March 1st, 2022

Mr. Steve Rutty  
Director, Grid Assets  
California ISO  
250 Outcropping Way  
Folsom, CA 95630

Dear Mr. Rutty,

In accordance with the Transmission Control Agreement (TCA) section 14.3, TCA Appendix C Section 4.0 and CAISO Tariff 4.8.3, Trans Bay Cable LLC (TBC) submits the following Public Access Availability Report for CAISO review.

**Performance:**

TBC’s summary performance for 2021 is:

| Total Annual Availability (excluding Scheduled) | 99.93% |

TBC completed all preventative maintenance for 2021, in accordance with CAISO approve Converter Station and Cable Maintenance Practices. Details are provided separately in the CAISO Standard Maintenance Reporting System TBC 2021 Review.

TBC operates a single DC transmission line (HVDC Facility) and has accrued 11 years of operational data. TBC has the ability to trend performance based on this data since the start of commercial operations. The Total Forced Outage duration in 2021 did not exceed TBC’s defined Upper Control Limit (UCL) for outage duration and was found to be within bounds and consistently less than the Center Control values as derived. In 2021, Total Forced Outage Duration was 391 minutes, compared to 1109 minutes of the previous year.

The following section provides details in TBC’s derivation of UCL, as well as other values used to create the Control Charts.
Control Charts:

TBC used the CAISO’s TCA, Appendix C, as a reference in creating TBC’s control charts. Forced Outage data of the TBC HVDC Facility was used to create the charts. The following outage data were not included in the control charts:

- Scheduled Outages
- Outages classified as “Not a Forced Outage” in the Maintenance Procedures
- Forced Outages which:
  - Were caused by events outside of TBC’s HVDC Facility including outages which originate in other transmission operator (TO) systems, other electric utility systems or customer equipment
  - Or outages which can be demonstrated to have been caused by earthquakes

The following variable and equations were extracted from the TCA and used to create TBC’s control charts:

### Annual Average Forced Outage Frequency for the TBC HVDC Facility

\[
F_{vc,k} = \frac{1}{N_k} \sum_{i=1}^{N_k} f_{ik}
\]

- \(N_k\) = number of Transmission Line Circuits in Voltage Class in calendar year “k”.
  - See Appendix C, Note 2, Section 4.1.1 of the TCA.

- \(f_{ik}\) = frequency of Forced Outages (IMS) for the “ith” Transmission Line Circuit as calculated in accordance with Appendix C, Section 4.1.1 of the TCA for calendar year “k”.

- Because the TBC HVDC Facility is considered a single transmission line, \(N_k\) will equal one (1) for each calendar year “k”.

- \(f_{ik}\) = frequency of Forced Outages (IMS) for the “ith” Transmission Line Circuit as calculated in accordance with Appendix C, Section 4.1.1 of the TCA for calendar year “k”.

- Because the TBC HVDC Facility is considered a single transmission line, “i” will equal one (1), and \(f_{ik}\) will simply be \(f_k\). \(f_k\) will equal the number of Forced Outages that occurred on the TBC HVDC transmission line each for calendar year “k”.

### Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility

\[
D_{vc,k} = \frac{1}{N_{o,k}} \sum_{i=1}^{N_{o,k}} d_{ik}
\]

- \(N_{o,k}\) = number of Transmission Line Circuits in the Voltage Class for which the...
Forced Outage(IMS) frequency Availability Measure ($f_{ik}$) as calculated in accordance with Section 4.1.1 of this Appendix C is greater than zero for the calendar year “k”. See Appendix C, Note 2, Section 4.1.1 of the TCA.

Because the TBC HV/DC Facility is considered a single transmission line, $N_{i,k}$ will equal one (1) for each calendar year “k”.

\[ d_{ik} = \text{accumulated duration of Forced Outages(IMS) for the “ith “ Transmission Line Circuit having a Forced Outage(IMS) frequency Availability Measure ($f_{ik}$) greater than zero for calendar year “k” as calculated in accordance with Section 4.1.1 of this Appendix C.} \]

Because the TBC HV/DC Facility is considered a single transmission line, “i” will equal one (1), and $d_{ik}$ will simply be $d_k$. $d_k$ will equal the total accumulated duration of Forced Outages the TBC Facility experienced each calendar year “k”.

\[ D_{vc,k} = \text{duration index for the Voltage Class (units = minutes/Transmission Line Circuit). The duration index equals the average accumulated duration of Forced Outages(IMS) for all Transmission Line Circuits within a Voltage Class which experienced Forced Outages(IMS) during the calendar year “k”}. \]

Because the TBC HV/DC facility is considered its own voltage class and a single transmission line “vc” will equal one (1), $D_{vc,k}$ will simply be $D_k$. $D_k$ will subsequently equal the number of Forced Outages that occurred on the TBC HV/DC Facility for each calendar year “k”.

\[ D_k = d_k \]

**CL for Annual Average Forced Outage Frequency for the TBC HVDC Facility**

\[ CL_f = \frac{\sum_{k=1}^{Y} \sum_{i=1}^{N_k} f_{ik}}{\sum_{k=1}^{Y} N_k} \]

$Y =$ number of calendar years prior to the date a TO becomes a PTO for which the PTO has reliable, continuously recorded Forced Outage(IMS) data.

TBC became a PTO from the beginning of commercial operation in November of 2010. Due to this the first calendar year used for the CL calculation will begin from the date of January 1st, 2011.

**CL for Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility**
CL_d = \sum_{k=1}^{Y} \sum_{i=1}^{N_{o,k}} d_{i,k} / \sum_{k=1}^{Y} N_{o,k}

CL_d = center control line value for accumulated Forced Outage^MIMS^ duration for each of the Transmission Line Circuits in the Voltage Class for “Y” calendar years prior to the date a TO becomes a PTO in which the Forced Outage^MIMS^ frequency (fik) was greater than zero.

Because of the assumptions made above, this calculation essentially becomes the average duration (in minutes) of Forced Outages since January 1st, 2011.

Upper Control Limit (UCL) and Lower Control Limit (LCL) for Annual Average Forced Outage Frequency for the TBC HVDC Facility

UCL_f and LCL_f define a range of expected performance extending above and below the CL. The UCL_f and LCL_f were generated by multiplying the total number of Forced Outages of since January 1st, 2011 by 99.75% (0.9975) and .25% (0.0025), respectively.

Upper Control Limit (UCL) and Lower Control Limit (LCL) for Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility

UCL_d and LCL_d define a range of expected performance extending above and below the CL. The UCL_d and LCL_d were generated by multiplying the total number of the duration (in minutes) of Forced Outages since January 1st, 2011 by 99.75% (0.9975) and .25% (0.0025), respectively.

Upper Warning Limit (UWL) and Lower Warning Limit (LWL) for Annual Average Forced Outage Frequency for the TBC HVDC Facility

UWL_f and LWL_f define a range showing if the number of annual TBC Forced Outages is approaching the UCL_f and LCL_f. The UWL_f and LWL_f were generated from multiplying the total number of Forced Outages since January 1st, 2011 by 97.5% (0.975) and 2.5% (0.025), respectively.

Upper Warning Limit (UWL) and Lower Warning Limit (LWL) for Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility

UWL_d and LWL_d define a range showing if the annual accumulated duration of Forced Outages is approaching the UCL_d and LCL_d. This number was generated from multiplying the total duration of Forced Outages since January 1st, 2011 by 97.5% (0.975) and 2.5% (0.025), respectively.
Performance Monitoring:

Based on the analysis of the control charts, TBC has identified that performance is accurately represented and in line with the calculated Center Control line values and should continue its preventative and predictive maintenance efforts in this manner.

Performance Outside Limits:

Performance was inside the upper and lower limits, with the LCL specified at 2.5% of the sum of accumulated forced outage duration since 2011. Performance outside of this limit was 0 minutes force outage duration, which was less than 2.5% of the sum of all previous forced outages. This was reviewed and found to be accurate.

Improving Performance:

TBC continues to explore new preventative techniques and use of industry best practices. These practices have provided a solid operational foundation for TBC over the past 11 years. TBC remains committed to the safe and reliable delivery of power to the city of San Francisco and strives to maintain this high level of performance while keeping its employees safe from COVID-19.

2021 Summary Outage Data:

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<tr>
<td>Scheduled</td>
<td>Scheduled</td>
<td>175,237</td>
<td>175,237</td>
</tr>
</tbody>
</table>

Total Outage Time (min) 175,628

Total Annual Availability (excluding Scheduled) 99.93%

Respectfully,

Michael Blunt
Operations Manager
Trans Bay Cable LLC
Appendix 1. Control Charts

Annual Accumulated Forced Outage Duration

- 21975.06
- 21479.38

Duration of Outage (minutes)

Year


Trans Bay Cable LLC
P.O. Box 666 Pittsburg, CA 94565