

1 **Q. (Reference Application, Schedule A, page 3)**

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3 **It is stated "The Memorial Substation Power Transformer Replacement project**  
4 **is required to maintain safe and adequate facilities at MUN Substation and to**  
5 **mitigate risks to the delivery of reliable service to the University." Please**  
6 **quantify the risk mitigated by the proposed project.**

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8 **A. A. Introduction**

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10 Newfoundland Power completed a risk assessment for the *Memorial Substation Power*  
11 *Transformer Replacement* project using its risk matrix methodology. The risk matrix  
12 methodology is used to assess the potential consequences of not proceeding with a  
13 capital project or program and the probability of that consequence occurring.<sup>1</sup>

14  
15 Figure 1 shows the risk matrix methodology.

Probability Values		Priority Score				
Near Certain	5	5	10	15	20	25
Likely	4	4	8	12	16	20
Possible	3	3	6	9	12	15
Unlikely	2	2	4	6	8	10
Rare	1	1	2	3	4	5
		1	2	3	4	5
		Negligible	Minor	Moderate	Serious	Critical
		Consequence Values				

**Figure 1 – Newfoundland Power Risk Matrix**

16 Probability and consequence values are determined on a scale of one to five using  
17 guidelines that apply quantifiable factors to facilitate objective reviews. The overall risk  
18 of not proceeding with a project or program is calculated by multiplying the  
19 consequence value by the probability value.

<sup>1</sup> See the *2023 Capital Budget Application, 2023 Capital Budget Overview, Appendix C.*

**B. Risk Assessment**

***Background***

Memorial University is Newfoundland Power’s largest single customer. Memorial (“MUN”) Substation is the original supply point for the university. MUN Substation has two power transformers. MUN-T2 is a 15/20 MVA, 66-12.5 kV power transformer. MUN-T1 has a lower rated capacity at 11.125/14.83 MVA.

Memorial University also has a redundant distribution supply point at Long Pond (“LPD”) Substation. LPD Substation was constructed in 2019 as a special facility through a contribution in aid of construction from the university.<sup>2</sup> Under normal operations, the university’s load is shared among MUN and LPD substations. If equipment at LPD Substation was to fail, the power transformers at MUN Substation are capable of carrying the full normal campus load. However, only half of the normal campus load could be transferred to LPD Substation following an equipment failure at MUN Substation due to limitations with customer-owned distribution infrastructure.<sup>3</sup>

With MUN-T2 out of service, Memorial University has lost the typical redundancy and operational flexibility provided by these substations. This increases the risk of prolonged outages to the university campus if MUN-T1 or equipment at LPD Substation were to fail.

***Assessment of Consequence***

Newfoundland Power assessed the consequence of an outage to Memorial University’s St. John’s campus using the guidance established as part of its risk matrix methodology.

Table 1 summarizes the guidelines applied for determining consequence values for reliability-related risks.

Table 1 Reliability Consequence Guidelines	
Factors	Other Considerations
Number of customers affected by potential outage: 1 – Less than 100 customers 2 – 100 to 500 customers 3 – 500 to 1,000 customers 4 – 1,000 to 5,000 customers 5 – Greater than 5,000 customers	Examples of other considerations include outage duration and frequency, resiliency to severe weather, system configuration (e.g. radial or looped), and the impact on operations of the loss of a technology or piece of equipment.

<sup>2</sup> See the response to Request for Information NLH-NP-001.

<sup>3</sup> See the response to Request for Information PUB-NP-001.

1 The risk assessment for the *Memorial Substation Power Transformer Replacement*  
2 project first used the number of students living on campus as a proxy to assess the  
3 impact of a customer outage. There are 1,700 students living on campus that would be  
4 affected by an outage. Student residences would be affected by rotating outages as  
5 customer-owned back-up generation is designed only for the operation of life safety  
6 systems. Using this proxy, the *Memorial Substation Power Transformer Replacement*  
7 project was first assigned a consequence value of "Serious (4)."  
8

9 Other factors were then considered. This includes the duration of an outage.  
10 Newfoundland Power estimates that, with MUN-T2 out of service, a failure at MUN  
11 Substation or LPD Substation could last up to three days while a portable substation is  
12 installed to restore service to the university. This would affect educational facilities for  
13 over 15,000 students and would likely lead to the suspension of university operations.  
14 The Company also considered the potential impact on critical loads supplied by LPD  
15 Substation. Without MUN-T2 in service, a failure at LPD Substation could disrupt service  
16 to critical healthcare facilities, such as the Health Sciences Centre and Janeway  
17 Children's Hospital. Based on these considerations, the final consequence value was  
18 determined to be "Critical (5)."  
19

20 ***Assessment of Probability***

21  
22 Newfoundland Power assessed the probability of an outage occurring to Memorial  
23 University's St. John's campus using the guidance provided as part of its risk matrix  
24 methodology. The methodology establishes that probability is a qualitative assessment  
25 based on engineering judgement using a scale of 0% to 100% as follows:  
26

- 27 (i) Near Certain (5) – Probable within a range of 91% to 100%.
- 28 (ii) Likely (4) – Probable within a range of 76% to 90%.
- 29 (iii) Possible (3) – Probable within a range of 26% to 75%.
- 30 (iv) Unlikely (2) – Probable within a range of 11% to 25%.
- 31 (v) Rare (1) – Probable within a range of 0% to 10%.

32  
33 Newfoundland Power considered that, with MUN-T2 out of service, a customer outage  
34 could result from the failure of equipment at either LPD Substation or MUN-T1. MUN-T1  
35 has undergone regular testing and results to date appear normal. However, the  
36 probability of a power transformer failing increases with age. MUN-T1 has been in  
37 service for 57 years. This exceeds the useful service life of a power transformer  
38 typically observed in the utility industry.<sup>4</sup> For Newfoundland Power's power  
39 transformers, the average age at failure has been approximately 40 years. Accordingly,  
40 the probability that a failure could occur resulting in an outage to Memorial University's  
41 St. John's campus was determined to be "Possible (3)."

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<sup>4</sup> Industry experience suggests the typical useful service life of a power transformer is between 30 and 50 years under ideal conditions. See International Council on Large Electric Systems ("CIGRE"), *Asset Management Decision Making Using Different Risk Assessment Methodologies*, 2013, page 94.

1 **Overall Risk Score**

2  
3 Table 2 summarizes the risk assessment for the *Memorial Substation Power Transformer*  
4 *Replacement* project.

Table 2 Memorial Substation Power Transformer Replacement Project Risk Assessment Summary		
Consequence	Probability	Risk
Critical (5)	Possible (3)	Moderate (15)

5 Based on a Critical (5) consequence value and a Possible (3) probability value,  
6 Newfoundland Power assessed that not proceeding with the project would present a  
7 Moderate (15) risk to the delivery of safe and reliable service to the customer. This  
8 represents the level of risk that would be mitigated if the project proceeds.