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Analysis of Efficiency for the 2008 and 2009 Integrated Energy Policy Reports:

Terms, Definitions, and Proposed Plan

A Discussion Paper for the Workshop on
Improved Measurement and Attribution
in the Energy Demand Forecasts

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I. Introduction

Attribution and estimation of the anticipated load impacts (kWh, kW, therms) of efficiency programs and standards have become increasingly important components of the California Energy Commission forecasting process, creating a new set of challenges for energy planners. This paper gives an overview of the factors motivating the greater attention paid to the quantification of energy efficiency impacts in this forecasting cycle and discusses the key issues involved in attribution and measurement. In addition, the paper presents a proposed approach to dealing with efficiency in a more detailed and comprehensive manner, consistent with the needs of Energy Commission forecast stakeholders, and provides a schedule of activities related to that approach.

II. Context and Background

With the adoption of the first Energy Action Plan (Plan) in 2003, energy efficiency became the “resource of first choice” for meeting the state’s future energy needs. The Plan, translated into numerical goals by the California Public Utilities Commission (CPUC) in 2004, and now combined with The Global Warming Solutions Act (AB 32) of 2006, raised proper accounting of energy efficiency impacts to critical importance.

The Energy Commission electricity and natural gas demand forecasts are used in a variety of venues, including the California Public Utility Commission’s long-term procurement and energy efficiency proceedings, transmission planning, and the AB 32 greenhouse gas emission reduction proceedings for the development and analysis of the impacts of efficiency strategies. The spotlight on energy efficiency therefore focused attention on how these forecasts incorporate efficiency programs and standards.

Fundamentally, the demand forecasts are intended to provide realistic projections of energy demand in California, rather than measure impacts of individual energy efficiency standards and programs. These impacts are implicit in the forecast, but calculating the effect of specific programs (and the measures promoted by them) in this framework, already a difficult task in isolation, is complicated by potential overlap with measures induced by other programs and concurrent price and other market effects. Attribution of impacts to individual programs leads to a certain degree of subjectivity in gauging the impacts of a given measure or set of measures, which has sparked questions and debate among interested parties.

The 2007 IEPR committed the Energy Commission to examining in 2008 and beyond issues raised with respect to the amount of energy efficiency included within the adopted demand forecast. On March 11, 2008 the IEPR Committee conducted a workshop at the Energy Commission on this topic and the closely related issues of the incremental effect of near-term efficiency programs and long-term efficiency potential beyond the adopted demand forecast. The result of this workshop was an agreement to begin a process designed to better delineate the impacts of energy efficiency within the Commission's energy demand forecast and to increase the capability of the Energy Commission to project efficiency program impacts.

In May 2008, the Energy Commission released the scoping order for the *2008 IEPR Update*. In the scoping order, under the topic of energy efficiency projections and demand forecast, the IEPR Committee directed Commission staff to explore:

- The best way to present a clear explanation of how energy efficiency is incorporated in the demand forecast that allows parties to understand how utility programs, standards, and other efficiency codes are included as inputs to the models used to develop the demand forecast.
- Evaluation of effects, such as price response, market effects, or trends in the market, and how they are included in or excluded from the demand forecast models.
- Clarifying what amount of efficiency program savings or potential are embodied in the forecast and what effect that will have on decisions to go forward with programs to achieve additional efficiency potential.
- Evaluation of potential new project capabilities to use in conjunction with the demand forecast to examine long-term alternative energy efficiency strategies, such as zero-emission building goals, in support of long-term greenhouse gas reduction goals.
- Identifying what collaboration is needed or desirable among utilities, the CPUC, the Energy Commission, and others to refine demand forecasting methods and create needed energy efficiency projection capabilities.

III. Statement of Problem

The prominence of energy efficiency creates two major challenges for state energy planners. The first comes from the idea of efficiency as the "resource of first choice." This implies that the impact provided by efficiency measures needs to be known as reliably as any generation resource with respect to resource adequacy and procurement. It follows that more precise measurements of the impacts of efficiency programs need to be made. However, it is very difficult to determine what level of reliability to assign to estimates of reduced consumption from efficiency measures, for at least three reasons. First, there are different ways to account for the impacts of programs taken in isolation, all subject to uncertainty. Second, the results, even if considered reliable, may not directly translate into reductions in demand. Finally, the impacts are conditional upon a stream of program funding and authorization decisions through time that may cumulatively have an impact as large as a single power plant.

In the case of a typical generation facility, one can determine how much power was generated at any given time with a high degree of accuracy. This is not the case for efficiency measures. Demand reductions due to efficiency programs must be estimated relative to what would have happened if the program were not in place. Such an "all else equal" analysis is confounded by overlap with and spillover effects from other measures, free ridership, and concurrent changes in the market not due directly to the program. Thus, there is rarely a one-to-one correspondence between efficiency savings as typically measured by a program analyst and a reduction in consumption. The result is that energy forecasters often discount the impact of efficiency programs, as their goal is to predict most accurately what amount of energy is going to be needed in the future.

The danger in relying on efficiency savings goals as a resource is that they are impacting current procurement decisions meant to ensure future adequate energy supply. Energy forecasters are therefore leery about assuming reliable and persistent reductions in demand estimated for current or projected programs years into the future. It is therefore imperative that energy program analysts refine and improve conservation quantification methods to yield reliable results that also take into account processes already at work in the market.

In addition, it is never certain what stream of proposed energy efficiency program funding or authorization decisions should be considered "committed" for inclusion within the demand forecast. Unlike future power plants, which involve a handful of major decisions (licensing by the appropriate regulatory agency, construction by the owner, or a long-term power purchase agreement), efficiency programs have typically been authorized for funding for a few years at a time. Even then, funding commitments are not the same as actual expenditures, and the actual types of programs implemented can yield overall savings levels that are usually different than the forecasted program impacts, particularly at the end use level.

The second challenge is to develop consistent measurement techniques. The Energy Commission's demand forecast, utility forecasting models, and stand-alone energy efficiency potential methods and models, such as Itron's ASSET model, often use different efficiency quantification methods when measuring the impact of efficiency programs and standards. Assumptions also differ regarding the impact of price and other market effects. Sorting out these differences will require an increasing level of cooperation among the various interested parties.

IV. Proposed Plan to Improve the Accuracy and Understanding of the Level of Energy Efficiency Investments or Savings Included in the Energy Commission Forecast

The Energy Commission proposes a four-step approach to improving the level of understanding of what types of program savings are contained in their committed forecast and the accuracy of these estimates:

- Step 1. Develop common terms and clarify the approach to conservation quantification for the 2008 IEPR cycle.
- Step 2. Review and compare the modeling methods, inputs, and data sources used in forecasts of savings in the Itron potential models, used recently to support the CPUC's goal setting process, and the Energy Commission end use forecasting model used to estimate the level of efficiency (under Warren-Alquist, the term is "conservation") reasonably expected to occur.

- Step 3. Compare interim savings estimates from both models for selected programs given common sets of input and or modeling assumptions. This step will focus on defining a common set of inputs for both models, such as historical and forecast measure penetration and saturation for lighting and space conditioning end uses and then analyzing the differences in savings estimates in both models. .
- Step 4. Propose improvements to the forecasting models (Energy Commission staff and Itron) and test the improvements in a revised February forecast of committed savings.

A more detailed discussion of each step and preliminary list of common terms is presented below.

Step 1 – Develop Analysis Approach and Common Terms

Understanding the level of current and future utility program savings embedded in any forecast of future electricity demand requires precise definitions of what types of "program savings" are being modeled as well as how they are being modeled. In the case of the Energy Commission forecast, there is a rich history of staff analysts and modelers attempting to clearly define what types of current and future utility programs would be included in the forecast; for example, using the CFM (Common Forecasting Methodology) data collection process in the mid 1990's. In addition, standardized formats to report program impacts have been created in the past to document the estimated impact of different vintages of both current and future building and appliance standards. However, in the past, little time was spent investigating the effects of different definitions and methods used to define the term "savings" in different models and forecasting applications. To resolve the difference in methods, we propose to develop a preliminary list of the *current* terms used in the Energy Commission forecasting, IOU-CPUC program impact reporting, and IOU-CPUC efficiency potential analyses and then discuss whether these terms or some modifications to them should be used in the next forecasting cycle at the workshop.

Table 1 presents a list of terms currently used to quantify or estimate the electricity "savings" associated with a variety of program and non-program effects likely to influence the overall demand for electricity. These definitions have been taken from the most recent CPUC energy efficiency goals analysis, the CPUC's Energy Efficiency Evaluation Protocols, and the Energy Commission's forecast documentation. At the workshop, we plan to discuss the pros and cons of continuing to use these terms, modifying them, or developing new ones. The ultimate goal is to reach agreement on definitions on a common set of "savings" terms to ensure the savings estimates from the forecasting and efficiency potential models are comparable.

Table 1 – *Current* Efficiency Quantification and Savings Concepts Commonly Used in California

Term	Definition
Energy Intensity	Estimated kWh required to meet a specific level of energy service demanded or work within a given end use, building type, or customer class - usually defined as a UEC or EUI (energy use intensity) example=kWh/HH or square foot. Intensity changes include both efficiency effects and changes in the level of energy service; for example, customers may choose to increase or decrease the temperature setting for hot water delivery over time.[1]
Energy Efficiency	Using less energy to perform the same function (Source: CPUC Evaluator protocols). In forecasting area usually defined as a reduction in energy use or the number of kWh required to provide a constant or slightly increased level of service demand at the end use, building type, or customer class. This reduction is caused by the installation of a more energy efficient system or measure, not a reduction in the level of service provided.
Energy Efficiency Improvement	Reduced energy use for a comparable level of service, resulting from the installation of a more efficient measure or the adoption of an energy efficiency practice.
Conservation	Reduction in the level of energy services demanded by customers in response to media messages, changes in societal norms, or price signals that are often temporary in nature. For example, reduced hours of lighting usage or setting up thermostat set point temperature in a summer peak event as exhorted by the Flex Your Power campaign.
Annual Savings (kWh)	A forecasted reduction in the energy intensity or UEC in a given end use or energy activity multiplied by the number of structural or consuming units forecast in a given year.
Cumulative Savings	The sum of annual savings estimated over a given time period measured relative to the baseline or reference year for savings calculations.
Baseline Year for Savings Calculations	Year which is used to start the savings calculation by freezing the energy efficiency for all end uses.
Frozen Efficiency Forecast	Baseline forecast constructed using forecasts of building stock, equipment saturation trends, and customer growth multiplied by frozen energy efficiency from the baseline year of the forecast. This forecast is intended to be used conceptually as the level of sales from which all types of program and non-program savings can be estimated.

[1] Intensities are usually measured at the end use level and thus imply saturation but energy intensities measured at the building level (e.g., kWh/HH) will also include the impacts of changes in equipment saturation over time

Table 1 – *Current* Efficiency Quantification and Savings Concepts Commonly Used in California (cont.)

Term	Definition
Rebound	A theoretical consequence of improved energy efficiency that induces the end-users to consume at a higher level of service after installation of energy efficiency measures because the cost per unit of service has been diminished. In effect, the consumer can now "afford" to consume more.
Calibration of Forecasted Sales to Actual Sales-Energy Commission model	Comparison of sales predicted by model to level of sales in the most recent historical year

Sources: **California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals**, Appendix B Glossary (CPUC, April) and **California Energy Demand 2008-2018, Revised Staff Forecast**, November 2007, CEC-200-2007-015-SF2.

The first four terms in the preceding table are included primarily to clarify the difference between energy efficiency and conservation actions, both of which may produce energy savings in the models but in different ways. Over the last twenty years, forecasting models tend to focus on the estimation of energy savings associated with incremental efficiency investments rather than predicting the level of savings associated with the adoption of conservation activities or behavior change. This is because there is less certainty in predicting to what extent observed or forecasted rates of customer adoption of specific conservation practices will be stable over time.[2] It has been argued that the level of savings anticipated from the installation of more efficient equipment is likely to be more stable even though the actual savings achieved will interact with customer operation and behavior.

Annual savings, the fifth term in this table, can result from both efficiency and conservation actions. The Energy Commission's current estimates of the level of "conservation" savings reasonably expected to occur is somewhat of a misnomer because the majority of savings quantified in the current Energy Commission model are a result of energy efficiency actions and not conservation. Similarly, when the CPUC adopts conservation savings goals it usually is referring to the savings caused by increased efficiency investments.

Thus even though the Energy Commission is required by law to estimate and include the level of *conservation* reasonably expected to occur in its forecast, in practice they have usually reported the level of energy savings induced by increases in the level of energy *efficiency* investments in appliances systems and the building stock over time . The Energy Commission should consider whether re-labeling the level of savings within the baseline efficiency forecast as EESRTO, *Energy Efficiency Savings Reasonably Expected to Occur*, as opposed to continuing to use the

[2] It is now commonly understood that some of the peak load savings that were induced by the 2000-2001 California Electricity Crisis have been eroded. This was a "conservation" effect induced by behavioral changes rather than an "energy efficiency" effect induced by hardware installations.

current label of CRETO; *Conservation Reasonably Expected to Occur*. All parties are invited to comment on the definitions in Table 1.

The last four terms in Table 1 (base year, frozen efficiency forecast, rebound, and calibration) are included because they are likely to be useful in isolating the different methods used to forecast energy savings in the Energy Commission and stand-alone efficiency potential models. For example, producing a frozen efficiency forecast is useful in comparing to what extent a model includes a presumed level of increases in energy efficiency or naturally occurring savings independent of whether programs or market forces continue to encourage customers to make more efficient purchases in the future. We believe that the best way to isolate this baseline naturally occurring trend in energy intensity may be to produce a frozen efficiency forecast that estimates the level of electricity sales if the level of efficiency observed in the building stock at baseline year 0 were frozen over the length of the forecast period. A frozen efficiency forecast can then be compared to the base case sales forecast to quantify the level of "savings" induced by program and non-program effects and to help understand the relative importance of different types of savings in any given forecast. Further analysis is likely still necessary to separately estimate the incremental program cycle savings from the market-driven savings (which may be a combination of price effects, changes in social norms or business practices, and effects from previous program cycles).

Table 2 describes the terms commonly used to describe estimates of savings for different types of government or utility-sponsored programs or natural market forces such as changes in price or efficiency-related technology characteristics. Most of the factors included in these definitions can be used to model or forecast changes in the energy intensity of the building stock (and thus savings) over time.

Table 2 – *Current* Definitions of Program and Market Induced Savings Commonly Used in California

Term	Definition
Program Direct Savings - (Utility, State or Local)	Savings tied to installations by participants in programs that are directly claimed by those programs; in the CPUC EM&V protocols these savings are associated with incentive programs in which a specific measure installation is tied to a program payment.
Free rider	A program participant who would have implemented the program measure or practice in the absence of a program in a particular program cycle. A key issue with this term is how it relates to and is quantified, in practice, relative to assumed naturally occurring or long-term market effects.
Efficiency Program (induced) or Net Savings - (Utility, State or Local)	Gross program savings estimate less the savings estimated for the fraction of program participants who were free riders. This adjustment is often summarized as the net-to-gross adjustment or net-to-gross ratio.
Program (Induced) Indirect Savings	Estimated savings from program-induced efficiency adoption in current or future years that are incremental to Program Direct Savings. Used in CPUC EM&V EE protocols to refer to savings from programs that are typically information, education, marketing or outreach programs in which the program's actions are expected to result in energy savings achieved through the actions of the customers exposed to the program's efforts, without direct enrollment in an program that has energy savings goals.
Market Effects/Transformation	A change in the structure or functioning of a market or the behavior of participants in a market that result from one or more program efforts. Typically, these efforts are designed to increase the adoption of energy efficiency products, services, or practices and are causally related to market interventions.
Savings from Market Effects/Transformation	Estimated changes in adoption of more efficient products, services, or practices induced by the cumulative effects of programs. Examples of market effects include program induced changes in efficiency product prices, availability of product, and awareness of products that lead to incremental savings in excess of direct program effects.
Standards (Induced) Savings	Savings attributed to the adoption of building or appliance standards (state or national) that require the installation of equipment or systems with lower energy intensity or increased efficiency.
Naturally Occurring (Market-Driven or Baseline Savings)	Savings attributed to efficiency improvements that are independent of program effects. A key issue with this concept is how it relates and is quantified, in practice, in relation to program-induced market effects and free ridership.
Price Induced Savings	Includes any price-induced changes in customer behavior or operation of existing equipment that leads to a reduction in the underlying energy intensity. Note that, in the current staff forecast, all behavior-induced changes in energy intensity are included in this category.
Committed savings	The level of future energy and peak savings estimated to result from the subset of programs that are fully funded and authorized.

Table 2 – *Current* Definitions of Program and Market Induced Savings Commonly Used in California (cont.)

Term	Definition
Uncommitted Savings	Uncommitted savings is the residual savings from the total level of saving found reasonably expected to occur (CRETO or ESRETO) less committed savings. In an example from the current policy setting, CPUC goals might be considered CRETO or ESRETO, but since they are not fully funded or authorized, some portion is considered uncommitted. Usually these estimates require some form of resource analysis to ensure they are economic and commitments by program managers to ensure the savings are realized. In the last IEPR cycle, "Uncommitted effects" were defined as the incremental impacts of the level of future programs (for example, savings associated with new equipment that exceeds current standards or early replacement of existing stock), impacts of new programs, and impacts from expansion of current programs.

Sources: **California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals**, Appendix B Glossary (CPUC, April 2006) and **California Energy Demand 2008-2018, Revised Staff Forecast**, November 2007, CEC-200-2007-015-SF2.

In the past, Energy Commission forecast models have explicitly produced forecasts of gross and net direct program savings and estimates of standards-induced savings. In this cycle, the Energy Commission will compare how estimates of economic potential and achievable potential for a given territory and set of program years compare to the estimates of "committed" and "uncommitted" impacts – summing to conservation reasonably expected to occur. In addition, the Energy Commission and Itron analysis teams will explore whether it makes sense to publish and compare estimates of price-induced, market driven, and or naturally occurring savings relative to a frozen efficiency or baseline forecast. Finally, we will explore whether it is possible to estimate indirect or program-induced savings, given the available data on measure saturation and penetration rates and adequacy of causal analyses.

We seek comments from parties on whether or not it is important to estimate the savings from both program and non-program factors within the Energy Commission forecast. We also seek comments on the strengths and weaknesses of the terms presented in Tables 1 and 2 parties' opinions on what major modifications or new terms are needed.

Forecasting models usually estimate the effects of some portion of the program and market influence listed above to develop aggregate estimates of the remaining potential to save energy given the observed amount of energy efficiency or the energy intensity at the baseline or zero year for the savings quantification exercise. Table 3 provides a list of terms currently used to characterize different types of potential in both the CPUC's goal setting process and the Energy Commission's forecast.

Table 3 – Applications of Savings Terms to Estimation of Future Energy Efficiency Potential

Term	Definition
Technical Potential	Estimated savings that result when all customers adopt all of the efficiency measures found to be technically feasible from an engineering perspective over the period of study. This estimate does not include consideration of cost effectiveness or what fraction of the customers will be willing and able to adopt efficiency measures over time.
Economic Potential	Estimated savings that would result from the adoption of all measures found to be both technically feasible (from above) and cost effective when compared to the cost of alternative supply investments (or other agreed upon economic criteria). Typically economic potential looks at societal costs and benefits and does not include non-energy costs and benefits that may influence customer adoption. Estimates of economic potential may or may not include program costs as well.
Achievable Potential	The amount of savings that can be achieved due to specific program interventions, for example, as a function of information delivery and financial incentives. Achievable potential often differs fundamentally from economic potential in that the analysis estimates customers' willingness to adopt based on customer utility functions, which can include direct financial net benefits (e.g., payback, rate of return, lifecycle savings, etc.) and other measure features (e.g., equivalence of energy service and non-energy costs and benefits). Terms used in California potential studies for different types of achievable potential have included: *current*, *business as usual, base, aggressive, full*, and *maximum achievable* potential, among others. All generally use forecasts of available program funding, rates, and avoided costs, along with measure-level costs and savings estimates, as inputs to consumer adoption modeling. Naturally occurring savings are often estimated directly in these models.
Conservation (*efficiency*) Reasonably Expected to Occur (CRETO)	The level of program and non-program induced energy savings found to be reasonably expected to occur over the forecast horizon. This has traditionally been defined as the sum of the committed and uncommitted savings estimates defined in Table 2.

Sources: Itron, **Assistance in Updating the Energy Efficiency Savings Goals for 2009 and Beyond (**Prepared for the California Public Utility Commission, September 2007) and California Energy Commission, **California Energy Demand 2008-2018 Staff Revised Forecast,** CEC-200-2007-015-SF2, September 2007.

We solicit parties comments relative to which of these terms make the most sense to use in developing conservative or realistic levels of aggregate savings to include within the baseline forecast. In addition we solicit comments on the pros and cons of estimating additional savings outside of the forecast in the form of annual savings goals similar to the process used to set savings goals adopted for municipal electricity utilities in the last IEPR process.

Many analysts believe that maximum achievable potential estimates for voluntary programs will always be less than the parallel estimate of economic potential from the same study for two key reasons. First, even if 100% of the extra costs of purchasing more efficient equipment are paid for through incentive programs, not all customers will agree to install the efficient measures.

Second, delivering programs to customers requires additional administration and marketing expenses beyond the incremental costs of the measures themselves which will constrain the total level of efficiency savings that will be economic to acquire. However, in some cases policy makers may decide that estimates of economic potential are also potentially achievable in the long run because of changes in future energy prices, types of efficiency programs offered, new regulations, or market conditions that have not been incorporated in the savings potential estimates. This was true in the 2007 IEPR cycle when the Energy Commission decided to use estimates of economic potential as the basis for setting annual savings goals that were found to be achievable.

Within this IEPR cycle, staff forecasters plan to develop a list of criteria that can be used to assess what level of program details and funding commitment will be needed to include programs in the CRETO category and its two subsets "committed" and "uncommitted." At a minimum this will include a list of details related to the anticipated reduction in unit energy consumption for key end uses of targeted customers, the anticipated level of customer adoptions and any evaluation or M&V studies available to verify or support the estimated level of energy intensity reduction. Utilities may be asked to provide additional program data via the CFM process.

In addition, the definition of conservation reasonably expected to occur (and the subset that is considered "committed") must include some criteria that will be used to assess the certainty that each program will be implemented. The certainty of program-induced savings generally falls as a function of time. In the past, this uncertainty has been addressed by only modeling programs scheduled to complete operation within a fixed number of years in the future (e.g., a program cutoff date). In earlier Electricity Report or Integrated Energy Policy Report proceedings, when defining "committed" savings, the Energy Commission has used program cutoff dates that range from 1 to 10 years from the forecast year. In this cycle, the Energy Commission will likely use 2011 as the cut-off date, since the CPUC is planning to adopt three years of funding authorization for programs operating in years 2009-2011. Alternative cutoff thresholds related to the cost effectiveness of programs or the perceived saturation of key efficiency measures will also be considered. Staff will also investigate whether it would be useful to use some portion of the achievable savings potential estimated by Itron in the past or the gross energy savings goals recently adopted by the CPUC as uncommitted conservation potential that should be considered as a potential alternative to supply over the next ten years.

Step 2 – Comparison of Quantification Methods and Inputs for Selected Energy Efficiency Programs and Standards

After working with parties to improve the definitions and use of terms as well as the proposed approach by mid-August, the Energy Commission and Itron team will review and compare the modeling methods and input data sources used in forecasts of savings from the two models. We propose to initially focus on the inputs and methods used to estimate the savings from utilities

2006-2008 commercial and residential lighting programs and then move on to new construction programs and HVAC. Parties will be asked to identify additional programs where a review of modeling methods and model inputs might be desirable. We will produce a document that describes the methods and inputs used to characterize savings from these programs.

To document progress made in this area, the team will describe the different processes used to estimate energy savings in each model by either aggregating measure penetration forecasts into utility programs or standards “bundles” (Itron potential model) or developing estimated changes in or trends in end use intensity (UEC’s or EUI’s) based on forecasts of efficiency measure saturations, market data, or the effective date of new standards (Energy Commission forecast model). This documentation will also include the methods or rules used to attribute what portion of the total estimated savings for a given end use or sector were caused or attributed to utility programs, non utility programs, naturally occurring conservation, or building and appliance efficiency standards.

This analysis will also characterize the different methods used in each model to estimate incremental energy savings from new state or federal standards when the building or equipment stock decays and turns over and identify a preferred method if possible. We will also identify how each model estimates naturally occurring savings as a function of price or other factors.

Anticipated issues to be analyzed include the determinants or methods used to estimate the levels of naturally occurring conservation or the baseline energy intensity of end uses over time, and how or if these baseline forecasts of energy intensity interact with the impacts of price induced changes. Examples of other issues the team plans to assess during this stage of the analysis include:

1. If a customer purchases a CFL in 2009 and this CFL needs to be replaced two years later, does his purchase of a replacement CFL constitute additional savings for the utility program or is this purchase now part of the new naturally occurring energy intensity and thus no savings are counted or estimated for a program as a result of this purchase?

2. How is the estimation of program induced savings in the example described above affected by the imposition of new lighting standards in the Huffman bill scheduled to take effect in 2012?

3. What is the best way to estimate baseline energy intensities of end uses that have been significantly affected by both the adoption of efficiency standards and programs over the last two decades?

4. Given the performance stand design of Title 24 Building Standards, what degree of judgment has been exercised in translating the requirements of the standards into one or more “packages” of measures that leads to specific end-uses efficiency impacts? Are

there alternative approaches to handle the inherent uncertainty of performance standards? Are all such alternative approaches equally valid?

5. How important is the selection of a baseline year in these savings calculations and what are the pros and cons of choosing historic baselines many years in the past versus updating the baseline to correspond to the most recent calibration analyses?

The final part of this analysis will be to understand and review the sources used in both the Itron and Energy Commission models to define the initial baseline saturation of key measures. Itron and staff analysts will attempt to ensure a similar starting year and measure saturation is being used in both models for key end uses to ensure consistency in the comparisons of measure penetration and or saturation forecasts. This step will culminate with the publication of a staff report that describes the differences in methods and inputs used to estimate savings in each model and a summary of lessons learned from this process.

Step 3 – Compare Interim Savings Estimates from Both Models for Selected Programs with Common Sets of Inputs and or Modeling Assumptions

This analysis step will focus on defining a common set of inputs for selected end uses within both forecasting models for the purpose of understanding differences in the output estimates of savings produced by the different modeling approaches. Common inputs will probably include: electricity price forecasts, avoided cost forecasts, historical and forecasted measure penetration rates, and resulting saturation levels for lighting and space conditioning end uses. Analysts may also want to compare input assumptions related to the forecast of base case intensity or naturally occurring savings forecast in the same period.

The output of this effort will be a report documenting estimates of savings for a common set of utility programs and building and appliance standards. The analysis will also contrast how the estimates of program-induced savings compare to the other types of savings estimates in the savings period; for example, price-induced savings, naturally occurring savings, and savings induced by current or future efficiency standards. This analysis should help reveal to what extent there is some potential for overlap in independent estimates of program savings based on manager reports versus estimates of program savings that occur within the context of a model that is simultaneously estimating savings from efficiency standards, price, and technological changes. This will also deal with the fact that utility program estimates are usually presented at the net savings level and thus make use of net–to–gross adjustments or ratios that may be different than those estimated in the Itron or Energy Commission models. Energy Commission staff will propose adjustments to either the model or the reported program savings estimates to make sure these comparisons of savings between two different sources are made on a consistent basis in the future.

Step 4 – Propose Improvements to the Forecasting Models (Energy Commission and Itron) and Test the Improvements in a Revised February Forecast of Electricity Sales which Will Include Estimates of Savings that are Considered Committed

In this stage, Energy Commission and Itron staff plan to work together to improve the sets of inputs used to estimate baseline and program-induced energy intensities over time as well as the model framework itself. This work will build off the program and design details provided by the investor-owned utilities in their 2009-2011 energy efficiency program portfolios. In addition, Itron plans to make additional data available to the Energy Commission that is has used to characterize the level and type of measure installations from 2004 to 2007 as a result of utility programs.

As a first analytical step, the Itron and the Energy Commission team will organize a calibration comparison process to assess each model's capabilities to backcast the level of likely energy savings from selected program and price effects and compare to actual energy usage observed for 2006 or 2007. The goal for this comparison process is for each team to specify or describe how their model makes use of recorded or historical data (consumption, evaluations of energy efficiency measure impacts, first year savings, energy efficiency program funding, measure and end-use saturation estimates, geographic location of customers, weather phenomena, etc.) and how their model "fits" to the entire set of data that are available.

The calibration comparison process will be used to assess the overall accuracy of both of the models in estimating gross and or net energy savings relative to a pre-program sales forecast and historic energy consumption data. We will also investigate whether this calibration process makes it easier or harder to determine what programs or market forces "caused" the observed increases in efficiency measure penetration over time. Itron will endeavor to review and bring forward all program related evaluation or market assessments for the measure and time period that may guide this assessment.

The team will also investigate whether the conservation analysis methods used in the Energy Commission forecast may be omitting "load increasing" phenomena that ought to be inserted into the model, thus, increasing the "pre-program" load forecast. The analysis team will then recommend both improvements to existing demand forecast methods and data and estimation processes in energy savings potential models to minimize the potential overlap of savings estimated for utility programs or standards as part of the CPUC goals process versus the level of savings estimated by the Energy Commission model as either "committed" or "uncommitted" conservation.

After this calibration process, the staff will implement its process of producing its forecast of committed conservation impacts for both utility and standards programs.

This work will culminate with the delivery of the Energy Commission's draft energy demand forecast in February of 2009 and a companion support document that will describe the improvements made to the model from both a methodology and input perspective.

V. Developing an Uncommitted Energy Efficiency Projection Capability

As noted in Section II of this paper, the scope of the 2008 IEPR inquiry into demand forecasting and energy efficiency includes consideration of new capabilities that do not now exist. The legal directive to prepare a forecast including "conservation reasonably expected to occur" has customarily been satisfied by including "committed" energy efficiency in the baseline demand forecast and carrying "uncommitted" energy efficiency and/or demand response programs as supply-side resources. The analytic methods used to estimate such "uncommitted" impacts have varied from cycle to cycle. In some instances they have been utility estimates requested as part of the CFM data requests.

The conceptual project plan guiding these demand forecast-energy efficiency efforts includes developing a new capability to assess "uncommitted" energy efficiency impacts. There are three obvious choices for developing such energy efficiency impacts:

- Inserting additional program characteristics into the Energy Commission demand forecasting models and making another run of the models. The difference between the baseline run with "committed" characteristics and the second run would develop "uncommitted" impacts.
- Adapt the spreadsheet model linked to Itron's ASSET model that was used to develop 2020 goals in the CPUC proceeding to produce impact estimates.
- Adapt the Itron ASSET model itself to make two sets of runs, with the difference being the impacts of a set of programs considered to be "uncommitted." Presumably this would involve some substantial subset of economic potential, but perhaps differ in some way from the way in which economic potential and achievable potential have been defined in CPUC exercises of the model.

Comments about which one of these approaches, or others, should to be used will help Energy Commission staff to formulate its model development decisions.

VI. Schedule for the Proposed Analysis Process

Table 4 – Analysis Phase and Time Frames

Analysis Phase	Time Frame
Step 1 - Develop common terms and approach	August - September 2008
Step 2 - Methods and inputs comparison	September - October 2008
Step 3 - Comparison of Savings outputs and Calibration of savings to historic sales	October - November 2008
Step 4 - Implement improvements to Energy Commission model and produce savings documentation volume to accompany draft Energy Commission electricity forecast	December - February, 2009
Develop an Uncommitted Energy Efficiency projection capability	June - July 2009