Q. Further to the response to PUB-NP-22, provide information in relation to the possible alternative approach discussed at page 6, setting out the number of additional customers that would be off the system and any technical concerns that would need to be addressed.

A. ***General***

The rotating power outage protocol adopted by Newfoundland Power in the period from January 2-8, 2014 was intended to maximize the use of available supply. As customer demand approached the limit of available generation, small blocks of customer load were rotated off and on the electrical system so that, to the extent practicable, the load matched *all* available generation.[1] Using this protocol there was practically no margin between the amount of generation available and the customer load on the system.

In the response to Request for Information PUB-NP-022, Newfoundland Power indicated that providing customers with advance notice of rotating power outages was impractical in the circumstances which existed during January 2-8, 2014. This was largely due to the series of destabilizing events which occurred on the Island Interconnected System during that time. Accordingly, Newfoundland Power is not in a position to set out the number of additional customers that would have been off the system and all technical concerns that would reasonably have needed to be addressed for the Company to have provided notice to its customers of the rotating power outages which occurred from January 2-8, 2014.

What follows therefore is a more complete explanation of the *general* approach referred to in the response to Request for Information PUB-NP-022.

Scheduling & System Margins

The possible alternative approach indicated at page 6 of the response to Request for Information PUB-NP-022 would require planning to rotate specific distribution feeders off and on the electrical system at scheduled times. The schedule would be planned in advance based upon the *forecast* peak load and *forecast* available generation on the Island Interconnected System for the planned rotation period. It would also be based upon forecast peak load for individual distribution feeders. In practical terms, the timing and magnitude of the system supply shortfall and distribution feeder peaks would need to be forecast hours in advance of commencing the rotating power outages.[2]

[1] The determination of which distribution feeders were rotated off and on the electrical system was guided by real-time monitoring of system frequency and voltage levels. System frequency for the Island Interconnected System provides an indication of the balance of electrical demand and supply on a system wide basis. Voltage levels measured at delivery points will provide an indication of the balance of electrical demand and supply on a local geographical basis. Together, system frequency and voltage levels provide an indication, in engineering terms, of how many and which distribution feeders can be rotated off and on the electrical system at any point in time.

[2] This practical requirement exists for at least two reasons. Firstly, effective customer notice practically must give the customers affected some opportunity to prepare or act. Secondly, from an implementation perspective, planned rotations require specific engineering judgments be made on a system wide basis (i.e., how much load is required to be rotated) and a local geographic basis (i.e., how much cold load pickup can be expected when a specific distribution feeder is reconnected to the system).

The number of additional customers that would be required to be off the electrical system using this approach would depend upon the expected range of error in the forecasts of peak loads and available generation. Put another way, scheduled distribution feeder rotations would practically require a margin between forecast peak loads and forecast available generation. This margin would be the determining factor for the number of additional customers that would be required to be off the electrical system.

There are a number of considerations that would influence the determination of an appropriate margin for forecast error. These include:

i. The stability of the Island Interconnected System at the time of undertaking scheduled rotating power outages;[3]
ii. The amount of advance notice to be given to customers;[4]
iii. The accuracy of the forecast of system peak;
iv. The accuracy of the forecast for the individual distribution feeder peaks;
v. The accuracy of available generation; and
vi. The accuracy of weather forecasts.

Estimating Customer Impacts

The number of additional customers that would be required to be off the system to enable advance scheduling of rotating distribution feeder outages can be estimated based upon an assumed margin for forecast error.

For example, if a 2% margin for forecast error was appropriate, the approximate number of additional customers off at any point in time during a scheduled rotation of distribution feeders would be 5,000.[5] Over a 3-hour period with a 30 minute rotation schedule, the approximate number of additional customers affected would be 30,000.[6]

If a 4% margin for forecast error was appropriate, the approximate number of additional customers off at any point in time would be 10,000, and the approximate number of additional customers affected over a 3-hour period with a 30 minute rotation schedule would be 60,000.

Conclusion

For the period January 2-8, 2014, Newfoundland Power was not in a position to estimate the number of additional customers that would have been off the system or all technical concerns that would have needed to have been addressed for customers to have been

[3] A stable electrical system is also a prerequisite to implementing rotating power outages. The system events during January 2-8, 2014 effectively precluded Newfoundland Power from implementing rotating power outages for extended periods.

[4] More advance notice would require forecasts over a relatively longer time horizon. Generally, forecasts over longer time horizons tend to be less accurate than forecasts over shorter time horizons.

[5] This approximation is based upon a forecast peak of 1,380 MW and typical winter peak distribution feeder loading of approximately 180 customers per MW (1,380 x 0.02 x 180 = 4,968, or approximately 5,000).

[6] With a 30 minute rotation schedule, there would be 6 distribution feeder rotations of approximately 5,000 additional customers over a 3 hour rotation period (5,000 x 6 = 30,000).

given advance notice of outages. However, it seems clear that scheduling rotating power outages in a manner that would have enabled giving notice to customers would have contributed to greater numbers of customers being affected by the outages.