Recommendations for Documentation of Seattle City Light Energy Delivery Capital Expenditures

February, 2010

Energy and Environmental Economics, Inc.

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Prepared for:
Tony Kilduff
Seattle City Council Central Staff

Prepared by:
Michael King, Arne Olson and Brian Horii
Energy and Environmental Economics, Inc.
101 Montgomery Street, Suite 1600
San Francisco, CA 94104

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1. Executive Summary

The Seattle City Council (Council) retained Energy and Environmental Economics, Inc. (E3) to review Seattle City Light practices pertaining to the documentation and communication of proposed energy delivery capital expenditure requests. The Council's interest in the study derives, in part, from experience with the utility's proposal for a new substation in the South Lake Union area. In this and other instances, the Council found that information provided by City Light was not sufficient in scope and depth to allow the Council to conclude definitively that the proposed expenditure was necessary and in the best interest of City Light ratepayers. City Light personnel, in turn, have at times found the Council's requests for additional information to be burdensome and possibly reflective of a lack of trust in City Light to effectively perform its duties.

To help address these issues and facilitate more effective communication between City Light and the Council, E3 recommends four primary enhancements to City Light's current communication practices:

1. **New Planning Document – the "T&D Outlook"**

   Our review has found that there is little publicly-available documentation and hence little public understanding of the planning challenges facing City Light's transmission and distribution functions. We believe that improving Council's understanding of general planning issues facing the utility and providing advance notice of specific issues that are likely to come before Council for funding will facilitate prompt review of City Light requests. **Therefore, we recommend that Seattle City Light produce a planning document (herein referred to as the "T&D Outlook") every five years that identifies future planning challenges and provides initial information regarding potential solutions.**

   The T&D Outlook should articulate utility and City policy objectives and provide an indication of the nature and extent of T&D investments that would likely be required to achieve these objectives, in addition to investments necessitated by normal load growth, updates to standards promulgated by the Western Electric

Coordinating Council (WECC) or the North American Electric Reliability Council (NERC), and other key drivers of T&D investments. Thus, the document can serve as a jumping-off point for discussion about policy priorities between City Light and the Council in the context of City Light's other needs.

Presently, radial and network system analyses are conducted by separate engineering groups within City Light. Past experience suggests that this organizational separation could result in suboptimal solutions for problems near the radial and network boundaries. In addition, the fragmented approach hinders the Council's understanding of the entirety of the future work expected by City Light. Therefore, the "T&D Outlook" should combine analysis of both network and radial distribution systems.

2. New Expenditure Review Document

The current Capital Improvement Plan (CIP) has two significant shortcomings. First, the CIP is not conducive to third party review. While the CIP provides a large quantity of data regarding specific projects, it is neither organized for easy review of normal, course-of-business work, nor detailed enough for a review of major projects. The content organization leads to a second significant shortcoming: inadequate time for the Council to review the CIP and proposed projects during the budget cycle. As a result, the Council has had to resort to using a "budget proviso" in order to obtain more information about major projects. Under this legislative mechanism, the City Light budget is approved as whole, but with a proviso that prevents money from being spent on specific projects. Council then requests additional information from City Light in order to lift the proviso. This mechanism is cumbersome and has not resulted in the provision of high quality information to Council.

To address the problems related to reviewing major projects, **City Light should provide a New Expenditure Review document to the City Council each year.** The New Expenditure Review would provide the Council with detailed information on any new planned projects that total more than $1 million over the life of the project or forecast horizon. Ideally, the New Expenditure Review should be provided to the Council well in advance of the normal budget cycle. This will expedite Council's review of planned projects and reduce the Council's need to rely on the proviso mechanism.

3. Enhanced CIP

While the new Expenditure Review Document will improve the process for reviewing large projects, there remains the need for the Council to review and approve a City Light budget that is mostly composed of normal-course-of-business expenditures. To facilitate that review, **City Light should add a summary of past and forecast expenditures by major work categories, and provide explanations for any substantial variations from the past expenditure patterns.**

4. City Light Process Improvements

In addition to these new submission requirements, E3 recommends two process improvements that could improve the consistency of City Light's analyses and facilitate better communication with the Council. Both are directed at developing a consistent foundation of analysis to underlie the documentation recommendations above.

- **Planning area definitions and forecasting**. In the past, boundary definitions for the purposes of forecasting and alternative solution development have at times changed from one phase of analysis to the next. This complicates comparison of study results. We recommend uniformity in the definition of study areas and small area forecasts to the maximum extent possible. We further recommend formal reconciliation of small area forecasts with system-level forecasts, and development of multiple forecast scenarios.

- **Use and licensing of distribution planning software**. Consistent use of distribution planning software would enhance City Light's ability to maintain consistent planning area definitions and study cases from the T&D Outlook through the annual CIPs. While such software has been purchased by City Light in the past, licenses have been allowed to lapse.

2. Background

The Seattle City Council retained E3 to review communication from Seattle City Light, particularly with regard to funding requests for large distribution projects, and to recommend improvements directed at facilitating Council review of proposed spending plans. The work grew out of Council's experience with City Light's proposal for a new substation in the North Downtown/South Lake Union area, an area in which the utility anticipated significant load growth due to zoning changes and planned construction projects. The review focuses principally on new, large capital projects but also encompasses information provided on routine projects as part of the Capital Improvement Plan (CIP). This report describes the results of the review.

2.1. About Seattle City Light

Seattle City Light is a municipally-owned utility that provides electric service to 350,000 residential customers and 40,000 non-residential customers within the cities of Seattle, Shoreline, Lake Forest Park, Burien, Normandy Park, SeaTac, Tukwila and Renton in western Washington State. City Light's power supply comes principally from hydroelectric generating resources on the Skagit and Pend Oreille Rivers in Washington and purchases of federal power from the Bonneville Power Administration. City Light has some of the lowest electric rates in the country, with residential rates averaging 6.32¢/kWh in 2008, compared to the national average of 11.26¢/kWh[1]. City Light maintains 656 miles of transmission circuits, 2,515 miles of distribution circuits, and 15 major substations within a service area of 131 square miles.

Seattle City Light is structured as a Department within the City of Seattle. The Superintendent of Seattle City Light is appointed by the Mayor and confirmed by the City Council, and reports directly to the Mayor. City Light's budget authority comes from the City Council. Funds for capital projects are requested each year through the Capital Improvement Plan, which the Mayor delivers to the City Council as part of the

[1] U.S. Energy Information Administration, Electric Sales and Revenue 2008, January 2020. http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html.

annual budget process. City Council reviews and approves the CIP, providing City Light with authority to spend City funds.

2.2. Context for this Review

The City Council requested E3 to conduct this review following its experience with reviewing City Light analysis of the need for a new substation in the North Downtown/South Lake Union area. City Light conducted a number of analyses over a period of several years that indicated the need for a new North Downtown Substation to serve anticipated dramatic load growth in South Lake Union. The substation was to be located in North Downtown near the Denny Way boundary between the downtown network and the radial distribution system that serves South Lake Union and most of City Light's service territory. The substation was expected to relieve anticipated constraints on the Broad substation by serving both a portion of the downtown network in the Denny Triangle area as well as the radial South Lake Union area. The substation project was justified with projections of rapid growth in the area due to rezoning approved by the City Council and a large number of redevelopment projects announced by private developers.

Complicating matters was a desire by some City Light customers and area landowners to convert distribution service in the South Lake Union area from a radial to a network configuration. Provision of network service in the area was said to be necessary to attract biotechnology firms, which can have a high energy density relative to other commercial customers and have a need for highly reliable service. Extending network service to the area would have accelerated the need for a new substation.

City Light first included the North Downtown Substation in its 2006 CIP at a total cost of $185 million, $73 million of which would be spent in the following six years. However, the CIP was not accompanied by sufficient documentation to allow the City Council to determine whether the project was in the best interests of City Light's ratepayers. Moreover, City Light's 2005 Transmission and Distribution Capacity Plan had evaluated several options for serving load in South Lake Union and had concluded that adding transformation capacity at the Broad substation was preferable to constructing a new downtown substation. Given the magnitude of the potential investment and the conflicting information from City Light, the Council was reluctant to approve the investment without additional information providing a clear demonstration of need.

The City Council asked E3 in 2007 to review City Light's load projections and advise the Council regarding City Light's proposed purchase of a suitable property for potential future substation construction. E3 recommended that the City Council approve the property purchase due to the limited supply of suitable properties and the potential for future increases in land costs. However, E3 recommended that approval of funds to construct the substation undergo a much more rigorous review.

During early 2008 the City Council requested that City Light provide additional information to support its position that the North Downtown Substation was the best solution to capacity problems in the South Lake Union area. Specifically, on January 7, 2008, the Council asked City Light for a brief report documenting statements by City Light staff that the addition of new transformation capability at the Broad substation was infeasible, contrary to the conclusions of the 2005 T&D Capacity Plan. On April 11, the Council asked City Light to provide a clarification of the load forecast for the North Downtown area including the effect of displacing existing load, an alternative plan for serving load reliably if the North Downtown Substation is not built, and a list of all CIP projects that may impact the capacity in the North Downtown area.

In response to these requests, City Light submitted on May 30, 2008 a document entitled "North Downtown Study" which presented further analysis in support of City Light's position that the North Downtown substation was needed. However, the document was not responsive to Council's request for an analysis of an alternative plan for serving load reliably if the North Downtown Substation is not built, nor did it provide enough information about City Light's load forecasting methodology for the Council to evaluate its reasonableness. Moreover, the analysis that City Light presented in the North Downtown Study was not consistent with previous analysis submitted to the Council. In particular, actual loads appeared to be lower than prior forecasts while forecasted growth rates were considerably higher. No explanation was provided for these variances from prior work, and changes to the study area boundaries made comparisons difficult.

E3 reviewed the North Downtown Study document in a memo to the Council dated July 2, 2008. E3's review identified a number of issues with the document and recommended further analysis to clarify the impact of key assumptions. E3 also recommended that the Council undertake a process of developing a set of standards for the analysis required for Council approval of City Light capital investments, with the goal being to improve future communication between City Light and Council by formalizing Council's requirements and reducing reliance on ad-hoc communication. The Council asked E3 to begin the process of developing these standards in early 2009.

2.3. Relationship to T&D Capacity Planning Framework

City Light has undertaken prior efforts aimed at improving distribution planning practices and communication. A significant example is the 2004 Transmission and Distribution Capacity Planning Framework, the purpose of which was to "improve its [City Light's] ability to analyze T&D capacity needs and communicate a comprehensive T&D Capacity Plan" (p.1).

The present report is intended neither to repeat nor replace the T&D Capacity Planning Framework. We concur with many of the detailed recommendations of the Framework and believe they remain useful for City Light. Rather, this report recommends a few, relatively easy-to-implement changes in communication that we believe will greatly improve the City Council's ability to perform its due diligence in the approval of expenditures, without the need to rely on multiple "one-off" requests for additional information.

2.4. Study Approach

E3's review of City Light planning and communication practices included three components. First, we reviewed documents provided by City Light to the Council. Second, we conducted a survey of other utilities' practices with regard to analysis and documentation of proposed distribution projects. Third, we conducted extensive and detailed interviews with a spectrum of City Light personnel.

2.4.1. CIP Documentation Provided for City Council Review

Each year, City Light produces a 6-year Capital Improvement Plan (CIP) that allows the Council to approve annual expenditures on a line-item by line-item basis (the Council approves expenditures for the first year of the plan only). CIP documentation available to the Council includes a short narrative overview (3 pages for the 2010 CIP) and a series of tables providing limited detail on each of the capital improvement projects (see Figure 1).

Figure 1: Sample Table from the 2010 CIP

Boundary - Transfer Blocks 151-156 Rock Damage Mitigation

BCL/Program Name:	Power Supply and Environmental Affairs - CIP	**BCL/Program Code:**	SCL250
Project Type:	Rehabilitation or Restoration	**Start Date:**	Q1/2009
Project ID:	6485	**End Date:**	Q4/2014
Location:	10382 Boundary Rd, Metaline, WA 99153		
Neighborhood Plan:	Not in a Neighborhood Plan	**Neighborhood Plan Matrix:**	N/A
Neighborhood District:	Not in a Neighborhood District	**Urban Village:**	Not in an Urban Village

This project removes vegetation, scale loose rock, and installs cable netting on the rockface above the transformer bays at Boundary in order to mitigate the danger posed by falling rock. This rockface has a history of rockfall incidents that have damaged outriggers and high voltage powerlines extending from the transformers. A geologic reconnaissance done in July and October 2000 indicates that rockfall incidents should be expected to continue and that the potential exists for much larger rocks to fall. A sufficiently large rockfall could cause extensive damage to a transformer, the "bonnet" over the transformer, transformer equipment, conductors, or outriggers.

	LTD Actuals	2009 Rev	2010	2011	2012	2013	2014	2015	Total
Revenue Sources									
City Light Fund Revenues	0	378	34	3,799	3,073	105	48	0	7,437
Total:	0	378	34	3,799	3,073	105	48	0	7,437
Fund Appropriations/Allocations									
City Light Fund	0	378	34	3,799	3,073	105	48	0	7,437
Total*:	**0**	**378**	**34**	**3,799**	**3,073**	**105**	**48**	**0**	**7,437**
O & M Costs (Savings)			0	0	0	0	0	0	0
Spending Plan		359	34	607	3,476	2,457	485	0	7,418

The CIP has many features that are useful for City Council review:

- A narrative statement that describes the project and need for the project
- Project start and end date
- Multi-year estimate of project cost
- Identification of project type and program/division

This same information is provided for every project, regardless of project size. Project sizes range from the tens-of-thousands to hundreds-of-millions of dollars.

While the information provided is useful, additional detail is needed for larger projects for the City Council to conduct its due diligence in evaluating the prudency of the proposed expenditure. In addition, the large number of project-specific tables does not provide a picture of overall costs by category compared to prior years; and as a result, Council has no information about why requested spending in certain areas is increasing or decreasing relative to previous requests. We discuss our recommendations for improving the CIP in Section 3.

2.4.2. Survey of Utility Distribution Planning Practices

In early 2009, E3 surveyed nine utilities (four public and five investor-owned) regarding their distribution planning practices. The purpose of the survey was to establish a range of common and best practices for evaluating distribution investments in order to inform our recommendations for City Light's practices. The survey was not intended to compare City Light to other utilities. Rather, the intent was to gather good ideas that could be used by City Light to facilitate improved communication with City Council, leading to more timely approval of necessary investments. The utilities were chosen to provide a comprehensive range of results, from smaller utilities with oversight structures similar to City Light's, to very large IOUs that are regulated by state public utility commissions.

To complete the surveys, we conducted brief introductory phone calls and reviewed available non-proprietary documents or filings (if any) provided to us by utility distribution planners. The review of written materials was followed by phone interviews that generally lasted 30 minutes to one hour, with follow-on communications as necessary. The survey results are presented in Appendix B; lessons from the survey inform our recommendations in Section 3.

2.4.3. In-person Discussion and Follow-up Telephone Interviews with City Light Personnel

On September 1, 2009, E3 consultants met with distribution engineering, forecasting, and finance personnel from City Light in a two-hour on-site meeting. We presented our approach, survey results, and preliminary conclusions to City Light personnel. We sought feedback on our preliminary conclusions, as well as insight into any issues not addressed by our work to date.

Based on discussion and issues brought to light at the September 1 meeting, E3 and City Light personnel agreed to a series of follow-up telephone interviews. We conducted four interviews with personnel from finance, forecasting, distribution planning, and distribution engineering.

Finally, E3 returned to City Light's offices on December 7, 2009, for a half-day, in-depth discussion of our revised recommendations. Information obtained from the in-person and telephone discussions inform our recommendations in Section 3.

3. Recommendations

This section presents E3's recommendations for analysis and documentation of proposed capital expenditures. Our recommendations are derived from (a) our review of the CIP and other project documentation provided to the City Council by City Light, (b) a survey of other utilities' practices pertaining to analysis and documentation of proposed distribution spending, (c) discussion and feedback from City Light personnel, and (d) our own knowledge of and experience in analysis of T&D investments.

In developing our recommendations, we have considered City Light's already substantial workload and the burden of additional analysis and documentation requirements. We believe our recommendations are reasonable and achievable, even under the assumption that no new resources are available to perform them. Most of our recommendations build on analysis and documentation already produced, or simply entail making internal documentation available to external parties. In some cases, we believe our recommendations will result in reduced workload for City Light. In other cases, our recommendations involve more work in initial documentation, but may save time over the long run as clear information from the outset will reduce the amount of follow-up required.

Our recommendations aim to ensure that the City Council will have sufficient information on proposed expenditures to perform its due diligence in accordance with its duties under the Seattle City Charter. In the past, information provided to the Council on proposed projects has not always been sufficient for the City Council to confidently approve the proposed expenditures. We believe our recommendations will both allow Council to perform its due diligence and enhance internal understanding and consistency regarding the proposals at City Light.

Our recommendations fall into two broad areas and five sub-areas:

- **Recommendations for Materials Submitted to the City Council**

- **Integrated T&D Planning Document**. We recommend City Light unify mid- to long-term T&D planning into a single document to be submitted to the City Council every five years.

- **Advance Communication for Significant New Expenditures**. For significant new expenditures, we recommend City Light provide an advance look to the Council with specific categories of information, including the evaluation of at least three alternatives according to specified metrics.

- **Capital Improvement Plan**. We recommend additional summary detail be added to the CIP.

- **Process Recommendations**

  - **Forecasting**. We recommend that City Light unify its definition of study areas across various documents to the maximum extent possible. We further recommend formal reconciliation of small area forecasts with system-level forecasts, and analysis of multiple forecast scenarios.

  - **Distribution Planning Software**. We recommend that City Light maintain current licenses for and use a distribution planning software package such as SynerGEE in order to promote consistency across analyses.[2]

Each of these is discussed in detail below.

3.1. Integrated Network and Distribution Planning Document

City Light's *Transmission and Distribution Capacity Plan* makes recommendations for capacity projects related to transmission, substations, system communications, and radial distribution facilities. The plan was produced in 2004 and updated in 2009.

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[2] E3 has no financial interest in any such software.

City Light currently plans to update this document annually. However, concerns that the release of certain information might violate NERC standards with respect to system security have prevented public release of the document. As a result, the document is currently unavailable to the general public. E3 reviewed the document under a non-disclosure agreement.

The Transmission and Distribution Capacity Plan focuses on radial distribution and includes only brief discussion of City Light's network distribution service areas. City Light documented a review of network systems in the Network Blueprint, first produced in 1999 following a vault fire and four-day outage of City Light's downtown network. Although the Network Blueprint was not meant to be a formal planning document, according to staff the document has been a highly useful guide in identifying projects in the intervening years and continues to be useful though it is clearly in need of an update.

Network and radial distribution planning are interrelated, especially when viewed over a long time frame. For example, the Broad substation currently serves both the downtown network and radial systems in North Downtown, Queen Anne and Magnolia. A proposed South Lake Union substation could have served both the existing network and radial systems, and potentially a new network in the South Lake Union area. Combining the two into a single planning process and document would foster a more integrated approach to identifying and addressing distribution system planning issues. In addition, both the radial and network systems are served by the same transmission facilities; hence, growth in both areas would contribute to the need for transmission upgrades.

Furthermore, combining the radial and network documents would provide the City Council and other reviewers such as the Mayor's Office, City Light Advisory Group, or the general public with a single, unified narrative on the distribution challenges facing the utility. Non-technical reviewers are likely to be less interested in the distinction between network and radial systems, and more interested in understanding the big picture of distribution challenges as a whole. A unified planning document would serve both as a guide for utility direction and as a reference for presenting individual projects or annual budgets to the City Council. The Council's review of individual projects and annual budgets will be facilitated by the Council's prior opportunity to review and understand the combined planning document.

Relationship to City Light's Strategic Plan

Our recommendations for a T&D Outlook are consistent with City Light's 2008 Strategic Plan, which describes an initiative of the utility to develop an "energy delivery infrastructure investment plan." The plan would be a "forward-looking ten-year infrastructure development program to address the energy delivery system design that will best meet customers' needs." [Seattle City Light, *Your Energy Future: Seattle City Light's Strategic Plan*, 2008, p. 26.] In our discussion of the T&D Outlook we provide recommendations for the scope and detail to be included in such a plan.

For these reasons, we recommend City Light combine the network and radial planning into a single planning document, herein referred to as the *T&D Outlook*, to be submitted to the City Council every five years. We also recommend that the document include discussions and forecasts of transmission expenditures, to the extent that such information can be shared with the public. While some information would need to be redacted for security reasons, we believe that the inclusion of transmission in the *T&D Outlook* is consistent with a unified planning document and will provide the Council with a more comprehensive picture of City Light's funding needs for its energy delivery infrastructure.

3.1.1. Requirements for the *T&D Outlook*

Below we discuss specific recommendations for information that should be included in the T&D Outlook.

Minimum ten-year planning horizon

The *T&D Outlook* should take a long-term view on challenges facing City Light; we recommend a minimum 10-year planning horizon. As noted in the Strategic Plan, City Light has already recognized the need to "take a ten-year view of capital requirements… [to] reflect the lead times required in our industry and… better inform … budget submissions required by the City."[3] The level of detail over the study period will vary. For most types of projects, a fairly detailed treatment should be provided for the first five years; the remaining study period may be discussed at a more general level. For transmission projects or special distribution projects with a longer project horizon, it may be useful and necessary to provide the higher level of detail for longer than five years.

Produced every five years

The *T&D Outlook* should be produced at least every five years, so as to ensure that the document is distinct from and not duplicative of the CIP. The Outlook's intent is to identify the big issues City Light may face in the next decade or two, and to set priorities for addressing them. While many of the utilities we surveyed produce a T&D plan annually, such plans tend to take a five-year planning horizon. In many ways, these T&D plans are similar to City Light's annual CIP. Some utilities also produce a more comprehensive study, similar in nature to our suggested *T&D Outlook*. These studies are typically conducted at intervals of five years or more.

A five-year interval will allow the analysis to be thorough and not rushed; the big issues identified in the document are likely to remain relevant over the time span; and staff will not be burdened with producing the document each year, allowing more time to focus on CIP documentation. While we recommend the public document be submitted to Council every five years, City Light may wish to produce the analysis

[3] *2008 Strategic Plan*, p.28.

and documentation more frequently for internal guidance, or possibly even for submission to Council, if circumstances are deemed to warrant it.

City Light's budgeting is performed on a biennial cycle, and City Light personnel raised the question of whether the T&D Outlook should be produced on an even year interval (i.e. every four or every six years) in order to align with budgeting. In our view, the *T&D Outlook* process and document is distinct from budgeting questions. Its intent, rather, is to identify issues and potential solutions at a high level, while budget issues will be explored in more detail in preparation of the annual CIPs. Therefore, we do not believe it is necessary to align the *T&D Outlook* with the budget cycle. However, City Light may find that a four- or six-year cycle is more desirable based on considerations with regards to staffing or budget cycle alignment. We believe our goals for the T&D Outlook could be met on a four- or six-year cycle.

Identify policy objectives

The T&D Outlook should consider distribution needs and issues over the whole utility and set priorities accordingly. To set priorities, the plan must consider not only engineering needs, but also utility and City policy objectives. Consideration should be given to existing city planning/urban planning documents and reports, as well as to large civic projects such as the Alaska Way viaduct / sea wall replacement project. Based on review of planning documents and other sources, the plan should identify policy objectives as they are understood by City Light. Explicitly aligning proposed T&D investments with identifiable policy objectives offers several advantages. First, it will demonstrate that City Light is cognizant of and taking steps to achieve the goals set out by City policymakers. Second, it will inform policy discussions by providing concrete evaluations of the effect of policy on City Light infrastructure requirements and ratepayers. Third, it will facilitate feedback and revision from City Light executives, the Mayor's office, and the City Council. Finally, it will simplify future agreement on specific projects included in the annual CIP.

Identify potential courses of action

For significant distribution planning issues identified, the T&D Outlook should begin to identify courses of action to address the situation. At least three alternatives for addressing each issue should be considered. These courses of action, or alternative solutions, may be broadly defined in the T&D Outlook and need not be fully qualified. The intention is simply to ensure the broadest possible thinking at this early stage of analysis. When each issue is examined in greater detail in the context of the appropriate year's New Expenditure Review (discussed below in Section 3.2), potential solutions identified in the T&D Outlook may be rejected, and/or new alternatives may be identified. Having potential solutions from the T&D Outlook, however, will provide a starting point for the more detailed analysis in the New Expenditure Review. Including this level of analysis in the T&D Outlook also provides an opportunity to approach the distribution system holistically and consider how potential solutions for different issues may interact with one another.

Estimate impact on utility rates

While the T&D Outlook does not identify specific solutions based on detailed engineering analysis, it should contain high-level estimates of the cost of each of the alternative solutions identified that are sufficient to calculate the impact on City Light rates. The T&D Outlook is not the place to conduct a detailed forecast of City Light rates, and there will be substantial uncertainty about the level and the design of future City Light rates. Nevertheless, T&D investments can have a substantial impact on utility rates, and we believe that providing high-level rate impact information can provide useful information for City policymakers to consider. Hence, we recommend that City Light estimate impacts on average rates for each of the three potential solutions identified for each significant planning challenge.

Responsible officer at City Light

The T&D Outlook should represent the utility's official view of upcoming T&D planning challenges, and the document itself should be regarded as formal communication between City Light and the public, including the Council. As such, the document should be reviewed by high-level City Light officials including director-level personnel in Communications and/or Legislative Affairs. The document should be signed and presented to Council by either the Customer Service and Energy Delivery Officer or the Superintendent.

3.2. Advance Presentation of Significant New Expenditures

At present, the City Council's primary means of reviewing City Light's spending plan is the annual CIP. The CIP may also be the primary or sole means for the City Council to learn of major new distribution system initiatives. The CIP is generally received by the City Council in late September, when the Mayor delivers the budget, and must be approved by the Council, in part or in whole, by late November. This affords little time for the Council to conduct a due diligence review of major new projects or categories of expenditure which it may be encountering for the first time in the CIP. More importantly, the documentation provided in the CIP, while useful at a summary level, is insufficiently detailed to allow the Council to judge the prudency of significant new projects or categories of expenditure.

While the Council first sees the CIP in September, it is generally provided to the Mayor's Office in May or June. In other words, by May or June, City Light has completed the analysis necessary to develop its proposed spending plan, including the identification and evaluation of any major new projects or expenditures. While additional prioritization occurs after City Light's work has been completed, there appears to be ample time to prepare information to Council about potential new expenditures that may be included in the CIP.

We recommend that City Light deliver to the City Council a "New Expenditure Review" at least 90 days prior to submission of the budget that would provide the City Council with detailed information on potential significant new expenditures. The information provided, described below, would be sufficiently detailed to allow the Council to conduct its due diligence in approving new expenditures. Even though the CIP may be modified by the Mayor's office during the budget process, we believe that this early delivery date is necessary to afford time for the City Council to request, and City Light to supply, any additional information that may be necessary while still allowing the Council to complete its review by the end of November. However, our recommendations are designed to ensure that such additional information requests are minimally necessary, as the intention is to provide the Council with a body of information that addresses key questions the Council might have.

Our recommendations for the New Expenditure Review document are described in detail in the remainder of this section. In many cases, City Light may already conduct the types of analyses we recommend, and may already document these analyses for internal review. For example, the documentation that City Light provides to the Mayor's office may include more detailed justification for specific line item increases. We believe that Council also needs to see such documentation in order to effectively do its job of reviewing City Light capital expenditures.

3.2.1. Threshold for New Expenditure Review

We recommend that any new expenditure request of greater than $1 million (over the life of the project or forecasted period of expenditure) be included in the New Expenditure Review. The new expenditure request may result from identification of a new discrete project, such as a new substation to serve forecasted growth, or increase in spending due to accelerated replacement of failing equipment to maintain reliability.

We selected the $1 million threshold to be consistent with City Light's current budget management process, in which lines of business are allowed to deviate by up to $1 million from approved line-item budgets in any single year, without seeking further approval from the Council (subject to the condition that overspending on one project must be matched by reduced spending on another). City Light already conducts detailed review, including identification of alternatives and cost-benefit analysis, for any new expenditure over $500,000. Thus, a threshold of $1 million should minimize creation of new work for the utility.

For each new expenditure request over $1 million, we recommend the following information be included in the New Expenditure Review:

- Project Need
- Forecasting
- Alternative Solutions Considered
- Selection of the Preferred Alternative

We describe each category of information below. Note that the documentation required may vary by investment type. For example, a project necessary to ensure safety for reasons unrelated to load growth would not require forecast documentation. Table 1 shows the types of documentation that should be required for each project type.

Each documentation element is described in the remainder of this section. We recommend the New Expenditure Review be arranged in chapters. Each chapter would cover a single new project or category of expenditure and would include sections for each element described below.

Table 1: Varying requirements for documentation by project type

	Documentation Required			
Project Type	Project Need	Forecasting	Alternatives	Preferred Solution
Equipment Replacement	X			
Safety	X		Fewer alternatives may be considered	X
Work requested by others	X		Case-specific	X
Reliability	X	May be less detailed	X	X
Capacity Expansion	X	Should be more detailed	X	X

3.2.2. Project Need

A detailed description of project need should be provided. The CIP already provides project type, such as “New Facility” and a short narrative description of the project. The New Expenditure Review should provide greater detail. It should answer the question: “what happens if the project is not built?” Depending on the type of project, information from among the following may be included:

- Is the project in response to work requested by others, such as facility relocation? If so, how firm is the timing or scope of the needed work?

- Is the new project needed to solve a reliability problem? If so, which reliability criteria are being or are in danger of being exceeded?
  - What is the basis for these reliability criteria? (E.g., internal standard, regulatory requirement, NERC standard, etc.)
  - Is the need based on historical exceedance of reliability criteria, projected exceedance under forecasted conditions, or a combination of the two?
- Is the new project needed to improve reliability performance? If so, why is the improvement needed, and how will the project improve reliability performance, based on measures such as system average interruption duration index (SAIDI), system average interruption frequency index (SAIFI), and momentary average interruption frequency index (MAIFI).
- If the need is based on forecasted conditions, how was the forecast determined? (See "Forecast" section below.)
- Is the new project needed to solve a capacity problem? If so, include a section on the forecasting that led to the determination of need.

3.2.3. Forecast

If need for the project is based on forecasted capacity constraints or forecasted exceedance of reliability criteria, a description of the forecast that led to this conclusion should be provided. The forecast documentation should describe:

- Definition of the small area or areas relevant to the forecast(s). The small areas used for forecasting would be expected to match the small area definitions used for planning as defined in the T&D Outlook. If any change was necessary from the definitions in the T&D Outlook, the reasons should be explained.
- Methodology of, and considerations in, the forecast(s)

  - Is the small area forecast based on historical metered data? If so, describe this data. If not, why not?
  - Is the small area forecast based on econometric/statistical analysis (regression)? If so, what determining factors were considered?

- Are planned customer additions considered? If not, why not?
  - What is the source of this data?
  - How is load growth from planned customer additions reconciled with the econometric forecast (if performed)?
  - How are planned or potential customer additions discounted to account for the possibility that not all may be realized? Demonstrate that the method for discounting additions is consistent with industry practice and appropriate for the relevant study area.

- Reconciliation of the small area forecast with the system forecast. If the load growth anticipated for the study area constitutes a substantial portion of the utility's total growth, this should trigger additional review to determine if the small area forecast should be adjusted downward or, alternatively, if utility's system-wide forecast should be adjusted upward.

In addition, multiple forecast scenarios should be presented. At a minimum, a high, medium, and low forecast should be provided based on reasonable extremes. This will allow alternative solutions to be compared under differing forecast assumptions.

3.2.4. Alternative Solutions Considered

A minimum of three alternatives should be considered. Where feasible, non-wires alternatives – such as distributed generation and/or demand response – should be evaluated. If non-wires alternatives are not feasible, the reasons for non-feasibility should be explained. In addition to three proactive cases, the "do-nothing" or deferral case should also be evaluated.

To the extent possible, the study area definitions should be consistent with the planning area definitions from the T&D Outlook. It is possible that the more in-depth examination of the problem that is part of the preparation of the CIP will reveal reasons why the study area boundary needs to be re-defined. If this is the case, the reasons should be explained and the new boundary area definition should be provided. The new study area definition should be used uniformly for all alternatives presented, so that they are compared on a level playing field.

As discussed in section 3.2.1, alternatives need not be presented for replacement projects, and can be limited for projects that are driven by safety or requests by others. However, for cases where there are alternatives with significantly different distribution system implications, alternatives should be presented.

3.2.5. Metrics and Information Provided

For each alternative, City Light should provide a standard set of information to the Council for review. The information should include both qualitative project descriptions as well as a number of metrics with which to evaluate the performance of the alternative and to support the choice of the preferred solution. Qualitative information that should be provided includes:

- A technical overview of the solution
- An evaluation of the effect of the solution on the reliability criteria, capacity constraints, or other factors driving the need for the solution
- Environmental considerations or impacts of the solution

City Light should also calculate the following quantitative metrics:

- Cost of the solution
    - Line item capital and O&M costs
    - Schedule of investments
    - Net Present Value (NPV) cost or NPV of cash flow under the solution

  - Discount rate used in NPV analysis

- Benefits of the solution
  - Increased revenue, if any
  - Reliability improvements in reducing SAIDI, SAIFI or MAIFI
  - Other financial benefits, if any

- Risk considerations
  - Identify any obstacles that could prevent completion of the solution
  - If need is based on load growth, and projected load growth does not materialize, can any adjustments be made to the project to save costs?
  - What if load growth is greater than anticipated? Will the project accommodate it?
  - Are there any other assumptions to which the costs, benefits, or reliability of the project are sensitive?

Risk considerations will be partly addressed by evaluating each alternative under the various load forecasts. A risk of stranded investment may be revealed, for example, if under a low or medium forecast scenario, the do-nothing or deferral case provides sufficient reliability and capacity at a better benefit/cost ratio than any of the proactive alternatives.

Each of the metrics above may be presented as changes compared to the preferred solution.

3.2.6. Preferred Alternative

This section should explain the basis for selecting the preferred alternative for which funding approval is sought. It is at this point that City Light may wish to refer back to the City Light and City policy priorities identified in the T&D Outlook, or discuss new policy priorities that have come to light since the T&D Outlook was produced. The policy priorities may determine selection of the preferred alternative in some cases.

If the Preferred Alternative is the least cost solution under all scenarios considered, then this section may be fairly brief. At a minimum, however, the following questions should be answered:

- Is the solution the least-cost / most NPV favorable solution under all scenarios?
- How does the preferred alternative address strategic, environmental, safety, or other considerations?

If the Preferred Alternative is not the least-cost solution under all scenarios, then more detailed discussion should be provided. This discussion may address issues such as:

- How was risk evaluated? If multiple scenarios were considered, was the Preferred Alternative the least cost solution under one or more of the scenarios? If so, why were these scenarios considered the most important in weighting the decision?
- If the Preferred Alternative was not least cost under any scenario, why was it chosen? Are there policy considerations, such as economic development within the service area, which led to the Preferred Solution?
- What other considerations were important, if any?

Appendix A provides a template guideline that City Light may wish to follow in providing the above information in the New Expenditure Review. This guideline document aims to foster uniformity in the presentation of the materials, which will facilitate City Council review and enhance overall communication of City Light planning efforts. It will also promote consistency in the analysis itself. The form should be considered a starting point and should be adjusted by City Light as appropriate.

3.3. Enhancements to Capital Improvement Plan

Current CIP documentation provided to the City Council is described in Section 2.4.1. The CIP is produced under a compressed schedule: projects are entered by sponsoring engineers into the CIP database in March of each year, internal and executive review is completed by May or June when the CIP is provided to the Mayor's Office, and City Council review begins in late September when the Mayor delivers the budget. City Council review must be completed by late November. The City Council may approve the CIP in total, modify any item in it, or place a "proviso" on certain items for which more information is desired. The proviso prevents the utility from spending any funds on the projects identified in the proviso, while allowing spending for other projects to proceed.

While the CIP is useful in many ways described in other sections of this report, it is at once both too voluminous to digest *and* lacking in sufficient detail. This stems partly from the fact that projects are given equal treatment regardless of whether expenditures total in the tens-of-thousands or hundreds-of-millions of dollars. On one hand, with over 200 individual project summary tables in the 2010-2015 CIP, it is difficult for the reader to gain understanding of expenditures in a particular program or project type. While the CIP narrative provides some of this information, summary tables would also be helpful, as described below. On the other hand, for large or exceptional projects, the information provided is insufficient to allow Council to perform a diligent review. This shortcoming is intended to be addressed by the New Expenditure Review discussed in the previous section.

Given our recommendation for City Light to produce a T&D Outlook every five years – rather than an annual transmission and distribution capacity plan – there is room and reason for City Light to provide additional detail in the CIP. We recommend that City Light amend the CIP as described below.

3.3.1. Summary of Expenditures for Each Program and Project Type

Figure 1 in Section 2.4.1 shows that the Boundary Transfer Block Rock Damage Mitigation project is part of the *Power Supply and Environmental Affairs* Program, and is of the *Rehabilitation or Restoration* project type. This information is useful, but also of note is the fact that many other projects are listed under each of these program and project areas. Under the current CIP documentation, there is no easy way to place the Rock Damage Mitigation project in the context of other projects of a similar, or of a different, sort.

Providing a summary by program and project type would allow the City Council and other reviewers to see at a glance the big picture and overall balance between different program and project types. We recommend that such a summary be provided in the CIP narrative. An example form for such a table is shown in Figure 2.

Figure 2: Example Table Showing Allocations by Program and Project Type

Fund Allocations by Program and Project Type ($000s)

	2010	2011	2012	2013	2014	2015	Total
Customer Service & Energy Delivery							
New Facility	110,212	121,233	133,357	146,692	161,361	177,498	850,353
Rehabilitation or Restoration	60,411	66,452	73,097	80,407	88,448	97,293	466,108
Total	170,623	187,685	206,454	227,099	249,809	274,790	1,316,461
Financial Services							
New Facility	1,041	1,145	1,260	1,386	1,524	1,677	8,032
Rehabilitation or Restoration	4,214	4,635	5,099	5,609	6,170	6,787	32,514
Total	5,255	5,781	6,359	6,994	7,694	8,463	40,546
Power Supply and Environmental Affairs							
New Facility	24,351	26,786	29,465	32,411	35,652	39,218	187,883
Rehabilitation or Restoration	26,205	28,826	31,708	34,879	38,367	42,203	202,188
Total	50,556	55,612	61,173	67,290	74,019	81,421	390,070
Total, All Programs	**226,434**	**249,077**	**273,985**	**301,384**	**331,522**	**364,674**	**1,747,076**

3.3.2. Summaries by Other Categories

In addition, we recommend that summary tables of the type presented in Figure 2 also be created for major work categories such as reliability compliance, reliability performance improvement, capacity, safety, work requested by others, operations and maintenance, and equipment replacement. If such categories are not already tracked by City Light for the purposes of CIP tracking, we recommend that City Light make the effort to categorize projects into these and other work categories so that such reporting may be provided in future CIPs.

3.3.3. Explanation of Variance from Historical Spending

The fund allocations by program and project type shown in Figure 2 should be compared to the totals in each category in recent years. Specifically, the first year total should be compared to the trend from recent years, and the six-year total should be compared to the trend of recent six-year totals. A brief explanation for significant deviations from prior year fund allocations in each category should be provided. This will aid the City Council's review by revealing areas where there is a dramatic change in the trajectory of expenditures, and will allow City Light to inform Council of reasons for the changes.

City Light's 2008 Strategic Plan provides a useful example of the type of historical comparison we recommend. Figure 12 (page 20 of the 2008 Strategic Plan) provides a view of capital expenditures from 1972 to 2007. While the chart is presented at a very high level of expense categorization (general plant, distribution, transmission, generation), the concept is similar to what we recommend be provided in the CIP at a greater level of detail. The text of the report discusses the trend and notes conditions that will likely require an increase in distribution investments compared to recent historical levels. Likewise, we recommend the CIP provide trending of the various project categories and an explanation of conditions that lead to any observed variance from historical trends.

3.3.4. Description of Relevance of Projects to the *T&D Outlook*

The *T&D Outlook* discussed in Section 3.1 will describe the challenges facing City Light distribution over the minimum 10-year planning horizon, and will identify at a high level the options for addressing these challenges. The CIP should be guided by and refer to the *T&D Outlook*. Major CIP projects or categories of projects should be placed in the context of the priorities identified in the T&D Outlook, so that a reader of the CIP can understand the ways in which the selected CIP projects are consistent with the needs and priorities identified in the Outlook. Since the *T&D Outlook* is to be produced every five years, it is possible that some needs will be identified outside of what was covered in the Outlook. The CIP documentation should discuss these newly identified areas of need and place them as much as possible within the context of the *T&D Outlook* priorities. If the newly identified areas are substantial enough, City Light may wish to consider updating the T&D Outlook ahead of schedule.

3.4. Process Recommendations

In addition to the analysis and documentation recommendations provided above, our review suggested some process recommendations that will help facilitate clear communication and funding requests. These recommendations include uniform definition of planning areas, forecasting practices, and use of planning software, as described below.

3.4.1. Planning Area Definitions

The T&D Outlook will identify "hot spots", areas where load growth or other conditions are likely to require significant distribution investment. Many other areas will be stable, forecasted to experience little or no growth.

The T&D Outlook should give careful consideration to planning area definitions, drawing distinctions between areas that are expected to experience different rates of growth. In particular, the boundaries between different areas should be carefully defined, as this will help to frame the detailed analysis that goes into preparation of the annual CIP. The intention should be to define the planning areas in the T&D Outlook, and consistently refer back to these definitions for small area load forecasting and in the annual CIPs, recognizing that unforeseen circumstances may require redefinition of the planning areas for purposes of the CIP.

PG&E's ideal planning area description is useful when considering planning area definitions: "An ideal study area would have a uniform load distribution and load growth rate, a single primary distribution voltage, strong distribution ties among the substations with the area, and no possible ties to substations outside the area. Such ideal areas are never encountered in practice, but area boundaries should be so selected that the area approaches as nearly as practicable to the ideal."

3.4.2. Forecasting

Our forecasting recommendations apply to all documentation discussed in this report, including the T&D Outlook, the New Expenditure Review, and the CIP. We recommend the following with regard to load forecasting.

Consistent definition of planning areas for small area forecasts

Capacity planning needs are driven by load forecasts. Load growth can vary substantially from one area to another within a utility. Therefore, to maintain analytical consistency, the definitions of small areas should remain consistent across load forecasts. To the extent possible, the planning areas defined in the T&D Outlook should be used for creating small area forecasts. These planning area definitions should remain consistent through each year's CIP, or if changes are necessary, the reasons should be made clear.

Reconciliation of small area forecasts with system forecast

We recommend small area forecasts be formally reconciled with the City Light system forecast. While the sum of small area forecasts will not exactly match the system forecast due to diversity in peak load timing, it should be consistent with the total system forecast. For example, the sum of area-specific peaks should grow at a similar rate as the system peak, and the relationship between the sum of non-coincident peaks of each small area and the system peak should be consistent with historical patterns. This will ensure that small area forecasters and system forecasters are working off a shared knowledge base and set of assumptions. This also ensures that the subject area expertise of forecasters is used and reflected in small area plans.

Creation of multiple scenarios representing a reasonable range of potential outcomes

We recommend that forecast risk be addressed through the creation of multiple load forecast scenarios. An example is the range of scenarios developed for South Lake Union (SLU) load growth. A study by an outside firm forecast 90% build-out of the SLU area by 2020. City Light developed three alternative scenarios to represent a range of possible futures, including 54%, 44%, and 27% build-out. The alternative scenarios additionally considered various usage mixes between residential, commercial and biotech. The range is appropriately broad, given the large uncertainty of future conditions; in an area with more pre-existing development, a reasonable range might be considerably narrower.

3.4.3. Use of Distribution Planning Software

One of the issues we identified in our review of documentation provided to the Council is inconsistencies in the small area definitions and load growth forecasts used in responding to City Council data requests over time. These inconsistencies have made it difficult for Council staff to interpret the information provided and compare it to prior information. It came to light during our interviews with City Light personnel that a primary reason for these inconsistencies is City Light's lack of distribution planning software. City Light personnel did not have access to a software package that allowed study cases to be saved for future reference. Hence, City Light's efforts to maintain consistent planning area definitions from the T&D Outlook through the annual CIPs would be greatly assisted by the use of distribution planning software. City Light has purchased such software in the past, but has not maintained licenses. This is inconsistent with common practice. All of the utilities we surveyed use a standard distribution planning software package and maintain current licenses (see Table 2).

We recommend that City Light make it a priority to maintain current licenses. This will enhance the consistency of analyses produced by City Light and will facilitate the City Council's review.

Table 2: Distribution Planning Software Used by Surveyed Utilities

Planning Software Used	Number of Utilities Using This Software	Percent Using This Software That Maintain Current Licenses
SynerGEE	4	75% (one non-response)
Distribution Engineering Workstation (DW)	1	100%
Aspen	1	100%
CymDist	1	100%
Internally developed (but transferring to CymDist)	1	N/A

Note: One of the nine utilities in our distribution planning survey did not receive this question; therefore n=8.

Appendix A: Project Approval Guidelines for Large Projects

Section 1: Need

Explain the basis for project need (list all that apply):

A) Equipment Replacement due to damage, wear, or obsolescence

B) Reliability Criteria

C) Capacity Planning

D) Other (please explain)

Please provide the following regarding project need

1.1 If “A” was selected above, please describe the specific reason equipment needs to be replaced.

1.2 If “B” was selected, please describe the reliability criteria that are driving the need

- What is the basis for these reliability criteria? (internal standard, regulatory requirement, etc.)
- Is the need based on historical exceedance of reliability criteria, projected exceedance under forecasted conditions, or a combination of the two?
- If the need is based on forecasted conditions, how was the forecast determined? (see specific forecast related questions in “1.3” below)

1.3 If “C” was selected, please describe the basis on which the forecasted need was determined

- Was a small area load forecast developed? If not, why not?
  - How was the area defined?
  - Was the small area forecast reconciled with a system-wide forecast (for example, the system-wide forecast for energy procurement)? If not, why not?
  - Is the small area forecast based on historical metered data? If so, please describe this data. If not, why not?
  - Is the small area forecast based on econometric/statistical analysis (regression)? If so, what determining factors were considered?
- Are planned customer additions considered? If not, why not?
  - What is the source of this data?
  - How is load growth from planned customer additions reconciled with the econometric forecast?
  - Are planned or potential customer additions discounted to account for the possibility that not all may be realized?

1.4 If “D” was selected, please provide a detailed description of the project need.

Section 2: Alternatives Considered

For projects related to capacity expansion and/or reliability please provide the information below on at least 3 proactive alternatives, as well as the do-nothing or deferral case. For safety-related projects, provide only as many alternatives as feasible. Equipment replacement projects do not require alternatives.

2.1 Please describe the study area defined for the consideration of alternatives. If the study area is consistent with the study area definition from the T&D Outlook, you may refer readers to the T&D Outlook.

> ***Guideline***: An ideal study area would have a uniform load distribution and load growth rate, a single primary distribution voltage, strong distribution ties among the substations with the area, and no possible ties to substations outside the area. Such ideal areas are never encountered in practice, but area boundaries should be so selected that the area approaches as nearly as practicable to the ideal.

2.2 Please describe the alternatives considered. For ***each*** alternative, please provide:

- A technical overview of the solution
- An evaluation of the affect of the solution on the reliability criteria, capacity constraints, or other factors driving the need for the solution
- Environmental considerations or impacts of the solution
- Cost of the solution
    - Line item capital and O&M costs
    - Schedule of investments
    - Net Present Value (NPV) cost or NPV of cash flow under the solution
        - Please specify the discount rate used in NPV analysis
- Benefits of the solution
    - Increased revenue, if any
    - Other financial benefits, if any
- Risk considerations
    - Identify any obstacles that could prevent completion of the solution
    - If need is based on load growth, and projected load growth does not materialize, can any adjustments be made to the project to save costs?
    - What if load growth is greater than anticipated? Will the project accommodate it?
    - Are there any other assumptions to which the costs, benefits, or reliability of the project are sensitive?

Section 3: Selection of Preferred Alternative

Please provide the following regarding selection of the preferred alternative:

3.1 From the alternatives considered, which was selected as the recommended solution?

3.2 On what basis was the preferred alternative selected?

- Is the solution the least cost / most NPV favorable solution?
    - If not, why was a more expensive alternative chosen?
- Were strategic, environmental, safety, or other considerations taken into account in choosing the preferred alternative? How?
- Were utility and City policy objectives a consideration in selection of the alternative?

3.3 Does allocating budget to this project jeopardize any other recommended projects?

- If so, on what basis is this project determined to be a higher priority for the available funds

Appendix B: Survey of Utility Distribution Planning Practices

Distribution Project Approval

Benchmarking Survey

Prepared for:

Tony Kilduff

Seattle City Council

March 2009

Energy and Environmental Economics, Inc.

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Survey of Utility Distribution Project Approval Processes

In early 2009, E3 surveyed nine public and private utilities on their distribution planning and external oversight processes. The survey included four public utilities (the British Columbia Hydro and Power Authority, Modesto Irrigation District, Sacramento Municipal Utility District, and City of Palo Alto Municipal Utilities) and five investor-owned utilities (Hawaiian Electric Company, Puget Sound Energy, Pacific Gas & Electric Company, San Diego Gas & Electric Company, and Orange & Rockland Utilities). We chose these utilities to provide a comprehensive range of results, from smaller utilities with oversight structures similar to City Light's, to very large IOUs with oversight from state public utility commissions. Because our intent was to provide information on "best" practices, we sampled several large IOUs under the assumption that the magnitude of their investments and their relatively strict regulatory oversight would lead to more defined processes and more thorough presentations of analyses.

Our survey specifically sought to determine:

- The process for identifying distribution system investment needs;
- The method for forecasting local area customer growth and system need;
- The degree to which alternative technical solutions were considered and documented for review;
- The financial measure of candidate solutions;
- Non-financial considerations in evaluating candidate solutions;
- The method for choosing a preferred solution;
- Internal review and approval processes; and
- External review processes.

To complete the survey, we conducted brief introductory phone calls and reviewed available non-proprietary documents or filings (if any) provided to us by utility distribution planners. After reviewing available documents, we conducted follow-up telephone interviews with utility personnel to fill in gaps and obtain additional detail not provided in the documents. In the sections that follow, we present the results, organized by topic. Each section includes a brief summary followed by a table with the specific information for each utility surveyed.

1. Identification of Need

Most utility distribution needs are identified through regular planning efforts undertaken on a small area basis by utility distribution engineers. Typically, identified projects are rolled up into a 5-year distribution plan, though formal budgeting may be performed for only the first one or two years of the plan. Occasionally, project needs may be identified outside of the standard planning process, due, for example, to equipment damage, unanticipated customer growth, or other reasons. In most cases, utility planners attempt to reconcile these new projects within the existing budget, though in some cases it may be necessary to seek approval for new budget.

Most distribution investments are rolled up into a single budget in the planning process described above, and are described only in summary form. However, for very large projects most utilities provide a much more detailed review of projects, as required either by senior executives of the company or external oversight organizations.

UTILITY	Method for Identifying Need
British Columbia Hydro	10-year plan produced annually. Also, 1- to 2-year detailed budget produced annually. Plan identifies projects needed for capacity, reliability, environmental, safety, conservation, or legal/regulatory reasons.
City of Palo Alto Utilities	There are two types of investments that are made. Replacing deteriorated infrastructure and installing new infrastructure for a particular need. The need for infrastructure replacement is determined by condition of the asset, reliability, and its age. Investment in new infrastructure is based on possible savings since Palo Alto does not have load growth.

UTILITY	Method for Identifying Need
Hawaiian Electric Co.	System planning group provides 1-year and 5-year forecasts annually. 20-year forecast performed less frequently. 1- and 5-year system forecasts are divided into smaller planning areas by distribution planning group, which also looks at monthly data from 12kV circuit level. Based on forecasts and circuit level data, load analysis identifies areas with insufficient distribution capacity. Customer service request are also taken into consideration – if it is a small addition it is simply handled by customer engineering dept., but larger additions are transferred to distribution planning dept.
Modesto Irrigation Dist.	5-Year T&D plan updated annually. For new business, included in annual budget approval process and based on established formula for cost per meter. All projects are reviewed and approved by the Board. Projects may be to meet a mandated upgrade requirement, to improve safety, to correct an overload condition, or contingency planning. Projects can arise outside of the normally scheduled planning studies due to, for example, safety concerns, reliability concerns or equipment damage.
Orange & Rockland	Annual 5-year forecast at transformer bank level and 2-year forecast at circuit level. Facilities must meet Planning Criteria under forecast conditions, otherwise plans are made to address deficiencies. Age of equipment is also a consideration in identifying needed projects. Currently working on a 15-year combined T&D study – this is a new undertaking. Most activities are covered within the 5-year plan. Even if a new large customer comes on unexpectedly, it usually takes long enough to be addressed in the next plan. If a voltage problem or equipment damage arises between the annual plans, it is addressed in a way that attempts to integrate into the activities specified in the plan. Otherwise scheduled projects may need to be delayed.

UTILITY	Method for Identifying Need
Pacific Gas & Electric	A 5-year plan is produced annually, based on projected growth and studies of historical reliability. The 5-year plan is the aggregation of the plans and proposals of engineers in charge of local areas. Engineers run studies toward end of year, resulting in a preliminary list. This analysis is approved at sr. engineer level, then compiled by managers and through increasing levels of management depending on the size of the project. The list identifies deficiencies, solution, budget. Annually recurring projects are separate. Things like voltage problems or power factors. Look at 5-year average of spending. Try to maintain average level of spending that has been determined to adequately maintain system. At final budget, a closer look is taken. Projects are aggregated and the total bottom-up budget is compared to a top-down budget derived from what has been approved in the rate case. Projects are prioritized and approved if they fit into the top-down budget. Must identify whether project is needed for safety, regulatory, reliability, or cost reasons.
Puget Sound Energy	10-year plan for substation level, 3-year feeder plan, both produced annually. Plans identify reliability issues. Planners come up with projects to meet future load and reliability. Besides load growth, reliability (e.g. SAIDI and SAIFI) could bring project up.
San Diego Gas & Electric	10-year plan developed annually, with greater detail on first 5 years, and budget for smaller period still. Distribution engineers develop substation/circuit forecast for every circuit in system. Run power flow program to identify whether there will be any deficiencies under the forecasted conditions, based on planning criteria.
Sacramento Municipal Utilities Department	Distribution planning creates an annual 5-year plan and an annual 1-3 year budget, based on two annual sales forecasts: a short-term (1-3 year) study for capital budgeting purposes and a long-term (10 year) forecast for the 5-year distribution plan. Transmission planning uses the 10 year forecast (1-in-10 version). Distribution planning divides the system forecast into four sub-areas, and also considers any additional information on growth in each area, such as planned customer additions. Generally, all necessary projects are captured in annual planning process, though equipment failure, etc., may necessitate a project that was not in the plan. Sometimes, projects identified in the plan will be deferred due to new information; for example, lower than expected growth rates due to economic slowdown. Project initiation may be driven by long-range planning, strategic plan, executive initiatives, customer action, asset improvement, system health, good ideas, risk mgmt, emergency.

2. Load Forecasting

Load forecasting is necessary to plan for growth on the distribution system. To be useful, the forecast must be specified to a level of geographic granularity sufficient to make investment decisions on different parts of the system according to their different rates of growth. This may be accomplished through a "top-down" method by allocating a larger, system forecast into smaller sub-areas or though a "bottom-up" method by considering determining factors and recent trends at the small area level and rolling these up into a total system forecast. The method chosen may depend on the size of the utility; very large utilities typically have processes in place whereby distribution engineers in charge of a local area develop the bottom-up forecast for those areas.

Utilities that develop bottom-up forecasts generally compare the sum of these small area forecasts to a larger system forecast produced for other purposes; for example, energy procurement. However, this comparison is often informal and while inconsistencies between the two forecasts are noted, they are not necessarily resolved.

UTILITY	Forecasting
British Columbia Hydro	Top-down, econometric forecast for whole province, divided into 5 different geographic regions, considering macro indicators such as employment, immigration, economy. Simultaneously a bottom-up analysis is performed on the approximately 70 substations throughout province, using the Metrics ND tool to analyze substation load. Bottom-up forecast considers historical load, known customer expansion plans, pockets of growth. Bottom-up forecast ideally should fall within a range specified by the top-down forecast. If bottom-up forecast does not fall in range, discussion ensues, but may or may not result in changes to one of the forecasts. Both forecast results are reported.
City of Palo Alto Utilities	Palo Alto only does system forecasts since the system is small (200 MW).

UTILITY	Forecasting
Hawaiian Electric Co.	System econometric forecast, considering economic indicators, population, weather. On the circuit level, the system forecast is reconciled with monthly substation readings. Known / planned customer additions are also taken into account. Small area forecasts are grouped by circuit design and substations. Where changes in load affect a circuit, this is defined as a sub-area. If a second area would not be affected by a load change in the first area, then the second area is defined as a separate sub-area. This design often correlates to geography, but is not strictly defined by geography. Distribution planners assign load growth from System forecast to sub-areas, and compare actual monthly readings from sub-areas to forecast. Public participation expressed interest in IRP-like planning down to the circuit level, but utility planners have found that this kind of intensive planning down to the 12kV level is not cost-effective.
Modesto Irrigation Dist.	Distribution area forecasts are based on historical loads and econometric studies. Any large customer load additions or departures are added or subtracted from the projection. Five-year forecasts are made for both circuit and substation facilities. Transmissions facilities are planned based on NERC planning criteria.
Orange & Rockland	Weather-normalized, 5-year, forward-looking econometric forecasts. Forecast is based on substation transformer and circuit peak load data recorded weekly. If data is not available, manual circuit and bank readings, as well as load logger readings, are utilized. Otherwise, historical data projections are utilized. Historical peak loads are regressed against population and temperature. Distribution banks are grouped into specific load areas based on switching capabilities to adjacent banks. For circuit forecasting, any curtailables or co-gens are treated as actual load in order to plan for the worst-case scenario. Circuit is then increased by the respective bank growth rate to determine the next year's projected load. Large block loads from new customers are then added.

UTILITY	Forecasting
Pacific Gas & Electric	Linear regression, based on weekly or bi-weekly meter readings, with ½ hour max demand and kWh usage, feeder ampere readings, load density reports from system analysis, weather data, customer growth, land-use planning reports. Data is entered into a forecasting tool that distribution planning system engineers use. "An ideal study area would have a uniform load distribution and load growth rate, a single primary distribution voltage, strong distribution ties among the substations with the area, and no possible ties to substations outside the area. Such ideal areas are never encountered in practice, but area boundaries should be so selected that the area approaches as nearly as practicable to the ideal." –*Guide for* Planning *Area Distribution Facilities*. One of the "key questions for project evaluation" is whether estimates are consistent with historical data. The sum of all local area planning forecasts performed by distribution planning engineers is compared against a system-level forecast performed by regulatory personnel. This comparison is informal, and inconsistency between the two plans does not necessarily imply that reconciliation will need to be performed. Rather, each plan is considered valid for its own purposes, and local distribution engineers and system planners each rely on their own forecasts.
Puget Sound Energy	Coordination between system planners, market researchers, and land planners. System econometric forecast done by forecasting group. Also look at block loads that are coming online in each planning area. Each county has its own planner, some bigger counties have multiple planners. Planners look at known block load additions in their area or use the system-wide forecast. Average growth has been about 2%. If local forecast based on block load additions is different than system forecast, planners use the forecast that is considered more certain or reliable; usually the block load forecast. This does not necessarily result in a recalibration of the system forecast, as higher growth in one planning area is generally offset by lower growth in another area.
San Diego Gas & Electric	Forecast is done annually, based on peak demands recorded on circuits. Regression analysis considering historical records, weather normalization, etc. Also consider planned customer additions. Sum of substation/circuit forecasts is compared to system-wide energy forecast, and the two must be consistent.

UTILITY	Forecasting
Sacramento Municipal Utilities Department	For transmission: developed for a normal, 1-in-2 probability peak load, a 1-in-5 probability peak load, and an adverse, 1-in-10 probability peak load. High, base, and energy efficiency potential scenarios considered. Small area distribution forecast includes four major sub-areas, which are defined based on whether load can be transferred from within distribution substations. Load that can be transferred is grouped together. Where load can't be transferred, for example due to limitations with phasing of transformers, a separate area is defined. There is no formal reconciliation of distribution sub-area planning studies with system-wide forecast. Because the total size of the utility is relatively small, this is less necessary than might be the case for a larger utility. Little disparity has been observed. Communication is generally good and if a large disparity were observed it would be communicated to the relevant groups.

3. Consideration of Alternatives

Utility distribution engineers commonly consider alternatives prior to recommending a project for approval. Typically, standard procedure includes consideration of a list of standard technical alternatives, which may vary by type of need or project. Larger or more complex problems may require development of custom alternatives.

Often, information on alternatives is presented only to immediate or mid-level managers, particularly if the project is small and considers only standard engineering alternatives. These projects are then rolled up into a summary plan for review by senior executives and external parties. In the case of large or complex projects, more detailed information is frequently requested by senior executives and external reviewers, and thorough analysis of alternatives may be among the documentation presented as a matter of course.

UTILITY	Consideration of Alternative Solutions
British Columbia Hydro	Based on the substation-level forecast, look for best way to provide capacity. Consider options including expand, new feeder, build new substation etc. Once substation level plan is set, go down to feeder level for planning. Consider capacity (overload), reliability, environmental, regulatory and other attributes. Consider standard best practices alternatives to solving feeder level capacity problems or other identified needs. More expensive projects require more thorough consideration of alternatives, including, possibly, conservation, DG. Under the $50 million level, alternatives are not necessarily presented to managers or regulators, but the analysis is presumed to have been done. Standard technical alternatives will have been evaluated. Questions may be asked, and the proposer of the project should be able to demonstrate that proposal is the best alternative.

UTILITY	Consideration of Alternative Solutions
City of Palo Alto Utilities	System studies are reviewed by the City Council. Alternatives are presented for projects that are large in scope or cost. Projects that are less than "a couple hundred thousand" in expenditure do not require presentation of alternatives. Some projects that have higher expenditures but that are routine or ongoing types of projects also may not require presentation of alternatives. But if a project has a larger budget and is not of a routine nature, alternatives will be reviewed. As well, projects that require California Environmental Quality Act (CEQA) review will have alternatives presented in the Environmental Impact Report (EIR).
Hawaiian Electric Co.	Has evolved over the years to include more evaluation of alternatives. Standard internal practice is to analyze alternatives, but this is not a formal requirement for smaller projects. For 130kV transmission or higher, a much higher level of scrutiny prevails and alternatives are definitely considered. Also, any projects going before the PUC include analysis and description of alternatives. For example, a recent substation proposal evaluated several other alternatives on the distribution and sub-transmission levels, including installing additional distribution transformers at different substations.
Modesto Irrigation Dist.	Begin with lowest-cost alternative and progress to the most expensive solution. For example, to correct a distribution overload they would first see if the condition could be corrected by switching. If not, they would evaluate a new tie or switch, reconductoring or building a new feeder. Board and public may request additional information on any project up for approval.
Orange & Rockland	A series of standard alternatives are considered. First, need to prove that distribution ties won't solve the problem. If more circuits are needed, need to show that best way to do this is through a new substation, if that is recommendation. Must show that the solution meets the need: backup? More capacity? What is the best way to realize increased capacity? If a substation is needed, ORU investigates a geographical area for available land, taking into consideration adjacent stations (capability to provide backup), location of existing transmission lines (limits cost to relocate feeds), and availability to exit proper number of circuits. Total cost analysis is performed considering cost of property, transmission to substation, and circuit exits.

UTILITY	Consideration of Alternative Solutions
Pacific Gas & Electric	Projects over 50K must evaluate alternatives, including do nothing case. Should consider deferral, reduction in scope, and any other feasible courses of action. At one time, there was a requirement to consider distributed generation as one of the alternatives, but this was not found to have enough value to justify continuing it.
Puget Sound Energy	Screen projects against alternatives including DSM, DR, fuel switching, pricing programs, and interruptible programs. Planners have a toolbox of standard engineering tools/alternatives. When a need spans two or more planning areas, planners coordinate on a solution. Even then, the list of alternative projects considered is fairly standard. Planners must present evidence that they have considered alternatives and why they ruled them out.
San Diego Gas & Electric	Benefits and costs of alternatives must be considered. Study and forecast identifies areas that need improvements; engineers develop project alternatives to address problems and document alternatives for review by Technical Review Group. If it is an isolated or small project, standard alternatives may be considered, but larger more complex projects may require the development of custom alternatives, possibly involving coordination between engineers responsible for different areas. Generally, the Technical Review Group approves an alternative and only this recommended project is carried forward, but for large projects (millions of dollars), documentation of alternatives may be carried forward to the Board.
Sacramento Municipal Utilities Department	Must consider alternative solutions and risks associated with not completing the project. Also must consider alignment with strategic directives. Distribution planning unit is expected to evaluate technical alternatives to solve a forecasted overload or other problem, but they are not required to present such analysis to executives or the board. Rather, distribution planning presents the best alternative (based on cost, benefits, etc.) and the list of proposed projects is grouped together and prioritized. Larger projects, like $20 million new transmission, are approved individually by the Board and must have more detailed analysis, including cost-benefit analysis.

4. Measurement of Reliability

Utilities typically distinguish between two types of reliability for planning purposes, though the two are related: capacity planning and basic equipment functioning / reliability. Utilities plan to their criteria in each case, though in the case of capacity planning there may be more flexibility in timing for completing necessary projects. The following reliability acronyms are used in discussing reliability in the table below:

SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
CAIDI	Customer Average Interruption Duration Index
CEMI	Customers Experiencing Multiple Interruptions
CELID	Customers Experiencing Longest Interruption Duration
EUE	Expected Unserved Energy

UTILITY	Measurement of Reliability
British Columbia Hydro	Normal reliability indices, such as SAIFI, CAIDI etc., plus BCH also has a Customer Based Reliability Index that considers customers' expectations. Customers in one area may require fewer reliability improvements to maintain a high level of satisfaction than customers in another area (as verified by surveys). The Customer Based Reliability Index takes this into consideration in a way that a pure reliability metric such as SAIDI can not. Also beginning to use two new metrics: Customers Experiencing Multiple Interruptions (CEMI), and Customers Experiencing Longest Interruption Duration (CELID).
City of Palo Alto Utilities	"Typical" reliability measures are used.

UTILITY	Measurement of Reliability
Hawaiian Electric Co.	Adequacy to provide capacity and provide back-up capacity for emergencies. Transformer loadings based on 0% and 1% loss-of-life, normal and emergency ratings, respectively. Line loadings based on cable ratings.
Modesto Irrigation Dist.	Primarily use SAIDI minutes, but also SAIFI and CAIDI. SAIDI is MID preference. Specific reliability goals are part of business plan.
Orange & Rockland	Circuit peak load restored from adjacent circuit ties within 1 hour using a maximum of four switching operations and less than 2000 customer hours of interruption. Transformer: 62% of the bank's peak load must be restored through adjacent circuit ties within 4 hours.
Pacific Gas & Electric	For capacity considerations, , percent overload on particular equipment, kW of un-served load projects can be triggered by engineering criteria (e.g. transformer operating temperature). For basic reliability, customer outage minutes on circuit, number of effected customers, number of sustained outages, SAIDI and SAIFI etc. used for projects like tree trimming, installing new circuit equipment. Each division has its own quality metrics for reliability, such as SAIFI, SAIDI, CAIDI, and response time.
Puget Sound Energy	To evaluate growth, EDC model (developed by EPRI) measures EUE resulting from transformer or circuit overload, outage reliability, and voltage limits. For reliability, look at outages, number of customers effected, etc (SAIDI, SAIFI, etc.)
San Diego Gas & Electric	Capacity planning considers, for example, circuit overload, bank overload. For reliability, consider overload under N-1 contingency: outage minutes, customers impacted, etc.
Sacramento Municipal Utilities Department	SAIFI, SAIDI, Distribution Capacity (Load at Risk), or, for transmission projects, transmission capacity (load at risk). For transmission, 10-year planning to meet NERC reliability standards.

5. Financial Measurement

In comparing the financial qualities of proposed projects, utilities generally consider the lifetime costs of the project on an NPV basis. Benefits, such as revenue increases, may also be considered. In some cases, utilities may attempt to place a dollar value on benefits resulting from the project; for example, improved reliability. Generally, however, the financial calculation is concerned exclusively with a comparison of project costs (and hard dollar benefits), with all projects meeting minimum reliability requirements.

UTILITY	Financial Measurement
British Columbia Hydro	Consider NPV of different project alternatives. Major substation upgrades include full life-time cost/benefit analysis for business case (50+ year).
City of Palo Alto Utilities	Revenue Requirement or least cost projection.
Hawaiian Electric Co.	Total project cost of the alternatives / Total Revenue Requirement. PVRR is calculated based on several different discount rates, but these results are not necessarily reported. Economics are generally driven by upfront capital costs, so total project cost generally provides the same ranking of alternatives as a PVRR calculation.
Modesto Irrigation Dist.	Total project costs are used. Staff provides cost breakdown and cost-benefit analysis. Financial consideration is based on NPV for all projects and project alternatives. Most capital projects are financed and O&M is cash based.
Orange & Rockland	Total cost of project. Must show, for example, that substation location is the cheapest considering all costs, including land price, cost of bringing in transmission, etc. PV calculation is not generally required.
Pacific Gas & Electric	PG&E uses a software package known as EASOP. NPV of cash flows (shareholder perspective). PG&E provides “NPV Factors” to simplify financial analysis. Must explain how benefits are measured (outages, additional revenue). Look at improvement in SAIFI, reduction in number of customers impacted, response time.

UTILITY	Financial Measurement
Puget Sound Energy	Measure return to shareholders and impact on customers of each new investment. NPV of operating income or of after-tax cash flow is considered. PSE considers revenue from incremental sales in its financial evaluation, but revenue is a small part of the overall equation when considering the value of UE, reliability, number of outages, customer complaints, infrastructure enhancement.
San Diego Gas & Electric	Considers year-by-year capital spending for the first 6 years of a project, and one lump sum for all years thereafter.
Sacramento Municipal Utilities Department	NPV, payback period, and soft dollar savings as a percent of total savings (this gives a higher ranking to projects that have hard dollar savings). Will consider costs and value of losses.

6. Risk Assessment / Sensitivity to Assumptions

When asked about risk assessment, most of the planners interviewed in our survey indicated that the risk they are concerned with is primarily the risk to reliability of the distribution system if a proposed project does not get approved. Other types of risk are secondary, such as the risk that more distribution capacity will be built than is immediately needed (due, for example, to lower than anticipated growth). However, these respondents also indicated that for larger projects with a higher level of scrutiny, questions regarding project risks may be posed by senior executives and external reviewers, and additional information may be requested demonstrating, for example, that project need is robust to changes in underlying assumptions.

UTILITY	Risk Assessment
British Columbia Hydro	On transmission system projects, sensitivity to assumptions is important because incorrect assumptions could result in years of stranded costs. For distribution system projects this is generally not the case. If growth slows, for example, capacity that is put in too early is generally useful within a couple of years, and in the mean time, the additional distribution investment provides a reliability benefit. Thus, the risk due to inaccurate assumptions is small and not heavily considered.
City of Palo Alto Utilities	Risk assessment or sensitivity analysis may be performed for some projects.
Hawaiian Electric Co.	Sensitivity analysis has been performed on the use of different discount rates. This generally shows total cost to be a valid metric as economics are generally driven by upfront capital costs. Overall, planning group tends to side on being more conservative and does not necessarily consider sensitivity to forecast assumptions. Executive staff, however, will bring in this level of scrutiny, asking questions about sensitivity to assumptions, and some projects have been deferred based on this executive scrutiny.
Modesto Irrigation Dist.	For T&D projects, risk assessment is incorporated in the engineering standards and operating bulletins. Financial considerations are also used.

UTILITY	Risk Assessment
Orange & Rockland	Try to build in a way that maintains flexibility. For example, transformer bank should have 50 year life. So substation might be sized to cover 20 years, with the remaining 30 years relying more on distribution ties. If growth projection was too high, substation will fully cover more than 20 years, which is good from a reliability standpoint. Also will try to send customers where there is available capacity.
Pacific Gas & Electric	Risk analysis is primarily concerned with understanding the risk of not doing certain projects due to a reduction in budget. Larger projects must consider sensitivity to assumptions. Risk assessment is really based on engineering judgment, looking at feedback they are getting from local officials on economic conditions, etc. As projects are reviewed and approved by executives, questions may come up regarding sensitivity to assumptions. Projects that appear less robust to changes in circumstance may be among the first to get cut, if necessary. If budget needs to be reduced by 5%, for example, in taking a harder look at projects, less obviously needed projects may be cut.
Puget Sound Energy	Sensitivity / risk analysis is generally concerned with whether or not project can be completed. Are resources available? Is budget overstated? Do nothing case is considered.
San Diego Gas & Electric	The type of risk evaluated is mainly the risk of not doing the project: what will be the impact on the system and customers if the project is not done. Based on data showing, for example, that a cable will fail once every three years – what will this mean if not addressed?
Sacramento Municipal Utilities Department	Risk generally expressed in terms of progress in meeting strategic objectives. Financial risk is not necessarily captured in ranking.

7. Environmental Considerations

Inasmuch as environmental considerations affect the feasibility or implementation of a project – for example, legally required compliance with environmental regulation or endangered species law – environmental considerations are taken into account by all utilities. Beyond this legal hurdle, environmental considerations are secondary to project distribution project evaluation at most utilities. This may be largely due to the fact that most distribution projects have limited environmental impact, and the difference in environmental impact between alternative solutions is smaller still. Some utilities, however, place more emphasis on environmental considerations in distribution planning, either due to local concerns (Hawaiian Electric) or company policy (BC Hydro). In the case of transmission planning, environmental concerns play a much bigger role.

UTILITY	Environmental Considerations
British Columbia Hydro	Environmental considerations may drive certain projects. BC Hydro has a regulatory directive to reduce PCBs, so this is a consideration. Also may need to consider avian impact, particularly for endangered species, which may result in undergrounding of lines.
City of Palo Alto Utilities	Large projects that will have an impact are required to go through the CEQA process. The report is commission by the Planning Department and approved by the City Council.
Hawaiian Electric Co.	Considers anticipated level of public resistance and aesthetics of overhead line.
Modesto Irrigation Dist.	Environmental considerations are addressed with each project to ensure compliance with all environmental laws.
Orange & Rockland	Environmental effects are taken into consideration inasmuch as existing laws or regulation will increase the costs of one or more alternatives.

UTILITY	Environmental Considerations
Pacific Gas & Electric	Environmental staff reviews projects, particularly with regard to endangered species (for example, a proposed line through a field may have an impact on an endangered species). EMF is also considered (no big lines near school or hospital). In addition, internal guidelines on spill and retention ponds reflect State and Federal guidelines.
Puget Sound Energy	Environmental considerations do make up part of the evaluation. Environmental effects are scored qualitatively and weighted in the prioritization tool, which considers environment and all other relevant factors.
San Diego Gas & Electric	Engineers give limited consideration to best of knowledge. At second round design/environmental review, other personnel may identify environmental concerns, which could then cause a reconsideration of alternatives.
Sacramento Municipal Utilities Department	Environmental effects are taken into consideration qualitatively –things like carbon, global warming, renewable (Green Energy program) – and this ranking is part of the evaluation of projects against strategic objectives.

8. Selection of Preferred Solution and Project Prioritization

For smaller, less expensive projects, the preferred solution is often agreed upon between the planning engineer and his or her manager. These projects are then rolled up into a plan that is reviewed in summary form.

For larger, more complex projects, utilities may be required by senior executives or external reviewers to provide a more thorough documentation of alternatives before a preferred alternative is approved. NPV of project cost or cash flow is a primary consideration in choosing from among project alternatives, but other factors may also come into play, such as environmental or strategic goals, or community/stakeholder input.

Regardless of the alternative selected on a project-by-project basis, budget pressure often means that the plan can not be approved in its entirety; projects, therefore must be prioritized. Many utilities use some type of project prioritization tool to accomplish this, scoring projects along various criteria such as financial, safety, strategic fit, and weighting each criterion subjectively (the same tool may have been used to select preferred project from among the identified alternatives). Other utilities may accomplish the same goal through a less formal give-and-take during the review process.

UTILITY	Selection of Preferred Alternative
British Columbia Hydro	Review considers: is it a good project technically; is it a good decision over the life of the project; project lifetimes costs and benefits. Projects that pass screening are prioritized/optimized, using a tool developed by consulting firm UMS that prioritizes projects based on a consideration of reliability measures (such as SAIDI), number of customers affected, environment, safety, etc. The tool allows discretionary weighting of the various considerations, thus allowing the prioritization to be aligned with strategic goals. Historically, focus has been on cost metrics, such as NPV, but more recently other attributes such as customer satisfaction, are gaining prominence.

UTILITY	Selection of Preferred Alternative
City of Palo Alto Utilities	The Engineer will make a recommendation on the best alternative. Staff reviews alternatives and makes a recommendation to City Council. Depending upon the project and the Council's interest in the subject additional information on alternatives may be discussed with the Council. Cost is only one evaluation criteria; citizen and council input can push the final decision in a different direction than the economics suggest.
Hawaiian Electric Co.	Purposely do not choose quantitatively. Rather, analysis is qualitative and decision must be justified rather than simply the outcome of a calculation. In a recent case, options likely to meet public resistance were removed from consideration. The preferred of those remaining was the most "practical" consideration based on minimal cost, resolution of overload conditions, provision of back-up, accommodation of forecast load increase, and future extensibility. On atypical projects other analysis may come up. For example, HECO recently built a new dispatch center. The design chosen was not necessarily the cheapest alternative, but was judged best when considering all criteria, such as security.
Modesto Irrigation Dist.	Preferred alternative is selected based on total cost. The lowest cost alternative is selected unless there are overriding considerations. Costs are based on NPV.
Orange & Rockland	Cheapest alternative based on total cost (normally not necessary to do NPV calculation). Multiple competing projects, all of which are designed to address forecasted exceedance of the planning criteria, are prioritized by picking the projects that have the best benefit-cost ratio. Budget does not normally allow all necessary (by planning criteria) projects to be completed.
Pacific Gas & Electric	Mainly NPV of cash flow. If not best NPV option, must have strong justification for choice. Other factors, such as safety and environment, are considered and a software tool helps to prioritize different criteria.

UTILITY	Selection of Preferred Alternative
Puget Sound Energy	Based on financial analysis (NPV of cash flow) of multiple alternatives, all of which maintain normal operating conditions for the equipment. An in-house tool can choose the best project from among alternatives, and prioritizes all proposed projects based on multiple factors including hard dollar project NPV and also value of UE, reliability, number of outages, customer complaints, infrastructure enhancement, etc. A dollar value is assigned to these variables where possible to get a score based on total benefit divided by project cost (benefit/cost ratio). Tool prioritizes among all projects given weightings of different criteria (cost, environment, safety, etc) and gives optimal choice.
San Diego Gas & Electric	Each type of project has its own criteria. In general look at cost of project, vs. cost/risk of not doing it (impact on reliability). More of a cost/benefit analysis than NPV of cash flow. Consider lifetime benefits of projects vs. cost. NPV doesn't always identify best solution.
Sacramento Municipal Utilities Department	Projects must pass various screening stages and are optimized through Investment Definition and Scoring Tool (IDST) Excel-based tool. ISDT optimizes based on cost, reliability, community concerns, work conditions, environment, assets and infrastructure. A series of questions are asked, like "if the project is delayed 1-year, will the impact on SAIDI be marginal, moderate, severe? Will reliability be marginally improved, not effected, greatly improved?" Etc.

9. Internal Oversight

Most utilities have a stratified internal approval process, with larger, more expensive projects requiring individual approval by more senior managers and executives. In review of the annual plan, smaller projects may be carefully reviewed by lower level managers before being rolled up to an aggregate level where they approved by senior executives, while larger projects may be approved separately at a level of management that rises with the size of the project before being aggregated into the plan. Individual projects that are identified outside of the planning process are similarly subject to different levels of sign-off depending on project size.

Senior company executives of large IOUs may exert downward pressure on expenditures in order to manage to a budget between rate cases. Yet it is not possible for senior executives (or the Council) to review every, single expenditure in detail. To some extent, senior executives and the Council must trust that due diligence has been performed by those closest to the proposed projects. But for the largest projects, it is sensible to require a more thorough presentation of project analysis and justification

UTILITY	Internal Oversight
British Columbia Hydro	Planning engineers perform analyses of alternatives and recommend preferred alternative. Distribution planning reviews proposed projects and prioritizes. As proposals move up through the management hierarchy, they are presented at an increasingly more summary level.
City of Palo Alto Utilities	Projects are approved through the budget process. Most projects are rolled-up and presented to executives, but for larger projects, additional detail and alternatives are reviewed.

UTILITY	Internal Oversight
Hawaiian Electric Co.	Project approval is required from an executive in the planning area to put the project in capital budget approval process, which is managed by the Finance Dept. The project then becomes part of the Capital Budget Report, but money can not be disbursed until authorization is granted. Authorization is given from the capital budget team, which includes executives from Finance, Engineering, possibly Regulatory. Any project exceeding $25 million requires approval from the Board of Directors.
Modesto Irrigation Dist.	All projects are reviewed by internal staff and approved by senior management.
Orange & Rockland	Proposed solutions, demonstrations of their necessity and effectiveness, and evidence that the best alternative was chosen are presented to company executives for approval.
Pacific Gas & Electric	5-year T&D plan. "Finance Board" review, T&D Board review. Annual budget review with T&D Board (*CFO reviews are no longer done)*. Specific project approval authority varies by level of expense. Under $200K – Sr. Engineer; $200-500k – Manager, $500-1million – Director; $1 million – V.P.; $10 million or more – board of directors. For the 5-year plan, plans are aggregated into a planning tool and the "Finance Board" reviews the integrated plan and cross-prioritizes the work. Program Managers make changes and update tool. Functional VPs review and accept the plan with modifications.
Puget Sound Energy	Portfolio of projects approved by directors and VPs. For changes that arise between approved plans, stratified approval levels based on cost (e.g. over $1 million Director approval; over $100,000 manager approval).
San Diego Gas & Electric	Projects proposed by engineers are reviewed by Technical Review Group, and then put forward to go into the budget. Above $500K receives its own budget, but smaller projects may be lumped together into different program budgets. Expenditures above thresholds may require approval of senior SDG&E company officers, and for very large projects, approval of Sempra Energy corporate officers and possibly even the Sempra Energy Board of Directors.
Sacramento Municipal Utilities Department	Projects are presented by distribution planning to business planning department. Projects are prioritized using the IDST tool and then rolled up into a single budget that goes before executives and the Board.

10. External Approval

The investor-owned utilities (IOUs), which make up the majority of our sample, all follow a similar process for expenditure approval. For these utilities, a level of expenditure, based upon the distribution plan and agreed upon by company executives, is requested to be made part of the rate base in a general rate case, which typically may occur every few years. In some cases, as with Hawaiian Electric Company and BC Hydro, projects exceeding a certain threshold may require individual approval from the regulating utility commission.

One notable distinction with the IOUs is that rate cases tend to be adversarial proceedings, and intervening ratepayer advocates review proposed expenditures and advocate against recovery of costs deemed excessive. These ratepayer advocates may be funded by the ratepayers themselves, as is the case with the Division of Ratepayer Advocates within the California Public Utilities Commission. Given the magnitude and complexity of the analysis, this may be the only effective way of presenting a non-utility viewpoint in the proceedings.

Smaller public utilities may have no comparable mechanism for external review of utility plans. Because of this, and because of the smaller total budget, external reviewers for these utilities may require documentation of thorough analysis at a lower project expenditure threshold.

UTILITY	Internal Oversight
British Columbia Hydro	BC Hydro is currently on a 2- or 3-year rate case cycle with the BCUC. Any projects greater than $50 million must be separately described, with detailed analysis and justification, including consideration of alternatives. Projects greater than $2 million must be listed and detailed analysis must be available if requested by the BCUC.

UTILITY	Internal Oversight
City of Palo Alto Utilities	The City Council has final budget approval for all expenditures. All projects are presented in a general way to Council through the budget process. Exceptional projects are reviewed with greater scrutiny, including consideration of alternatives.
Hawaiian Electric Co.	All transmission projects and distribution projects over $2.5 million go before the PUC. As well, the PUC approves overall distribution spending in general rate cases.
Modesto Irrigation Dist.	Board approves all projects. External audits are performed.
Orange & Rockland	The planned expenditures from the 5-year plan are given to the public utilities commission for approval in a general rate case.
Pacific Gas & Electric	PUC approves plan in General Rate Case. Generally, distribution projects are not brought up for approval between rate cases. Rather, the total available budget is taken from what was approved in the rate case and projects are prioritized within this budget. For transmission, collaboration with the CAISO and final approval from FERC.
Puget Sound Energy	Planned expenditures become part of general rate case before the public utilities commission.
San Diego Gas & Electric	PUC approves plan in General Rate Case. Generally, distribution projects are not brought up for approval between rate cases. Rather, the total available budget is taken from what was approved in the rate case and projects are prioritized within this budget. For transmission, collaboration with the CAISO and final approval from FERC.
Sacramento Municipal Utilities Department	Board sees projects rolled up into categories (IT, distribution, etc.) The (elected) Board approves the budgeted projects as a group, allowing some leeway to readjust later, within budget. Planning personnel are prepared to show summaries of data, like increased outages due to cable problems leading to greater expenditures on cable replacement.