

**Fred James**

Chief Regulatory Officer

Phone: 604-623-4046

Fax: 604-623-4407

[bchydroregulatorygroup@bchydro.com](mailto:bchydroregulatorygroup@bchydro.com)

May 11, 2018

Mr. Patrick Wruck  
Commission Secretary and Manager  
Regulatory Support  
British Columbia Utilities Commission  
Suite 410, 900 Howe Street  
Vancouver, BC V6Z 2N3

Dear Mr. Wruck:

**RE: British Columbia Utilities Commission (BCUC or Commission)  
British Columbia Hydro and Power Authority (BC Hydro)  
Annual Reporting of Reliability Indices  
Annual Response to Directive 26 of Commission Decision on F2005/F2006  
Revenue Requirements Application (F05/F06 RRA)**

---

BC Hydro writes as required by Directive 26 of the Commission's decision on our F05/F06 RRA to provide an annual reporting of reliability indices.<sup>1</sup>

Directive 26 states that BC Hydro is expected to present reliability indices (SAIFI, SAIDI, CAIDI, ASAI, SARI, MAIFI, generation forced outages, availability, and generation outage rates) both combined and disaggregated (where applicable) on an annual basis with comparisons to Canadian Electricity Association (**CEA**) averages.

In this filing, BC Hydro is providing reliability indices for distribution, transmission and generation performance through F2018. As in previous years, BC Hydro reliability statistics are provided on a fiscal year basis and compared with the CEA calendar year data.

### **Distribution and Transmission Update**

The most recent annual CEA reports for distribution and transmission are the 2016 Annual Service Continuity data on Distribution System Performance in Electrical Utilities and the Bulk Electricity System. CEA data on distribution and transmission

---

<sup>1</sup> BC Hydro submitted its initial distribution and generation reliability indices compliance filing in September 2005, and subsequently reported the available reliability indices in May 2006 as part of the F2007/F2008 RRA. Starting in May 2007, BC Hydro began filing annual reports with the Commission on these reliability indices. Transmission system reliability indices for the years prior to F2012 were provided separately by the British Columbia Transmission Corporation (**BCTC**) in its Transmission System Capital Plan filings. BC Hydro provided the transmission system reliability indices starting in F2012, subsequent to the integration of BC Hydro and BCTC in F2011.

May 11, 2018  
Mr. Patrick Wruck  
Commission Secretary and Manager  
Regulatory Support  
British Columbia Utilities Commission  
Annual Reporting of Reliability Indices  
Annual Response to Directive 26 of Commission Decision on F2005/F2006 Revenue  
Requirements Application (F05/F06 RRA)

performance for the 2017 calendar year are not yet available. The comparative reliability indices, both combined and disaggregated for BC Hydro's distribution and transmission systems, are presented in Attachment 1, in tabular and graphical form through to F2018.

### **Generation Performance Update**

The most recent annual CEA report on generation performance is the 2016 Generation Equipment Status Annual Report. CEA data on generation performance for the 2017 calendar year are not yet available. The comparative reliability indices, both combined and disaggregated for BC Hydro's generation system are presented in Attachment 2, in tabular and graphical form for the ten-year period ending F2018.

For further information, please contact Chris Sandve at 604-974-4641 or by email at [bchydroregulatorygroup@bchydro.com](mailto:bchydroregulatorygroup@bchydro.com).

Yours sincerely,



(for) Fred James  
Chief Regulatory Officer

Is/ma

Enclosures (2)

**F05/F06 Revenue Requirements Application  
Annual Response to Directive 26 of BCUC Decision**

---

---

**F2018 Annual Reporting of Reliability Indices**

**Attachment 1**

**Distribution and Transmission Reliability Indices**

---

This section includes the following distribution and transmission indices:

SAIFI	a measure of the number of sustained interruptions (longer than one minute) an average distribution customer will experience in a year
T-SAIFI-MI	a measure of transmission interruptions of less than one minute in duration that a delivery point experiences in a year
T-SAIFI-SI	a measure of transmission interruptions of one minute or more that a delivery point experiences in a year
T-SAIDI	a measure of the average total interruption duration, in hours that a delivery point experiences in a year
SAIDI	a measure of the amount of time, in hours, an average distribution customer is without power in a year
CAIDI	a measure of the average interruption, in hours, per interrupted distribution customer in a year
%ASAI	a measure of the percentage of time service is available in the year
CEMI-4	percentage of customers experiencing four or more outages in a year
MAIFI	a measure of the frequency of momentary (less than one minute) interruptions per distribution customer served in a year
DPUI	a measure of overall bulk electricity system performance in terms of a composite index of unreliability expressed in system minutes in a year. It takes into account all forced and planned outages except interruptions attributed to generators
SARI	a measure of the average restoration time, in hours, for each transmission delivery point in a year

As noted in Provision 9x of the F2011 Revenue Requirements Application Negotiated Settlement Agreement, BC Hydro is also reporting its CEMI-4 reliability metric, and SAIFI, SAIDI, CAIDI, ASAI, and CEMI-4 metrics normalized using the IEEE 2.5 Beta method. CEMI-4 is not benchmarked externally as utilities are at varying stages in their development of this metric.

**Table 1 Reliability Indices – BC Hydro Overall and CEA Overall  
(All-Event Indices, Not Normalized)**

Year	BC Hydro Overall				CEA Overall			
	SAIFI	SAIDI	CAIDI	%ASAI	SAIFI	SAIDI	CAIDI	%ASAI
F1996	1.40	3.04	2.17	99.965	2.80	3.06	1.09	99.965
F1997	1.43	2.95	2.03	99.966	2.39	2.86	1.20	99.967
F1998	1.13	2.00	1.76	99.977	2.35	3.70	1.57	99.958
F1999	1.50	4.23	2.82	99.952	2.40	3.32	1.38	99.962
F2000	1.21	2.28	1.88	99.974	2.59	4.31	1.67	99.951
F2001	1.18	2.51	2.13	99.971	2.26	3.23	1.43	99.963
F2002	1.41	3.60	2.55	99.959	2.41	3.67	1.52	99.958
F2003	1.45	3.77	2.60	99.957	2.33	4.06	1.74	99.954
F2004	1.63	4.51	2.77	99.949	2.67	10.65	3.99	99.878
F2005	1.47	3.96	2.69	99.955	1.98	3.95	2.00	99.955
F2006	1.78	3.82	2.15	99.956	2.13	4.80	2.26	99.945
F2007	2.78	11.40	4.09	99.870	2.53	7.85	3.11	99.910
F2008	1.90	5.68	2.99	99.935	2.32	5.47	2.36	99.938
F2009	1.92	5.24	2.73	99.940	2.34	6.29	2.69	99.928
F2010	1.71	4.25	2.49	99.952	2.01	4.20	2.09	99.952
F2011	1.89	5.28	2.80	99.940	2.20	5.17	2.35	99.941
F2012	1.92	5.08	2.65	99.942	2.63	6.16	2.34	99.930
F2013	1.59	3.70	2.33	99.958	2.54	4.66	1.83	99.947
F2014	1.83	5.19	2.83	99.941	2.72	9.49	3.49	99.892
F2015	1.72	5.11	2.97	99.942	2.39	6.38	2.67	99.927
F2016	2.29	10.69	4.66	99.878	2.32	5.08	2.19	99.942
F2017	2.17	5.50	2.53	99.937	3.10	5.65	1.82	99.936
F2018	2.13	6.56	3.08	99.913	n/a	n/a	n/a	n/a

**Table 2 Reliability Indices – BC Hydro (Distribution)  
and CEA (Distribution)  
(All-Event Indices, Not Normalized)**

Year	BC Hydro (Distribution)				CEA (Distribution)			
	SAIFI	SAIDI	CAIDI	%ASAI	SAIFI	SAIDI	CAIDI	%ASAI
F1996	0.95	2.66	2.78	99.970	1.85	2.51	1.35	99.971
F1997	0.88	2.35	2.64	99.973	1.74	2.39	1.38	99.973
F1998	0.70	1.60	2.28	99.982	1.70	3.21	1.87	99.963
F1999	1.02	3.61	3.54	99.959	1.69	2.82	1.67	99.968
F2000	0.65	1.80	2.78	99.979	1.93	3.80	1.97	99.957
F2001	0.73	1.98	2.72	99.977	1.77	2.83	1.60	99.968
F2002	0.86	2.94	3.43	99.966	1.86	3.19	1.71	99.964
F2003	0.89	3.18	3.59	99.964	1.74	3.55	2.03	99.960
F2004	1.21	3.50	2.89	99.960	1.89	5.69	3.01	99.935
F2005	1.06	3.57	3.35	99.959	1.56	3.49	2.24	99.960
F2006	1.25	3.27	2.61	99.963	1.74	4.33	2.49	99.951
F2007	2.29	10.49	4.58	99.880	2.11	7.35	3.49	99.916
F2008	1.45	5.01	3.44	99.943	1.86	4.94	2.66	99.944
F2009	1.42	4.54	3.21	99.948	1.88	5.65	3.01	99.936
F2010	1.21	3.61	2.98	99.959	1.59	3.63	2.28	99.959
F2011	1.43	4.77	3.34	99.946	1.74	4.65	2.67	99.947
F2012	1.37	4.40	3.22	99.950	2.09	5.59	2.68	99.936
F2013	1.06	3.08	2.92	99.965	1.86	4.13	2.22	99.953
F2014	1.45	4.66	3.20	99.947	2.05	8.59	4.19	99.902
F2015	1.34	4.44	3.31	99.949	1.79	5.67	3.16	99.935
F2016	1.91	10.13	5.30	99.884	1.79	4.54	2.53	99.948
F2017	1.74	4.83	2.77	99.945	2.44	5.08	2.08	99.942
F2018	1.69	5.82	3.44	99.934	n/a	n/a	n/a	n/a

**Table 3 Reliability Indices – BC Hydro Overall – Normalized using IEEE 2.5 Beta Method**

Year	BC Hydro Overall – Normalized using IEEE 2.5 Beta method				
	SAIFI	SAIDI	CAIDI	CEMI-4 (%)	%ASAI
F2010	1.52	3.50	2.29	13.18	99.960
F2011	1.61	3.83	2.38	15.26	99.956
F2012	1.67	3.89	2.34	15.37	99.956
F2013	1.46	3.33	2.28	10.45	99.962
F2014	1.68	4.14	2.46	12.52	99.953
F2015	1.35	3.37	2.49	10.13	99.962
F2016	1.60	3.42	2.14	14.00	99.961
F2017	1.88	4.37	2.33	16.43	99.950
F2018	1.67	3.94	2.36	14.55	99.955

**Table 4 Reliability Indices – BC Hydro CEMI-4 Overall (All-Event Indices, Not Normalized)**

Year	BC Hydro Overall
	CEMI-4 %
F2010	15.22
F2011	19.26
F2012	17.43
F2013	12.88
F2014	15.10
F2015	15.15
F2016	23.77
F2017	19.45
F2018	20.87

Note: CEA does not survey for CEMI-4 or IEEE 2.5 Beta.

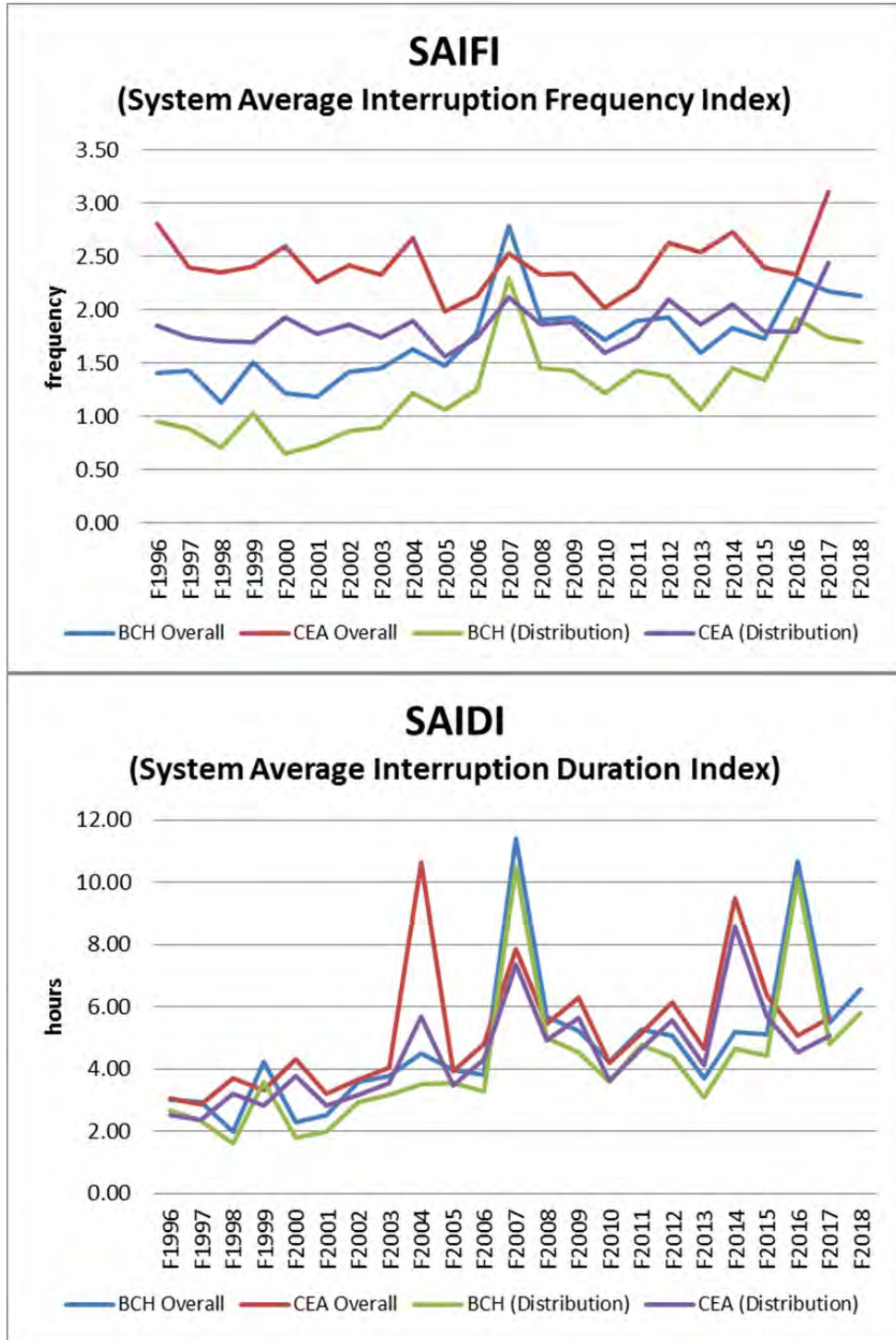
**Table 5 Reliability Indices – BC Hydro (Transmission) and CEA (Transmission) (Forced Data) (All-Event Indices, Not Normalized)**

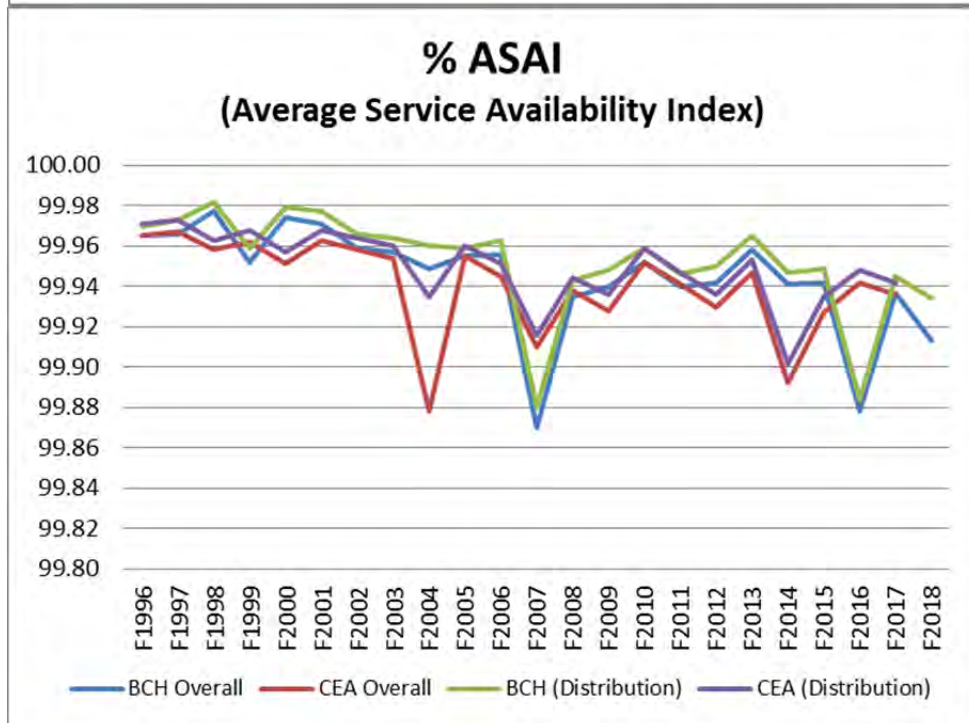
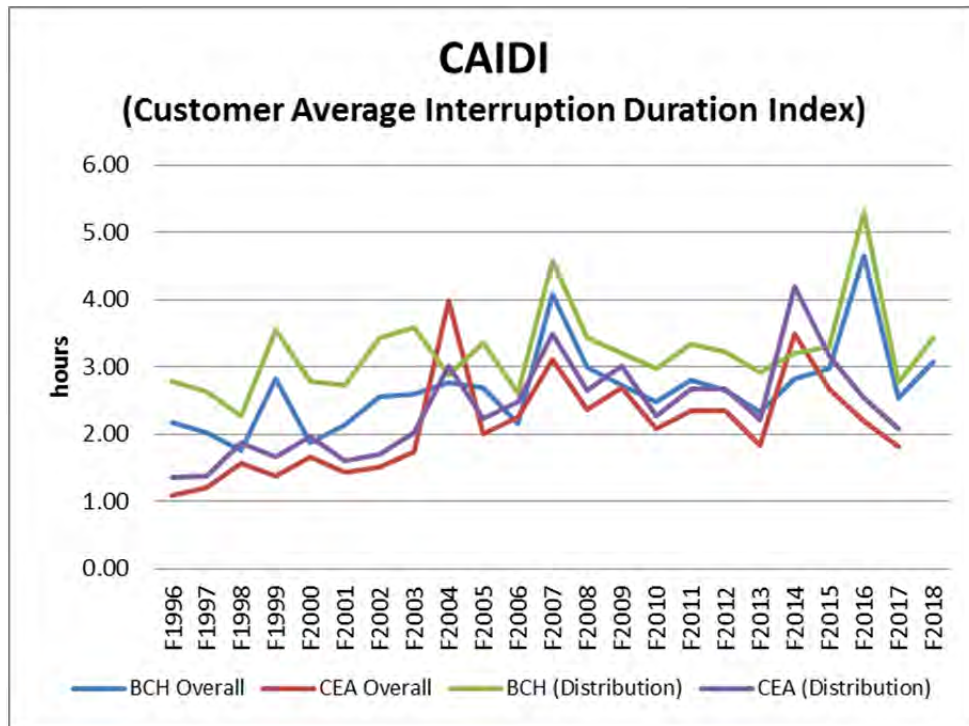
Year	BC Hydro (Transmission) (Forced)					CEA (Transmission) (Forced)				
	T-SAIFI-MI	T-SAIFI-SI	T-SAIDI	DPUI	SARI	T-SAIFI-MI	T-SAIFI-SI	T-SAIDI	DPUI	SARI
F2005	0.90	0.82	1.68	18.02	1.96	0.67	0.85	1.51	21.00	1.65
F2006	0.75	0.91	1.73	25.31	1.87	0.81	0.85	1.29	32.00	1.52
F2007	1.26	1.11	3.80	47.16	1.87	0.91	0.79	1.54	25.51	1.52
F2008	0.87	0.83	2.11	50.54	3.40	0.87	0.74	1.30	18.82	1.94
F2009	0.65	0.72	1.93	35.13	2.42	0.64	0.75	1.23	21.48	1.64
F2010	0.72	1.02	2.31	26.99	2.44	1.01	0.71	1.41	24.98	1.98
F2011	0.38	0.71	1.30	11.31	1.83	0.54	0.64	1.39	13.22	2.16
F2012	0.43	0.86	1.55	19.39	1.81	0.84	0.81	1.73	23.35	2.13
F2013	0.56	0.74	1.64	17.16	2.19	0.84	0.90	4.48	51.18	4.98
F2014	0.74	0.87	2.57	25.18	3.01	0.86	0.83	2.59	27.07	3.11
F2015	0.83	0.74	2.11	26.41	2.86	0.72	0.83	2.56	19.24	3.10
F2016	0.79	0.63	2.46	27.77	3.90	0.85	0.74	2.15	15.60	2.90
F2017	0.63	0.61	2.52	33.61	4.13	0.70	0.75	1.93	22.33	2.58
F2018	0.30	0.69	2.50	30.13	3.62	n/a	n/a	n/a	n/a	n/a

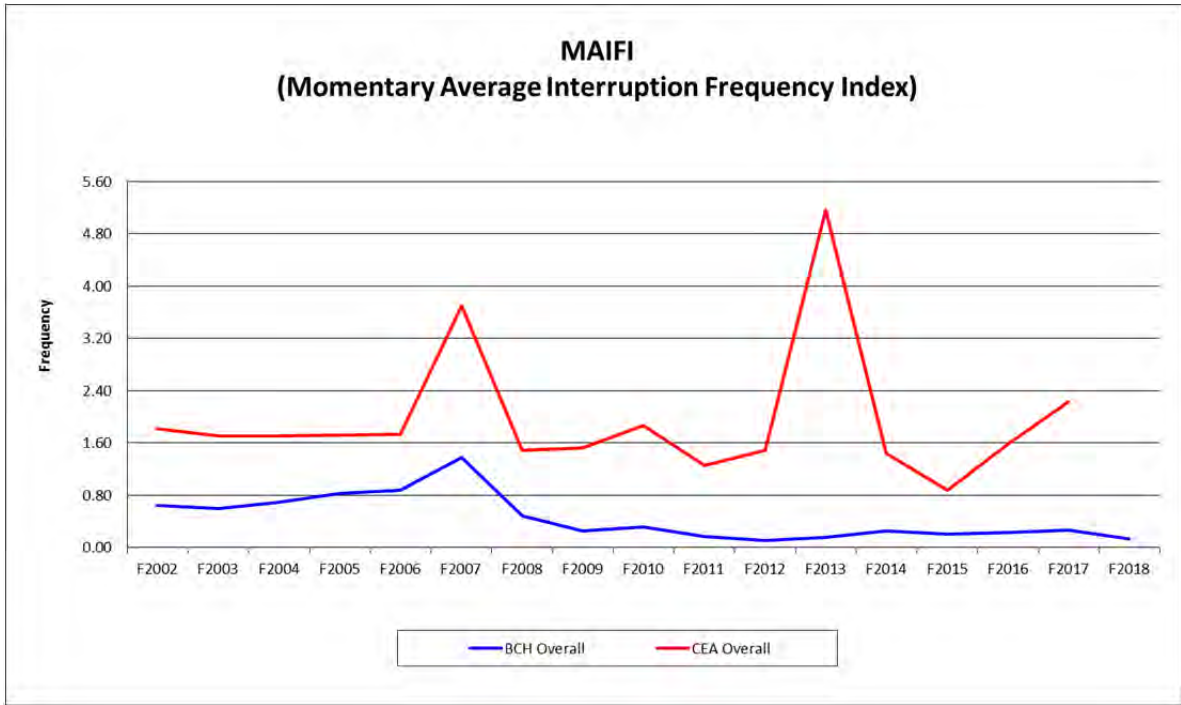
Note: The CEA Bulk Electricity Study program reports only on forced outage results as not all the participating utilities report planned outages.



**Distribution Graphs**

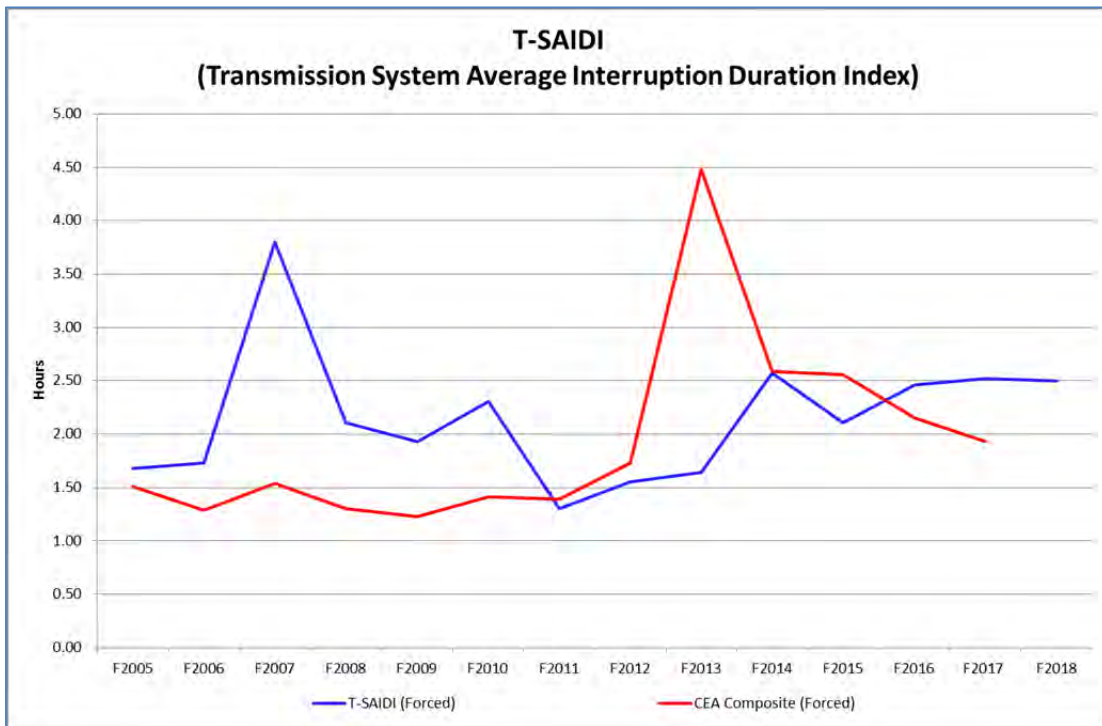
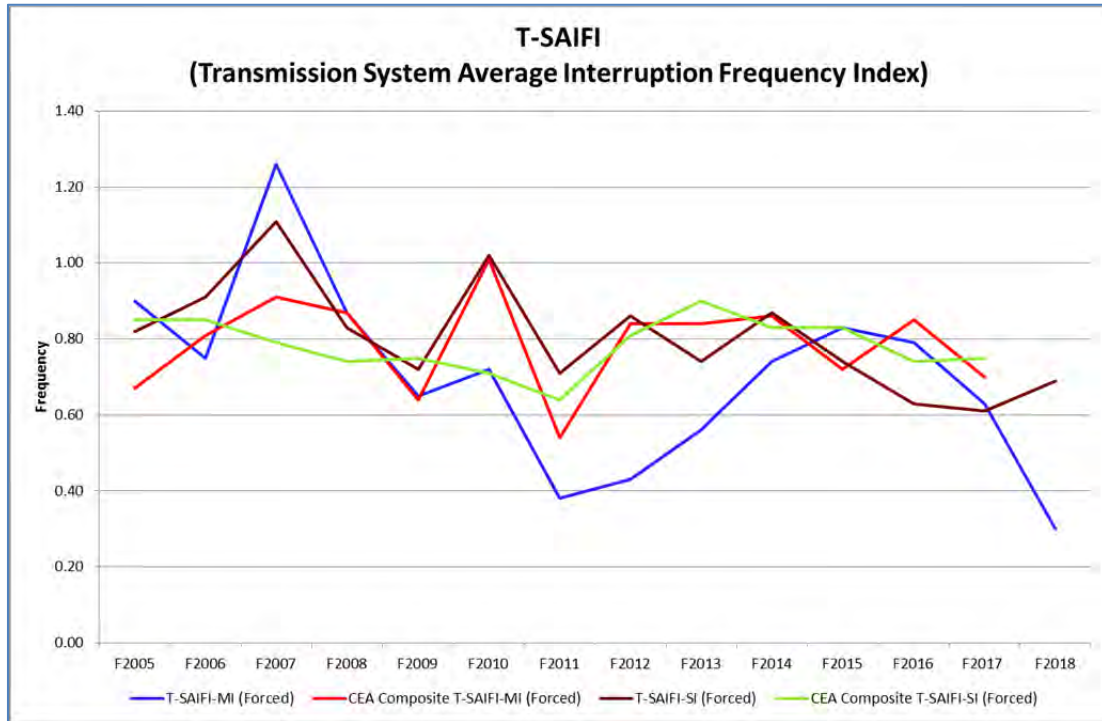


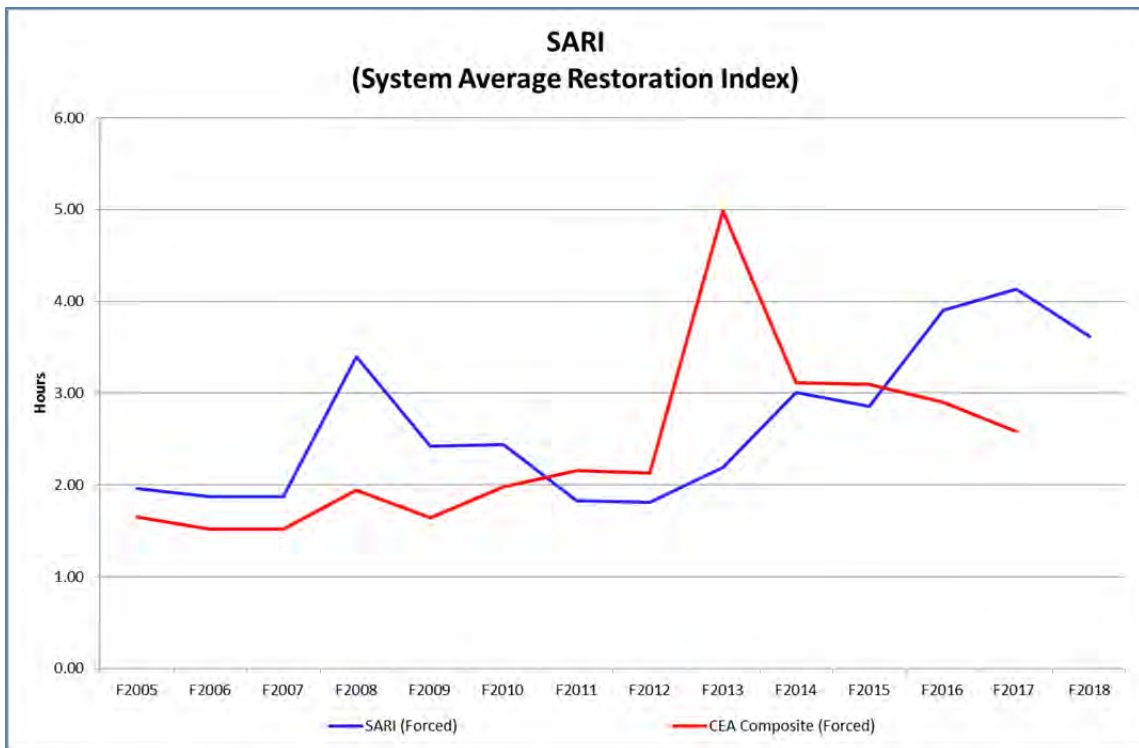
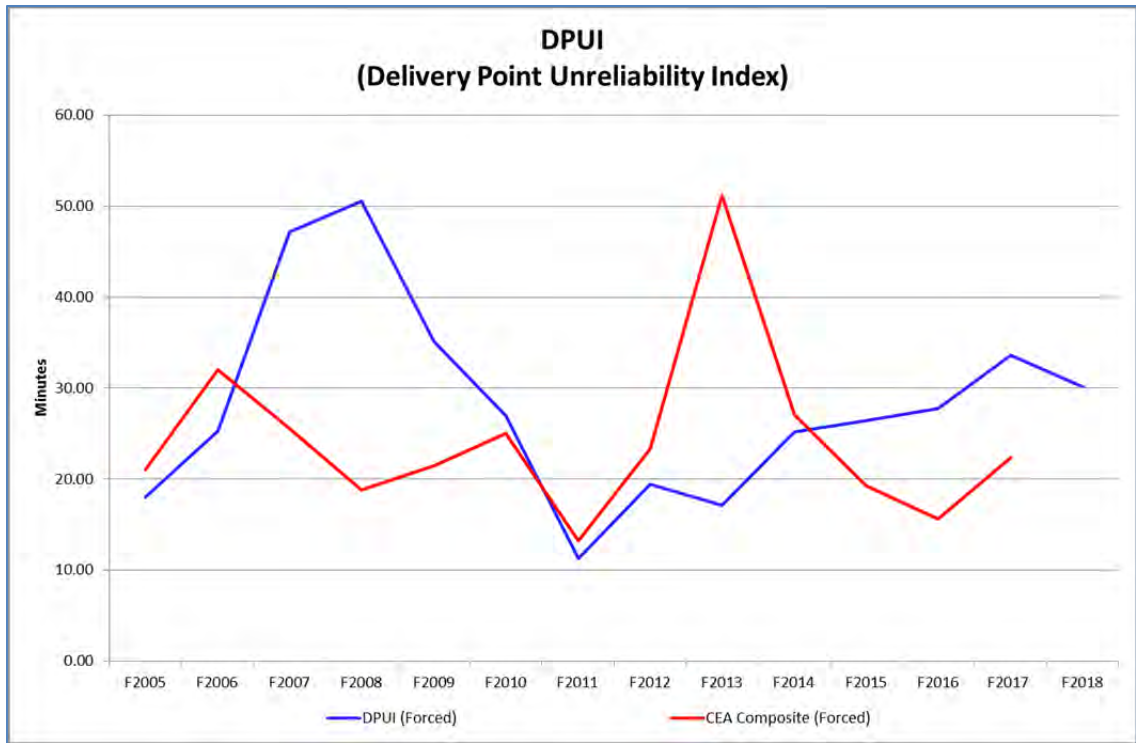




Note: The customer momentary interruptions and the resulting MAIFI may not apply to the utility's total customer population in the CEA comparison. Momentary outages are any interruptions on the feeders of less than one minute duration, caused by disturbance on the distribution, substation or transmission system.

**Transmission Graphs**





**F05/F06 Revenue Requirements Application  
Annual Response to Directive 26 of BCUC Decision**

---

---

**F2018 Annual Reporting of Reliability Indices**

**Attachment 2**

**Generation Reliability Indices**

Fiscal Year	BC Hydro Hydroelectric Units					CEA Hydroelectric Units					
	Average Availability Factor (%)	Average Operating Factor (%)	Average Forced Outage Count (Including starting failures) (Internal) <sup>Note 1</sup>	Average Forced Outage Factor (%) (Including starting failures) (Internal) <sup>Note 1</sup>	Failure Rate	Calendar Year	Average Availability Factor (%)	Average Operating Factor (%)	Average Forced Outage Count (Including starting failures) (Internal) <sup>Note 1</sup>	Average Forced Outage Factor (%) (Including starting failures) (Internal) <sup>Note 1</sup>	Failure Rate
F2009	85.6	71.3	2.0	5.2	2.1	C2008	93.5	80.0	2.5	2.0	2.1
F2010	84.7	68.7	2.1	2.2	2.3	C2009	91.8	77.1	2.4	1.4	2.0
F2011	81.9	68.0	2.0	5.1	1.9	C2010	90.4	70.3	2.2	3.0	1.9
F2012	82.2	69.8	2.4	5.0	2.7	C2011	88.4	72.5	2.5	3.9	2.2
F2013	82.7	72.6	2.0	3.4	2.3	C2012	89.2	72.0	2.5	3.8	2.3
F2014 <sup>Note 2</sup>	80.5	64.7	2.5	4.7	2.7	C2013	87.9	74.0	2.4	3.9	2.1
F2015 <sup>Note 3</sup>	81.1	65.1	2.4	3.7	2.9	C2014	87.5	73.5	2.4	5.0	2.1
F2016 <sup>Note 3</sup>	82.2	65.9	2.0	4.1	2.4	C2015	87.9	70.4	3.2	6.2	2.1
F2017 <sup>Note 3</sup>	81.7	67.6	1.8	4.4	1.9	C2016	86.7	71.7	3.1	6.2	1.9
F2018 <sup>Note 3</sup>	80.5	65.5	1.7	2.6	2.0	C2017	n/a	n/a	n/a	n/a	n/a

**Definitions**

- Availability Factor = Operating Time + Available-But-Not-Operating Time / In Commercial Service Time <sup>Note 4</sup>
- Forced Outage Count = Average Number of Forced Outages / Unit / Year (Including Starting Failures)(Internal)
- Forced Outage Factor = Forced Outage Time (including Starting Failures)(Internal) / In Commercial Service Time <sup>Note 4</sup>
- Failure Rate = Forced Outage Count (excluding Starting Failures)(Internal) / Operating Time X In Commercial Service Time <sup>Note 4</sup>

**Notes**

1. Outages with causes that were external to Generation, such as Transmission System forced outages, are excluded from this measure.
2. Data excludes ALU Unit 1 and SHU Unit 1, which have been forced out of service for an extended period.
3. Data excludes ALU Unit 1, SHU Unit 1 and ELK Units 1 and 2 which have been forced out of service for an extended period.
4. In Commercial Service Time represents the number of hours in the measurement period that the unit(s) were considered part of the active fleet.

CEA Data taken from table 6.1.1 "All Units"

