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GWP Conservation Voltage Reduction Program

June 7, 2018

glendale
california

Overview

Municipal Utility NE of Los Angeles

89,000 electric meters

35,000 water meters

Deployed Smart Grid in 2011

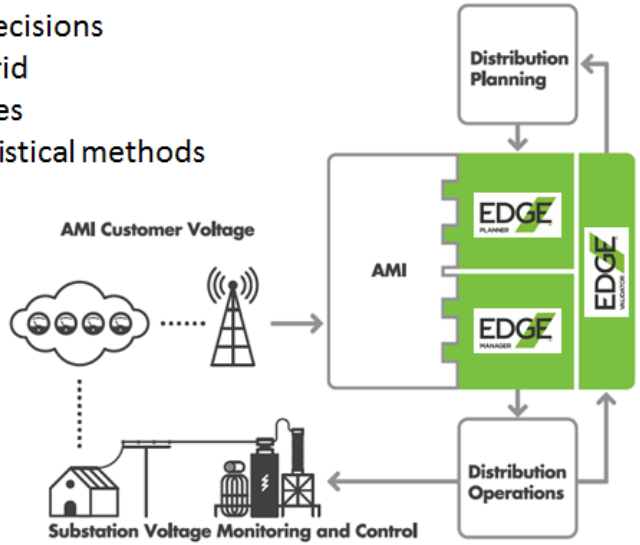
Selected Dominion Voltage, Inc. (DVI) Edge CVR solution in 2014

Technology

- EDGE Solution
  - Planner – Determines the bell weather meters, outliniers, min/max voltage
  - Manager – Dashboard manages each transformer voltage performance
  - Validator – Calculates the Energy Savings

Greater And More Sustainable Savings

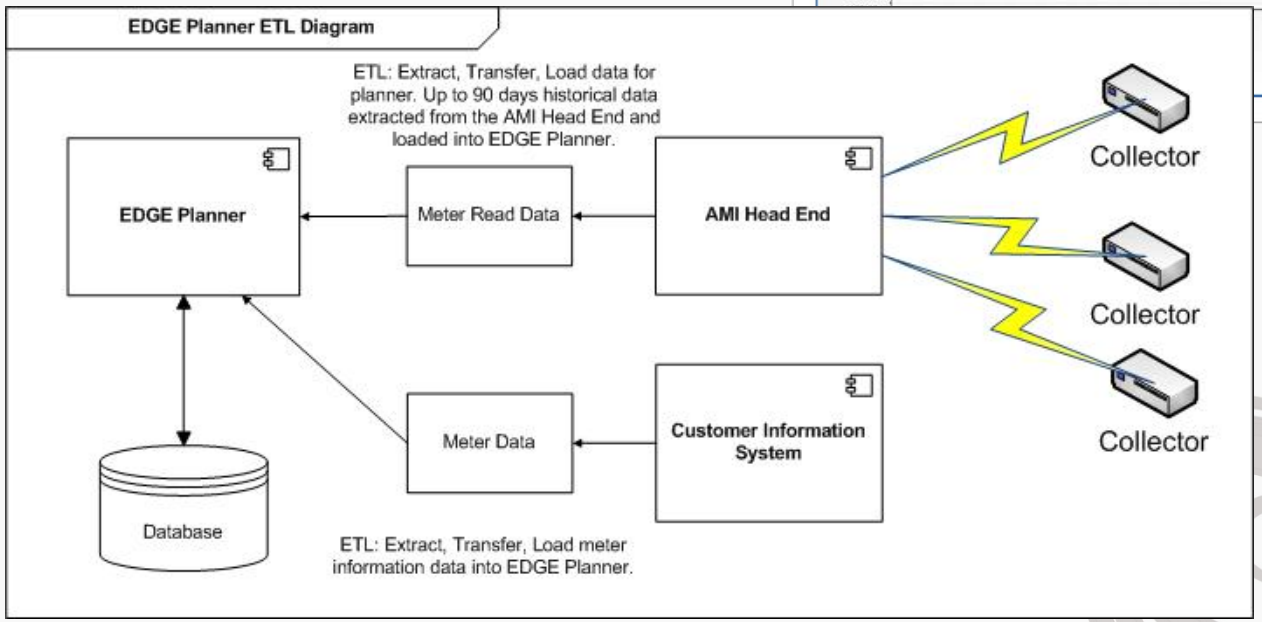
- Uses real-time AMI data to make control decisions
- Responds dynamically to changes on the grid
- Identifies circuit improvement opportunities
- Measures savings using EPRI validated statistical methods



EDGE uses AMI voltage data along with existing SCADA controls to optimize voltage levels on the network, offering seamless integration from the customer home to the control center.

Voltage Conservation Pilot

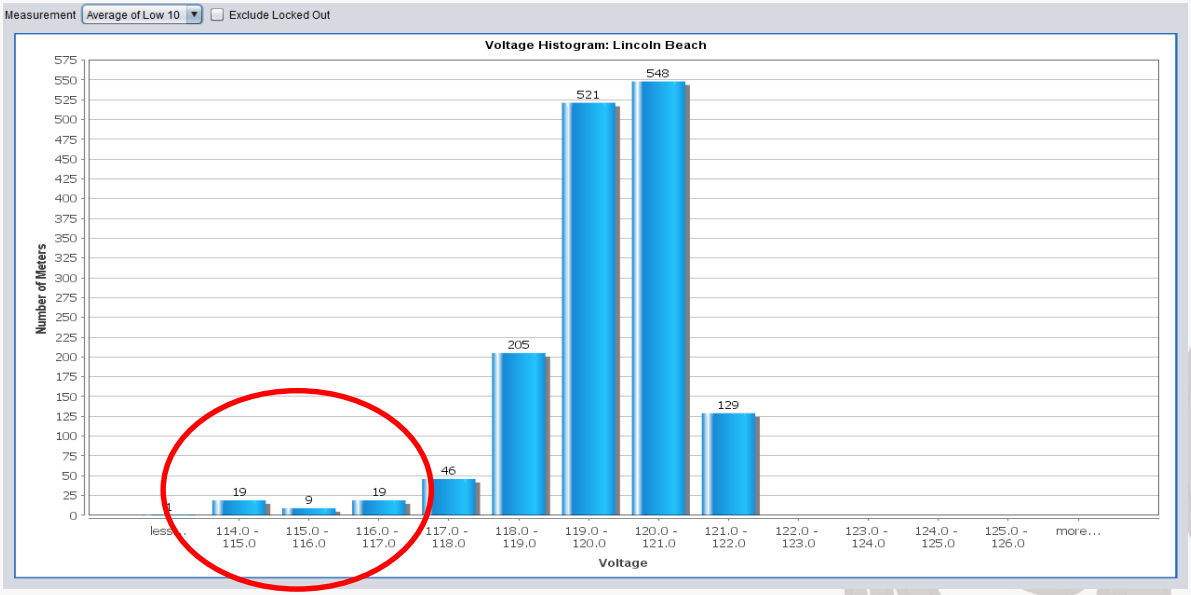
- AMI Based Pilot
  - September 2014
- 15 Min Voltage Data
- AMI Openway Adaptor
- 20 Bell Weather Meters
- Voltage Range 114V – 126V
- 1 Transformer and 1 Feeder
  - 3,800 meters



Program Roll Out

Planning Phase

- Prior to going live, voltage outliers (meters < 114v) were addressed
- Once the AMI voltage data is collected **EDGE Planner** is a powerful tool for pinpointing areas and meters where voltage is low.
- After outliers are identified and graphed a field investigation is requested to determine the causes for low voltage
- Low voltage outliers are a barrier keeping EDGE from using the full range of voltage reduction and thereby reducing it's effectiveness and ability to generate cost savings so they're definitely worth some pretty good effort to correct.



Program Roll Out

- 2014 Pilot – 1 Feeder and 1 Transformer
- In FY 15-16, we added 2 more transformers and 5 additional feeders to the demonstration program.
- In FY 16-17, we added 5 more transformers and 10 additional feeders to the demonstration program.
- Currently we have a total of 19 transformers and 33 feeders in the program.
- Within the next two years, GWP expects to have a full scale program in place controlling 38 transformers and 54 feeders.

Energy Efficiency Savings

- Average Savings per feeder was 2.2%

Program Year	CVR Trans-formers	CVR Feeders	Annual EE Savings (MWh)[1]	Incremental Cost[2]
FY 15-16	3	6	1,235	$ 164,823
FY 16-17	8	16	3,002	$ 409,063
FT 17-18[3]	18	31	10,893	$ 660,704
Full Program[3]	38	54	22,997	$ 934,026

[1]Life of measure assumed to be 1 year.

[2]Annual cost includes one time perpetual license fee and pilot costs prorated over 54 feeders, plus program overhead, labor and materials to upgrade and maintain transformers and feeders during the progam year. Program life is assumed to be

[3]EE Savings are estimated based on past results.

Energy Savings Methodology

The DVI EDGE Validator calculates energy savings for us

- It uses a statistical pairing process to determine the CVR factor, which is then combined with voltage reduction data to calculate energy savings.
- Energy savings is calculated for each hour during the CVR On period.
- Energy savings percentage is based on the change in voltage multiplied by the CVR factor.
- The difference between the baseline voltage (the average bus voltage during the CVR Off period) and the actual measured bus voltage during the CVR On period is used to determine the percentage change in voltage.

Energy Savings Methodology

- Using the energy savings percentage and the actual Mwh usage, Validator calculates how much Mwh would have been consumed if CVR was not performed (calculated baseline energy). The difference between the measured Mwh use and the calculated Mwh is the Mwh being saved.

$$Energy\ Saving\% = \%\Delta V \times CVR\ factor$$

$$Calculated\ Baseline\ Energy = \frac{Measured\ Energy\ MWh}{(1 - Energy\ Saving\%)}$$

$$Calculated\ Baseline\ Energy - Measured\ MWh = MWh\ saved$$

Implementation Barriers

- There were no regulatory barriers – City Council was fully supportive of the project
- There were no technical barriers to the program – the technology worked as promised
- The major barrier was the human factor - Electric Service staff were convinced the system would harm the load tap changers and increase operations and maintenance costs; additionally, they were convinced that CVR energy savings were not real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