



Princeton University Substation & Electrical Upgrade Project

February 28, 2019

CampusEnergy2019



HILTON NEW ORLEANS RIVERSIDE

February 26 - March 1, 2019 | New Orleans, LA

Project Background

- ▶ Princeton University connected to PSE&G at 26kV in two locations
 - Elm Substation
 - Charlton Substation
- ▶ 2018 Peak Load ~28 MW
 - Gas Turbine Generator
 - Solar
- ▶ PSE&G 26kV overhead distribution is at capacity
 - Future campus expansion limitation
 - Overhead distribution exposure

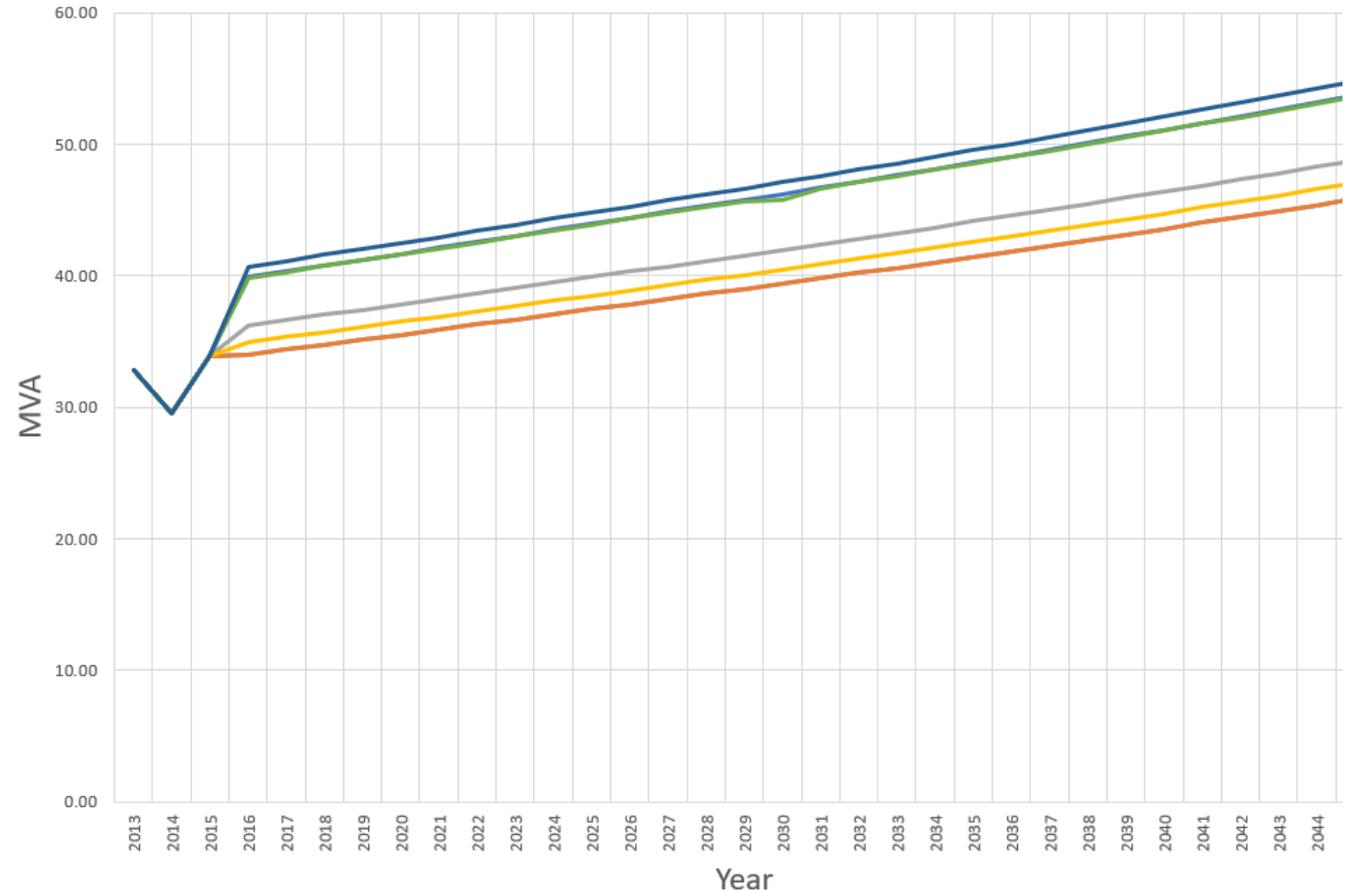


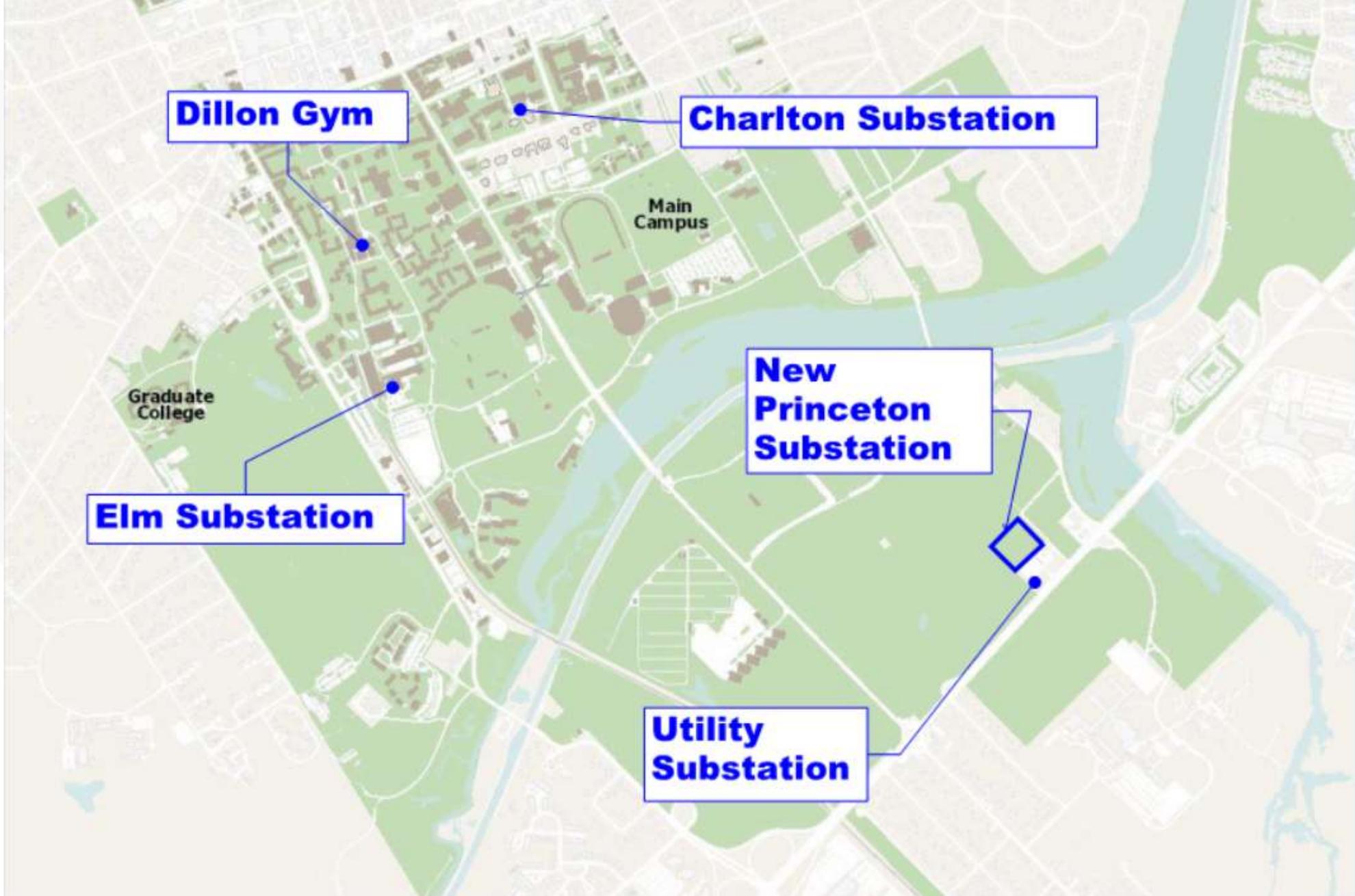


Design Goals

- ▶ Support Campus Expansion
 - Increase electrical capacity
 - Lake Campus, etc.
- ▶ Support Campus Goals
 - Sustainability
 - Redundancy – N+1
 - Reliability
 - Resiliency
 - Maintainability
 - Improve Campus Voltage Regulation

Princeton Load Growth Options





Dillon Gym

Charlton Substation

Elm Substation

**New
Princeton
Substation**

**Utility
Substation**

Main
Campus

Graduate
College

Project Scope

- ▶ Construct new 69kV Substation (69kV – 26.4kV)
 - Greater reliability at 69kV transmission vs. 26kV Utility O/H distribution system
- ▶ Reconfigure Charlton & Elm Substations to be served from new Princeton Substation
 - Overhead -> Underground Service
- ▶ Elm Substation Upgrades
 - Two new 12/16/20 MVA transformers
 - New 5kV switchgear
- ▶ Replace 5kV Switchgear at Dillon Gym

Project Team

- ▶ Princeton University
 - Technical & Operations Team
 - Construction Management & Project Management
 - Civil Construction
- ▶ Burns & McDonnell
 - Electrical
 - Structural
 - Communications/SCADA/Automation
 - HDD Design (Brierley)
- ▶ Van-Note Harvey
 - Civil Engineering/Local Codes



69kV Substation

- ▶ Location
 - Adjacent to existing PSE&G Station
 - Coordinated with expansion
- ▶ Ring Bus Design
 - High reliability
- ▶ Three 69kV transmission system connections
 - Geographically distinct
- ▶ Two 69kV:26kV 50/67/83 MVA transformers
 - 2-hour fire-rated separation wall
 - Oil containment
 - LTC – 26kV Voltage Regulators



69kV Substation

- ▶ 69kV Relay/Control House – University Owned
 - Utility Controlled 69kV Pass-Thru Yard (2 x 69kV Lines)
 - Future (3 x 69kV Lines)
- ▶ Two 26kV Switchgear Buildings - University Owned/Controlled
 - Main-Tie-Tie-Main
 - Relay & Synchronizing Panel
- ▶ Future Telecom Entrance Point
- ▶ Backup Generator
- ▶ Aesthetic Considerations







Horizontal Directional Drill

- ▶ Two 2000' bores – 60' deep
- ▶ 36" Diameter Holes
- ▶ 26kV - A & B Feeders
- ▶ Telecom



Elm Substation

- ▶ 26kV Service to new substation
 - Utility ->Owner-served
- ▶ Upgrade transformers
 - 12/16/20 MVA
- ▶ Replace 5kV Switchgear
- ▶ Synchronizing Panel
- ▶ Construction Phasing



Charlton Substation

- ▶ 26kV Service from new substation
 - Utility ->Owner-served
- ▶ Protective Relaying Upgrades
- ▶ Coordination of Utility Outage



Project Schedule

- ▶ 69kV Substation Energization: April 1st, 2019
- ▶ Charlton Substation Cut-Over: June 2019
- ▶ Elm Substation Cut-Over: Fall 2019
- ▶ Substantial Completion: Fall 2019



Considerations and Project Applications

- ▶ Utility Coordination – Early and Often!
- ▶ Aesthetics and Site Location
- ▶ Factory Equipment Testing
- ▶ Load Growth
 - Integration with Utility Master Plan
- ▶ Underground Utilities
 - Close coordination with Princeton





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