



Trans Bay Cable Dead Bus Energization and Load Restoration in San Francisco

2012/2013 CAISO Transmission Planning Meeting

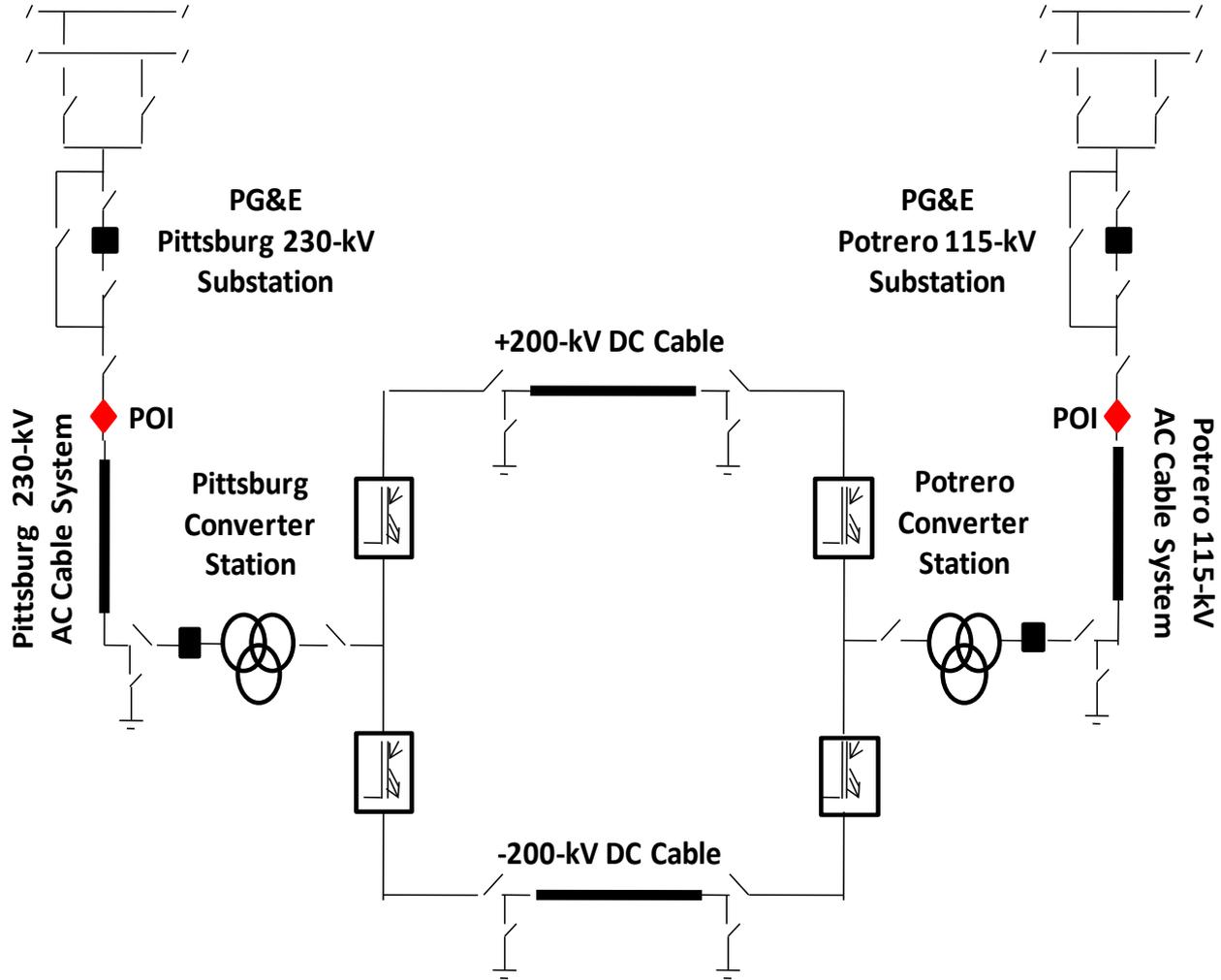
September 27, 2012

Problem Statement

- Contingency: Loss of Martin substation - Loss of Service to San Francisco, including Potrero 115 kV Bus.
- The TBC cable has tripped.
- TBC has no way to energize the dead bus at Potrero, when relying on PG&E is not an option
- Explore the feasibility of dead bus energization of Potrero 115 kV bus, Black start restoration of the Trans Bay cable and deliver load to the city of San Francisco.
- There are no large motor loads in San Francisco
- Supports System Restoration efforts to restore service to San Francisco and CAISO's efforts to meeting NERC EOP-005 standards

Requirements

- Energizing the cable requires
 - a) Plant startup power (≤ 1 MW at the distribution level)
 - b) Ability to meet startup inrush current of about 9 kA (on the 115 kV side at Potrero)
 - c) Requires reference bus voltage and frequency at Potrero
 - d) Short-circuit Rating requirement of 18.5 kA at Potrero
 - e) Short-circuit Rating requirement of 19.5 kA at Pittsburg



Requirements

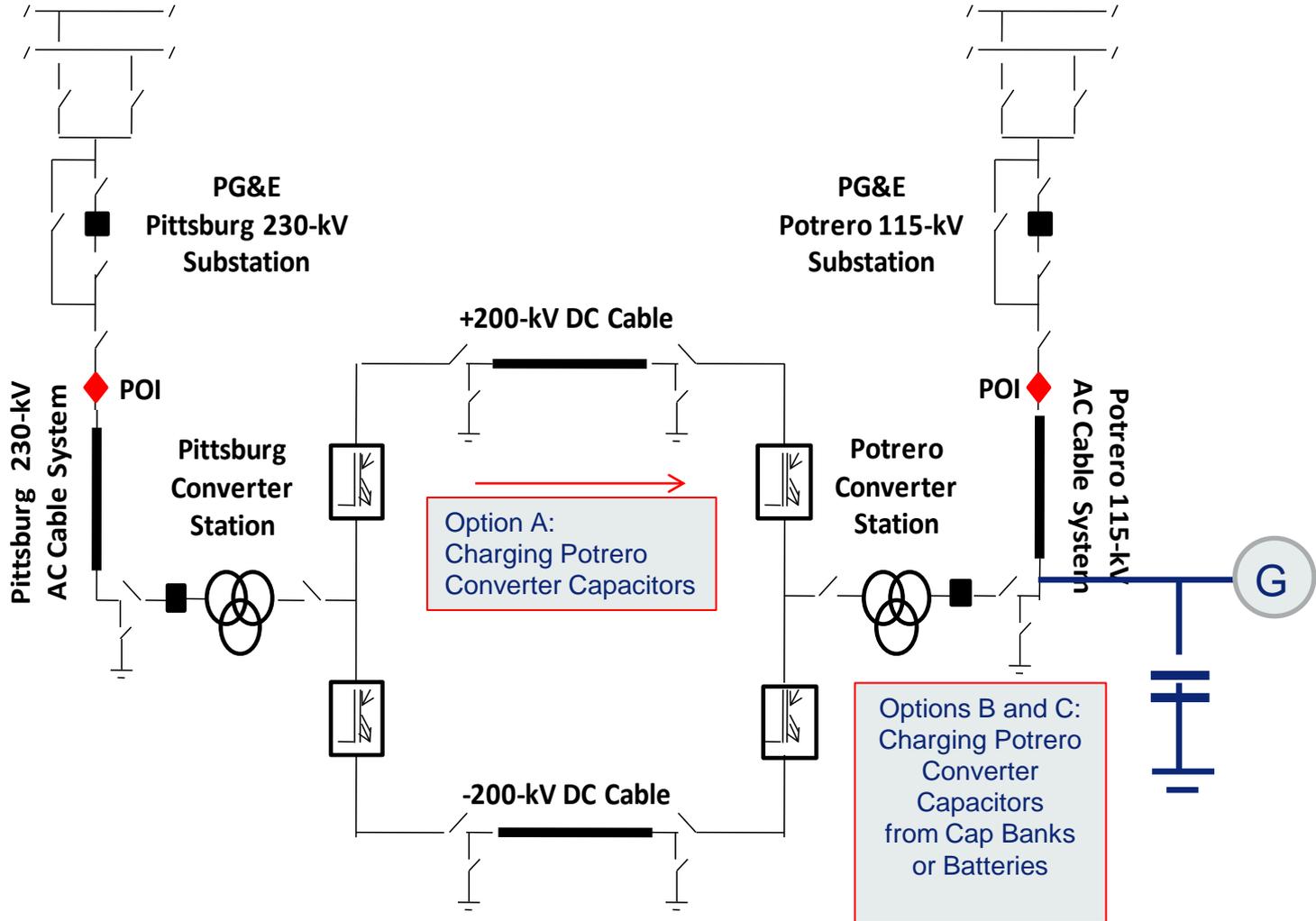
- Energizing the cable requires
 - a) Plant startup power (≤ 1 MW at the distribution level)
 - b) Ability to meet startup inrush current of about 9 kA (on the 115 kV side at Potrero)
 - c) Requires reference bus voltage and frequency at Potrero
 - d) Short-circuit Rating requirement of 18.5 kA at Potrero
 - e) Short-circuit Rating requirement of 19.5 kA at Pittsburg
 - f) Once the cable has been energized, TBC will transfer power to Potrero to serve San Francisco load

Potrero Converter and Station requirements

- Local Generation requirement at Potrero
 - Local generator to serve the plant load (e.g., 1.5 MW unit with Redundancy)
 - The generator will also provide reference bus voltage and frequency
- Charging converter Module capacitors
 - One Capacitor per module
 - 216 modules per arm, with 6 arms
 - 1296 Capacitors for all six arms

Charging Potrero Converter Capacitors Options

- Charge Potrero Converter Capacitors via the DC cable (from Pittsburg)
- Charge Potrero Converter Capacitors using local Capacitor banks at Potrero (24 - 30 MVARs)
- Charge Potrero Converter Capacitors using local batteries



Requirements

- Coordination with PG&E and CAISO;
- Requires additional instrumentation and changes to the Control & Protection schemes by Siemens;
- Requires re-designing and re-configuring start up sequence, possibly just during the black start conditions
- Costs: Generator/s; Instrumentation, Control & Protection system changes; Startup Logic changes;
- Initial Estimate : \$20 Million to 30 Million; To be refined working with Siemens and other vendors;