Q. GENERATION - HYDRO

Rattling Brook Hydro Plant Refurbishment (Clustered) - $18,242,000

PUB 9.0 NP

Provide a cost benefit analysis that allows the urgent requirements to be dealt with in 2007 and delays the remaining until 2008, 2009 or 2010, depending on the attention required. Include the costs that will be incurred, as well as the opportunity costs of delaying the expansion of the capacity.

A. **1.0 Urgent Requirements**

Based on the physical condition and age of the plant assets, it is Newfoundland Power's assessment that the following components of the project are required to be completed in 2007:

1. Penstock replacement ($11,705,000)
Because of its deteriorated condition and concerns regarding excessive leakage following de-watering, as well as related safety concerns, the penstock needs to be replaced.

2. Surge tank refurbishment ($1,663,000)
SGE Acres recommended refurbishment based on a conditional assessment that found corrosion of the lower riser pipe and other deficiencies.

3. Main valve replacements ($577,180)
Because of excessive leakage past the valves and the resulting inability to enter the scroll case to inspect and maintain equipment, the valves require replacement. In addition, the original control systems are obsolete.

4. Bearing cooling water system upgrades ($144,000)
This equipment is past its service life, is deteriorated and has been a key source of operational problems in recent years.

5. Powerhouse heating and ventilation upgrades ($96,020)
The existing ventilation system is deteriorated and the pneumatic operators are in poor condition. The heating system is inadequate to meet the current needs of the plant.

6. Switchgear and controls upgrades ($2,112,305)
Most of this equipment is original to the plant, and is obsolete and in various stages of deterioration.

7. Forebay communication/distribution line upgrade ($129,000)
The communications line has an unacceptable degree of damaged cables. The distribution line crossarms are in poor condition and some of the insulators are known to be prone to

failure. This line is not readily accessible in the winter months, which could delay repairs and impair plant operations.

8. Interest During Construction, Project Management and Insurance ($598,500)

The cost of these components of the project constitutes approximately 93% of the total 2007 cost estimate for the Rattling Brook Refurbishment Project.

2.0 Interdependent Requirements

The remaining components, including the bearing and instrumentation upgrades, AC/DC distribution upgrades, the exciter rewind, grounding transformer, communication relocations, and water level monitoring and control upgrades, account for approximately 7% of the total 2007 project cost estimate. Replacement of these components are not considered to be urgent by reason of their condition. However, they must be completed in 2007 because of their interdependence with the work that does require urgent attention in 2007.

To ensure that plant operations are integrated, and that the urgently required equipment is properly commissioned, it is necessary to complete the entire proposed work scope as an integrated project in 2007.

For example, the bearing instrumentation is required to monitor the generator and protect the bearings from heat damage or loss of oil. The existing bearing and other instrumentation is obsolete and will not interface with the modern control system that is to be installed in 2007. If the controls upgrade were to proceed in 2007 without replacement of the bearing instrumentation, the plant system would be left without condition monitoring on the bearings. Operating the generating facility without appropriate condition monitoring would risk significant damage to the generating units. It would also void insurance coverage related to bearing damage.

Similarly, the original AC panel is functional. However, it lacks sufficient capacity to handle the additional loading from the proposed upgrades, including the new heating and ventilation equipment. Since it is necessary to upgrade the powerhouse heating and ventilation system in 2007, the AC panel must also be upgraded. It is also necessary to relocate the existing AC panel in 2007 to accommodate the new plant layout.

The original DC panel is also functional. However, the existing panel does not have the capacity for the additional DC circuits that are required for the new actuators for the new valves to be installed in 2007. Because of its age and the lack of capacity for expansion, it is necessary to replace the panel.

3.0 Cost Benefit Analysis

The scope of the Rattling Brook Refurbishment Project reflects the results of the condition assessments of the plant completed in 2005, and includes only the work that is

reasonably necessary to complete in 2007. All further capital work on the Rattling Brook Plant is appropriately scheduled for future years. The anticipated future capital expenditure requirements are shown in the 50-year plan briefly outlined in Volume II, *Appendix H*: *Feasibility Analysis*, Attachment A, page 1.

The economic analysis set out in *Appendix H: Feasibility Analysis* indicates a levelized cost of energy from a refurbished Rattling Brook hydroelectric plant of 2.9¢/kWh. Availability of this low cost energy over the long-term is clearly beneficial to both Newfoundland Power and its customers.

4.0 Opportunity Costs of Delay

The opportunity costs of delay can be addressed from a number of perspectives.

The first perspective is the cost of delay in bringing on the additional energy and capacity which the Rattling Brook Refurbishment provides. At page 1 of the Rattling Brook Hydro Plant Refurbishment Report, it is indicated that the *additional* energy generated following the project will displace approximately 10,500 bbls of fuel a year at Holyrood. This equates to approximately $570,000 in annual opportunity cost at the current Holyrood fuel forecast ($54.20 x 10,500 = $569,100). This calculation does not account for the additional 2.9 MW of capacity available to the system.

A second perspective on the opportunity cost of delay relates to the risk of plant failure. Should the Rattling Brook Plant fail in service, its 69.8 GWh of annual energy production will not be available to the island interconnected grid. To displace this energy production with production at Holyrood would require an additional 110,800 bbls of fuel. This equates to approximately $6,000,000 in annual opportunity cost at the current Holyrood fuel forecast ($54.20 x 110,800 = $6,005,360). This calculation does not account for the loss of the current 11.2 MW of capacity at Rattling Brook.