**Q: Reference:** ***Review of Newfoundland and Labrador Hydro Power Supply Adequacy and Reliability Prior to and Post Muskrat Falls Final Report, August 19, 2016, Page 77, Conclusion IV-17***

> ***"It is likely that Hydro has underestimated the potential number of bipole outages",***

***Page 35, Paragraph 5***

> ***The calculations performed by manufacturers typically apply past experience, which is continuously reviewed. The manufacturers learn from their experience, which improves reliability and availability of future schemes using the same technology and building blocks", and***

***Page 36, Section 2. Impact of Outages, a. Bipolar Outages, Paragraph 3***

> ***"Experience from other bipolar HVdc systems shows that most modern HVdc schemes do not experience bipole trips (simultaneous loss of both poles) very frequently -- only every few years."***

**Please confirm whether or not the Cigre data relied upon by Liberty in Conclusion IV-17 includes older HVdc systems that do not fit the Liberty description of the "modern HVdc schemes" that "do not experience bipole trips (simultaneous loss of both poles) very frequently – only every few years".**

A. It is confirmed that the Cigre data included in PUB-NLH-212, Attachment 2, Appendix B, included HVdc schemes which entered service from 1976 to 2001, which means that the oldest scheme was 31 years old in 2007 and the newest scheme was 6 years old.

The statement "Experience from other bipolar HVdc systems shows that most modern HVdc schemes do not experience bipole trips (simultaneous loss of both poles) very frequently -- only every few years." was a reflection of Dr. Andersen's personal experience from more than 40 years in the industry, that the general performance (including the number of bipolar outages) has improved significantly during that time.

The most recent Cigre data, published this year at the Paris Session, included the following data:

Table IV - Number of Forced Outages by Severity

| System | Number of Forced Outages | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2013 | | | | 2014 | | | |
| | All Outages | Bipole Outages | Pole Outages | Converter Outages | All Outages | Bipole Outages | Pole Outages | Converter Outages |
| Square Butte | 15 | 3 | 12 | 0 | 11 | 2 | 9 | 0 |
| Nelson River BP1 | 34 | 1 | 7 | 26 | 38 | 0 | 6 | 32 |
| Nelson River BP2 | 18 | 1 | 2 | 15 | 24 | 0 | 7 | 17 |
| Hokkaido- | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Honshu | 2 | 1 | 1 | 0 | 4 | 1 | 3 | 0 |
| CU | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 |
| Gotland 2 & 3 | 12 | 0 | 1 | 11 | 12 | 0 | 1 | 11 |
| Itaipu BP1 | 2 | 0 | 1 | 1 | 7 | 0 | 1 | 6 |
| Itaipu BP2 | 6 | 2 | 4 | 0 | 4 | 0 | 4 | 0 |
| Rihand-Dadri | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kii Channel | 4 | 1 | 3 | 0 | 4 | 0 | 4 | 0 |
| Talcher-Kolar | 2 | 0 | 2 | 0 | 2 | 1 | 1 | 0 |
| SAPEI | 10 | 1 | 9 | 0 | 26 | 3 | 23 | 0 |
| Ballia-Bhiwadi | 11 | 0 | 11 | 0 | 4 | 0 | 4 | 0 |
| Adani | 6 | 2 | 4 | 0 | 3 | 0 | 3 | 0 |

Gotland 2&3, Kii Channel and BritNed do not use HVdc OHL. The table shows that bipolar outages do occur, both for young and older HVdc schemes.