Q. The Firm capability for the hydroelectric resource was defined by the most adverse three year sequence of reservoir inflows. Please indicate the anticipated Muskrat Falls generation for the most adverse year of record. Please describe the portion of FIRM energy attributable to Churchill Falls.

A. Nalcor understands this question to be in the context of the following statement in Nalcor's Submission:

> Firm capability for the hydroelectric resources is the firm energy capability of those resources under the most adverse three-year sequence of reservoir inflows occurring within the historical record.[1]

The definition of firm energy used for Nalcor's and NL Hydro's modeling is consistent with this definition:

> The definition of firm energy used for this study is the maximum average energy that can be produced during the most severe dry sequence of the hydrological record. The dry sequence begins after the last period when secondary energy was generated and ends when the reservoirs are just empty.[2]

or this very similar version:

> The value of firm is specifically determined based on the critical hydrologic period which covers a sequential set of years defined by the seasonal reservoir (Smallwood) being at full supply level (FSL) at

[1] Nalcor's Submission, page 30
[2] CE-28 (Public) Revision 1, page 34

> the beginning of the critical period and at Low Supply Level (LSL) at the end of the period.[3]

When the Island system's production is evaluated against this definition, the critical sequence is three years in duration. This three year duration is the result of application of the definition, not the definition itself. Production during the "most adverse year of record" is represented by the annual production at the end of the critical hydrological period, and therefore the value of 4.47 TWh/year[4], as reported in Exhibit CE-27 Rev. 1 (Public), accurately represents, in Nalcor's view, Muskrat Falls' firm production.

Please note Nalcor's latest modeling[5] includes both the Churchill Falls and Muskrat Falls facilities and reservoirs, and Churchill Falls production has been based on the terms of the Hydro Quebec Power Contract that will be in effect when Muskrat Falls is in service. More specifically, Nalcor's power and energy modeling assumes that Churchill Falls will be receiving Continuous Energy, as defined in Schedule III, Article 1.1 (II) of the Hydro Quebec power contract[6]:

> "Continuous Energy" means, in respect of any month, the number of kilowatt hours obtainable, calculated to the nearest 1/100 of a billion kilowatt-hours, when the Annual Energy Base is multiplied by the number which corresponds

[3] CE-21, page 11
[4] Exhibit CE-27 Rev. 1 (Public), page 3
[5] as represented in Confidential Exhibit CE-21
[6] http://www.pub.nl.ca/applications/Nalcor2009Water/files/applic/Application-VolumeII-Revised.pdf, pg. 99

to the number of days in the month concerned and the result is then divided by the number which corresponds to the number of days in the year concerned.

Under these conditions, Churchill Falls monthly production is approximately constant.

Analysis by Hatch indicates the critical period to be from 1984 to 1996 in the 50 year record used for analysis. The inflows can be found in CE-28, Rev. 1 (Public), beginning at page 73. Analysis contained in Confidential Exhibit CE-21 indicates firm production from CF over this critical period to be approximately 4,170 MW.

The tailrace flow at Churchill Falls corresponding to this rating is approximately 1,450 $m^3/s$.

Based on this outflow over the critical period, the contribution from Churchill Falls would be as follows:

| Year | Churchill Falls Flow ($m^3/s$) (Note 1) | Gull Island Local Inflow ($m^3/s$) (Note 2) | Muskrat Falls Local Inflow ($m^3/s$) (Note 3) | Total Flow at Muskrat Falls ($m^3/s$) | % From Churchill Falls |
|---|---|---|---|---|---|
| 1984 | 1450.0 | 390.9 | 64.2 | 1905.1 | 76.1 |
| 1985 | 1450.0 | 373.3 | 61.3 | 1884.5 | 76.9 |
| 1986 | 1450.0 | 364.2 | 59.8 | 1874.0 | 77.4 |
| 1987 | 1450.0 | 370.6 | 60.8 | 1881.5 | 77.1 |
| 1988 | 1450.0 | 390.2 | 64.0 | 1904.2 | 76.1 |
| 1989 | 1450.0 | 306.2 | 50.2 | 1806.5 | 80.3 |
| 1990 | 1450.0 | 163.8 | 26.9 | 1640.7 | 88.4 |
| 1991 | 1450.0 | 294.8 | 48.4 | 1793.2 | 80.9 |
| 1992 | 1450.0 | 348.5 | 57.2 | 1855.6 | 78.1 |
| 1993 | 1450.0 | 375.6 | 61.6 | 1887.2 | 76.8 |
| 1994 | 1450.0 | 412.9 | 67.8 | 1930.7 | 75.1 |
| 1995 | 1450.0 | 331.3 | 54.4 | 1835.6 | 79.0 |
| 1996 | 1450.0 | 369.4 | 60.6 | 1880.0 | 77.1 |

Note 1: Churchill Falls flow estimated based on 4,170 MW firm output as per CE-21.

Note 2: as per CE-28 Rev. 1 (Public) page 79

Note 3: as per CE-28 Rev. 1 (Public) page 80