RETI Net Short Update

Evaluating the Need for Expanded Electric Transmission Capacity For Renewable Energy

Introduction to the RETI Net Short

Modifications to California's electric transmission system will be required to accommodate state energy policies and changes in demand while maintaining reliability. The Renewable Energy Transmission Initiative (RETI) is responsible for identifying conceptually changes likely to be needed for the state to satisfy a 33% Renewable Portfolio Standard (RPS). In order to do so, the amount of additional renewable energy which will require transmission access must be quantified. That additional renewable energy is referred to as the "RETI Renewable Net Short".[1]

The RETI net short value depends on many factors which are discussed below. Most of these factors have been evaluated by the California Energy Commission (CEC) in its energy demand forecast, a component of the Integrated Energy Policy Report (IEPR). Previous estimates of the RETI net short[2] relied on the 2007 forecast. The CEC demand forecast has recently been revised significantly in the 2009 IEPR.[3] This document describes the revised estimate of the RETI net short based on the latest demand forecast and also includes a low load scenario that reflects the CEC post-IEPR report, "Incremental Impacts of Energy Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast" as well as updated information on incremental CHP and incremental producer side of the meter DG.

Not all of the factors which determine the RETI net short value have been evaluated by the CEC or other agencies.[4] Previous net short estimates have largely ignored these factors.[5] The numerical value reported in this document, 52,764 gigawatt-hours (GWh), is consistent with RETI's previous methodology.

In order to finalize a credible conceptual transmission plan, however, all significant factors which influence the net short value must be evaluated. In addition to reporting the net short value determined by the earlier methodology, this document also discusses factors which have not yet been evaluated and which will determine the net short value appropriate for renewable transmission planning.

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[1] The RETI net short is referred to in this document as simply the "RETI net short" or the "net short". RETI's net short terminology may differ from other applications which do not distinguish between additional renewable energy which requires transmission and renewable energy which does not.

[2] Earlier estimates of the RETI net short can be found in the RETI Phase 1B Report and in the Phase 1B Update Report available on the RETI web site at http://www.energy.ca.gov/reti/index.html.

[3] California Energy Demand 2010-2020, CEC Publication Number CEC-200-2009-012-CMF. The document and associated data forms are available at http://www.energy.ca.gov/2009publications/CEC-200-2009-012/index.html. The uncommitted energy efficiency forecast is out for comment and its results are reflected in the low load scenario presented in Appendix B.

[4] The CEC demand forecast methodology considers expected changes that have been planned for by utilities and approved by utility regulators. Changes which might reasonably be expected but are not included in approved plans are not included in the demand forecast.

[5] The exception was the RETI estimate of incremental photovoltaic (PV) generation which was discussed in the Phase 1B Update Report. See Footnote 2.

Summary of Changes in the Net Short from Previous Update

The largest changes in the net short from RETI's previous value are due to changes in projected electricity demand resulting from the recent recession.[6] RPS energy procurement requirements are based on retail sales by load serving entities (LSEs.) Changes in LSE retail sales from the values used in the February, 2009, net short update are shown in Table 1 below:

RETI Net Short Estimates 2009 & 2010 (GWh)			
	LSE Retail Sales	**Existing Renew.**	**RETI Net Short**
February 2009	308,070[7]	36,807	59,710
January 2010	285,734	38,174	52,764

Table 1 – RETI Net Short Estimates 2009 & 2010 (GWh)

A second major factor contributing to the decline in the net short estimate is the increase in "existing" renewable energy believed to be on line at the end of 2009 compared to 2008. This February 22nd version of the report also includes a low load scenario that reflects incremental impact estimates for Energy Efficiency programs after 2012, for additional CHP development and for producer side of the meter distributed generation. The low load scenario indicates a net short of 36,926 GWh, however it should be noted that the low load net short is based on estimates of incremental impacts that are highly uncertain. Several other minor changes are discussed later in this document.

Caveats to the Net Short Calculation

The net short values shown in Table 1 have two important caveats: Projections are inherently uncertain. For example, the CEC demand forecast relies on uncertain projections of economic growth. In addition to the reference economic forecast the CEC also considered a more economically optimistic case and a more pessimistic case. Projected demand in these two cases differed from the reference case by about ± 2%.[8] The corresponding uncertainty in the 2010 net short is about ± 2,000 GWh, about ± 4%, as shown by the Net Short Calculator.[9]

In addition to inherent uncertainty in the inputs to net short calculations, appropriate values for producer side of the meter distributed generation have not yet been produced by the CPUC's Renewable Energy Distributed Energy Collaborative (ReDEC).[10] Moreover, values for incremental producer side DG, CHP and Energy Efficiency are highly uncertain and thus use of these inputs for purposes of transmission planning is somewhat controversial. All of these incremental inputs to the net short calculation *lower* the net short value further and the low load scenario takes a first look at what these impacts could be.

Efforts are underway by RETI and elsewhere to evaluate all of the factors needed for improved projections of new California transmission capacity needed for renewable energy. As this information becomes available, the RETI net short value will be updated accordingly. In the

[6] California Energy Demand 2010-2020.
[7] The IEPR has a 10-year forecast horizon; the 2007 IEPR included LSE sales projections to 2018 which were extrapolated to 2020 for RETI by CEC staff.
[8] California Energy Demand 2010-2020.
[9] An Excel spreadsheet version of the Net Short Calculator is available at XXX. Users can modify inputs to the Calculator to examine the resulting impact on the RETI net short. See Appendix A.
[10] Preliminary technical potential results were produced for presentation to the ReDEC in December, 2009, but to date an estimate of producer side of the meter DG market potential that is feasible by 2020 has not been produced.

meantime, renewable energy planning activities relying on the RETI net short should be cognizant of the limitations associated with the value reported in this document.

Evaluating the Need for Renewable Transmission

Provision of Energy Services

Planning for the electricity sector is best considered in a broader energy context, since changes in another sector may change the use of electricity. The major components are shown in Figure 1.

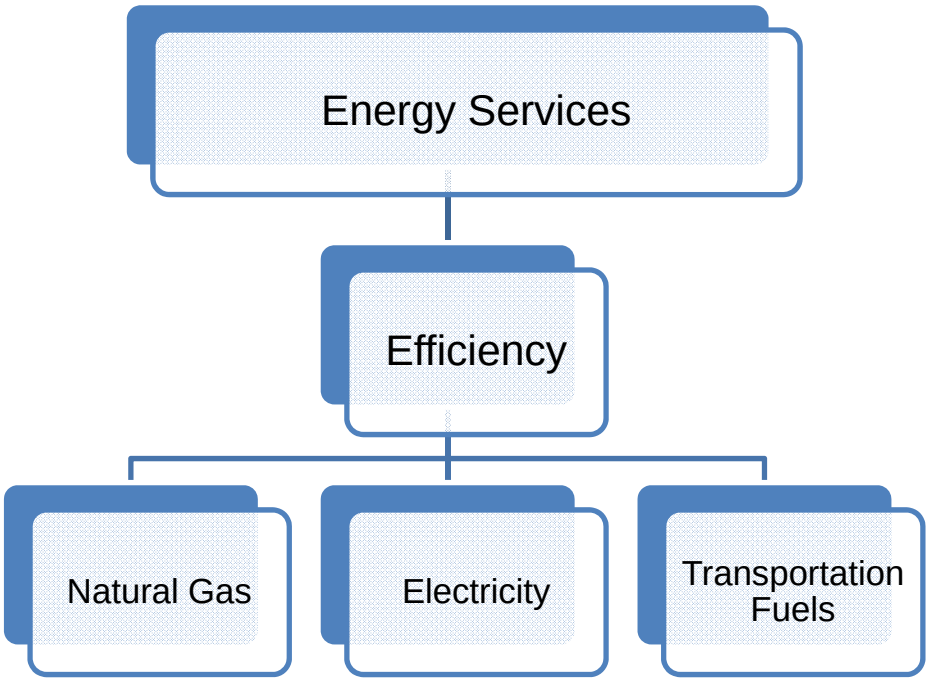

Figure 1 - Major Components of California's Energy System

The services that energy provides—heat, light, transportation, etc—are what matter to consumers. The amount of energy required to provide these services depends on the efficiency with which the energy is used. Improving energy efficiency is the state's highest strategic energy priority, as established in the Loading Order.

In addition to services provided by electricity, natural gas is widely used for space and water heating, cooking, and industrial applications.[11] Transportation fuels are obtained almost exclusively from petroleum. The focus of this paper is on electricity, but the other sectors have been included in Figure 1 as reminder that policies to reduce the use of heat or transportation fuels—promotion of plug-in hybrid vehicles, for example—affect electricity sector plans.[12]

Demand for electric energy services depends on population, economic activity, energy prices, changing technology, and so forth. Official projections of these factors, efficiency improvements,

[11] Propane is often used in rural areas where natural gas is unavailable.
[12] California Energy Demand 2010-2020. The CEC projects that about 4,400 GWh will be used by residential electric vehicles in 2020.

and resulting electricity demand are the responsibility of the CEC and are reported in its demand forecasts.

The CEC recognizes, of course, that projections are uncertain. Changes in demand for energy services depend on projected economic activity, for example. In addition to the economic forecast used as the basis of its 2009 demand forecast, the CEC also considered more optimistic and more pessimistic economic scenarios. In these scenarios, demand for electric energy services increased and decreased about 2% (about 6,000 GWh) respectively.[13]

The Role of Efficiency

CEC forecasts of efficiency improvements and energy savings are based on the effect of *adopted* appliance standards, naturally occurring savings and utility programs. The reference forecasts do not include estimates of additional efficiency savings which might reasonably be expected to occur in the forecast time frame—so-called "uncommitted" or "incremental" efficiency savings—for which an approved plan does not exist. However, the low load scenario does include incremental savings estimates. Since both committed and incremental efficiency savings forecasts influence future demand for electric energy, it is essential that the CEC, CPUC, ARB, CAISO and CTPG ("planning entities") agree on reasonable forecasts—including forecasts of incremental energy savings—so that a maximum degree of stakeholder and public consensus can be developed.

The models used by the CEC to forecast the need for energy services are sophisticated, and input methodology has been standardized. The methodology for forecasting incremental efficiency savings has not. Until all appropriate agencies agree on a reasonable forecast of efficiency savings and a broad consensus is reached among the public on how to incorporate the effects of these uncertain forecasts on the net short, decisions on electricity projects will be subject to more dispute than necessary.

Challenge #1 – Development of broad consensus among stakeholders and the public on reasonable expectations for the improvement in energy efficiency and agreement by CEC, CPUC and ARB.

Electricity Supplies

Figure 2 illustrates the major components of the state's electricity supply. Numerical values and nomenclature shown are based on the CEC demand forecast included in the 2009 IEPR for the year 2020 as modified by RETI's PV projections.[14] Private Supply represents consumer-owned generation used "behind the meter" and not supplied to the consumer by the local utility.[15] Utility Supply represents total sales by all LSEs. Losses—occurring in both transmission and distribution systems—are estimated for utility supplies only.

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[13] Ibid.

[14] As described in the previous net short update, RETI includes estimated "incremental" PV generation in addition to CEC projections. As a result, the values of some components shown in this document differ somewhat from those in the CEC demand forecast. Refer to the Net Short Calculator and Appendix A for details.

[15] For purposes of this paper, "utility" includes non-utility load serving entities. Renewable private supply does not count toward RPS goals under current rules since the RPS targets are based on LSE sales.

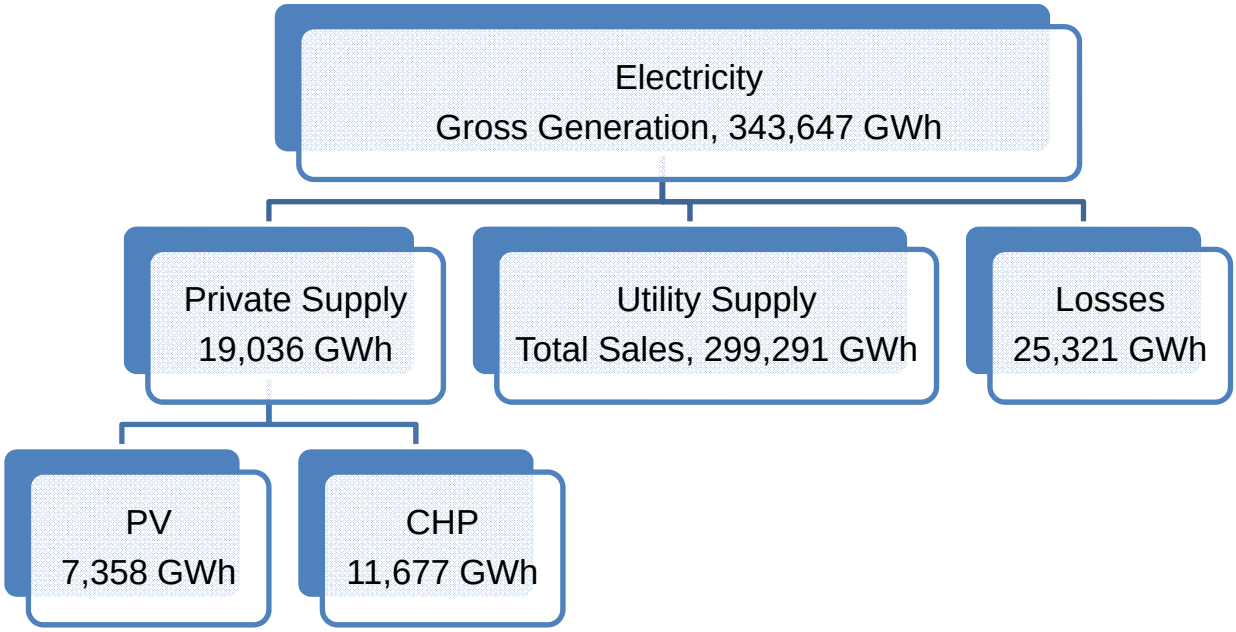

Figure 2 – California Electric Energy Supplies and Losses in 2020 (CEC Forecast)

Also illustrated in Figure 2 are the components of private supply estimated by RETI for 2020, summarized as PV and combined heat and power (CHP).[16] Projected PV generation comes from familiar rooftop solar panels which primarily serves owners' needs.[17] Also shown as potential private supply is "combined heat and power" (CHP). Currently this electrical component is generated primarily from fuel combustion in industrial applications where exhaust heat is used in other processes with high overall efficiency. Fuel cells are emerging as a potential source of CHP, and deployment of this technology could increase significantly if costs are reduced substantially.[18]

Since increasing private supply reduces the need for utility supply, the level of private supply also helps determine the need for expanded transmission capacity and development of generation projects for utility supply. If the recent significant decline in PV prices continues when economic conditions improve then current forecasts may substantially underestimate expected private supply in 2020. Failure of planning entities to build stakeholder consensus on the rate of penetration of PV and CHP private supply and agree on a common forecast will make it more difficult than necessary to reach agreement on the need for proposed generation and transmission projects.

Challenge #2 - Development of broad consensus among stakeholders and the public on reasonable expectations for the penetration of PV and/or CHP and agreement by CEC, CPUC and ARB.

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[16] This document assumes that all non-renewable private supply comes from combined heat and power facilities. The CEC value is used.
[17] A small amount may reach other customers under "net metering" arrangements.
[18] See Combined Heat and Power Market Assessment, ICF Incorporated, October 2009, pages 27 and 28. Energy Commission report: CEC-500-2009-094-D.

Utility Electricity Supplies

Components of utility supply (referred to as "total sales" in the CEC demand forecast) are shown in Figure 3. A fraction of utility supply is used by water agencies for pumping loads and is not subject to RPS requirements. The remainder is sold at retail by load serving entities (LSEs) to consumers. The RPS target is for LSEs to obtain 33% of retail sales from eligible renewable resources by year 2020.

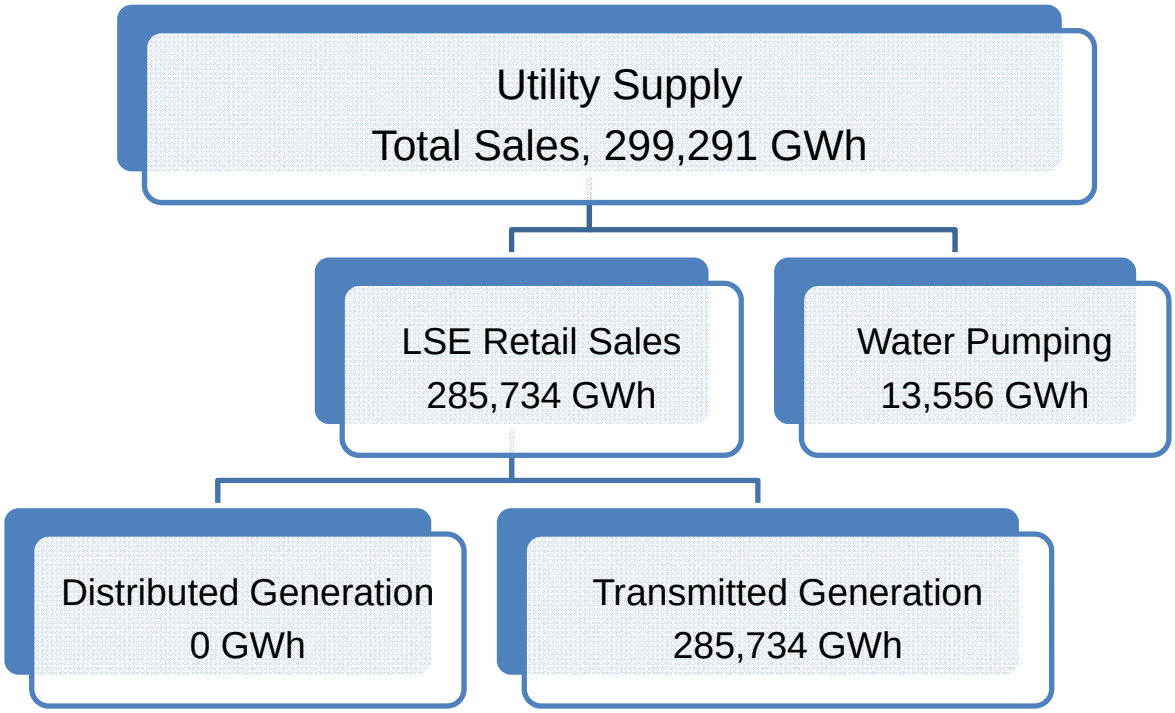

Figure 3 – Components of Utility Electricity Supply

Utility Supply Requiring Transmission

The components of transmitted generation subject to RPS requirements are shown in Figure 4. In the absence of significant distributed generation, transmitted generation is equal to LSE Retail Sales as shown in Figure 3. Satisfying the 33% RPS in 2020 would require a projected total of 94,292 GWh as shown in Figure 4. CEC estimates that 38,174 GWh of RPS eligible renewable energy were on line at the beginning of 2010[19], implying that an additional 56,118

[19] Private communication from CEC staff.
Existing renewables as of 1/1/10 include:
31,272 GWh reported in 2008 Net System Power Report
2,533 GWh IOU renewable online since 2008 NSP
2,116 GWh short-term out of state on lines since 2008 NSP
2,253 GWh POU online since 2008 NSP

GWh must be added by 2020. 3,355 GWh of that is expected to be supplied by miscellaneous renewable energy projects which do not require increases in transmission capacity.

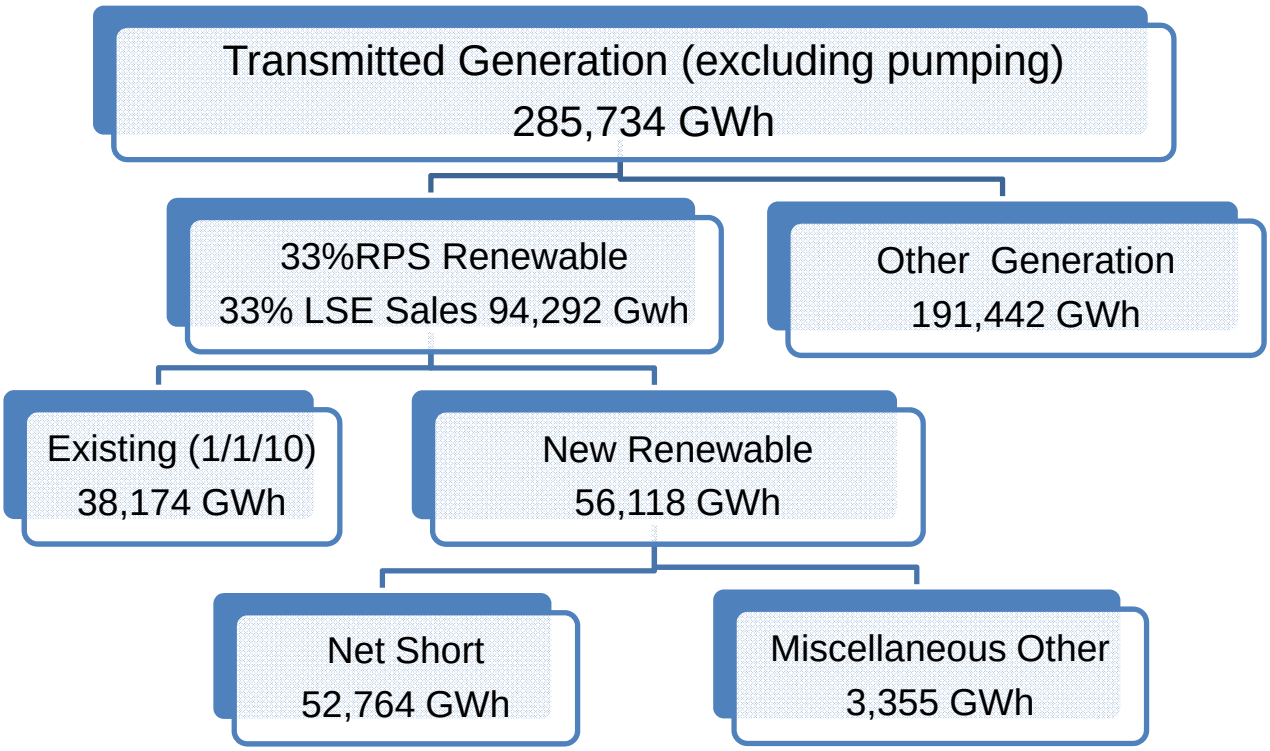

Figure 4 – Components of Transmitted Generation, Excluding Water Pumping Loads

The "Miscellaneous Other" category includes potential distributed RPS-eligible renewable generation components of utility supply. At present, nearly all LSE supplies—including renewable energy—are transmitted through the high voltage electricity grid. When the advent of lower cost PV projects of 20 MW or smaller and occupying sites of about 100 acres or less, the potential exists for substantial development of distributed solar generation located close to urban loads and connected to the grid at lower voltage substations in the electric distribution system. Although distributed generation currently is small, it has the potential to increase substantially.

The distribution system, however, is designed to enable energy from the high voltage transmission system to reach consumers, not to transmit energy in the opposite direction. The highly technical question of how much distributed generation can be connected without compromising safety and reliability has not been fully investigated and resolved.

Challenge #3 - Development of broad consensus among stakeholders and the public on reasonable expectations for distributed generation and agreement by CEC, CAISO and CTPG.

Table 2, taken from the Net Short Calculator, shows all the components of the net short calculation with the values used in the current assessment. Table 3, is a net short calculation

for the low load scenario assumptions. Documentation of the assumptions for both tables is included in the appendix but the assumptions supporting the net short calculation are described briefly here since they are new.

Low Load Scenario Assumptions

Table 3 shows the net short calculation for the low load scenario. The low load scenario is different in three areas: incremental energy efficiency, incremental private CHP and incremental miscellaneous other generation. The incremental energy efficiency has the largest impact with 16,267 GWh. The estimate reflects the medium incremental energy efficiency estimates for IOU's reported in the Energy Commission's February 2010. The low load scenario augments the Energy Commission estimate by assuming that POU's penetration of incremental efficiency will be proportional to the IOU penetration on a per KWh sales basis.

Table 3 further shows an incremental CHP impact of 13,629 GWh. The low load scenario reflects the 2019 base incremental CHP estimate from the October 2009 Energy Commission report prepared by ICF. The low load scenario also adds generation to the Miscellaneous Other Generation category to reflect incremental penetration of producer side of the meter distributed generation. No estimate of expected producer side of the meter distributed generation has been produced by the California energy agencies to date so the number chosen is a place holder pending the provision of a well-founded estimate. The number chosen uses the RETI consensus that private PV and incremental private PV will be 7,358 GWh, and assumes that producer side of the meter DG will be the same amount. Some producer side of the meter DG is already reflected in other generation so once this amount is netted out, an increment of 6,741 GWh is added to other miscellaneous generation.

The net short for the low load scenario is a highly uncertain number. Reasonable estimates of lower and upper bounds on the EE, CHP and producer DG incremental effects have not been promulgated by the agencies so the extent of the uncertainty is not known. However, the estimates provided appear to be within the realm of technical feasibility given the studies produced to date.

Variable	Variable Name	2020 Value GWh (Note 1)
Electric Energy Services	EnergyServices	343,647
Incremental Efficiency	IncEff	0
Gross Generation	GrossGen	343,647
Total Private Supply	TotPrivSupply	19,036
Private PV	PrivPV	3,218
Incremental Private PV	IncPV	4,140
Private CHP	PrivCHP	11,677
Incremental Private CHP	IncCHP	0
Net Losses	Losses	25,321
Utility Supply	UtilSupply	299,291
Water Pumping	PumpLoad	13,556
LSE Retail Sales	RetailSales	285,734
Non-RPS Generation	OtherGen	191,442
Existing Non-RPS Generation (Note 1)	ExistOther	217,745
Decline in Non-RPS Generation	**FreedFossil**	**26,303**
33% RPS Generation	RPSGen	94,292
Existing Renewable Generation (Note 1)	ExistRenew	38,174
New Renewable Generation	NewRenew	56,118
Misc. Other Generation	MiscRenew	3,355
RETI Renewable Net Short	**NetShort**	**52,764**

Table 2 – Components of the Net Short Calculation

Variable	Variable Name	2020 Value GWh (Note 1)
Electric Energy Services	EnergyServices	343,647
Incremental Efficiency	IncEff	16,267
Gross Generation	GrossGen	327,380
Total Private Supply	TotPrivSupply	32,665
Private PV	PrivPV	3,218
Incremental Private PV	IncPV	4,140
Private CHP	PrivCHP	11,677
Incremental Private CHP	IncCHP	13,629
Net Losses	Losses	22,989
Utility Supply	UtilSupply	271,727
Water Pumping	PumpLoad	13,556
LSE Retail Sales	RetailSales	258,170
Non-RPS Generation	OtherGen	172,974
Existing Non-RPS Generation (Note 1)	ExistOther	217,745
Decline in Non-RPS Generation	**FreedFossil**	**44,771**
33% RPS Generation	RPSGen	85,196
Existing Renewable Generation (Note 1)	ExistRenew	38,174
New Renewable Generation	NewRenew	47,022
Misc. Other Generation	MiscRenew	10,096
RETI Renewable Net Short	**NetShort**	**36,926**

Table 3 – Components of the Net Short Calculation Low Load Case

Transmission of Electricity from Non-Renewable Resources

In addition to renewable energy satisfying the RPS, 67% of retail sales are from "other" resources, including hydroelectricity, nuclear, and fossil-fueled generation. The value shown in Figure 4 and Table 2 is a decrease of 26,303 GWh from 2009 levels.[20] A major policy goal of the RPS is to decrease emissions of carbon dioxide from fossil fuel combustion, so presumably this reduction will be made in fossil-fueled generation rather than in nuclear or hydroelectric generation.

Depending on which fossil generators provide less energy, transmission capacity now used for fossil-fueled electricity may be available to transmit renewable energy. For example, currently the state depends on electricity imported from neighboring regions for substantial amounts of energy transmitted to California consumers over the state's transmission system. If this imported fossil energy were replaced by imported RPS eligible renewable energy[21], up to 26,303 GWh of existing state transmission capacity might be available reducing the renewable net short substantially.[22]

However, which fossil-fueled generators will be less relied on in the future is uncertain. For example, the state's Water Quality Control Board has issued a draft policy limiting the amount of water that California power plants can use for "once through" cooling (OTC power plants).[23] Reductions in fossil-fueled generation may therefore come from closure or curtailment of OTC power plants rather than from imports.

Increasing reliance on renewable generators and reducing the use of fossil generators is likely to have significant implications for operation and reliability of the electricity grid. It may be necessary to replace OTC plants with air-cooled generators to provide standby capacity for local reliability, for example. Studies indicate that no insurmountable technical difficulties are likely to arise, but further studies are underway.

Despite this uncertainty, less fossil-fueled electricity will require transmission across the grid, making it likely that at least some of this capacity will be available for transmitting renewable energy. Transmission plans must describe convincingly how this capacity is being used to reduce the need for new facilities.

Challenge #4 - Development of broad consensus among stakeholders and the public on reasonable expectations for displacement of fossil-fueled generation and agreement by CAISO, CPUC, ARB, CEC, and CTPG.

Transmission of Electricity from Renewable Resources

New transmission facilities needed to satisfy the state's renewable energy goals will depend heavily on where the renewable generators will be located. RETI has studied *potential* locations

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[20] LSE other generation in 2009 computed as {gross generation – losses – private supply – water pumping – existing renewable generation}. See 2009 Demand Forecast forms 1.1c and 1.2.

[21] How much out of state renewable energy should be allowed to be used to satisfy the RPS is a controversial issue.

[22] Due to differences in fossil and renewable generation locations and capacity factors, transmission capacity now used by fossil generation **cannot** be assumed to be available and adequate to transmit the same amount of renewable energy.

[23] State Water Resources Control Board, November 23, 2009 draft, Clean Water Act Section 316(b), available at:
http://www.waterboards.ca.gov/water_issues/programs/npdes/docs/cwa316/otcpolicy112309_clean.pdf

in considerable detail.[24] Considerable uncertainty remains, however, about where development will in fact take place. Utilities have signed contracts with individual renewable projects and some projects already have agreements to interconnect with the grid, but not all of these projects will be completed by 2020. The state Desert Renewable Energy Conservation Plan (DRECP) under development may limit development in certain areas. The federal Bureau of Land Management (BLM) also is studying areas for potential development. New areas are being proposed, as well. Plans are underway to increase transmission capacity in neighboring regions to deliver renewable energy to California.

Several years may elapse before renewable energy development patterns are clear. Since major transmission projects have lead times of 7 years or more, however, decisions on needed new transmission facilities must be made in the next year or so if sufficient capacity is to be available by 2020.

As discussed below, uncertainties in renewable energy development patterns—as well as uncertainties in efficiency savings, PV private supply, and so forth—are dealt with by considering various scenarios of future generation patterns, fossil and non-fossil.

Use of Tradable Renewable Energy Credits for RPS Compliance

In December, 2009, the CPUC issued a proposed decision which, if adopted, would allow the use of tradable renewable energy credits (TRECs) for RPS compliance.[25] Discussion of TRECs, their use for RPS compliance, and implications for transmission planning is beyond the scope of this document. However, widespread use of TRECs could change estimates of needed new transmission capacity substantially. Entities involved in transmission planning should monitor the potential development and implementation of TREC policies and adjust plans accordingly in the future.

RETI's Role in Future Energy Planning Activities

As is apparent from the above discussion, a great many factors influence decisions about what new transmission facilities are expected to be needed by 2020 to meet the state's energy goals. These major factors are shown in Table 3:

Factor #	Area	Issues
1	Energy Services	economic and technology changes
2	Efficiency	uncommitted efficiency savings
3	Private Supply	PV and CHP penetration
4	Utility Supply	distributed generation development
5	Renewable Generation	location and quantity of resources developed
6	Other Generation	location and quantity of displaced resources

Table 3 – Major Factors Determining Need for Expanded Transmission Capacity for RPS

Factors 1-4 in Table 3 must be quantified and agreed upon before the net short value can be used for credible transmission planning (see also Table 2.)

[24] RETI Phase 2A Report. An update of data in this report is in progress and should be released in the near future.

[25] Decision Authorizing Use of Renewable Energy Credits for Compliance with the California Renewable Portfolio Standard, Revised Proposed Decision of ALJ Simon, mailed December 23, 2009. Available at: http://docs.cpuc.ca.gov/efile/PD/111679.pdf.

> **Recommendation – Building consensus on appropriate inputs to the net short calculation which have yet to be determined should be given high priority by RETI stakeholders and other transmission planning entities.**

Since the formation of RETI, electricity planning by other entities has accelerated. The California Independent System Operator (CAISO) has launched its Renewable Energy Transmission Planning Process (RETPP). The California Public Utilities Commission (CPUC) is engaged in its Long Term Procurement Planning process (LTPP.) A newly formed California Transmission Planning Group (CTPG) has begun a statewide planning process. The Air Resources Board (ARB) is identifying strategies to reduce greenhouse gas emissions, including increased reliance on renewable energy.

In order to successfully implement state policies, in addition to agreement on inputs to the net short calculation, all planning entities must agree on planning scenarios to be used (Factors 5 & 6 in Table 3.) The need for any particular transmission project cannot be credibly demonstrated if official agencies disagree on the methods and inputs used to evaluate that need. In addition, the broadest possible consensus on assumptions, projections, and scenarios must be developed among stakeholders and the public in order to minimize disagreement over the need for individual projects.

Summary

The RETI net short calculation, using previous methodology, now has an estimated value of 52,764 based on the latest CEC forecasts. A low load scenario has been developed and it yields an estimated net short of 36,926. In addition to uncertainty arising from projected economic growth, agreement must be reached on several other essential inputs before the net short value can be used for renewable transmission planning. In addition, realistic scenarios for future renewable development and declining fossil energy use must be agreed upon in order to develop credible conceptual transmission plans.

> **Recommendation – Building consensus on appropriate inputs to the net short calculation which have yet to be determined should be given high priority by RETI stakeholders and other transmission planning entities.**

The engagement of many other planning entities, in addition to RETI, in renewable transmission planning requires that all must work closely together to ensure emerging plans are based on a common methodology. Although all these entities are represented in RETI, they have their own processes, stakeholder involvement requirements, and so forth. RETI's planning role has therefore changed significantly. For the last two years RETI has provided the major forum for stakeholder involvement in renewable transmission planning discussions. In the future, RETI's role will increasingly involve coordination of planning activities by other entities which affect the need for new transmission projects.

Appendix A
RETI Net Short Calculator – Base Case

Variable	Variable Name	2020 Value GWh (Note 1)	Description (Note 1)
Electric Energy Services	EnergyServices	343,647	Services provided by electricity and electric efficiency. Calculated as gross generation per 2009 demand forecast , Form 1.2, plus "other" LSE sales, Form 1.1c, not included in Form 1.2 (Note 4)
Incremental Efficiency	IncEff	0	Incremental efficiency savings not included in the 2009 demand forecast.
Gross Generation	GrossGen	343,647	Electric generation required to meet load net of incremental efficiency savings.
Total Private Supply	TotPrivSupply	19,036	Behind the meter private generation, assuming none is sold to LSEs via net metering or other arrangements. Components are assumed to be customer-owned PV and CHP.
Private PV	PrivPV	3,218	PV from CEC Form 1.2, not RPS eligible under current rules.
Incremental Private PV	IncPV	4,140	RETI approved increase to CEC value, 2009 net short update. (Note 5) (energy from 3.7 GW @ 0.2 cf)
Private CHP	PrivCHP	11,677	Non-PV self-generation from CEC form 1.2
Incremental Private CHP	IncCHP	0	Potential Increase in non-PV private supply, eg CHP, above CEC value.
Net Losses	Losses	25,321	Net Losses = LossFactor*(GrossGen - TotPrivSupply). LossFactor is calculated from Form 1.2 data.
Utility Supply	UtilSupply	299,291	Gross Generation less losses and private supply
Water Pumping	PumpLoad	13,556	Total Pumping Load from Form 1.1c
LSE Retail Sales	RetailSales	285,734	Utility Supply less Water Pumping
Non-RPS Generation	OtherGen	191,442	67% of LSE retail sales

Existing Non-RPS Generation (Note 1)	ExistOther	217,745	Non-renewable generation on line 1/1/2010, calculated as 2009 LSE sales excluding pumping (Form 1.1c) minus existing renewable generation.
Decline in Non-RPS Generation	**FreedFossil**	**26,303**	**Decrease in non-renewable generation requiring transmission 2010-2020, excluding changes in pumping loads.**
33% RPS Generation	RPSGen	94,292	33% of LSE retail sales
Existing Renewable Generation (Note 1)	ExistRenew	38,174	RPS eligible generation on line 1/1/2010 (CEC staff data). (Note 2)
New Renewable Generation	NewRenew	56,118	New RPS eligible renewable generation required to meet 33% goal.
Misc. Other Generation	MiscRenew	3,355	New RPS eligible renewable generation NOT needing transmission expansion, **including RPS elegible renewable distributed generation** (Note 5) and 33% of "other" LSE sales, Form 1.1c. (Note 4)
RETI Renewable Net Short	**NetShort**	**52,764**	**New RPS eligible renewable generation NEEDING transmission expansion.**

Appendix A
RETI Net Short Calculator Notes – Base Case

Notes
1) All values are 2020 projections except for "existing" resources.
2) Existing renewables as of 1/1/10 include:
31,272 GWh reported in 2008 Net System Power Report
2,533 GWh IOU renewable online since 2008 NSP
2,116 GWh short-term out of state on lines since 2008 NSP
2,253 GWh POU online since 2008 NSP
3) Miscellaneous other renewable generation includes:
1862 GWh Small projects from Phase 1B Report less ocean wave and current projects
876 GWh of utility owned distributed PV (500 MW)
33% of retail sales by "other" LSEs
4) "other" LSEs are:
City of Needles
Mountain Utilities
Pacificorp
Sierra Pacific Power Company
Surprise Valley Electrical Corporation
Trinity Public Utility District
Truckee-Donner Public Utility District
5) Incremental PV is unchanged from 2009 net short update. In addition, 876 GWh (500 MW) is now credited to miscellaneous other generation.

APPENDIX A
Net Short Calculator – Low Load Scenario

RETI Net Short Calculator Low Load Scenario

Color indicates potential for user input.

Variable	Variable Name	2020 Value GWh (Note 1)	Description (Note 1)
Electric Energy Services	EnergyServices	343,647	Services provided by electricity and electric efficiency. Calculated as gross generation per 2009 demand forecast , Form 1.2, plus "other" LSE sales, Form 1.1c, not included in Form 1.2 (Note 4)
Incremental Efficiency	IncEff	16,267	Incremental efficiency savings not included in the 2009 demand forecast.
Gross Generation	GrossGen	327,380	Electric generation required to meet load net of incremental efficiency savings.
Total Private Supply	TotPrivSupply	32,665	Behind the meter private generation, assuming none is sold to LSEs via net metering or other arrangements. Components are assumed to be customer-owned PV and CHP.
Private PV	PrivPV	3,218	PV from CEC Form 1.2, not RPS eligible under current rules.
Incremental Private PV	IncPV	4,140	RETI approved increase to CEC value, 2009 net short update. (Note 5) (energy from 3.7 GW @ 0.2 cf)
Private CHP	PrivCHP	11,677	Non-PV self-generation from CEC form 1.2
Incremental Private CHP	IncCHP	13,629	Potential Increase in non-PV private supply, eg CHP, above CEC value. (Note 6)
Net Losses	Losses	22,989	Net Losses = LossFactor*(GrossGen - TotPrivSupply). LossFactor is calculated from Form 1.2 data.
Utility Supply	UtilSupply	271,727	Gross Generation less losses and private supply

Water Pumping	PumpLoad	13,556	Total Pumping Load from Form 1.1c
LSE Retail Sales	RetailSales	258,170	Utility Supply less Water Pumping
Non-RPS Generation	OtherGen	172,974	67% of LSE retail sales
Existing Non-RPS Generation (Note 1)	ExistOther	217,745	Non-renewable generation on line 1/1/2010, calculated as 2009 LSE sales excluding pumping (Form 1.1c) minus existing renewable generation.
Decline in Non-RPS Generation	**FreedFossil**	**44,771**	**Decrease in non-renewable generation requiring transmission 2010-2020, excluding changes in pumping loads.**
33% RPS Generation	RPSGen	85,196	33% of LSE retail sales
Existing Renewable Generation (Note 1)	ExistRenew	38,174	RPS eligible generation on line 1/1/2010 (CEC staff data). (Note 2)
New Renewable Generation	NewRenew	47,022	New RPS eligible renewable generation required to meet 33% goal.
Misc. Other Generation	MiscRenew	10,096	New RPS eligible renewable generation NOT needing transmission expansion, **including RPS elegible renewable distributed generation** (Notes 5, 7) and 33% of "other" LSE sales, Form 1.1c. (Note 4)
RETI Renewable Net Short	**NetShort**	**36,926**	**New RPS eligible renewable generation NEEDING transmission expansion.**

APPENDIX A
Net Short Calculator Notes – Low Load Scenario

Notes
1) All values are 2020 projections except for "existing" resources.
2) Existing renewables as of 1/1/10 include:
31,272 GWh reported in 2008 Net System Power Report
2,533 GWh IOU renewable online since 2008 NSP
2,116 GWh short-term out of state on lines since 2008 NSP
2,253 GWh POU online since 2008 NSP
3) Miscellaneous other renewable generation includes:
1862 GWh Small projects from Phase 1B Report less ocean wave and current projects
876 GWh of utility owned distributed PV (500 MW)
33% of retail sales by "other" LSEs
4) "other" LSEs are:
City of Needles
Mountain Utilities
Pacificorp
Sierra Pacific Power Company
Surprise Valley Electrical Corporation
Trinity Public Utility District
Truckee-Donner Public Utility District
5) Incremental PV is unchanged from 2+A33009 net short update. In addition, 876 GWh (500 MW) is now credited to miscellaneous other generation.

6) Incremental Private Combined Heat and Power estimate taken from CEC repor CEC-500-2009-094-D, Table C-2, estimate for 2019, and is the sum of direct electricity savings as well as electricity savings from reduced heat load.
7) The low load scenario adds producer side of the meter DG of 6,741 GWh (7,258 GWh (the same as customer side of the meter PV) less an overlap of 617 GWh between other miscellaneous base case and the incremental PV for the low load case). The assumption to make low load miscellaneous generation the same as sum of the private and incremental PV is supported by the following feed-in tariff programs: SMUD's feed in tariff (100 MW limit), AB 32's feed-in tariff for all RPS eligible renewables up to 3 MW (750 MW limit) and the CPUC ALJ's ruling on a standard contract feed-in tariff for all IOU RPS elibigible renewables up to 10 MW (1000 MW limit) sum to a total of 1850 MW which yields about 2/3 of the 6,741 GWh.

Appendix A
CEC Demand Forecast Form 1.1c Summary

Form 1.1c

California Energy Demand 2009-2020 Staff Revised Forecast

Electricity Delivieries to End Users by Agency* (GWH)

Planning Area	Agency	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PGE Total		105,795	102,236	102,567	103,768	105,255	106,918	108,104	109,282	110,503	111,829	113,080	114,329	115,643
SMUD	Sacramento Municipal Utility District	10,935	10,620	10,629	10,762	10,964	11,164	11,322	11,461	11,586	11,705	11,825	11,949	12,079
SCE Total		99,069	94,985	95,045	95,990	97,258	98,808	99,978	101,202	102,452	103,745	104,987	106,249	107,558
LADWP	Los Angeles Department of Water and Power	24,820	24,029	23,927	24,167	24,574	24,901	25,121	25,330	25,539	25,738	25,944	26,153	26,365
BUGL Total		2,287	2,228	2,223	2,241	2,273	2,297	2,308	2,317	2,326	2,335	2,343	2,352	2,361
PASD	City of Pasadena	1,252	1,217	1,218	1,226	1,235	1,240	1,242	1,246	1,250	1,254	1,257	1,261	1,266
DWR	Department of Water Resources	6,675	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729
SDGE Total		20,623	20,169	20,258	20,488	20,809	21,179	21,457	21,742	21,997	22,266	22,532	22,816	23,102
IID	Imperial Irrigation District	3,291	3,273	3,336	3,419	3,519	3,614	3,696	3,781	3,874	3,971	4,069	4,171	4,280
OTHER Total		1,763	1,763	1,773	1,782	1,791	1,800	1,810	1,819	1,829	1,839	1,849	1,859	1,869
Statewide Total		276,509	269,250	269,705	272,572	276,407	280,650	283,767	286,908	290,084	293,410	296,617	299,869	303,253
Total Pumping Load		11,715	13,331	13,324	13,339	13,358	13,394	13,417	13,440	13,462	13,490	13,511	13,533	13,556
Total Statewide Retail Deliveries excluding pumping		264,794	255,919	256,381	259,233	263,049	267,256	270,350	273,468	276,622	279,920	283,105	286,336	289,697

This table includes retail sales and other deliveries only measured at the customer level; losses and consumption served by self-generation are excluded.

* Includes sales from entities outside of California. Thus, total sales in row 70 are higher than state totals given in Form 1.1b.

Appendix A
CEC Demand Forecast Form 1.2 Summary

Form 1.2 - Statewide
California Energy Demand 2010-2020 Staff Revised Forecast
Net Energy for Load (GWh)

Year	Total Consumption	Net Losses	Gross Generation	Non-PV Self Generation	PV	Total Private Supply	Net Energy for Load
2005	271,192	21,875	293,067	11,440	227	11,667	281,400
2006	280,010	22,566	302,575	11,680	321	12,001	290,575
2007	285,373	23,035	308,408	11,501	440	11,941	296,467
2008	286,771	23,307	310,078	11,373	652	12,025	298,053
2009	280,049	22,598	302,648	11,522	1,040	12,563	290,085
2010	280,843	22,635	303,478	11,574	1,338	12,911	290,567
2011	284,001	22,884	306,885	11,590	1,620	13,210	293,675
2012	288,123	23,219	311,343	11,607	1,901	13,507	297,836
2013	292,649	23,581	316,230	11,615	2,184	13,799	302,431
2014	296,047	23,846	319,893	11,624	2,467	14,091	305,802
2015	299,471	24,111	323,582	11,632	2,750	14,382	309,200
2016	302,929	24,380	327,309	11,641	3,033	14,674	312,635
2017	306,314	24,662	330,977	11,650	3,094	14,744	316,233
2018	309,561	24,935	334,496	11,659	3,134	14,793	319,702
2019	312,854	25,211	338,065	11,668	3,176	14,844	323,221
2020	316,280	25,498	341,778	11,677	3,218	14,896	326,882