MEMORANDUM

EUGENE WATER & ELECTRIC BOARD

Rely on us.

TO:	Commissioners Simpson, Brown, Helgeson, Manning and Mital
FROM:	Mel Damewood, Engineering Manager; Frank Lawson, Systems Engineering Supervisor; Richard Jeffryes, Senior Engineer; Chris Jones, Associate Engineer
DATE:	February 3, 2016
SUBJECT:	Electric System Reliability
OBJECTIVE:	Information Only – Electric Master Planning Preamble Series

Introduction

In April 2016, EWEB will present the Board with a long-term electric system plan that will focus on transmission and distribution infrastructure. In preparation, a series of memoranda will provide background information on topics relevant to this planning effort, including assessments of different parts of the system, the factors that affect reliability and resiliency, and future technology trends. This is the third informational memorandum in the series, following memos on "overbuilt" and "underbuilt", and electric system resiliency.

Discussion

The Impact of Reliability

A major differentiator between electricity providers is the reliability of delivery. The product (electricity) is "on-demand": it needs to be continuously available, it is presently difficult to store in significant quantities, and disruptions are costly. Understanding the impact of reliability on customers, along with understanding the factors that affect reliability, are key drivers of EWEB's electric system planning effort.

Reliability Measurements

EWEB, like most U.S. utilities, measures reliability using standard methods developed by the Institute of Electrical and Electronics Engineers (IEEE). While IEEE Standard 1366 defines twelve different measurements, the most commonly reported are System Average Interruption Frequency Index (SAIFI), which is the average number of disruptions per customer per year, and System Average Interruption Duration Index (SAIDI), which is the average time of disruption per customer. These standard measures exclude large storms, as these types of events (termed Major Event Days) are not reflective of general system reliability.

Causal Analysis

Electric system reliability is affected by system design, capital replacement, system operating practices, equipment operation and maintenance practices, territory topology, and weather conditions. For example, in the Eugene metro area, EWEB's alternate-source (i.e. "redundant") transmission & distribution design allows for single transmission line outages without loss of power to customers, and for easy re-distribution of power within the distribution system (a.k.a.

"backfeeding"). Comparatively, the McKenzie River Valley has less redundancy, longer lines, wooded terrain, and funneled winds that result in reliability numbers four to six times worse than in the metropolitan area.

EWEB's maintenance programs, including equipment inspection and tree trimming, eliminate some operational or situational causes of outages. All transmission corridors are trimmed every two years, except for the Carmen Smith line which is trimmed annually. Overhead distribution is trimmed every four years, with vegetation management crews returning more often (every two years) to circuits with vegetation "hot spots".

Equipment maintenance and replacement is an integral part of EWEB's evolving asset management program. In some cases, EWEB attempts to proactively replace high-impact assets before they fail. Transmission breakers, that fail unsafely, and substation power transformers that serve thousands of customers are examples of equipment that EWEB routinely maintains, tests, and replaces. Other lower-impact equipment, including distribution transformers that serve few customers, are replaced responsively after failure.

Customer Impact

Outages affect customers in a variety of ways, including impacts on health and safety, communications, social inconvenience, and economics. Electricity has become a critical commodity, relied on for personal and economic vitality. In our electric system planning effort, EWEB is considering these varied impacts. For example, the economic impact to our customers differs depending on the outage location, time of day, and duration. Using data from Berkeley National Labs and EWEB's modeling system, the estimated costs of outages to customers can be predicted. For example, if the Oakway substation along Coburg Road were to have a one-hour midday outage, the 2,421 customers (including 612 commercial) would experience an estimated economic loss of between $2-4 million. The same outage at a residential substation in south Eugene (e.g. the Dillard substation area), the economic loss to the 2,979 customers (2,904 residential, 75 commercial) would be around $400,000. Comparing these figures to EWEB's lost revenue of less than $1,000 in each case shows that the community as a whole, not EWEB, bears the primary cost of outages, both to economic vitality and quality of life. EWEB's investments in improved reliability thus have the potential to serve as community investments with wide-ranging positive impacts.

Benchmarks

EWEB's system reliability, using SAIFI (incidents per year) and SAIDI (outage minutes per year), compares favorably to aggregated national statistics. EWEB's reliability ranks in the top 94 of the more than 1,230 utilities surveyed by the American Public Power Association (APPA). However, these statistics vary widely by state, and by type of utility. Public power utilities (primarily municipals) had consistently better reliability than rural cooperatives and investor-owned utilities. In Oregon, for example, EWEB is near the mean of public utilities in outage frequency (0.41 vs. 0.43 incidents/year), but was significantly slower to make repairs (59 vs. 32 minutes/year), potentially due to the reliability impact of EWEB's lower-density McKenzie River Valley and a lack of distribution system automation. A summary of EWEB reliability benchmarks for public power utilities are as follows.

Table: Comparison of Public Power Utilities (excludes IOUs and Co-Ops)

Territory	No. of Utilities	SAIFI Incidents/Year	SAIDI Minutes/Year
EWEB	1	0.41	59
U.S.	502	0.86	48
Oregon	10	0.43	32
Washington	21	1.02	121
California	22	0.54	37

Source: APPA RP3 Survey

Planning Impact

Understanding the reliability impact of design, capital investment, territorial profile, and asset management is a key criterion in EWEB's electric system planning. Reliability, along with safety and EWEB's obligation-to-serve, will be the basis for prioritizing "compulsory" levels of infrastructure replacement. However, going forward reliability-based investments will be evaluated both at a system level, and based on the impacts to our customers. Design changes, equipment maintenance, and replacement strategies will balance the benefits of improved reliability and cost with the added intent of preparing our system for future new products, advances in technology, and evolving industry trends.

TBL Assessment

This memorandum does not contain a TBL analysis.

Recommendation

No specific recommendations are made in this Board memorandum. However, Management recommends that the Board consider the issues raised in this memorandum as the Strategic Plan is updated, Master Plans are adopted, and ten-year CIPs and annual budgets are considered and approved.

Requested Board Motion/Action

No Board action is requested in this Board memorandum.