Demand Forecast Energy Efficiency Quantification Project (DFEEQP) Working Group – Approaches for Including Energy Efficiency in Demand Forecasts

2009 IEPR Staff Workshop: Joint CEC/CPUC/Itron Project for Energy Efficiency Measurement and Attribution

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Energy Efficiency in Concept

- Energy efficiency (EE) reflects measures installed (e.g., motors, appliances, building shell) or practices undertaken (e.g., more efficient new construction) instead of "standard/base" practice.
- Efficiency impacts are **never directly observed or measured**, but reflect estimates of consumption that would have occurred in the future if the base technology or practice had been implemented.
- Program savings estimates rely on energy efficiency impact evaluation data developed over time through extensive analysis (statistical comparison of bills, engineering estimates, direct measurements of comparison groups, changes in measure saturations and markets).

High-Level Comparison of Methods: CEC/CA Utilities/CPUC EE Goals

- DFEEQP participants presented and discussed high-level information regarding construction of their demand forecasts and in particular, methods for including energy efficiency.
  - Energy Commission Staff
  - IOUs
  - POUs (LADWP, SMUD)
- Itron's Statistically Adjusted End-Use (SAE) Modeling Group also presented.
- CPUC EE Potential and Goals Studies (Itron) – not a demand forecast *per se* but play a role in various policies and forecasts.

Overall Approach to Demand Forecasting

- Energy Commission
  - End-use based forecasts.
- CA Utilities
  - Econometric forecasts
  - Supplemented in some instances by post-model end-use based adjustments.
- CPUC EE Potential Studies (Related to EE Goals)
  - Adoptions of EE rather than demand *per se.*

Basic Approaches to Incorporating EE Program Effects in Forecasts

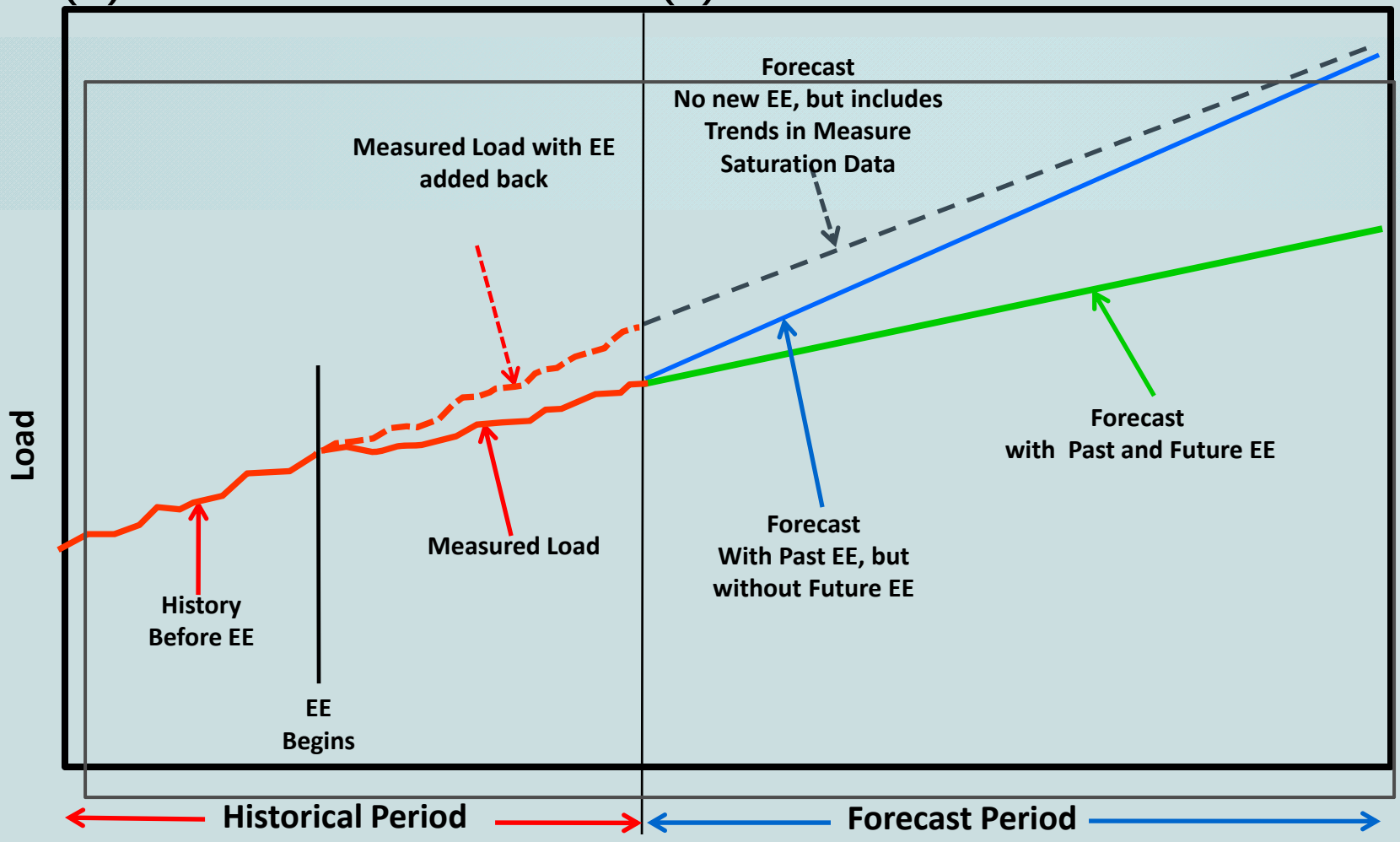
Method 1: Reconstitute Loads

- Add estimates of historic energy efficiency program accomplishments to recorded sales forecast to develop an estimate of sales that "would have occurred" without energy efficiency.
- Create placeholder demand forecast using the parameter estimates that result from higher historical/reconstituted load.
- From this placeholder forecast, subtract efficiency impacts from historic programs where measures are still in place and subtract expected future energy efficiency from the programs.

Method 1: Reconstitute Loads

(Source: Based on Itron 2009)

(1) $\text{Load} + EE^{history} = f(x) - EE^{history} - EE^{future}$



Basic Approaches to Incorporating EE Program Effects in Forecasts

Method 2: Historic EE as Explanatory Variable

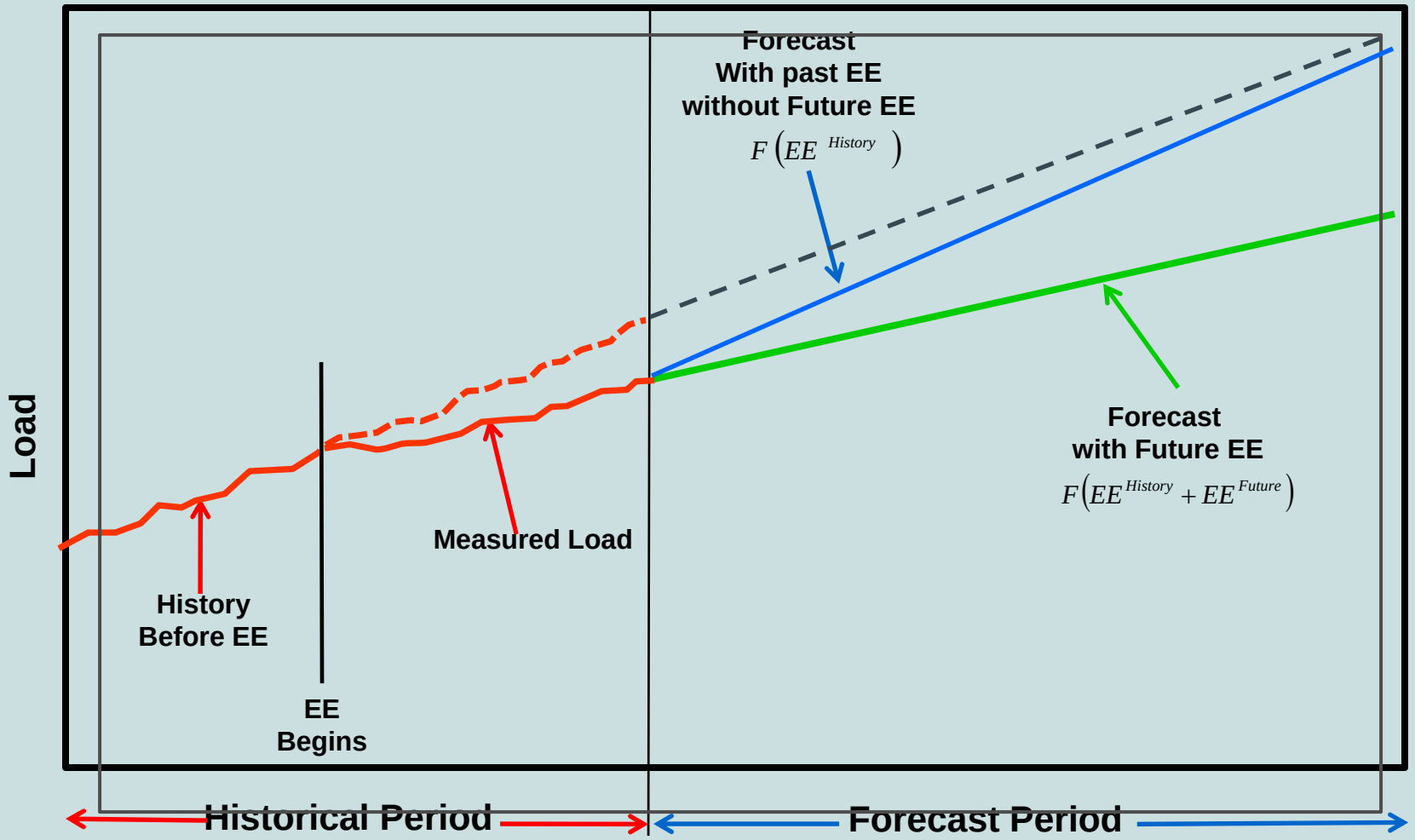
- Treat historic EE accomplishments as an explanatory variable for historic demand.

- Develop demand forecast going forward by incorporating EE programs through variables in the model or through post-processing of model forecasting results. This shows explicit measurement of the expected impacts of future programs.

Method 2: EE Variable

(Source: Based on Itron 2009)

(2) $\text{Load} = f(x, EE^{\text{history}} + EE^{\text{future}})$



Basic Approaches to Incorporating EE Program Effects in Forecasts

Method 3: Forecast with Changes in EE Trends

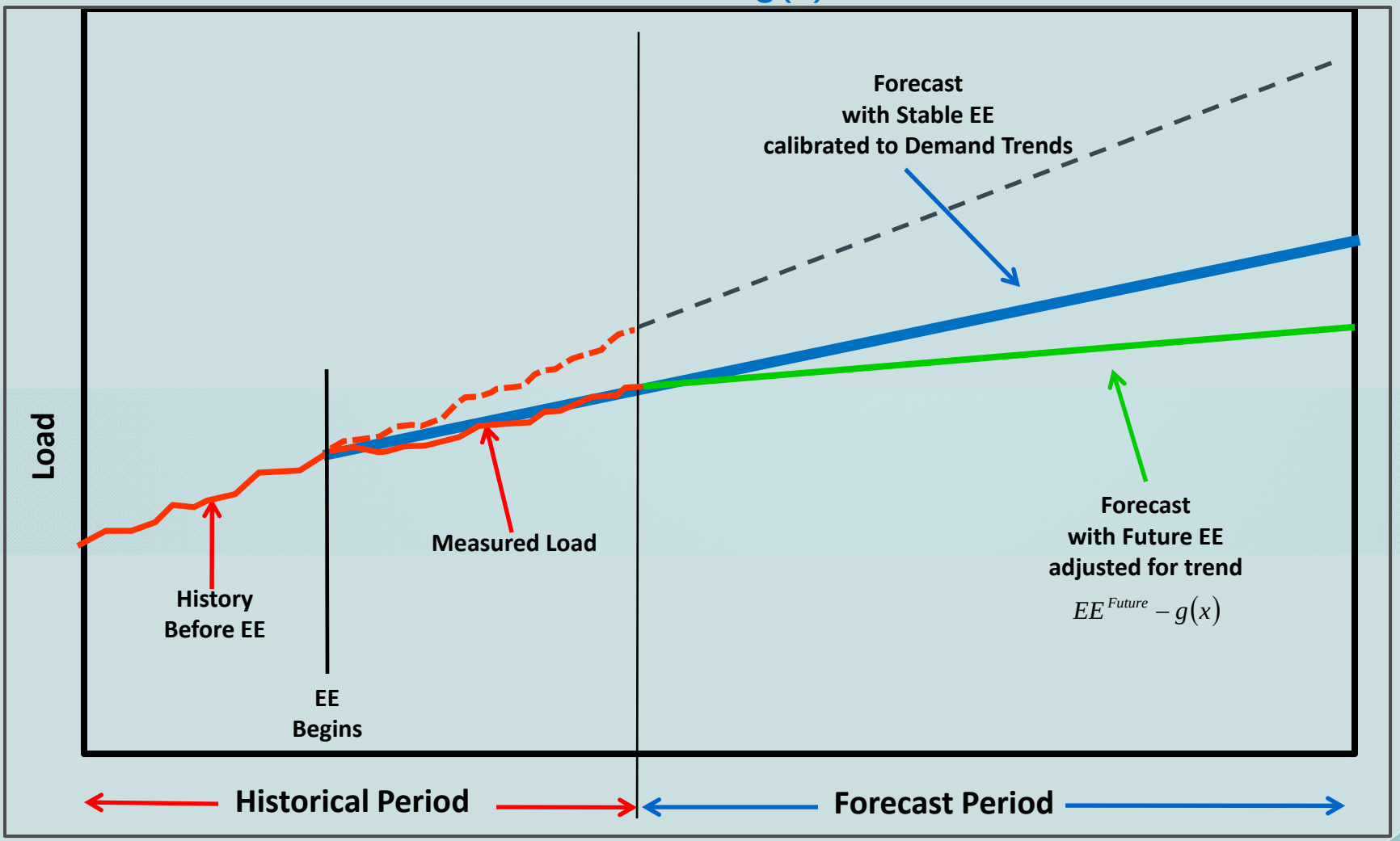
- Develop placeholder forecast for future demand based on historic demand – no need to explain amount of EE in the historical data.
- Modify if needed for EE expected to occur to the extent future savings are expected to be different than prior history, e.g.,
  - Increased/decreased expenditures
  - Emphasis on market transformation vs. resource acquisition
  - Emphasis on energy vs. peak reductions.

Method 3: Model DSM Trend

Source: Based on Itron 2009

(3) $Load = f(x) - EE^{AboveTrend}$

Where $EE^{AboveTrend} = EE^{future} - g(x)$



Variability of Approaches to Including EE Program Effects in Forecasts

- All demand forecasting methods can be done at end-use, sector, or overall portfolio level, utility or statewide – depends on model structure and input data.
- Methods 1 & 2 require information about EE program savings, as does Method 3 if future EE is expected to differ from historic.
- CA Utilities are using Methods 1 (SCE, LADWP) & 3 (PG&E, SDG&E, SMUD) in the context of econometric forecasts. In practice methods are blended.
- CEC is using Method 2 in the context of an end-use forecast.
- Varying approaches in models and data assembly (e.g., sector-level, end-use level, overall utility level), historic period, replacement at end of useful measure life and time horizon (history and future) for forecast.

Forecasting EE: Program Data Matters

EE Program Accomplishments are Reported in Several Dimensions – Net and Gross by *Ex Ante*, Verified, *Ex Post*

	Gross **(Savings from EE vs. Base Technology) --** **Parameters include (e.g.):** **•Hours of operation** **•Weather** **•Affected area/measure** **•Measure life**	**Net** **(Gross savings less what "would have occurred" if no program was offered)** **•Usually based on surveys** **•Can be based on studies of evolving market trends** **(Often < 75 % of Gross estimate)**
Ex Ante	Initial Estimate X Number of Installations–Most Consistently Reported	
Verified	Initial Estimates X Number of *VERIFIED* (Inspected) Installations	
Ex Post "Realized"	Estimates following eval. of Net and Gross –"Official" Final Version Can be higher or lower than *Ex Ante* – often 30-40 % lower "Realization rate" is ratio of *Ex Ante* to *Ex Post* (Net and Gross) Can require 2-5 years to complete evaluation.	

Forecasting EE: Program Data Matters

- *Ex ante* accomplishments are most consistently available/most used in forecasts.
- Level of aggregation varies (measure, end-use, program, implementation approach, utility).
- *Ex post* accomplishments reflect best estimate of actual – often reported several years later in various formats and levels of "true-up" (overall utility, sector, market segment, program).
- *Ex post* accomplishments not reported in same level of aggregation as *ex ante* – difficult to match results back to original categories.

Forecasting EE: Incorporation of EE Standards

- CEC explicitly captures effects of standards in its end-use models; may not fully capture rebound effects.
- Utilities tend not to explicitly incorporate the effects of standards into the econometric models – as the standards begin to affect historic demand, this will be reflected in forecasts of future demand based on observed trends.
- In some cases, utilities explicitly incorporate key standards.

Forecasting EE: Incorporation of EE Policies

- There is increasing emphasis on including policy goals for future EE in the forecasts (e.g., CPUC Goals, AB32, AB 2021, etc.) based on utility interpretation of regulatory obligations.
- CEC does *not* include policy targets as goals; explicitly rejected such an approach in the 2008 IEPR Update.
- Goals as set forth by policies/legislation can be difficult to interpret in the aggregate (varying alignment, overlap, updated on different schedules than program inputs, etc.).
- Furthermore, whether goals are achievable or readily quantifiable creates uncertainty in construction of demand forecasts. Some utility solutions entail producing several versions of their forecast for different purposes.

Including EE in Demand Forecasts: Summary

- Estimating effects of consumption that never occurs due to EE interventions is complex.
- Several basic approaches to including EE in demand forecasts.
- CA utilities and Energy Commission use varying approaches for incorporating EE program accomplishments and EE standards.
- EE program data are critical for forecasting purpose but are not readily available in formats well suited for this purpose.
- Incorporating EE policies into forecasts presents several concerns.
- DFEEQP Working Group participants are motivated to identify issues and develop solutions.
- Progress is being made in making inclusion of EE impacts more transparent.