

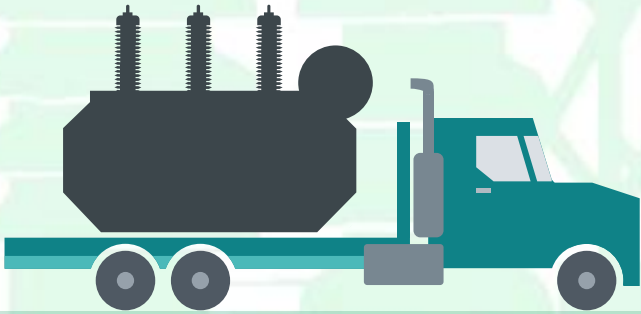
Installation and Energization of the World's First EHV Rapid Response Multi-Voltage Transformer Lease (#314)

Eduardo Gomez Hennig, Scott Gray, David Calitz & Ewald Schweiger



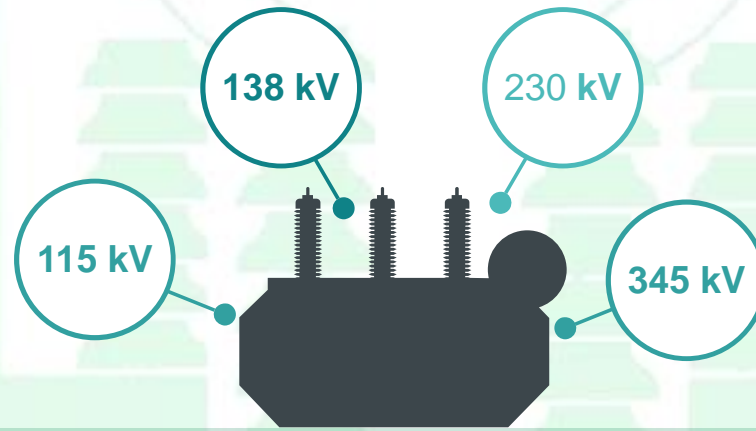
Multi-Voltage Resilience GSU for rapid deployment

Mobile



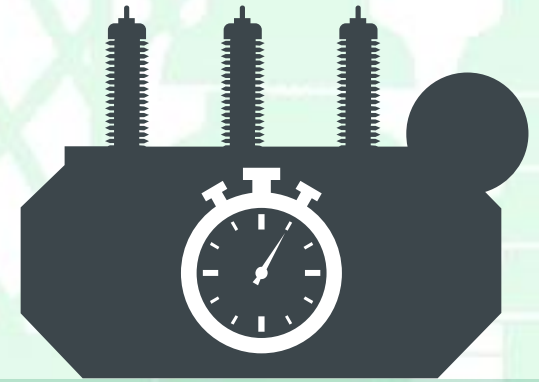
Compact and
lightweight design

Versatile



Covering different ratings

Rapid Installation



Plug and Play
connections and bushings

Multi-Voltage Resilience GSU Characteristics

First glance - 345 kV GSU in the test bay



Final testing end March 2018

- ➔ Flexible
- ➔ Quick Deployment

Technical data

Three units 83.3 MVA – single-phase – 60 Hz (250MVA bank)
Possible operating voltages (@ three phase rating):

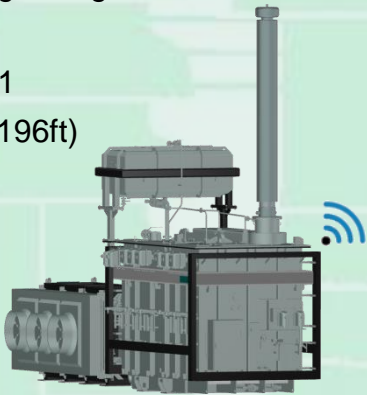
	Vector Group	D	D	Y	D	Y	D	Y	D	Y	D	Y
	LV Voltage [kV]	34.5	20	34.6	18	31.2	16	27.7	14	24.3	12	20.8
HV Voltage [kV]	400 ^{*)}	●	-	-	-	-	-	-	-	-	-	-
	345	-	●	●	●	●	●	●	●	●	●	●
	230	-	●	●	●	●	●	●	●	●	●	●
	138	-	●	●	●	●	●	●	●	●	●	●
	115	-	●	●	●	●	●	●	●	●	●	●

Tertiary 13.6kV ^{*)}400kV via adapter and BIL 900kV

- Switching links utilized to change between operating voltages
- Noise level 75 dB(A)
- KDAF – Ester Fluid – Synthetic Ester – MIDEL 7131
- Plug-in bushings and LV cable connections (60m ~196ft)

Low transport weights:

- Fully assembled and oil filled: ~214,000 lbs., 97 t
- Transport weight (transformer) w/o oil: ~114,600 lbs., 52 t
- Unit assembly without oil: ~135,000 lbs., 62 t
- Oil: 9,740 gal, 78,882 lbs., 35.8 t



Installation, configuring voltages, processing, filling and testing

- Installation of 3 single phase units, conservators and coolers
- Configuring operating voltages
- Installation of all accessories and piping
- Vacuum processing and oil filling of transformers
- Bushing testing and installation
- Testing of single-phase transformers
- Arrester testing and installation
- Testing all accessories, alarms, trip contacts, etc.
- Installation and testing of isophase modifications
- Installation and testing of station service transformers
- Connecting and testing of main control cabinet
- ➔ Successful commissioning



Multi-Voltage Resilience GSU Characteristics

- Need lots of manpower! – 6.4 Lbs./ft (9.5 kg/m)
 - 36 x 200 ft (~60 m) cables installed
 - Total installed cable length of roughly 7200 ft (2195 m)
 - Maintained 3 ft (~1 m) spacing between cable bundles
 - Installed control cables between transformers and main control cabinet
 - Cables tied down onto wood mats/timbers
 - Testing unit as a three-phase bank to verify ratio and phase relation
 - Connecting the main HV jumpers
 - Installation of isophase busbar links
 - Remove all tools, materials and debris
 - Check all switches for proper operation and set to positions for normal operation
 - Clean up laydown area and prep for long term storage
 - Final inspection/walkdown
- ➔ Ready for energization!



Thank You! – Questions?

