RETI - CONCEPTUAL TRANSMISSION PLANNING
PHASE 2A REPORT
BASE CASE SCENARIO

I. Introduction

In Phase 2 of the conceptual planning process, RETI stakeholders have formulated a base case scenario for expansion of the state's transmission system to provide access to renewable energy resource areas and deliver that energy to California consumers. This paper outlines the choices that were made in the development of the base case scenario, the data inputs, and the methodology devised to assess transmission scenarios. The Phase 2A Report contains a complete description of the base case scenario, the methodology, and the assessment results.

RETI planning scenarios consider potential renewable energy inputs to the transmission system, demand for that energy in load centers, and specific additions to the network that are likely to be required to satisfy that demand. Only network transmission facilities in which energy can flow in either direction are included. "Trunklines" and "gen-ties" which deliver renewable energy from resource areas to the network have been considered only to identify the points of interconnection to the network.

Network upgrades will be needed if the existing network has insufficient capacity to transmit additional energy economically and reliably. The current RETI scenario assessment process does not have the capability of identifying potential congestion in the network which could make operations uneconomical. Nor does the present assessment process identify potential reliability issues.

The determination that any component of RETI scenarios will be ***needed*** can be made only after further assessment in other venues ensures economical and reliable grid operations. The purpose of RETI conceptual planning scenarios is to identify network upgrades that are ***likely*** to be needed to meet the state's renewable energy goals and which of those upgrades are most important.

A conceptual transmission scenario is developed by choosing a set of potential new network facilities, renewable energy sources, and renewable energy loads. The facilities are conceptually added to the existing system, and the scenario is assessed by computing the percentage of energy from each resource area that is expected to flow in each line segment included. These percentages, known as "shift factors" are multiplied by the amount of energy available from each area, suitably weighted by economic and environmental factors and by levels of commercial interest. The results provide a measure of the expected renewable energy value of the line segments included in the scenario.

The assessment process does not provide information about the amount of energy that would flow in the line segments if they were added to the system. Nor does it determine whether the existing system could accommodate those flows if the line segments were *not* in place.

Nevertheless, if the assessment finds that a high percentage of energy from desirable renewable resource areas would flow in proposed new line segments if they were added to the network, there is a reasonable likelihood that they would be valuable additions to the state's

transmission system. Further assessment of the resulting energy flows is required, but the scenario results provide a reasonable basis for guiding future study.

This paper describes the choices that were made to develop the Phase 2A conceptual transmission plan base case scenario, the results of which are included in the Phase 2A report. A flow diagram of the scenario development and assessment process is appended.

II. Inputs

Conceptual planning scenarios are developed which allow energy from identified sources to satisfy expected loads. The scenario also identifies a set facilities proposed to transmit the energy from the sources to the loads or energy "sinks". Every transmission scenario contains these three elements – sources, sinks, and components of network facilities.

A. Sources — CREZ Energy & Capacity

1. Capacity, by technology – DATA

The energy sources included in the base case scenario consist of all of the renewable energy resource areas identified in Phase 1, as revised in Phase 2A. Potential ultimate generation capacity for each of the four renewable technologies – biomass, geothermal, solar and wind – has been estimated for each area (CREZ) and these capacity estimates provide an essential data input for the scenario.

a) Total

For purposes of the Draft Phase 2A Report, total estimated generation capacity of all technologies in identified CREZ, as revised from Phase 1, have been considered. A more sophisticated scenario could consider generation capacity expected for different times of year or even different hours of the day. This has not been done in Phase 2A.

b) Commercial Interest

Alternatively, generation capacity having known commercial interest could be used as the data input. Estimates of this capacity can be made from known power purchase agreements and requests for grid interconnection. Phase 2A reports the energy expected from this generation but does not report capacity explicitly.

2. Capacity, maximum simultaneous SCENARIO CHOICE

Power flow analysis requires estimates of how much of the scenario capacity will be available simultaneously. The current RETI assessment methodology does not include power flow studies, but Southern California Edison (SCE) has performed initial studies, the results of which are not included in the Phase 2A Report.

a) Total

For purposes of SCE's power flow studies, maximum simultaneous capacity included all geothermal and biomass capacity from all CREZ, together with 80% of solar capacity and 20% of wind capacity.

b) Commercial Interest

Alternatively, maximum simultaneous capacity could be based on known commercial interest. This alternative has not been examined in Phase 2A.

3. *Energy - SCENARIO CHOICE*

Renewable energy associated with CREZ generation capacity is calculated using the methodology developed by Black & Veatch in Phase 1. Scenarios can choose how much of this capacity will be assumed to be available in any chosen time frame. For purposes of the Draft Phase 2A Report, total estimated capacity for all CREZ has been chosen. This input will be revised downward in the final Phase 2A report to include only as much capacity as needed to meet expected demand. The ***relative*** results of the scenario assessment will be unaffected by this change, but the absolute values reported will decrease.

The "shift factors" described below are insensitive to the magnitude of the renewable energy available from the CREZ. They represent the ***percentages*** of CREZ energy flowing in the proposed line segments. Total CREZ energy is used for purposes of reporting relative results. Nevertheless, for reporting purposes, the final Phase 2A Report will use only CREZ energy estimated to be sufficient to meet policy goals.

4. *Interconnection points - SCENARIO CHOICE*

The assessment methodology requires knowledge of the points at which each CREZ will be interconnected to the system. In Phase 2A these points have been identified by a process similar to that used in Phase 1.

5. *Economic Score - DATA*

To estimate relative value of line segments included in the scenario, the relative economic value of the energy from each CREZ is used as an energy weighting factor. CREZ economic data inputs were computed using the Phase 1 methodology for each CREZ as revised in Phase 2.

6. *Environmental Score - DATA*

To estimate relative value of line segments included in the scenario, the relative environmental value of the energy from each CREZ is used as an energy weighting factor. CREZ environmental data inputs were computed using the Phase 1 methodology for each CREZ as revised in Phase 2.

B. Sinks — LSE Renewable Demand

1. *Net short energy – DATA*

In addition to source data the scenario assessment methodology requires information about the demand that the renewable energy is expected to satisfy. In essence, this information tells the energy where it needs to go. The annual total demand for additional renewable energy in California to satisfy a 33% renewable portfolio standard is called the "renewable net short". This was estimated in Phase 1 and subsequently revised.

a) Annual average

The statewide annual average net short for the year 2020 was divided between 11 load serving entities, and locations at which this energy was assumed to be taken from the grid were identified. For purposes of the draft Phase 2A Report, new estimates of LSE net short positions were computed. Totals agreed well with the Phase 1 net short calculations but exceeded the revised estimate since factors involved in the revision were neglected. In the final Phase 2A report, each LSE net short estimate will be revised downward on a pro rata basis so that the total equals the revised net short. Uniform percentage reductions in LSE net short positions will not alter the relative assessment results.

b) Time of day, year

A more sophisticated scenario could consider demand as a function of season or time of day. The usefulness of such detail is questionable, however, since the RPS is an annual average energy requirement.

C. Network Transmission Components

1. All elements – SCENARIO CHOICE

The third essential ingredient is the list of transmission facilities which will be added conceptually to the existing system in the scenario. During development of the base case scenario, several different lists were proposed. The base case scenario described in the draft Phase 2A Report includes over 200 separate transmission elements, including over 100 separate line segments. This list will be modified in the final report.

2. Line Segments - DATA

a) Electrical

The electrical characteristics of the transmission components must be identified in order to compute the system response to renewable energy inputs. In Phase 2A this information was provided by SDG&E and used to compute the "shift factors" which describe the percentage of energy from each CREZ expected to flow in each line segment included in the scenario.

b) Environmental

Environmental concerns associated with each line segment included in the base case scenario were evaluated quantitatively by the Environmental Working Group. These results are reported together with energy results in the Phase 2A Report.

c) Cost

The investment costs associated with the facilities included in the base case scenario have been estimated by several methodologies. In the draft Phase 2A Report, costs have been estimated using a generic methodology. Results are reported together with energy and environmental results.

3. Transmission Group Components - DATA

For reporting purposes, the line segments in the base case scenario have been combined into functional groups. 14 such groups are described in the draft Phase 2A Report. Groupings are expected to change in the final report.

III. Outputs

A. Transmission Scenario Results

For purposes of the draft Report, energy, environmental and cost results for each line segment in a group are summed to obtain a result for each group. Summation overstates the group energy results and efforts are underway to improve the group energy rating methodology.

1. Energy – CALCULATION

The draft Phase 2A Report includes, for each line segment and each group, results for raw energy, energy weighted by CREZ economic and environmental scores, and for energy of commercial interest. These results were found to be highly correlated, and a combined energy score was devised to be representative of all four energy categories.

2. Environment – CALCULATION

The environmental evaluations for each line segment were summed to obtain an environmental score for each group.

3. Cost – CALCULATION

The cost estimates for each line segment were summed to obtain a cost estimate for each group.

B. Scenario Implications

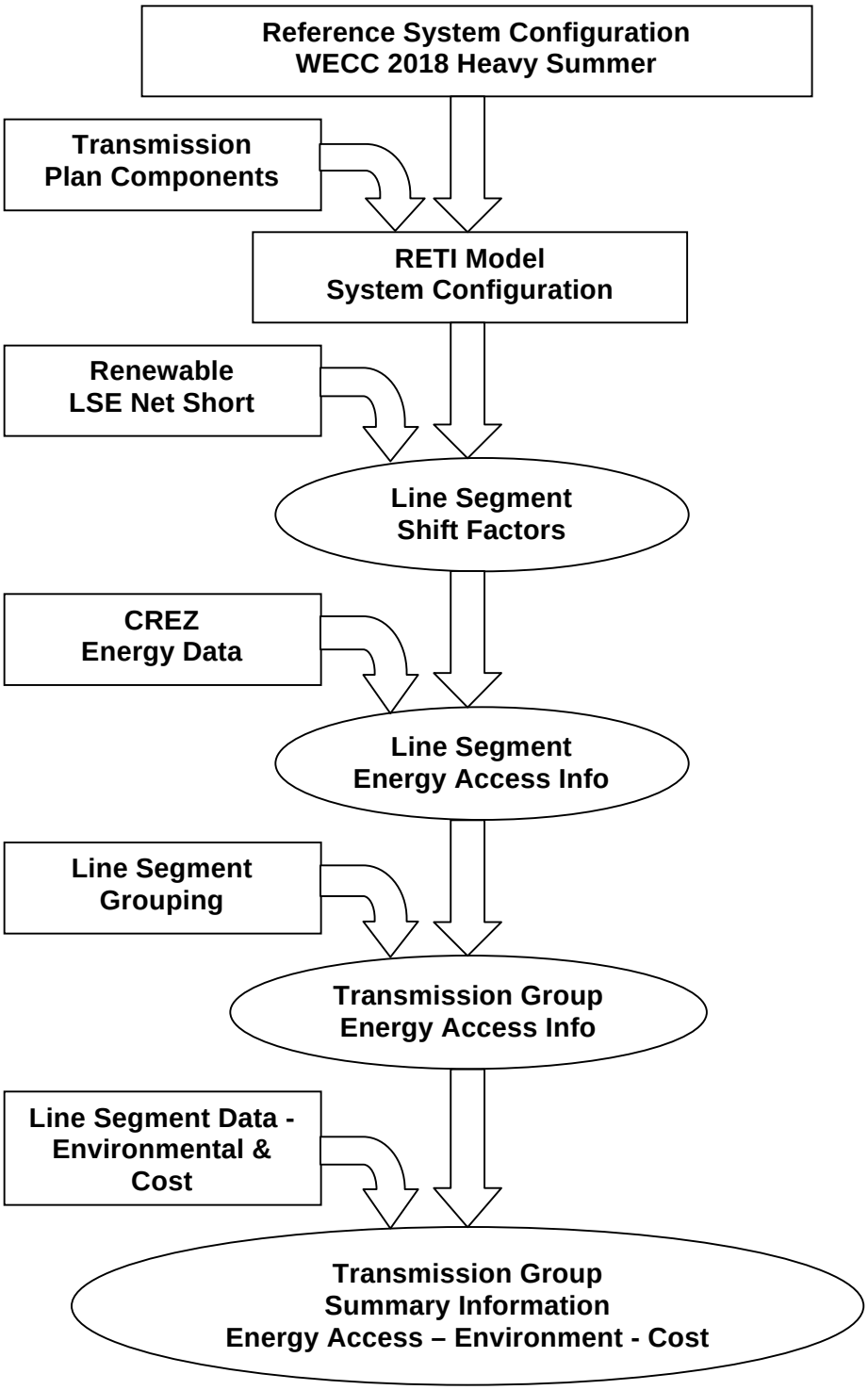
The energy, environmental and cost results for each group provide a reasonable basis on which detailed transmission planning can proceed. Groups providing access to relatively large numbers of CREZ with large amounts of energy from preferred CREZ and having relatively good environmental scores and reasonable cost are candidates for immediate further detailed study and analysis. Groups accessing relatively less energy and/or having relatively poor environmental scores and high costs are likely to be considered longer term additions to be studied in the future.

Inputs to the base case scenario reported in the draft Phase 2A are certain to change, so the base case scenario should be kept up to date in order to be meaningful in the future. Moreover, the base case scenario is one of several scenarios that could be devised to provide useful information. Additional scenarios to investigate alternate network configurations and/or renewable development patterns will be developed in the future.

IV. Scenario Evaluation

As mentioned above, scenario assessments based on shift factors provide useful information but cannot determine whether a line segment is needed. Such a determination requires a comparison of system power flows with and without the proposed addition. In Phase 2A, SCE has performed preliminary power flow studies, but further detailed studies are required to fully evaluate the base case scenario.

In addition, environmental evaluation of the base case scenario is preliminary and full evaluation required by NEPA and CEQA must be performed on line segments identified most valuable based on electrical factors.


Reference System Configuration
WECC 2018 Heavy Summer
Transmission
Plan Components
RETI Model
System Configuration
Renewable
LSE Net Short
Line Segment
Shift Factors
CREZ
Energy Data
Line Segment
Energy Access Info
Line Segment
Grouping
Transmission Group
Energy Access Info
Line Segment Data -
Environmental &
Cost
Transmission Group
Summary Information
Energy Access – Environment - Cost