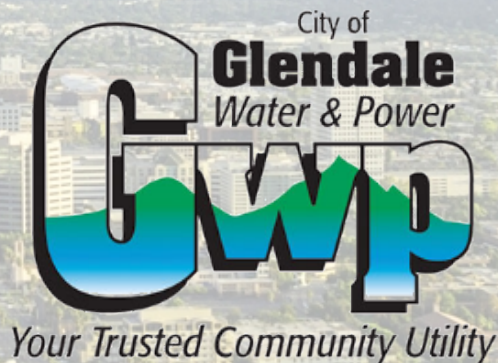




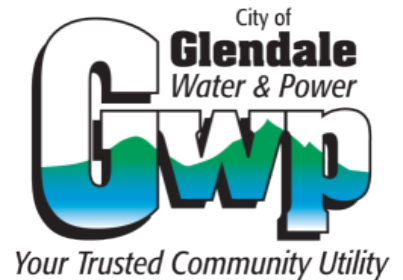
4 kV to 12 kV Conversion Program Update

February 01, 2021



4 kV to 12 kV Conversion Plan

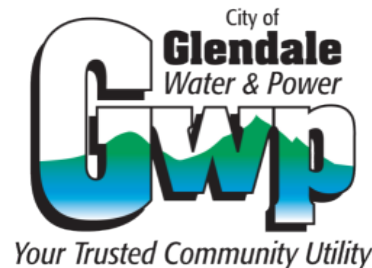
- Glendale Power System overview
- Why do conversions? What is being converted?
- Completed conversion projects of the past five years
- Ongoing conversion projects
- Comparison with Pasadena and Burbank
- Other related projected
- Accomplishments



4 kV to 12 kV Conversion Plan

Glendale Power system overview:

- Population Approx. 206,000
- Square Miles 31
- Number of Distribution Miles 502 (Length wise: 77% -12kV; 23% - 4 kV)
- Number of Feeders – Total 105 (58 –12 kV; 47– 4 kV) ... > 50% - 12 kV
- Number of Sub-transmission Miles 56
- Number of Sub-Transmission lines – Total 26 (15 – 69 kV; 11 – 34.5 kV)
- Number of Poles 14,763
- Number of Substations 14
- Number of Meters 89,564



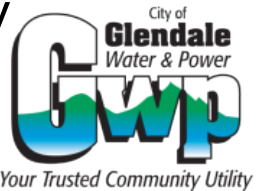
4 kV to 12 kV Conversion Plan

Why do conversions :

- To increase the System efficiency (If a line voltage is raised the line current will decrease proportionally hence the resistive losses on the line conductor will be lower and more power will be delivered to the destination).
- The 12 Kv Distribution System will also be able to carry Three (3X) more the amount electrical power to our customers, increasing peak load delivery and future growth ... EVs, all Electric homes, Distributed Solar + Energy Storage ...)

What is being converted:

- Distribution system is being converted from 4kV to 12KV
- Sub-transmission System is being converted from 34.5kV to 69kV



4 kV to 12 kV Conversion Plan

Completed conversion projects of the past 5 years:

- 2019-2020 - Three Tropico Substation 4 kV feeders were converted to 12 kV
- 2016-2017- Fourteen Grandview 4 kV feeders were converted to six 12 kV feeders
- 2016-2017- Six Bel Aire 4 kV feeders were converted to 12 kV feeders and Bel Aire feeders became part of Grandview and Western Substation feeders.

Ongoing conversion projects:

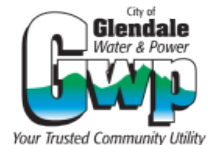
- GWP is currently working on conversion of remaining four Tropico substation 4kV feeders.
- GWP has been systematically converting our system from 4 kV to 12 kV through annual Council approved Capital Improvement Projects and our program is consistent with other utilities. The conversion is labor and time intensive, arduous and expansive and not something accomplished overnight. Working with IBEW Local 18 to look at options to assist in that area of converting our remaining feeders to 12 kV.
- Staff long-term plan is to implement all Conversion Upgrades in-house labor only, requires increase Line Mechanic head count by 10 staff members.
- Conversion Plan needs additional support for Staff and Professional contracted resources:
 - Assistance in Engineering/Designing and Upgrading Substations for Higher Power and Voltage, New Transformers, Circuit Breakers, in Designing use of covered conductors – to minimize risk of wildfires in tier 3 zones (where applicable), in Designing the Conversion Work ...
 - Assistance in the Conversion Work
 - Assistance in Inspection of our Distribution System
 - Assistance in Distribution System Studies (software modeling of our power system, to ensure safety and reliability) including new Distributed Energy Resources (DERs).



4 kV to 12 kV Conversion Plan

- A Comparison below of the conversion efforts by both Pasadena and Burbank in comparison to Glendale. Pasadena is slightly ahead of all of us primarily due to their ability to use contractors for all of their conversion work.
- The chart also depicts our staffing comparisons and even though the other cities are smaller they have considerably more staff than we do which is also a benefit in getting the work completed. The final fact on the conversion program is that while we have more than 50% of the total feeders operating on 12 kV, the system is actually operating on 12 kV at a much higher capacity. Currently our system is being supplied by 77% 12 kV and 23% 4 kV based on the length of the circuits.
- During heat waves - An all 12 kV system is the goal and it will help in extreme heat events but will not prevent the kind of transformer failures related incidents were we have in high sustained heat.
- Customer Service Benefits - Such increasing peak load delivery and reducing system losses is consistent with the results we have experienced. In the final analysis 12 kV will serve our GWP Customers with a new reliable system and have the ability to grow to meet future customer needs.

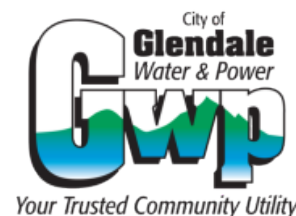
Distribution System Conversion Comparison			
	Non-Management Staff	Use Contractors for Conversions	% Complete
Burbank	38	Overhead - No Underground - Yes	55
Pasadena	25	All	60
Glendale	19	No	50



4 kV to 12 kV Conversion Plan

Other related projects:

- In addition to the 12kv conversion program we have also initiated our wildfire mitigation upgrade program which will further add to our already completed modernization efforts and includes installation of covered overhead wire, connection terminations and upgraded transformers. These efforts not only protect against system related fire causation but also aid in the defense of damage from Mylar balloons and tree branch/frond contact.
- Related substation upgrade projects: Along with the 4k/12kV conversion of the feeders from the substations, there is need to upgrade the substation transformers to support the load growth. In order to increase reliability of the system the substations will be converted to 69k/12 kV operation to support the distribution conversion.



4 kV to 12 kV Conversion Plan

Recent Accomplishments: GWP Annual Report - Electric Services Division - July 1st 2019- Jun 30th 2020

To better serve the community, the Electrical Services Section of Glendale Water & Power (GWP) continues to make improvements in the electrical distribution, substation, communication and transmission system infrastructures. Improvements in the form of upgrades and/or replacements of aging equipment are necessary to improve the system reliability and to save labor cost on the system maintenance. Improving our infrastructure, keeps us ready for the future challenges and enhances the system reliability by increasing operational efficiency. Our customers can count on reliable and affordable power:

Distribution System

- Replaced 1.61 circuit miles of aged underground high voltage cable
- Completed the engineering design and released to construction to rebuilt Vault #1097 (Kenwood Street A/W, 2ND Vault N/o Lexington Drive).
- Installed 500 feet of substructures and an 8'x22' vault on Vine street, east of San Fernando Rd to expand the electrical system and to improve system reliability by converting overhead lines to underground.
- Completed over 1,256 electric service upgrades/reconnects
- Replaced 15 deteriorated poles
- Replaced /installed 161 distribution transformers



4 kV to 12 kV Conversion Plan

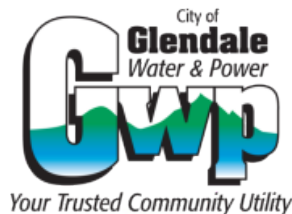
Adams Hill 4kV/12kV Project:

- Rebuilt 16 poles for 12kV operation
- Replaced 31 deteriorated poles
- Replaced 13 distribution transformers

Converted #3 Tropico and #5 Tropico feeders to 12 kV operation, this project will continue into 2021...

Street Lighting:

- Converted over 1,015 street lights with LED's
- Replaced 600 feet of street light conduit near 1049 Alcalde Dr. to improve street lighting system reliability.
- Replaced 165 feet of street light conduit near 508 Porter street as part of street light system improvement.
- 5 new street lights have been installed for customer requests via the street lighting petition process.
- A design for 70 new pedestrian lights and 10 new street lights around the First/Last Mile train station has been created and submitted for Public Works' "GTC First/Last Mile Regional Improvements" Project.

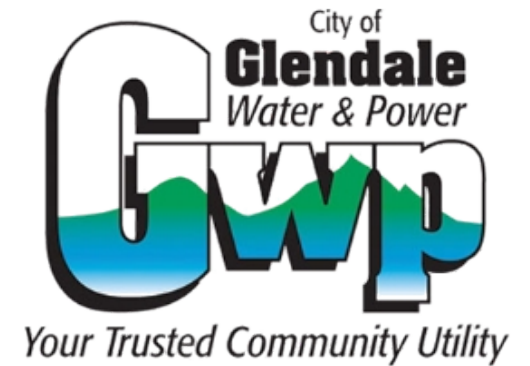


4 kV to 12 kV Conversion Plan

Substation, communication and system protection:

- Commissioned the new Supervisory Control and Data Acquisition (SCADA) system.
- Commissioned Magnolia Power plant (MPP) dynamic scheduling.
- Upgraded Rossmoyne- Scholl line differential relays from electromechanical to microprocessor based relays.
- Completed the engineering design and issued a job package for construction to upgrade the Scholl-Tropico line differential relays.
- Upgraded Western Substation feeder #7 & #8 overcurrent relays.
- Installed circuit breaker trip coil monitors for 10 Rossmoyne substation circuit breakers.
- Upgraded Grandview pump house switchgear for 12Kv operation.
- Upgraded Howard substation feeder #8 regulator





Thank You!

