

# The University of Rochester Electrical System Master Plan

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UNIVERSITY of  
**ROCHESTER**



# Agenda



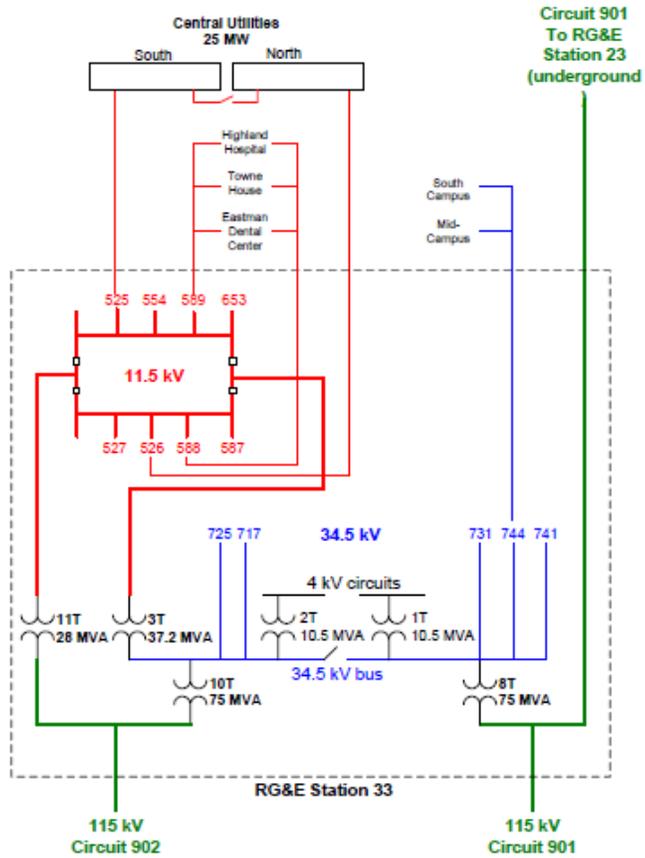
- Introduction to University of Rochester
- Electrical System Highlights
- Overall Electrical System Study
- Main Substation Project
- Completed System Upgrades
- Current/Future Projects
- Project Financial Summary

# The University of Rochester



- Founded in 1854, Private University
  - Central Heating Plant -1924
  - Medical Center – 1926
  - River Campus - 1930
- 158 Buildings, over 12MM gross SF building space
- 10,500 students (graduate and undergraduate)
- 800 bed hospital, regional trauma center
- Central chilled water system - 2 chiller plants (32,000 tons)
  - Mid-campus plant (12,000 tons – 2008/2014)
- Five steam boilers (498,000 lbs/hr)
- Steam & medium temperature hot water distribution systems
- 25MW Steam Turbine Generation (2 units - 2005)
- \$54MM annual utilities budget

# Electrical System Highlights



- **Utility Supply Connections**

- CHP/River Campus/Medical Center @ 11.5 kV (RG&E Stn 33)
- Mid-campus/South Campus @ 34.5kV (RG&E Stn 33)

- **Capacity vs. Demand**

- Total Electrical Load (2010) = 37.5 MVA
- Projected Future Load (2030) = 71 MVA

- **Concerns with Existing Utility Supplies**

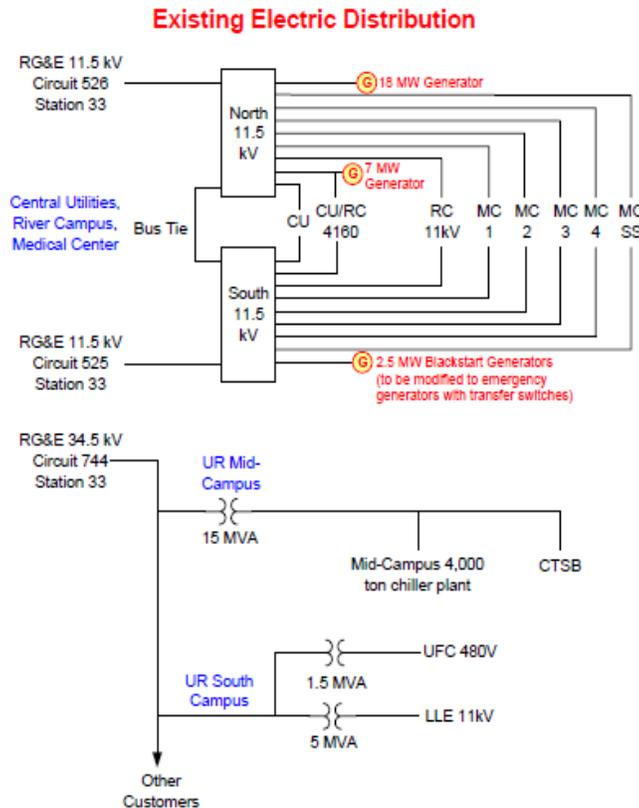
- No additional capacity available/no plans for supply growth
- Reliability issues
  - Stn 33 equipment failures
  - Equipment age – end of life

# Electrical System Highlights



- Campus Divided into 4 Main Geographic Areas:
  - River Campus
  - CHP/Medical Center
  - Mid-Campus
  - South Campus
- 2010 Load Breakdown
  - River Campus – 7.5 MVA/12 MVA future
  - CHP/MC – 20 MVA
  - Mid-campus – 4 MVA/25 MVA future
  - South Campus – 4 MVA/14 MVA future

# Electrical System Highlights



- 11.5kV and 4.16kV distribution levels
- Central Utilities (CU) 11.5kV substation main connection to utility
- Dual radial feed from CU 11.5kV sub to distribution substations
  - River Campus, Medical Center, CHP
- Loop feeder system from distribution substations to building loads
- 18MW (11.5kV) & 7MW (4.16kV) steam turbine generators
- 34.5 kV radial supplies to MCCP & South Campus

# Overall Electrical System Study



- Started in 2010/Completed in 2012
- On-site review of existing equipment, ratings, trip settings & condition
- Created electronic model of electrical distribution system (EasyPower)
- Analysis completed using modeling software
  - Short Circuit/Arc Flash/Protection Coordination
  - Load Flow
- Evaluate potential locations for new university substation & distribution configuration

# Study Results/Recommendations



- Replace existing electromechanical relays with microprocessor based electronic relays.
- Located over-dutied equipment.
- Identified documentation deficiencies – Single line Diagrams & Operating Diagrams.
- Recommended relay setting and fuse sizing changes to enhance coordination and reduce arc flash levels.
- Identified preferred utility substation location & distribution configuration.
- Recommended implementation of system wide SCADA system to improve monitoring/control/troubleshooting.

# Study Results/Recommendations



- Three potential locations for new 115 kV Substation:

	Stn33/CHP	Mid-campus	South Campus
Pro's	<ul style="list-style-type: none"> <li>• Close to existing 115 kV ROW</li> <li>• Close to majority of existing load</li> </ul>	<ul style="list-style-type: none"> <li>• Centralized</li> <li>• Close to future load growth</li> </ul>	<ul style="list-style-type: none"> <li>• Close to existing 115 kV ROW</li> <li>• Close to future load growth</li> <li>• Not congested/no impact to campus plan</li> </ul>
Con's	<ul style="list-style-type: none"> <li>• Very congested area</li> <li>• Premium real estate</li> <li>• CHP expansion</li> <li>• RG&amp;E resistance</li> </ul>	<ul style="list-style-type: none"> <li>• Need extension of 115 kV</li> <li>• Premium real estate</li> <li>• Chiller Plant expansion/Thermal storage</li> </ul>	<ul style="list-style-type: none"> <li>• Further away from majority of current load</li> </ul>

- The South Campus location was selected.

# New Main Substation Project



- New 115 kV utility switchyard (by RG&E)
- 2 x 100% transformer & switchgear arrangement
- 75MVA capacity
- Automatic transfer capability
- HMI for remote monitoring and breaker control
- Phase I: Mid-campus & South Campus loads
- MCCP substation expansion
- Ductbank capacity for Phase 2 extension (CHP/RC/MC)
- Construction start late 2013/on-line March 2015 (~15 MVA load)

# New Main Substation Project



# New Main Substation Project



# Multiple Infrastructure Upgrade Projects



- Upgrade protection relays to electronic microprocessor based relays in existing 11.5kV switchgear
- Replace existing 4.16kV switchgear at end of service life with new switchgear
- Implement relay setting changes and replace fused switches with breakers as necessary for manageable arc flash levels
- Automatic transfer capability at 11.5kV and 4.16kV switchgear

# Current/Future Projects



- Main Substation Phase II
  - Transfer remaining campus electrical loads to the new substation with new feeders
  - Includes River Campus, Medical Center and CHP
- 4.16kV Re-cabbling Project (River Campus)
  - Replace aging cable with new feeder cables
  - Maximum utilization of existing infrastructure
  - New ductbanks – as required for route diversity
  - Provide additional feeder loop to relieve heavy loading on existing feeders and projected future buildings

# Project Financial Summary



- Completed/Current Projects
  - Main Substation/MCCP expansion/South sub repl. - \$23 M
  - 11.5 kV CU Swgr relay replacement -\$121 K (construction)
  - 11.5 kV MCCP Swgr relay replacement -\$179 K (construction)
  - 5 kV RC swgr replacement - \$1.5 M
  - CHP Xfmr primary switch replacement -\$134 K
- Future Projects
  - RC 5 kV Distribution/Recabbling -\$6 M over 6 years
  - Main Substation Phase 2 Load connection for CHP/MC - \$11.9 M

# The University of Rochester Electrical System Master Plan

Thank you



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