

The Upgrade of the Northern Terminal of the Pacific NW-SW HVdc Intertie Celilo Converter Station

Dan Kell
TransGrid Solution
Canada

Karl Mitsch
US-DOE BPA
USA

Mark Reynolds
Power Engineers
USA



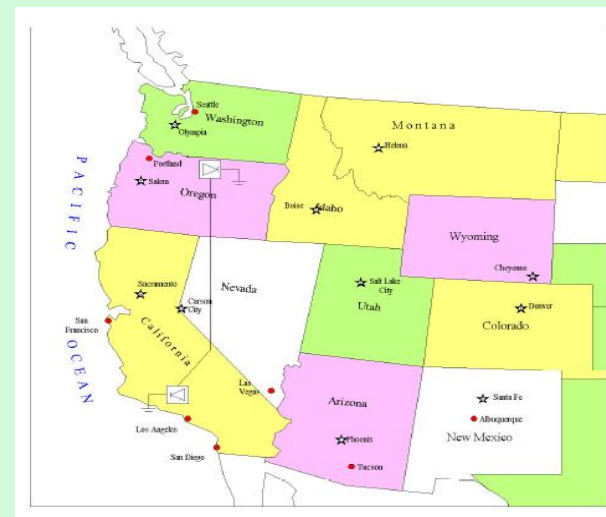
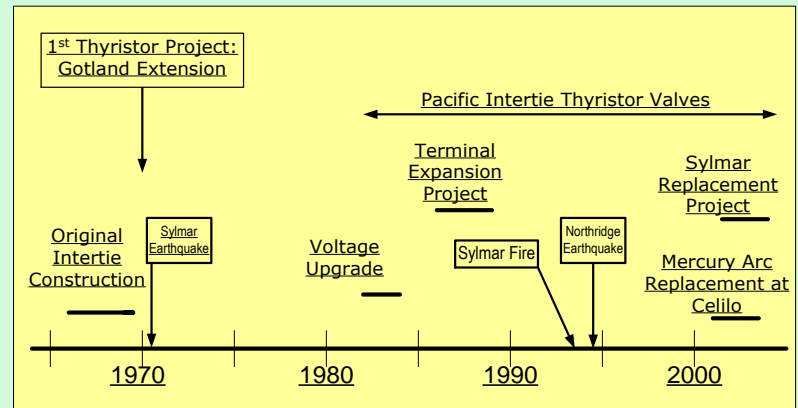


Introduction

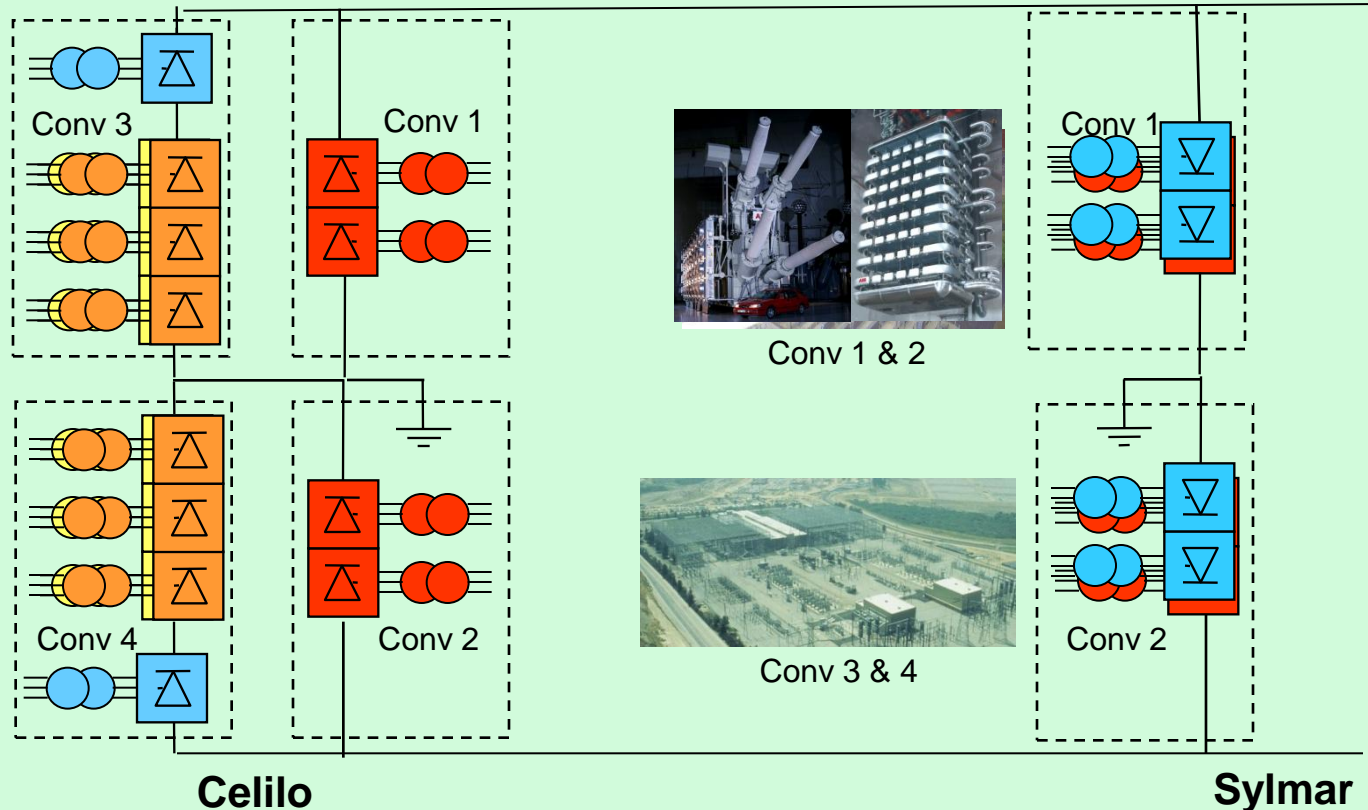
- Bonneville Power Administration (BPA) is in the process of upgrading their portion of the Pacific DC Intertie (PDCI). This project consists of two major components:
 - Upgrade of the Celilo terminal
 - Re-insulation and upgrade of the dc transmission line.
- The upgrade of the converter will include;
 - The complete furnishing of a new ± 560 kV bi-polar (12-pulse per pole) converter station rated at 3800 MW.
 - All ac and dc filters shall be replaced with new filters.
 - The transmission line upgrades include new insulation for operation at +/- 560 kV dc for North to South transfers, shunting of splice fittings, replacement of dampers and installation of failure containment deadends.

History

- In 1977, Current upgrade based on studies of design margin in the equipment raised the current to 2.0kA using inherent capacity of the valves and bringing the rating to 1600MW
- In 1984, the system was upgraded to +/-500kV by adding 1 x 100kV, thyristor valve group rated for 2kA, which increased the Bipole rating to 2000MW.
- In 1989, 12-pulse parallel thyristor valve groups were added (Converter 1 and 2), rated for +/-500kV, 1.1kA, which increased the PDCI capacity to 3100MW.
- In 2003, the mercury arc valves of Celilo Converters 3 and 4 were replaced with thyristor valves of the same rating, maintaining the current rating of converters 3 and 4 at 2kA, and the station rating of 3100MW. In 2004, at Sylmar, the parallel +/-500kV 1100MW converters were replaced with a new +/-500kV 3100MW converters and the original mercury arc converters 3 and 4 were retired. The replacement was required as a result of extensive damage sustained at the Southern terminal during the 1994 Northridge earthquake.



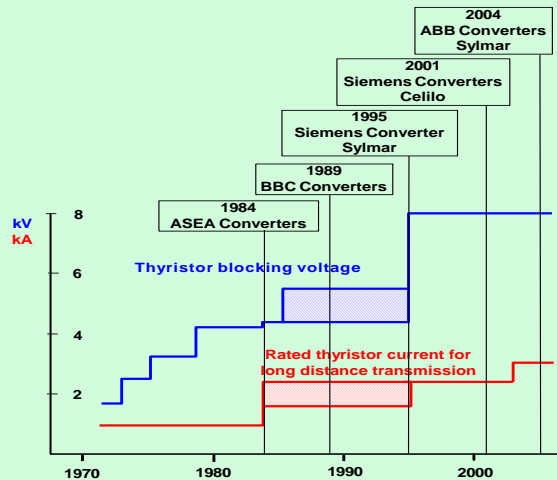
PACIFIC DC INTERTIE REPLACEMENT & UPGRADE



2004 Replace 1100MW converters 1 & 2 at Sylmar with new 3100 MW converters

Upgrade Project Justification

- Sustain
 - For the Celilo terminal, retain the existing four converter architecture and replace systems and components as they reach their end of life.
 - The dc line would also require substantial improvements to bring the line performance up to current NESC/CAL-GO95 standards. Addition of Insulator Bells, selective use of NCI Insulators, change-outs of Shunt-Fittings, and minor conductor hardware replacements

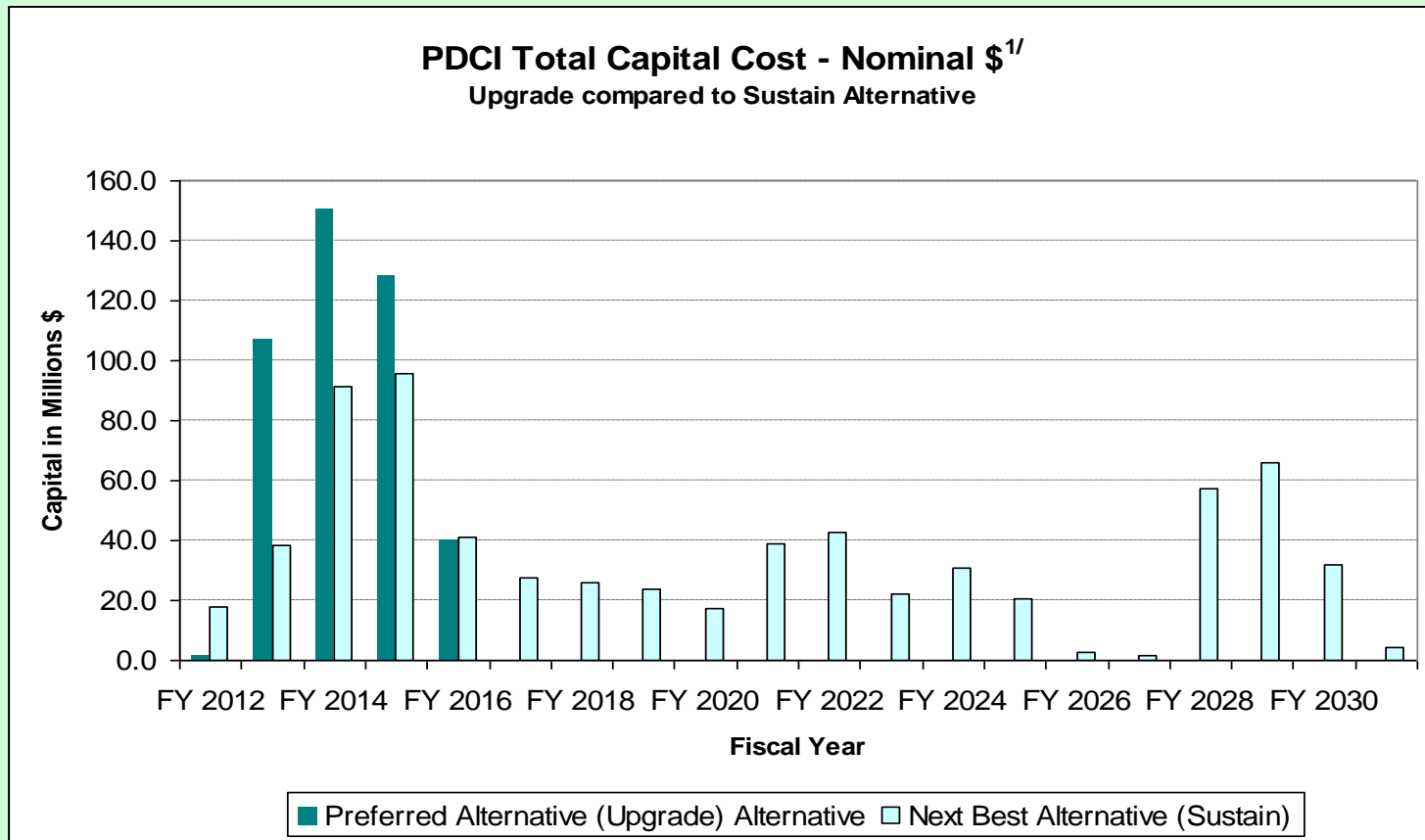


Upgrade Project Justification

- Upgrade
 - Replacement of the existing Converter equipment with new dc converter equipment capable of the entire station rating.
 - The dc line would require re-insulation to allow operation at a higher dc voltage.
 - The Upgrade alternative also allows the opportunity to increase power transmission capability in the N to S direction by taking advantage of some latent capability in the Sylmar Converters.
 - The dc line would also require substantial improvements to bring the line performance up to current standards.



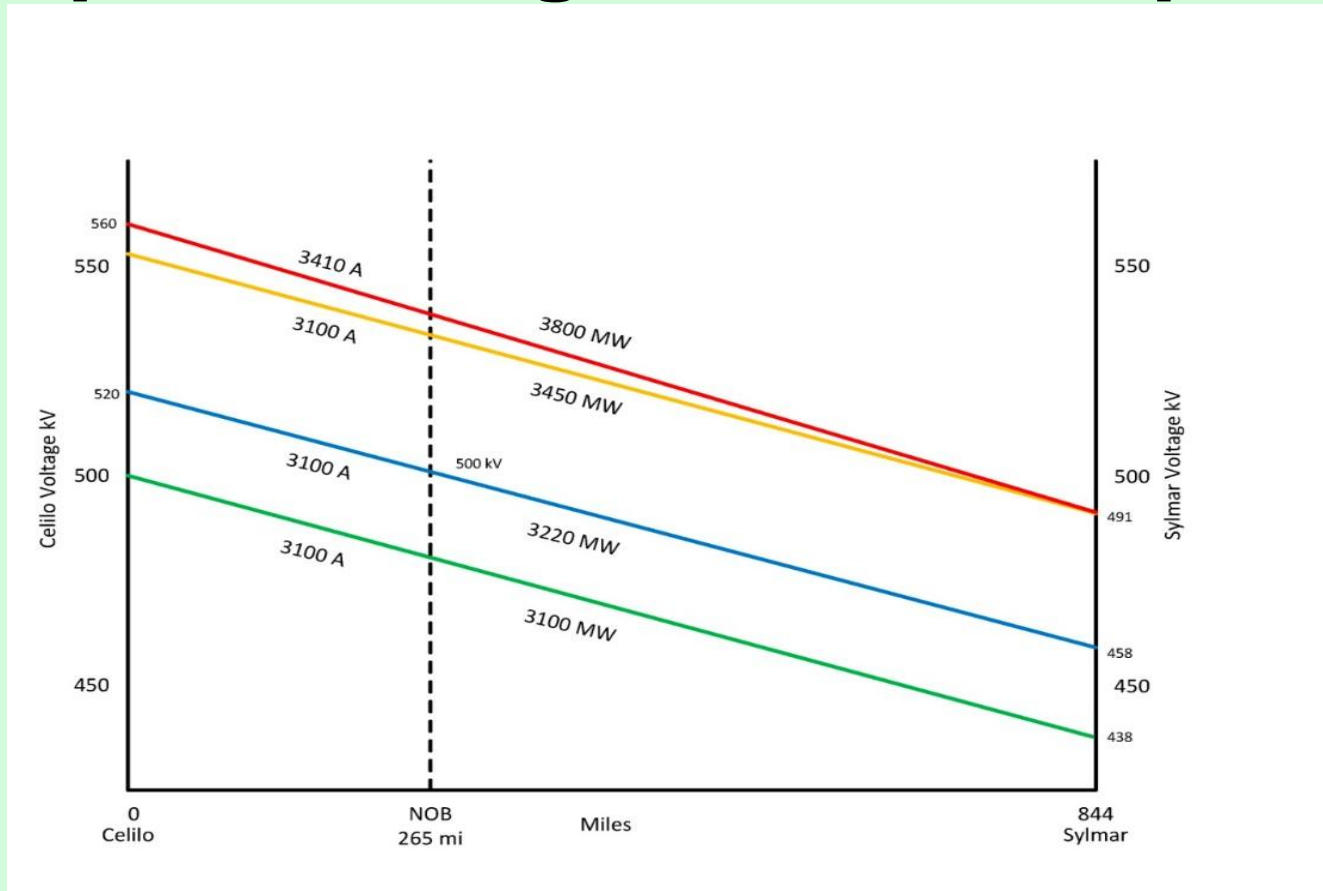
Upgrade Project Justification



Upgrade Project Justification

- The Upgrade option also has several other benefits such as:
 - Utilizing one vintage of technology, reducing maintenance and spare part inventory for a simplified station configuration and the possibility of dynamic scheduling for the link.
 - When compared to the Sustain option it is one large project instead of a stream of a several projects over 25 years.
- Ultimately BPA chose the Upgrade alternative as the best approach to maintaining reliable and economic operation into the future

Proposed Stages of Development



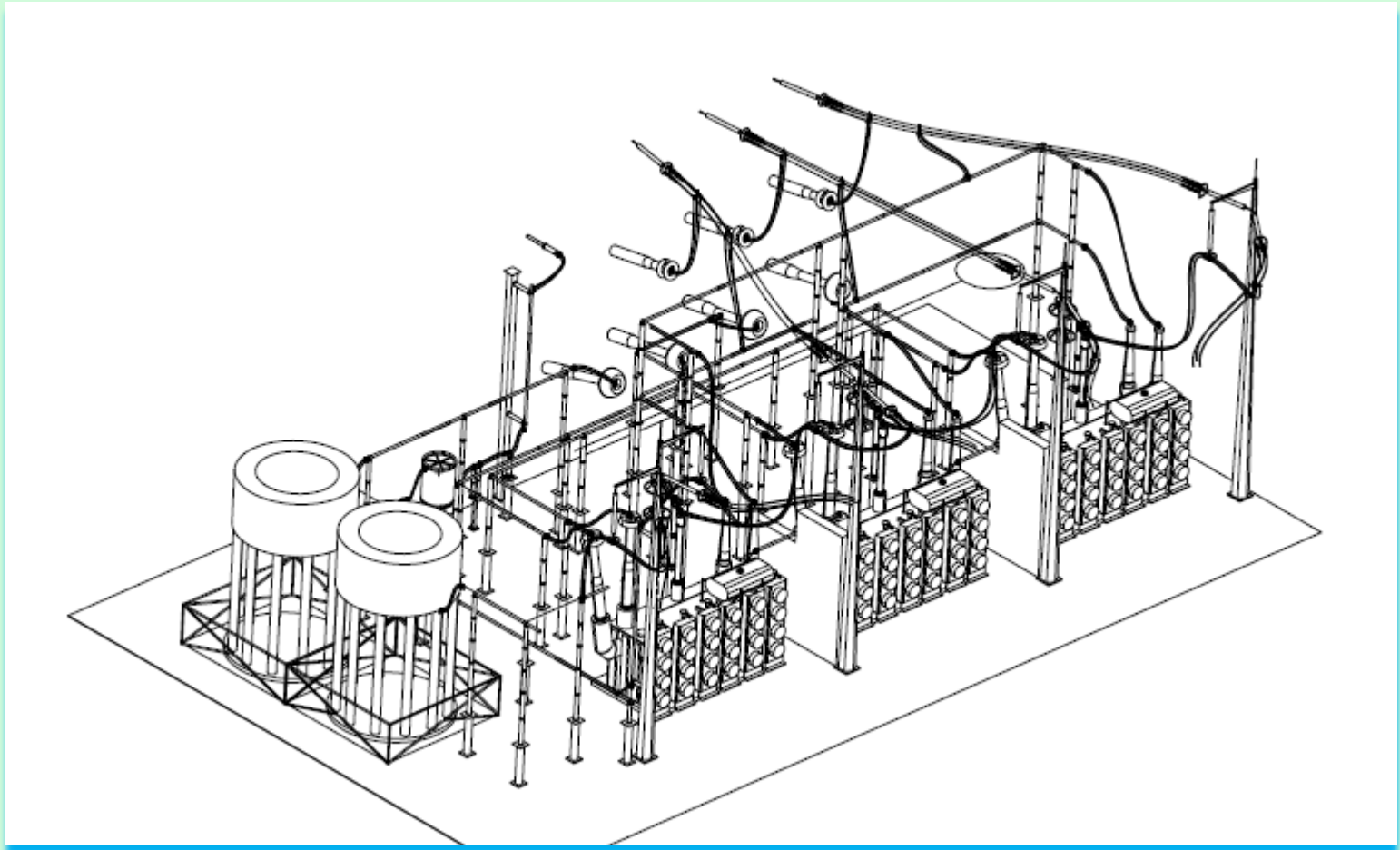
Existing: 3100 MW, Stage 1: 3220 MW, Stage 2: 3450 MW, Stage 3: 3800 MW

Unique Challenges

- Testing (with minimum outage times)
- Maintaining capacity during construction (design to minimize unscheduled outage potentials)
- Utilizing existing valve hall (minor seismic improvements)
- Maintaining the Footprint
- Electrode and Electrode line



A LOOK INTO THE FUTURE AT CELILO



USNC CIGRE- EPRI - GRID OF THE FUTURE
October 21-23, 2013 – Boston MA USA



Conclusions

- Early in 2013, stage 1 of the upgrade project was awarded to ABB. The terminal will be completed by December 2015 and the line work is scheduled to be complete by November 2017.
- By careful up-front planning and specifying what is required, the PDCI upgrade project is off to an excellent start
- Design Review and planning activities are in progress, with release of apparatus design specifications expected this Fall (2013)
- Beginning of apparatus manufacturing in early 2014
- Outage coordination and planning for control replacement at both terminal stations (Celilo & Sylmar)

Questions

Dan Kell

dkell@transgridsolutions.com

Mark A Reynolds

mark.reynolds@powereng.com

Karl Mitsch

kamitsch@BPA.gov