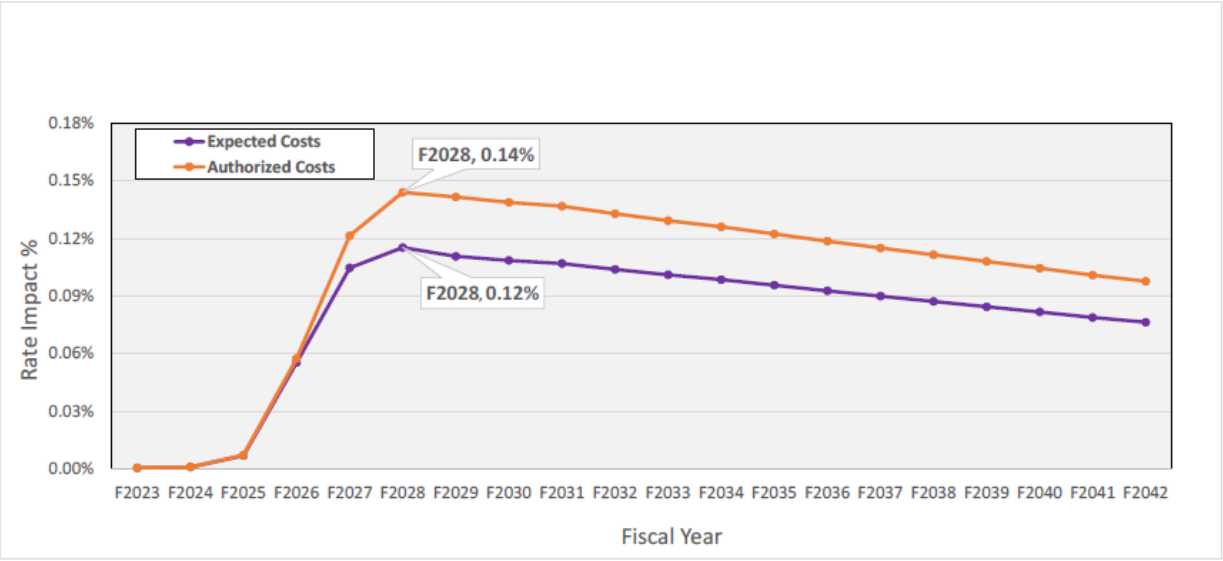
Row No.	Description	Cost Estimate ($ million)[108]
	Pre-Full Implementation Phase Costs[109]	
1	Identification	[redacted]
2	Definition	[redacted]
3	Partial Implementation[110]	[redacted]
4	**Total Pre-Full Implementation Phase Costs**	[redacted]
	Remaining Implementation Phase Costs[109]	
	Remaining Implementation Phase Direct Construction Costs	
5	McLellan Substation	[redacted]
6	Clayburn Substation	[redacted]
7	Ingledow Substation	[redacted]
8	Meridian Substation	[redacted]
9	Burrard Synchronous Condenser Station[111]	[redacted]
10	**Total Remaining Implementation Phase Direct Construction Costs**	[redacted]
	Remaining Implementation Phase Indirect Construction Costs	
11	General Management	[redacted]
12	Engineering & Design	[redacted]
13	**Total Remaining Implementation Phase Indirect Construction Costs**	[redacted]
14	**Total Remaining Implementation Phase Costs**	[redacted]
15	Total Before Contingency & Loadings	[redacted]
16	Contingency	[redacted]
17	Escalation	[redacted]
18	Capital Overhead	[redacted]
19	Interest During Construction	[redacted]
20	**BC Hydro Expected Amount[112]**	**102.46**
21	Project Reserve, including Special Reserve of $9.7 million	**27.09**
22	**BC Hydro Authorized Amount**	**129.55**

4.2.2 Rate Impact

The Project will impact BC Hydro's revenue requirements, including amortization and finance charges. BC Hydro performed a rate impact analysis and estimates a rate impact of 0.12 percent in fiscal 2028.[216] BC Hydro identifies the cumulative incremental rate impact as the total rate increase relative to the fiscal 2023 rates.[217] BC Hydro provides the rate impact analysis for the Project in Figure 4 below:

[215] Exhibit B-1, Table 4-7, pp. 4-33–4-34.
[216] Ibid., p. 4-39.
[217] Ibid., p. 4-39, footnote 116.

Figure 4: Project Rate Impact – Expected and Authorized Cost[218]



For both the Expected Cost estimate and Authorized Cost estimate, there is an initial increase in BC Hydro's revenue requirements in the early years as the assets are placed in service. The incremental rate impact declines after fiscal 2028 because of lower finance charges resulting from amortization recovered from ratepayers over time.[219]

4.3 Exclusion of BSY Decommissioning and Remediation Costs from Project

As discussed in Section 3.4 above and notwithstanding the BCUC's CPCN Guidelines, BC Hydro retained Wood to prepare a Class 5 cost estimate at an accuracy range of +100%/-35% for relocating the control building, and decommissioning and remediating the BSY site.[220] However, BC Hydro excluded this estimate from the Project cost and explains its reasons for excluding all BSY decommissioning and remediation costs from the scope of work for the Project as follows:[221]

- The decommissioning and remediation and Project scopes of work, costs and timing are not linked together in any way that would suggest the decommissioning and remediation scope of work and Project scope of work should be combined;[222]
- The scope and costs of decommissioning and remediating BSY, if required, will ultimately be determined by the future use of the BSY site, which has not yet been determined;[223]
- There is a substantial disconnect between the timing and schedule of the current scope of the Project and the decommissioning and remediation of the BSY site;[224] and

[218] Exhibit B-1, p. 4-38.
[219] Ibid., p. 4-39.
[220] Exhibit B-12, BCUC IR 2.40.4; Exhibit B-3, Attachment 10, p. 39.
[221] Ibid., BCUC IR 2.40.1.
[222] Ibid., BCUC IR 2.32.3.
[223] Ibid.
[224] Ibid.

- The inclusion of decommissioning and remediation in the scope of the Project, as it stands, would lead to delays and unnecessary costs for continuing to run BSY.

BC Hydro states that it would be unable to provide an updated rate impact analysis under a scenario where BSY decommissioning and remediation is included in the Project cost because a Class 3 cost estimate cannot be prepared for this work, based on the information currently available.[225] In addition, BC Hydro states that it was unable to comment on whether the rate impact of any decommissioning or remediation costs would be based on net salvage accounting.[226]

BC Hydro maintains that the Class 3 cost estimate for the Project is complete and accurate as it currently stands and the scope of work necessary to decommission and remediate BSY does not affect either the completeness or accuracy of the cost estimate. BC Hydro further explains there is insufficient information available at this time to prepare a Class 3 cost estimate for the decommissioning and remediation work at BSY.[227] BC Hydro states that it plans to develop a Class 3 cost estimate for decommissioning and remediation activities at a later date as part of the Burrard Facility Dismantling Project (Dismantling Project).[228] BC Hydro had planned to initiate the Dismantling Project in 2023 and complete the identification and definition phase activities for decommissioning and remediating BSY leading up to and including a Class 3 cost estimate by 2026.[229] BC Hydro states the scope of the Dismantling Project will ultimately be determined by the future use of the BSY site and will not be influenced in scope, design, costs or risks by this Project.[230] BC Hydro further explains that it has not conducted any further cost-benefit analyses or risk assessments to evaluate the timing of site remediation but plans to do so within the Dismantling Project.[231]

BC Hydro has also initiated the Burrard Control Building Relocation Project (Control Building Project) in 2022.[232] BC Hydro states that if it proceeds with decommissioning the turbine building at BSY, it will be necessary to relocate the protection and control equipment that supports the switchyard to a newly constructed control building within the switchyard, due to the deteriorated condition of the current building.[233]

BC Hydro is initiating and prioritizing these projects such that the BSY site is available for an alternate use as soon as practical after stopping operation of BSY at the end of 2025, subject to the BCUC's decision on the Project.[234]

BC Hydro states that the Project, the Control Building Project and the Dismantling Project are not sufficiently linked to be reviewed as part of the same CPCN process. BC Hydro asserts that the Project is not dependent on either of the other two projects. BC Hydro states that while the need for the Dismantling Project depends on whether the Project is approved, they are otherwise independent. While the Control Building Project could proceed at any time, its timing could be influenced by the future use of the BSY site. Apart from that, the Control Building Project is completely independent. BC Hydro states there is no connection between the projects from a

[225] Exhibit B-12, BCUC IR 2.40.4.1.
[226] Ibid., BCUC IR 2.40.4.1.1.
[227] Ibid., BCUC IR 2.40.4.
[228] Ibid., BCUC IR 2.40.4.2
[229] Ibid.
[230] Ibid., BCUC IR 2.32.3
[231] Ibid., BCUC IR 2.39.2
[232] Exhibit B-7, BCUC IR 1.10.2
[233] Workshop Transcript Volume 1 Revised, p. 76.
[234] Exhibit B-7, BCUC IR 1.10.2.

system planning or operational perspective, and that there is a substantial disconnect between the schedule and timing of each. BC Hydro states it has addressed the linkage between the projects by including the relevant costs and characteristics in its SDM process.[235]

Since the future use of the BSY site is uncertain, BC Hydro assumes under its "high cost scenario" from the Wood conceptual cost estimate that decommissioning and remediation would involve removing all equipment and structures to below ground level and remediating soil and groundwater to meet CSR industrial land use standards.[236] However, BC Hydro explains that the extent of work required would be dependent upon the future tenant's requirements. If a future tenant only needs part of the property, there may not be a requirement to remove any or all of the above and below ground structures, or to complete soil and groundwater remediation as mandated by regulations.[237] As such, BC Hydro states its responsibility for any decommissioning and remediation has not been determined.[238]

While BC Hydro identifies a low risk with deferring site remediation, it also recognizes potential increases to remediation requirements over time due to increase in contaminant mitigation and regulatory standards relating to soil and groundwater remediation.[239] BC Hydro states that it is not under any current obligations to remove unused assets from, or remediate, the BSY site.[240] BC Hydro states that if it were to start removing assets and remediating the accessible areas of the BSY site now, it would increase the likelihood of undertaking unnecessary work, potential mobilizing and demobilizing costs, and any additional safety risks associated with commencing work prior to the future use of the site being determined.[241]

Positions of the Parties

BCOAPO agrees with BC Hydro's decision to exclude the work and costs related to the decommissioning and remediation of the BSY site from the scope and costs of the Project.[242] BCOAPO notes that the future use of the site remains unknown, therefore the scope of the Dismantling Project is also unknown.[243] As BC Hydro has explained, the need for remediation is governed by the CSR, whose regulatory requirements apply depending on whether the BSY is used within 12 months following the termination of operations at the site, and if future environmental assessment results determine the site to be 'high risk'.[244] BCOAPO notes that given the uncertainty as to whether remediation will be required and, if so, the magnitude of that cost, BCOAPO considers it would be inappropriate to include the work and cost for remediation as part of the current Project.[245] BCOAPO submits it has no issues with the proposed Project cost.[246]

RCIA submits that the evidence shows that the Project scope includes decommissioning and remediation activities of at least some portions of the BSY site which form an integral part of the Project as they directly link

[235] Exhibit B-12, BCUC IR 2.32.3.
[236] Workshop Transcript Volume 1 Revised, p. 76.
[237] Exhibit B-12, BCUC IR 2.39.5.1.
[238] Ibid., BCUC 2.32.1.
[239] Ibid., BCUC IR 2.41.5.
[240] Exhibit B-7, BCUC IR 1.11.2.
[241] Exhibit B-12, BCUC IR 2.39.5.1.
[242] BCOAPO Final Argument, p.17.
[243] Ibid., p. 20.
[244] Ibid., p.18.
[245] Ibid., pp. 19-20.
[246] Ibid., p. 30.

to the retirement of BSY. RCIA cites examples from BC Hydro's evidence that the scope of work includes work required to make the BSY site safe and mitigate immediate environmental risks. RCIA submits that these activities mean site remediation. RCIA cites that BC Hydro confirmed site remediation would be triggered "when all operation on a parcel of land stops." RCIA submits that the inclusion of decommissioning and remediation in the Project alternative analysis is further evidence of the link between the Project and BSY decommissioning and remediation. RCIA notes that remediation works will be triggered once operations stop at BSY and as such, the approval of this Project will trigger an undefined scope of work.[247]

RCIA further notes that lack of sufficient information on the scope and cost of BSY site remediation obscures and understates the Project's scope and cost. RCIA points out that BC Hydro "refuses to provide any assurance" on the upper limit of remediation costs. RCIA submits BC Hydro has a lack of understanding of the regulatory requirements related to the remediation of the site pending further site investigations. RCIA notes that lack of sufficient scope and cost information available for BSY decommissioning and remediation could result in potentially higher costs to ratepayers than indicated in the Application.[248] RCIA accordingly submits that the Project should not be permitted until the scope and costs associated with the decommissioning and remediation of the BSY site are better understood.[249]

In reply, BC Hydro submits that RCIA's evidentiary references do not support its assertion that substantial site remediation is triggered by the retirement of BSY or that its activities form an integral part of the Project.[250] BC Hydro refutes RCIA's assertion that the Project will trigger remediation activities, stating that remediation of land parcels will likely be triggered under the CSR process once operations at the land parcel stop for a period of 12 months. However, several further steps then need to take place before there is a possibility of mandated remediation.[251] BC Hydro explains the Project will not stop operations at BSY completely as BC Hydro will continue to operate the Burrard switchyard on the large land parcel and the gas control station on the small land parcel.[252] BC Hydro submits that RCIA does not address how there is a risk that the scope or costs of the decommissioning and remediation work will be materially higher such that it would make a material difference to the $270 million difference in the PV of the total cost between the Substation and the Burrard Alternatives.[253]

The CEC agrees with BC Hydro that costs related to the decommissioning and remediation of the BSY site are not appropriately tied to the Project.[254]

The CEC submits that deferral of decommissioning and remediation costs could achieve further cost savings for the Project and result in the Project falling under the CPCN threshold.[255] In response to the CEC's suggestion that the Project may not have met the CPCN threshold, BC Hydro clarifies that any decommissioning and remediation costs associated with the BSY site will not be part of the Project scope and that the existing CPCN threshold would be exceeded for the Project regardless of decommissioning and remediation costs.[256]

[247] RCIA Final Argument, pdf pp. 15-16.
[248] Ibid., pdf pp. 17-18.
[249] Ibid., pdf p. 9.
[250] BC Hydro Reply Argument, p.17.
[251] Ibid., p.18.
[252] Ibid., p. 19.
[253] Ibid., p. 23.
[254] CEC Final Argument, p. 33.
[255] Ibid., p. 29.
[256] BC Hydro Reply Argument, p. 13, footnote 58.

The CEC finds the cost estimate of the Project to be appropriate and further considers the assessment of rate impacts as presented by BC Hydro to be reasonable, notwithstanding the possibility of a lower Project rate impact if remediation costs are deferred.

Panel Determination

BC Hydro argues that the scope and costs of decommissioning and remediating the BSY site will ultimately be determined by the future use of the BSY site. BC Hydro states that the current scope of the Project does not have any influence on the scope, design, costs, impacts, or risks of decommissioning and remediation of the BSY site. However, the Panel finds that the scope, design and costs associated with decommissioning and remediation of the BSY site impact the evaluation of the Alternatives, the selection of the best alternative and the Project cost and rate impact evaluation. The Panel finds that if the BSY site stops operating such that this triggers the CSR requirements, decommissioning and remediation will need to be undertaken and should properly form part of the Project costs.

BC Hydro submits that the scope of site remediation cannot be defined at this time because this scope depends on the future use of the BSY site. BC Hydro submits that it plans to prepare a Class 3 cost estimate for decommissioning and remediation of the BSY site in the Dismantling Project. The Panel finds BC Hydro's argument to ignore decommissioning and remediation of the BSY site to be not compelling. If BC Hydro were to stop operations at the BSY site, it will require the Dismantling Project inclusive of decommissioning and remediation to be executed. Furthermore, as stated by BC Hydro, if it proceeds with decommissioning of the turbine building at BSY, it must relocate the protection and control equipment that supports the switchyard to a newly constructed building within the switchyard, therefore tying the Control Building Project to the execution of the Dismantling Project. The Panel finds that the Lower Mainland Reactive Power Reinforcement Project is directly tied to the Dismantling Project and to the Control Building Project, and that the three projects should be filed as one, as both the Dismantling Project and Control Building Project materially impact the evaluation of the total costs and ratepayer impacts associated with the Lower Mainland Reactive Power Reinforcement Project.

The Panel agrees with RCIA that BC Hydro has failed to provide adequate quantification and clear information about the potential scope, cost, and time associated with stopping operations at the BSY site and has not provided sufficient evidence to demonstrate that the BSY retirement will not trigger substantial, mandatory decommissioning and remediation activities at the BSY site. The Panel also agrees with RCIA that BC Hydro has not demonstrated the BSY site decommissioning and site remediation costs are immaterial relative to the estimated cost of the Preferred Alternative without decommissioning and site remediation. The Panel considers that BC Hydro's responses to the BCUC's information requests that attempted to elicit further information about the reasons for excluding that work from the Project scope and the potential magnitude of the decommissioning and site remediation costs, to be not particularly illuminating. The Panel agrees with RCIA that the lack of sufficient information on the scope and cost of the BSY site decommissioning and remediation obscures and understates the Project's scope and cost.

The Panel finds that the scope of the Project should include all aspects of decommissioning and remediating the BSY site upon stopping operations at the BSY site with the time of retirement being dependent on the alternative selected. If the Meridian Option of the Substation Alternative were selected as the Preferred Alternative, the decommissioning and remediation of the entire BSY site would be required upon the retirement

and stopping operations of the BSY site. Similarly, upon the retirement and stopping operations of the BSY site in the Hybrid Alternative by 2035, and upon the retirement of the BSY site in the Burrard Alternative, in 2065, decommissioning and remediation of the entire BSY site would be required.

Although the CSR process is not triggered until operation of a site is stopped, it is clear that BC Hydro is already evaluating options to decommission and remediate the BSY site as it has initiated both the Dismantling Project and the Control Building Project to determine the scope of work to be undertaken when (and not if) operations at the BSY site are stopped.

The Panel finds that for the Substation Alternative, and the Hybrid Alternative, the scope of work associated with demolition and remediation of the entire BSY site should have been included in the Project scope. Similarly, for the Burrard and Hybrid Alternatives, the Panel finds that the scope of work associated with demolition and remediation of the non-operating areas at BSY should have been included in the immediate scope of those alternatives, and demolition and remediation of the operating areas should have been included in the scope of work upon stopping operations at the BSY plant.

In short, the Panel considers that, for the effective review of the merits of the Project, BC Hydro must submit the full scope of work for the Preferred Alternative including the full scope of decommissioning and remediation of BSY, the associated Project costs at a Class 3 estimate, and the resulting rate impact. By not including the scope of work associated with decommissioning and remediation of BSY, BC Hydro's evaluation of the full scope and cost of the Project is incomplete, and the rate impact of the Project cannot be fully or satisfactorily assessed by BC Hydro or the BCUC.

5.0 Overall Panel Determination

Positions of the Parties

RCIA opposes granting a CPCN for the Project as currently proposed.[257]

The CEC recommends that the BCUC grant a CPCN for the Project and direct BC Hydro to file a compliance report on deferral of removal, restoration, replacement, and remediation costs through maintaining minimum functions at the BSY until the future use of the site has become clearly defined and is progressing toward implementation.[258]

BCOAPO submits, given the scope of the proposed Project, BC Hydro has appropriately applied for a CPCN pursuant to sections 45 and 46 of the UCA and recommends that the BCUC approve the Project subject to its assessment of BC Hydro's evidence.[259]

[257] RCIA Final Argument, pdf p.6.
[258] CEC Final Argument, p. 1.
[259] BCOAPO Final Argument, p. 4.

Panel Determination

As already noted, the Panel acknowledges that BC Hydro has established the need to manage reactive power on its transmission system. However, the Panel finds that the Application and in particular, BC Hydro's evaluation of the Preferred Alternative to be incomplete and therefore, insufficient support for the granting of a CPCN for the Project.

The Panel does not accept BC Hydro's methodology for assessing the Feasible Alternatives due to the largely qualitative nature of its SDM process and the lack of clear cost differentiation between the different alternatives. The Panel considers the Project being proposed in the Application to be incomplete as submitted as it is missing a significant scope of work associated with the decommissioning and remediation of the entire BSY site. The Panel finds BC Hydro's comparison of the PV between alternatives to be incomplete because it does not include all applicable Project scope in the cost estimate of each alternative, and furthermore, does not properly account for the overlapping cost ranges associated with these Class 5 cost estimates for the various alternatives which render the financial analysis suspect.

Accordingly, the Panel finds that the evidence adduced in this proceeding does not demonstrate that the Lower Mainland Reactive Power Reinforcement Project is in the public interest and denies the granting of a CPCN for this Project as unwarranted. Having so determined, we see no need to review all of the considerations set out in the CPCN Guidelines.

In the meantime, the Panel encourages BC Hydro to continue its efforts to develop, and, in due course, reapply as required for approval of one or more projects that would address the need to manage reactive power on the BC Hydro transmission system to maintain the transfer capability of the Interior to Lower Mainland Transmission System, to maintain voltage control for the Metro Vancouver Regional Transmission System, and to relieve voltage constraints to support load growth in the Central Fraser Valley Regional Transmission System. Alternatively, BC Hydro is at liberty to file another CPCN application for the Project which addresses the deficiencies identified in this decision for BCUC review and approval.

The Panel also directs BC Hydro to file, within 90 days of the date of this decision, its contingency plan to manage the need for reactive power on its transmission system in the interim.

6.0 Confidentiality

In accordance with Part IV of the BCUC's Rules of Practice and Procedure, BC Hydro filed the following exhibits on a confidential basis and submitted that these documents contain information related to physical and cyber security, and commercially sensitive information related to BC Hydro's cost estimates which could prejudice BC Hydro's position in future negotiations (Confidential Exhibits):[260]

- Exhibit B-1-1, BC Hydro submitting the Application including confidentially held Chapter 4 and Appendices F, G, H, J, K and L;

[260] Exhibit B-1, cover letter, pp. 1-2.

- Exhibit B-1-3, BC Hydro submitting confidential Application – Errata;
- Exhibit B-3-1, BC Hydro submitting responses to BCUC Request for Information including confidentially held attachments 1 to 8;
- Exhibit B-7-1, BC Hydro submitting confidential responses to BCUC IR No. 1;
- Exhibit B-8, BC Hydro submitting confidential responses to BCUC confidential IR No. 1;
- Exhibit B-9-1, BC Hydro submitting confidential responses to Intervener IR No. 1
- Exhibit B-12-1, BC Hydro submitting confidential responses to BCUC IR No. 2;
- Exhibit B-13, BC Hydro submitting confidential responses to BCUC Confidential IR No. 2;
- Exhibit B-14-1, BC Hydro submitting confidential responses to Intervener IR No. 2; and
- BC Hydro submitting its confidential reply argument.

BC Hydro also provided public versions of the above-mentioned Confidential Exhibits, with redacted information, except for Exhibits B-8 and B-13 and the attachments to Exhibit B-1-1 and B-3-1 as stated above.

Positions of the Parties

No interveners made submissions on BC Hydro's confidentiality requests.

Panel Determination

Based on the proposed timing of completion of the Project, BC Hydro has requested discrete time limits for the Confidential Exhibits to be kept confidential due to their customer-specific commercially sensitive nature and physical and cyber security. **In light of the denial of this Application, the Panel directs that the Confidential Exhibits be kept confidential until the BCUC determines otherwise.**

DATED at the City of Vancouver, in the Province of British Columbia, this 24th day of January 2024.

Original signed by:

A. K. Fung, KC
Panel Chair / Commissioner

Original signed by:

A. C. Dennier
Commissioner

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ORDER NUMBER
G-20-24

IN THE MATTER OF
the *Utilities Commission Act*, RSBC 1996, Chapter 473

and

British Columbia Hydro and Power Authority
Application for a Certificate of Public Convenience and Necessity
for the Lower Mainland Reactive Power Reinforcement Project

BEFORE:
A. K. Fung, KC, Panel Chair
A. C. Dennier, Commissioner

on January 24, 2024

ORDER

WHEREAS:

A. On November 22, 2022, British Columbia Hydro and Power Authority (BC Hydro) filed an application with the British Columbia Utilities Commission (BCUC) pursuant to section 45 and 46 of the *Utilities Commission Act* (UCA) seeking a Certificate of Public Convenience and Necessity (CPCN) for the Lower Mainland Reactive Power Reinforcement Project (Application);

B. In the Application, BC Hydro proposes to install reactive power compensation equipment at the Meridian, Ingledow, McLellan and Clayburn substations and stop using the Burrard Synchronous Condenser Station to manage reactive power on BC Hydro's transmission system;

C. On December 15, 2022, by Order G-363-22, the BCUC established a regulatory timetable for a review of the Application;

D. BC Hydro filed the following exhibits on a confidential basis (Confidential Exhibits) during the proceeding:

- Exhibit B-1-1, BC Hydro submitting the Application including confidentially held Chapter 4 and Appendices F, G, H, J, K and L;
- Exhibit B-1-3, BC Hydro submitting confidential Application – Errata;
- Exhibit B-3-1, BC Hydro submitting responses to BCUC Request for Information including confidentially held attachments 1 to 8;
- Exhibit B-7-1, BC Hydro submitting confidential responses to BCUC IR No. 1;
- Exhibit B-8, BC Hydro submitting confidential responses to BCUC confidential IR No. 1;
- Exhibit B-9-1, BC Hydro submitting confidential responses to Intervener IR No. 1;

- Exhibit B-12-1, BC Hydro submitting confidential responses to BCUC IR No. 2;
- Exhibit B-13, BC Hydro submitting confidential responses to BCUC Confidential IR No. 2;
- Exhibit B-14-1, BC Hydro submitting confidential responses to Intervener IR No. 2; and
- BC Hydro submitting its confidential reply argument.

E. By Orders G-8-23, G-127-23, G-173-23, G-208-23, and G-265-23 the BCUC established further and amended regulatory timetables, to include among other things, a BCUC workshop, two rounds of information requests, and final and reply arguments; and

F. The BCUC has considered the evidence and submissions filed in this proceeding and makes the following determinations.

NOW THEREFORE for the reasons set out in the Decision issued concurrently with this order, the BCUC orders as follows:

1. BC Hydro is denied a CPCN for the Lower Mainland Reactive Power Reinforcement Project.

2. BC Hydro is directed to file within 90 days of the date of this decision, its contingency plan to manage the need for reactive power on its transmission system in the interim.

3. The Confidential Exhibits shall be kept confidential until the BCUC determines otherwise.

DATED at the City of Vancouver, in the Province of British Columbia, this 24th day of January 2024.

BY ORDER

Original signed by:

A. K. Fung, KC
Commissioner

British Columbia Hydro and Power Authority
Application for a Certificate of Public Convenience and Necessity for the Lower Mainland Reactive Power Reinforcement Project

GLOSSARY AND ACRONYMS

ACRONYM / GLOSSARY	DESCRIPTION
AACE	Association for the Advancement of Cost Engineering
Application	BC Hydro's application to the BCUC for a CPCN for the Lower Mainland Reactive Power Reinforcement project
BC Hydro	British Columbia Hydro and Power Authority
BCOAPO or BCOAPO et al.	British Columbia Old Age Pensioners' Organization, Active Support Against Poverty, Disability Alliance BC, Council of Senior Citizens' Organizations of BC, Tenants Resource and Advisory Centre, and Together Against Poverty Society
BCUC	British Columbia Utilities Commission
BGS	Burrard Thermal Generating Station
BSY	Burrard Synchronous Condenser Station
CEA	*Clean Energy Act*
CEC	Commercial Energy Consumers Association of British Columbia
Central Fraser Valley Assessment	Central Fraser Valley Transmission System Assessment
Confidential Exhibits	The exhibits BC Hydro has filed confidentially within the Lower Mainland Reactive Power Reinforcement Project proceeding
Control Building Project	Burrard Control Building Relocation Project
CPCN	Certificate of Public Convenience and Necessity
CSR	Contaminated Site Regulation
Dismantling Project	Burrard Facility Dismantling Project
Feasible Alternatives	The three alternatives for the project identified through a structured decision-making process as being feasible (Substation, Burrard, and Hybrid alternatives)
IR	Information Request
2021 IRP	BC Hydro's 2021 Integrated Resource Plan
kV	Kilovolt

ACRONYM / GLOSSARY	DESCRIPTION
MVAr	Mega Volt-Amps Reactive
MW	Megawatts
OATT	Open Access Transmission Tariff
Project	BC Hydro's proposal to install equipment used to manage reactive power on the transmission system, and to cease operations at the Burrard Synchronous Condenser Station
PV	Present Value
RCIA	Residential Consumer Intervener Association
SDM	Structured Decision Making
SDS	Site Disclosure Statement
Transmission System Study	Interior to Lower Mainland 500 kV Transmission System Assessment Study
UCA	*Utilities Commission Act*
Wood	Wood Canada Limited

British Columbia Hydro and Power Authority
Certificate of Public Convenience and Necessity
Lower Mainland Reactive Power Reinforcement Project Application

EXHIBIT LIST

Exhibit No.	Description
COMMISSION DOCUMENTS	
A-1	Letter dated December 13, 2022 – Appointing the panel for the review of the BC Hydro Lower Mainland Reactive Power Reinforcement Project
A-2	Letter dated December 15, 2022 – BCUC Order G-363-22 establishing a regulatory timetable and public notice
A-3	Letter dated January 16, 2023 – BCUC Order G-8-23 establishing a further regulatory timetable
A-4	Letter dated January 16, 2023 – BCUC providing workshop guidance to BC Hydro
A-5	Letter dated January 27, 2023 – BCUC letter to BC Hydro requesting more information relating to the application
A-6	Letter dated January 30, 2023 – Commissioner Andrew Pape-Salmon Notice to Parties
A-7	Letter dated February 10, 2023 – BCUC providing Workshop information
A-8	Letter dated February 24, 2023 – BCUC providing Workshop information and live stream link
A-9	Letter dated March 20, 2023 – BCUC Information Request No. 1 to BC Hydro
A-10	**CONFIDENTIAL** - Letter dated March 20, 2023 – BCUC Confidential Information Request No. 1 to BC Hydro
A-11	Letter dated April 14, 2023 – BCUC approval of BC Hydro's request for an extension to file Information Request No. 1 responses
A-12	Letter dated June 2, 2023 – BCUC Order G-127-23 establishing a further regulatory timetable
A-13	Letter dated June 14, 2023 – BCUC amending the Panel for the review of the application
A-14	Letter dated June 26, 2023 – BCUC Information Request No. 2 to BC Hydro
A-15	**CONFIDENTIAL** - Letter dated June 26, 2023 – BCUC Confidential Information Request No. 2 to BC Hydro

A-16	Letter dated July 4, 2023 – BCUC Order G-173-23 establishing an amended regulatory timetable
A-17	Letter dated August 1, 2023 – BCUC request for submission regarding BCOAPO's extension Request
A-18	Letter dated August 4, 2023 – BCUC order G-208-23 establishing an amended regulatory timetable
A-19	Letter dated August 29, 2023 – BCUC request for Final Argument submissions
A-20	Letter dated October 5, 2023 – BCUC response to CEC request for an extension
A-21	Letter dated October 10, 2023 – BCUC order G-265-23 establishing an amended timetable

APPLICANT DOCUMENTS

B-1	**BRITISH COLUMBIA HYDRO AND POWER AUTHORITY (BC HYDRO)** - Certificate of Public Convenience and Necessity (CPCN) Lower Mainland Reactive Power Reinforcement Project Application dated November 22, 2022
B-1-1	**CONFIDENTIAL** - Letter dated November 22, 2022 - BC Hydro submitting confidential CPCN Lower Mainland Reactive Power Reinforcement Project Application
B-1-2	**PUBLIC** - Letter dated May 15, 2023 - BC Hydro submitting CPCN Lower Mainland Reactive Power Reinforcement Project Application - Errata
B-1-3	**CONFIDENTIAL** - Letter dated May 15, 2023 - BC Hydro submitting confidential CPCN Lower Mainland Reactive Power Reinforcement Project Application - Errata
B-2	Letter dated January 11, 2023 - BC Hydro submitting confirmation of Public Notice in compliance with G-363-22
B-3	Letter dated February 13, 2023 – BC Hydro submitting response to BCUC request for information
B-3-1	**CONFIDENTIAL** - Letter dated February 13, 2023 – BC Hydro submitting confidential response to BCUC request for information
B-4	Letter dated February 24, 2023 – BC Hydro submitting workshop presentation replaced on February 28th, 2023 due to typographical error
B-5	Letter dated March 6, 2023 – BC Hydro submitting request for correction to workshop Transcript Volume 1 dated February 27, 2023

B-6	Letter dated April 6, 2023 – BC Hydro submitting extension request to file BCUC and Intervener Information Request No. 1 responses
B-7	Letter dated May 15, 2023 – BC Hydro submitting responses to BCUC Information Request No. 1
B-7-1	**CONFIDENTIAL** - Letter dated May 15, 2023 – BC Hydro submitting confidential responses to BCUC Information Request No. 1
B-8	**CONFIDENTIAL** - Letter dated May 15, 2023 – BC Hydro submitting confidential responses to BCUC Confidential Information Request No. 1
B-9	Letter dated May 15, 2023 – BC Hydro submitting responses to Interveners Information Request No. 1
B-9-1	**CONFIDENTIAL** - Letter dated May 15, 2023 – BC Hydro submitting confidential responses to Interveners Information Request No. 1
B-10	Letter dated June 29, 2023 – BC Hydro submitting extension request for responses to Information Request No. 2
B-11	Letter dated August 2, 2023 – BC Hydro submitting response to BCOAPO's extension request
B-12	Letter dated August 15, 2023 – BC Hydro submitting responses to BCUC Information Request No. 2
B-12-1	**CONFIDENTIAL** - Letter dated August 15, 2023 – BC Hydro submitting confidential responses to BCUC Information Request No. 2
B-13	**CONFIDENTIAL** - Letter dated August 15, 2023 – BC Hydro submitting confidential responses to BCUC Confidential Information Request No. 2
B-14	**PUBLIC** - Letter dated August 15, 2023 – BC Hydro submitting responses to Intervener Information Requests No. 2
B-14-1	**CONFIDENTIAL** - Letter dated August 15, 2023 – BC Hydro submitting confidential responses to Interveners Information Requests No. 2
B-15	Letter dated October 5, 2023 – BC Hydro submitting extension request for filing Reply Argument

INTERVENER DOCUMENTS

C1-1	**BRITISH COLUMBIA OLD AGE PENSIONERS' ORGANIZATION, DISABILITY ALLIANCE BC, COUNCIL OF SENIOR CITIZENS' ORGANIZATIONS OF BC, AND THE TENANT RESOURCE AND ADVISORY CENTRE (BCOAPO) –** Letter dated January 17, 2022 – Request to intervene by Leigha Worth
C1-2	Letter dated April 3, 2023 – BCOAPO submitting Information Request No. 1 to BC Hydro
C1-3	Letter dated June 26, 2023 – BCOAPO submitting Information Request No. 2 to BC Hydro
C1-4	Letter dated July 26, 2023 – BCOAPO proposing amendment to the regulatory timetable
C2-1	**COMMERCIAL ENERGY CONSUMERS ASSOCIATION OF BRITISH COLUMBIA (CEC)** Letter dated January 18, 2022 – Request to intervene by David Craig and Christopher Weafer
C2-2	Letter dated March 7, 2023 – CEC submitting Confidentiality Declaration and Undertakings
C2-3	Letter dated April 3, 2023 – CEC submitting Information Request No. 1 to BC Hydro
C2-4	Letter dated June 26, 2023 – CEC submitting Information Request No. 2 to BC Hydro
C2-5	Letter dated October 4, 2023 – CEC submitting extension request for filing Final Argument
C3-1	**RESIDENTIAL CONSUMER INTERVENER ASSOCIATION (RCIA)** - Letter dated January 19, 2022 – Request to intervene by Abdulrahman Abomazid
C3-2	Letter dated February 5, 2023 – RCIA submitting Confidentiality Declaration and Undertakings
C3-3	Letter dated March 6, 2023 – RCIA submitting Confidentiality Declaration and Undertaking for Michael Walsh
C3-4	Letter dated April 3, 2023 – RCIA submitting Information Request No. 1 to BC Hydro
C3-5	Letter dated June 5, 2023 – RCIA submitting Confidentiality Declaration and Undertakings
C3-6	Letter dated June 21, 2023 – RCIA submitting Information Request No. 2 to BC Hydro
C3-7	Letter dated August 21, 2023 – RCIA submitting Confidentiality Declaration and Undertakings