



Department Source: City Utilities - Water and Light

To: City Council

From: City Manager & Staff

Council Meeting Date: October 7, 2019

Re: Capacity of Perche Creek Substation

Executive Summary

Council made a request for a report on the electric capacity and load serving reliability of the Perche Creek substation. At its current loading level, it is very unlikely that an equipment failure, such as the loss of one of the transformers, would result in long term or purposeful outages (rolling blackout).

Discussion

The current state of the City's electric capacity is similar to its state in 2017 when data from that summer was analyzed by Quanta Technologies for their report, the Independent Distribution Study for Columbia, MO. The report analyzes the adequacy of existing substations and distribution feeder capacity to meet current and anticipated future loads. The results of the substation capacity adequacy assessment indicate that the existing substation capacity should be adequate for up to 10 years.

As part of the study, Quanta determined the rated capacity of each substation by adding the rated capacity of the remaining transformers in the station in the event that one of the transformers was lost. The City provided load profiles of each distribution circuit for 2017 and Quanta calculated the non-coincidental peak demand, utilization factors and load factors for substations, substation transformers, and distribution circuits. Peak demand generally occurs during times of high temperatures (greater than 90°) from the hours of 2 PM to 7 PM. At peak demand, with all substation transformers in service, substation loading varied from 42% to 80% indicating that none of the substations are overloaded with all substation transformers in service. In the unlikely event of the loss of a single substation transformer during peak demand, substation loading varied from 68% to 160% of rated load, indicating that substations may be overloaded for the loss of one transformer. Perche Creek substation was identified at 160% of capacity and the most likely to be overloaded in the event of the loss of a single substation transformer.

Quanta studied several mitigation strategies including transferring load from overloaded substations to adjacent substations by using distribution switching procedures in the event of the loss of a single substation transformer. All of the substations that may be overloaded for the loss of one transformer can be mitigated using this strategy. In the event of the loss of one of the transformers at Perche Creek, the report indicates there is enough available capacity at adjacent substations to support the temporary transfer of load from Perche Creek to one of the adjacent substations. The report also indicates that it should be possible to utilize this mitigation strategy for the next 10 years, as long as annual peak load growth remains below 2% per year from the 2017 values. This translates to a peak load of 328 MW

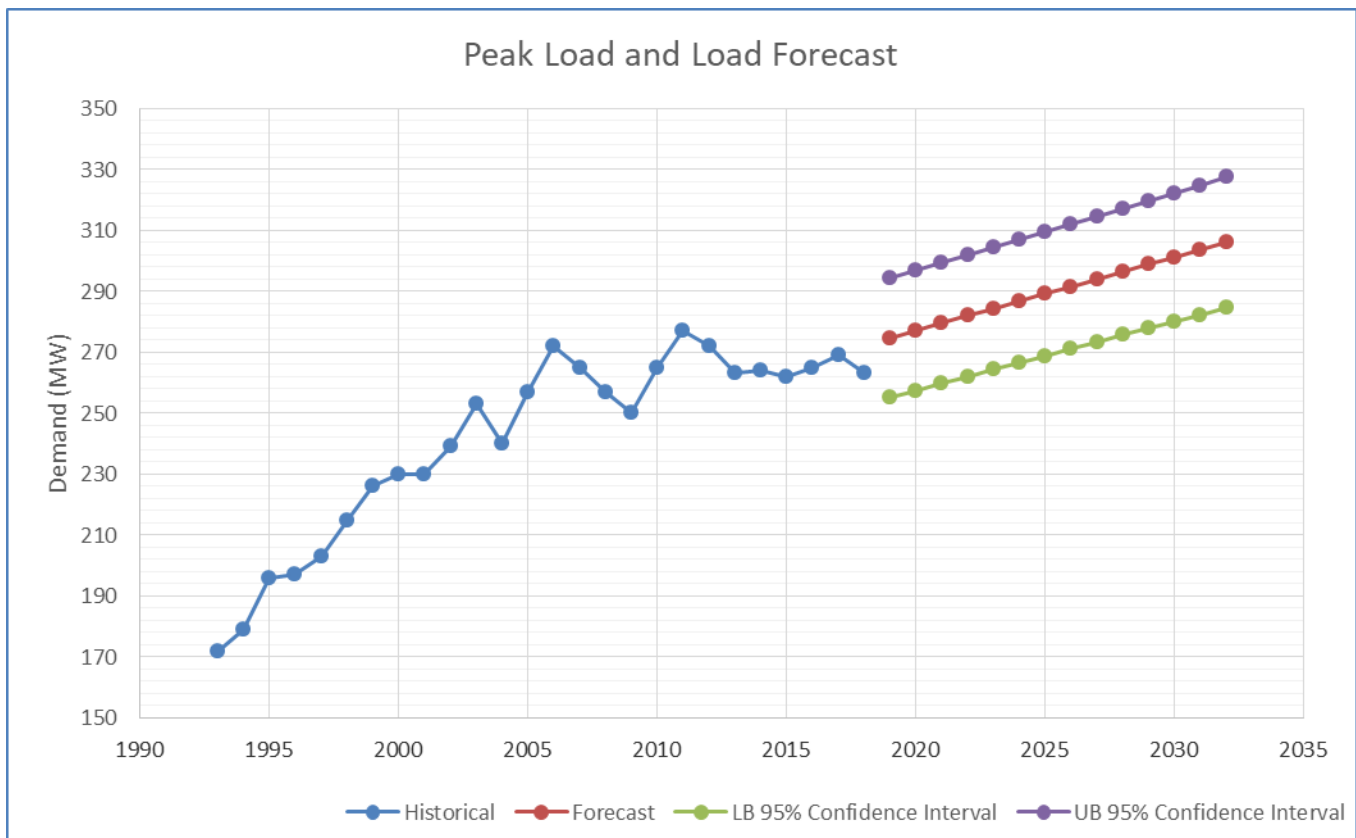


City of Columbia

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and assumes a growth pattern similar to what has been seen in the past few years with large developments in west and southwest of Columbia.

Since the report, load growth for 2018 and 2019 has been relatively flat with peaks of 263 MW and 260 MW respectively. This is especially true when compared to the 2017 data with a peak of 269 MW and the all-time peak of 277 MW in 2011. Staff produces a forecast on an annual basis, with a demand forecast model that is based on multiple regression analysis based on historic data. The model uses variables including the number of customers and maximum daily average temperature for the month. The growth in customer rate is 621 customers each year on average. The temperature variable is averaged over the 25 year period in the model. The model is used to forecast demand and create a 95% confidence interval for each year (see chart below). The forecast currently projects a less than 1% per year growth rate.



The City has added roughly 500 service transformers since the study has been completed. There is some concern that recent load patterns may not be representative of a “worst-case” for the City. The City has not experienced extended temperatures of 105 degrees or greater since it set its all-time peak in the summer of 2011. The Integrated Electric Resource and Master Planning Task Force is in the process of developing a Spatial Load Forecast that should better reflect the potential for load growth on each of the City’s distribution circuits. The Task Force will be working with the consultant to recommend projects that may be necessary to address the communities need for electric reliability and mitigate events such as loss of one of the transformers at Perche Creek substation.



In the unlikely event of the loss of one of the transformers at Perche Creek and insufficient capacity at adjacent substations to support the temporary transfer of load, the utility would shed load according to its Load Shed Plan. This plan ranks circuits by the number of critical loads associated with each circuit. Residential customers are targeted to be shed first while critical services such as hospitals, fire stations and the water and wastewater treatment plants are shed last.

Fiscal Impact

Short-Term Impact: None

Long-Term Impact: None

Strategic & Comprehensive Plan Impact

[Strategic Plan Impacts:](#)

Primary Impact: Infrastructure, Secondary Impact: Not Applicable, Tertiary Impact: Not Applicable

[Comprehensive Plan Impacts:](#)

Primary Impact: Infrastructure, Secondary Impact: Not applicable, Tertiary Impact: Not Applicable

Legislative History

| Date | Action |
|------|--------|
| None | None |

Suggested Council Action

No action requested, information only.