The Brattle Group

PG&E's Non-Residential Enrollment Forecast

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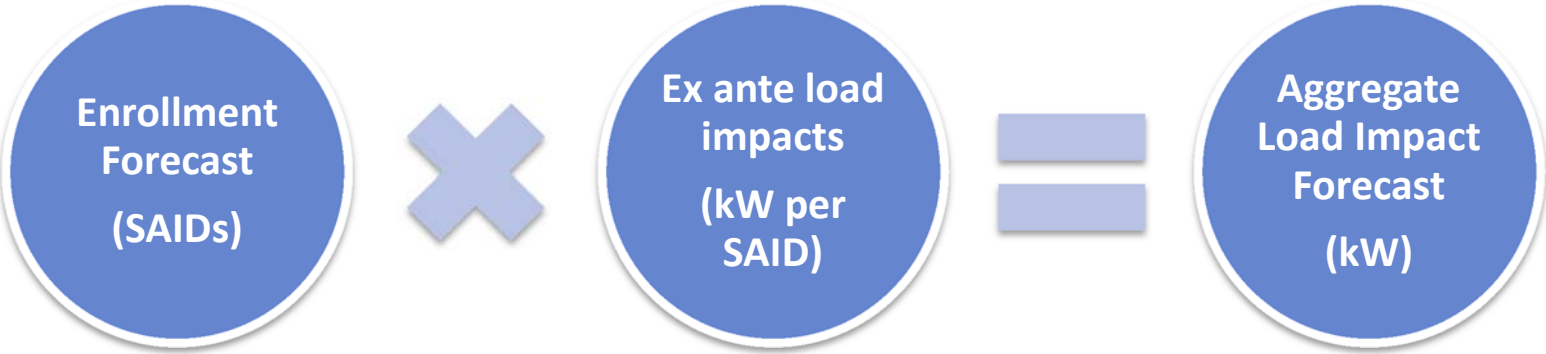
Overview

- Brattle forecasted monthly non-residential enrollments in fourteen DR programs for the eleven years from 2011 through 2021
- We also integrated non-residential per SAID load impacts (CAEC and FSC) and the residential forecasts (FSC) to forecast PG&E's entire DR portfolio
- This presentation focuses on the non-residential enrollment forecast methodology and results



Resources in PG&E's 2011-2021 DR Portfolio

Non-Residential Programs	
Non-Event Based	
PLS	Permanent Load Shift
TOU	Time of Use
Event Based	
AMP	Aggregator Managed Portfolio (Day Of & Day Ahead)
BIP	Base Interruptible Program
CBP	Capacity Bidding Program (Day Of & Day Ahead)
DBP	Demand Bidding Program
PeakChoice	PeakChoice (Committed & Best Efforts, Day Of & Day Ahead)
PDP	Peak Day Pricing
SmartAC	SmartAC

Residential Programs	
Non-Event Based	
TOU	Time of Use
Event Based	
SmartRate	SmartRate
PDP	Peak Day Pricing
SmartAC	SmartAC

Components of the Forecast

The difficulty was to forecast enrollment while tracking:

- Current enrollments in 14 DR program
- Historical enrollment and de-enrollment probabilities
- Different default dates for agriculture customers and certain rate schedules
- Population growth and interval meter deployment
- Whether each customer has had an interval meter for 12 months
- Dual enrollment rules and eligibility
- Aggregator program targets and PG&E marketing plans
- All of the above for 24 different customer segments
  - 3 sizes times 8 local capacity areas

Methodology

The Model

Inputs

- Current DR enrollment
- Historical DR enrollment
- Non-residential population data
- Meter status
- Expected population growth
- Meter deployment schedule

Programs

- Discrete Choice Model
- Forecasting model including Markov Chain
- All programs done in SAS

Output

- Monthly net enrollments in 14 programs: Jan. 2011 through Dec. 2021
  - By size and LCA
  - Dual enrollments
  - Portfolio analysis
  - Aggregate load impacts
  - Uncertainty adjustment

Markov Chain

In a given month of the forecast, customers are distributed across DR programs (including no program)

- In each month, there is a certain probability that customers will join a program
- Similarly, in each month, there is a certain probability that customers enrolled in a program will leave that program
- Applying these enrollment and de-enrollment probabilities each month leads to a "Markov Chain" sequence

Markov Chain: a mathematical system that undergoes transitions from one state to the next, based only on the previous state and not any other historical information

Discrete Choice Model (DCM)

The Discrete Choice Model (DCM) is a multinomial logit regression model that estimates the probabilities of choosing between a set of mutually exclusive alternatives

- Provides answers to two questions that drive the Markov Chain:

Question 1:

- Given a customer is not currently enrolled in a program, what is the probability they enroll in BIP, DBP, dual BIP & DBP, one of four PeakChoice options, some other DR program, or remain in no DR program?

Question 2:

- Given a customer is currently enrolled in a program, what is the probability that they de-enroll?

PDP Default

Customers are eligible to be defaulted to PDP once they reach their particular default date *and* they have 12 months of meter data

- Many customers are expected to remain on PDP when defaulted
- Others will choose to opt-out
  - We use probabilities based on historical large PDP default data
- Others will choose to opt-out *after bill protection ends*
  - We use relationship between opt-out rate before and after bill protection ends from prior survey research
- Customers who opt-out of PDP go to TOU

Aggregator Targets and PG&E Plans

AMP Day Of	• Aggregators expected to meet target of 149 MW by May 2011
AMP Day Ahead	• Aggregators expected to meet target of 40 MW by May 2011
CBP Day of	• Regression predicts CBP Day Of growth based on total AMP growth
CBP Day Ahead	• Regression predicts CBP Day Ahead growth based on total AMP growth
SmartAC	• Follows PG&E's market planning forecast through 2014, then holds enrollment constant
PLS	• Based on PG&E's enrollment target, as outlined in its 2012-2014 Demand Response Programs Application

Other Factors

Population Growth

- More customers (by size and LCA) are eligible to join programs

Interval Meter Deployment

- More customers accumulate 12 months of interval data and are eligible for default to PDP

Dual Enrollments

- Historically, largest dual enrollment in BIP & DBP

The Forecast

The output is a monthly net enrollment forecast for the 132 months from January 2011 through December 2021

- All enrollments are forecasted by size and LCA
- We do additional portfolio analysis to adjust for dual enrollments
- Uncertainty analysis accounts for variance in both load impacts and enrollments

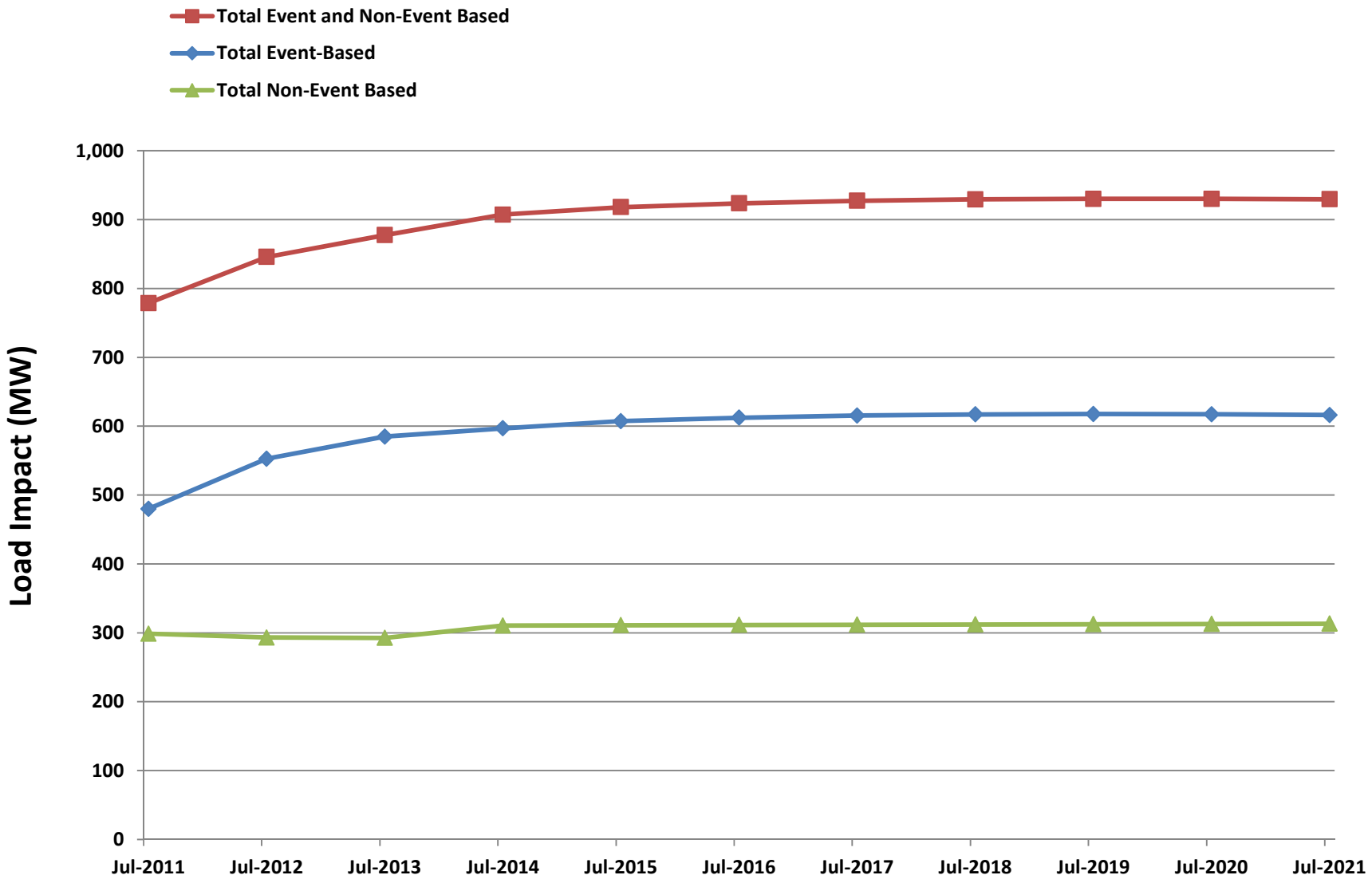
Results

Non-Residential Enrollment Forecast: Starting and Ending Month of the Forecast

		Jan. 2011	Dec. 2021
Non-Event Based	PLS	27	418
	TOU	99,686	500,279
Event Based	AMP	785	993
	BIP	193	267
	CBP	846	1,089
	DBP*	1,054	0
	PeakChoice	316	3,791
	PDP	1,925	138,855
	SmartAC	3,069	10,635
	Total DR Enrollments	107,902	656,328

*All DBP customers are forecasted to move to Peak Choice, Best Efforts, Day Ahead in 2013

Non-Residential Load Impact Forecast: Totals July of Selected Years



Conclusion

- **Event based enrollments increase to 150,000 by the end of the forecast, mainly driven by AMI rollout to small and medium customers and increases in PDP enrollments**
- **Non-event based enrollments—almost all TOU—increase to over 450,000 by 2012 and to 500,000 by the end of the forecast period**
- **Based on these results and the ex ante load impact estimates, aggregate average load impacts are expected to exceed 900 MW by the end of the forecast**

For Further Information

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