

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC APPLICATION OF DUKE ENERGY)	CASE NO.
KENTUCKY, INC. TO AMEND ITS DEMAND SIDE)	2022-00251
MANAGEMENT PROGRAMS)	

NOTICE OF FILING

Notice is given to all parties that the following materials have been filed into the record of this proceeding:

- The digital video recording of the evidentiary hearing conducted on March 28, 2023 in this proceeding;
- Certification of the accuracy and correctness of the digital video recording;
- All exhibits introduced at the evidentiary hearing conducted on March 28, 2023 in this proceeding;
- A written log listing, inter alia, the date and time of where each witness' testimony begins and ends on the digital video recording of the evidentiary hearing conducted on March 28, 2023.

A copy of this Notice, the certification of the digital video record, and hearing log have been served upon all persons listed at the end of this Notice. Parties desiring to view the digital video recording of the hearing may do so at <https://youtu.be/ecGI92Mals8>.

Parties wishing an annotated digital video recording may submit a written request by electronic mail to pscfilings@ky.gov. A minimal fee will be assessed for a copy of this recording.

Done at Frankfort, Kentucky, this 18th day of May 2023.



Linda C. Bridwell

Executive Director

Public Service Commission of Kentucky

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

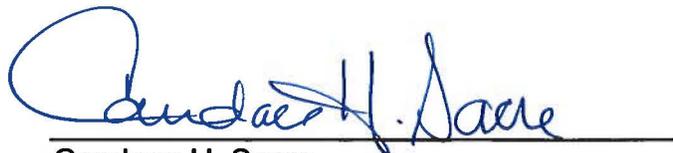
ELECTRONIC APPLICATION OF DUKE)	CASE NO.
ENERGY KENTUCKY, INC. TO AMEND ITS)	2022-00251
DEMAND SIDE MANAGEMENT PROGRAMS)	

CERTIFICATION

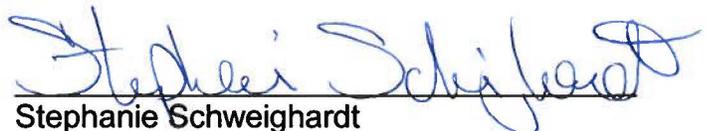
I, Candace H. Sacre, hereby certify that:

1. The attached flash drive contains a digital recording of the Formal Hearing conducted in the above-styled proceeding on March 28, 2023. The Formal Hearing Log, Exhibits, and Exhibit List are included with the recording on March 28, 2023;
2. I am responsible for the preparation of the digital recording;
3. The digital recording accurately and correctly depicts the Formal Hearing of March 28, 2023; and
4. The Formal Hearing Log attached to this Certificate accurately and correctly states the events that occurred at the Formal Hearing of March 28, 2023, and the time at which each occurred.

Signed this 15th day of May, 2023.



Candace H. Sacre
Administrative Specialist III



Stephanie Schweighardt
Kentucky State at Large ID# KYNP 64180
Commission Expires: January 14, 2027



Session Report - Detail

2022-00251 28Mar2023

Duke Energy Kentucky, Inc. (Duke Kentucky)

Date:	Type:	Location:	Department:
3/28/2023	Demand Side Management	Hearing Room 1	Hearing Room 1 (HR 1)

Witness: Melissa Adams; Paul Alvarez; Tim Duff; Bruce Sailors; John Swez
 Judge: Kent Chandler; Angie Hatton; Mary Pat Regan
 Clerk: Candace Sacre

Event Time	Log Event	
9:07:32 AM	Session Started	
9:07:36 AM	Session Paused	
9:08:23 AM	Session Resumed	
9:08:45 AM	Chairman Chandler Note: Sacre, Candace	Good morning. On the record in 2022-00251, electronic application of Duke Energy Kentucky, Incorporated, to amend its demand side management programs.
9:08:58 AM	Chairman Chandler Note: Sacre, Candace	My name is Kent Chandler. I am Chair of the Kentucky Public Service Commission. Joining me today are Vice Chairman Angie Hatton and Commissioner Mary Pat Regan.
9:09:06 AM	Chairman Chandler Note: Sacre, Candace	Hearing and videoconferencing recommendations. (Click on link for further comments.)
9:09:48 AM	Chairman Chandler Note: Sacre, Candace	The purpose of today's hearing is to take evidence in this matter.
9:09:52 AM	Chairman Chandler Note: Sacre, Candace	Entry of appearance of counsel. (Click on link for further comments.)
9:09:57 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Larisa Vaysman.
9:10:13 AM	Asst Atty General Cook Note: Sacre, Candace	Lawrence Cook.
9:10:20 AM	Asst Gen Counsel Frederick PSC Note: Sacre, Candace	Tina Frederick.
9:10:26 AM	Chairman Chandler Note: Sacre, Candace	Public notice. (Click on link for further comments.)
9:10:35 AM	Chairman Chandler Note: Sacre, Candace	Outstanding motions. (Click on link for further comments.)
9:10:36 AM	Camera Lock Comm Center Activated	
9:10:39 AM	Camera Lock Deactivated	
9:10:44 AM	Chairman Chandler Note: Sacre, Candace	Public comments. (Click on link for further comments.)
9:11:20 AM	Camera Lock Wireless Mic Cam Activated	
9:11:35 AM	Camera Lock Deactivated	
9:13:23 AM	Chairman Chandler Note: Sacre, Candace	First witness?
9:13:28 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Bruce Sailors.
9:14:03 AM	Chairman Chandler Note: Sacre, Candace	Witness is sworn.

9:14:13 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Examination. Name and address?

9:14:29 AM Atty Vaysman Duke Kentucky - witness Sailers
Note: Sacre, Candace Direct Examination. Cause certain testimony and responses be filed?

9:14:40 AM Atty Vaysman Duke Kentucky - witness Sailers
Note: Sacre, Candace Corrections or changes?

9:14:49 AM Atty Vaysman Duke Kentucky - witness Sailers
Note: Sacre, Candace Asked same questions, responses be same?

9:14:58 AM Chairman Chandler
Note: Sacre, Candace Questions?

9:15:19 AM Camera Lock Intervenor Activated

9:16:10 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Cross Examination. Clarify, employed by Duke Energy Kentucky or Duke Energy Business Services?

9:16:26 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Understanding is peak time rebate program up and running two years now?

9:16:40 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Going to call peak time rebate PTR for short?

9:16:48 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace As result, company has a lot of experience-based data, not just models, for program?

9:17:02 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace A lot of data generated by smart meter infrastructure?

9:17:22 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Call smart meter infrastructure AMI because not just meters but entire system?

9:17:29 AM Camera Lock PTZ Activated

9:17:39 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Duke Kentucky retained Resource Innovations to perform evaluation, measurement, and verification study?

9:17:44 AM Camera Lock Intervenor Activated

9:17:54 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Call study EM&V?

9:18:02 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Results of EM&V covered summer 2020 through summer of 2021?

9:18:26 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace EM&V attached as Appendix E to application?

9:18:35 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace EM&V showed customers liked PTR?

9:18:49 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Participating customers very likely to recommend to others?

9:19:00 AM Camera Lock Deactivated

9:19:05 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Have in front of you application?

9:19:13 AM Camera Lock Wireless Mic Cam Activated

9:19:18 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Turn to EM&V?

9:20:04 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Page 52?

9:20:23 AM Chairman Chandler
Note: Sacre, Candace Appendix E, in terms of echo? (Click on link for further comments.)

9:20:39 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace See Table 4-14?

9:20:47 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Confirm 200 out of 241 pilot participants recommend PTR to friend/family?

9:22:00 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Recollection right there in the table?

9:22:32 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Subject to check, accept is 83 percent?

9:22:49 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Unusually high rate program satisfaction?

9:23:10 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Aware other companies in Kentucky are in various stages of offering PTR program?

9:23:42 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Pilot period of program showed participants reduced usage during peak periods?

9:24:10 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Examination. What was that again?

9:24:42 AM Camera Lock Deactivated

9:24:45 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace EM&V found average demand reduction 0.14 kW per participant per summer critical peak event?

9:25:19 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Explain to Commission what critical peak events are?

9:25:20 AM Camera Lock Intervenor Activated

9:25:30 AM Camera Lock PTZ Activated

9:26:52 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Mentioned 0.14 kW, when read EM&V consists 6.1 percent of average consumer load?

9:26:52 AM Camera Lock Intervenor Activated

9:27:17 AM Camera Lock PTZ Activated

9:27:25 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Page 6 of EM&V?

9:27:45 AM Camera Lock Intervenor Activated

9:27:47 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Also true participants have WiFi-enabled thermostat have an even greater percent of reduction?

9:28:11 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace That is discussed more in Appendix F?

9:28:24 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace More participating customers yield more conservation and demand response?

9:28:37 AM Camera Lock PTZ Activated

9:29:25 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace True more customers participate yield more conservation and demand response?

9:30:07 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace True company ask participants provide cell phone numbers at time enroll and provide notice upcoming CPEs by text message?

9:30:30 AM Camera Lock Intervenor Activated

9:30:52 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Examination. Not much of answer, may just indicate not have definitive evidence it won't?

9:31:04 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Do this as profession, compared to status quo of program - emails, saying expert judgment conveying events by text message have any impact on savings?

9:31:20 AM Camera Lock Comm Center Activated

9:31:37 AM Camera Lock Comm Wide Activated

9:31:54 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Easier for me to get hold of you if I message your personal cell number or email your email address?

9:32:16 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Wouldn't that provide more timely notice?

9:32:31 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Take your time in industry, got your CV, not think that fact easier to inform by text message, not think also apply to participants these programs?

9:33:36 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Actual informing them result in additional savings?

9:33:48 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Distinct issues, notifying somebody and them taking efforts reduce usage two different items?

9:33:58 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Separate from that, Cook alluded to and you answered about programmable thermostats, technology?

9:34:08 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace What if timely notified them and they had to take no additional effort to reduce usage, fix that second half not having evidence?

9:34:38 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Aware of any programs where appliances sent messages by utilities to respond to utility-driven programs?

9:35:36 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Perception truth or not, Kentucky is last in adoption of things across the spectrum, people had these programs, Maryland peak time program around ten years, aware of program?

9:36:12 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace If need figure out what EM&V said, can just read EM&V report, reason are in your position and have experience is can speak to things outside the EM&V report, fair?

9:37:27 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Not what asking about, peak time rebate identified peak time event, indicate will send price signal however much can reduce, if reduce usage will provide compensation for system benefits provided reducing usage?

9:37:57 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Why care whether person touched thermostat, got on phone and turned thermostat down, or turned down before left home, why care whether or not reduction occurred by any of those activities if reduced usage?

9:38:32 AM Chairman Chandler - witness Sailers
Note: Sacre, Candace Do you care? Is utility indifferent as to how customer reduced usage?

9:39:04 AM Camera Lock Intervenor Activated

9:39:07 AM Asst Atty General Cook - witness Sailers
Note: Sacre, Candace Cross Examination (cont'd). EM&V report said Duke offers text message alerts but required pilot customers set up preference separately after enrollment?

9:40:01 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Could method company chose do after enrollment process have reduced number of participants that choose text messages?
9:40:52 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Could reduction in number of participants electing to receive text message alerts impacted demand reductions measured in PTR pilot?
9:41:10 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	True during pilot only 8.2 percent of participants took step of enrolling for text message notification of CPEs?
9:41:26 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	In response to data request, AG 1-11, subpart B?
9:42:40 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	While you have response to AG's First Data Request, turn to Item 4?
9:43:39 AM	Asst Atty General Cook Note: Sacre, Candace	Don't know, do you know, counsel?
9:44:03 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Open that, have that with you physically?
9:44:50 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	10-04 sponsored by Jean Williams.
9:45:57 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Read into record what question posed there?
9:47:03 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	At this point, your counsel asserted objection in question, explain why Duke did not compare PTR response to customers who received text alerts and customers who did not receive text alerts?
9:48:20 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Of the PTR participants who participated in survey requested by EM&V contractor, most common recommendation cited to improve program was notification method or timing?
9:50:05 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Going back to actual EM&V, go to page 66 and let me know when there?
9:50:41 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Read into record sentence begins "One lesson learned from this pilot," read that paragraph?
9:51:26 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Continue with rest of paragraph over on to next page?
9:52:05 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Continues "Duke staff identified one potential improvement," read that?
9:53:21 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Could company have designed program such so participants provide phone number at time of registration?
9:53:44 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	According to EM&V report, second most common recommendation survey found more useful if Duke made program information and energy saving tips more available?
9:54:41 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Think that company could provide information that would help participants prioritize most impactful loads could minimize during CPE?
9:55:26 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Since engaging in public education program, beneficial even if repeat in different locations, might serve create more impact?

9:56:14 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Duke AMI records customer energy usage by time of day and day of week?
9:56:27 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Records energy usage by time of day and by day of week?
9:56:46 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	AMI required for time-based rates like PTR?
9:57:24 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Agree that PTR program makes good use of AMI capabilities to record usage by time of day?
9:58:01 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Not one answering questions today, maybe some other time.
9:58:21 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Reason Duke not want to offer program that is popular and reduces energy usage during peak times?
9:59:06 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Can you tell us participation rate Duke Kentucky employed in conclusion PTR not cost effective?
10:00:11 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Again, to give context to answer, agree with me 1.5 percent set forth in response to AG's First Data Request, Item 21, and second set of data requests, Item 16?
10:00:55 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	PTR is a time-of-use rate, correct?
10:01:07 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Duke Kentucky is proposing another time-of-use rate in rate case?
10:01:21 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Describe high level basics of what critical peak pricing does?
10:03:26 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Customers enrolled in critical peak pricing pay higher rate than today during on-peak hours?
10:03:48 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Accurate/fair to say carrot and stick approach between PTR and critical peak pricing, since critical peak pricing is higher rate not be more stick approach as opposed to peak time rebate which seeks to reimburse people for peak/demand response behavior?
10:05:00 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Examination. Saying peak time rebate prices and timing were not researched?
10:05:42 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Sounds like critical peak pricing more focused on covering utility's cost of service whereas peak time rebate attempting avoid different values if avoided provide system benefit?
10:06:08 AM	Camera Lock Comm Wide Activated	
10:06:41 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Talking about programs conceptually, response to Cook asking about carrot and stick and conceptually about critical peak pricing and peak time rebate, sounds like critical peak pricing backwards looking in attempt cover cost of service, peak time rebate looking at avoided cost values and more forward looking avoid drive costs for customers?
10:07:45 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Both those things are true without your response, distinction between the two?

10:08:30 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Critical peak pricing not proposed as DSM program in rate case?
10:08:38 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Cost effectiveness not taken into account as much as proposal is insofar as revenue requirement shortfall that deferral accounting proposed?
10:08:59 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	No comparison cost to expenses or cost to operate critical peak pricing verse cost it avoids, proposal just says carve out cost of service study and insofar as not earn revenue requirement from program will make up through deferral accounting?
10:09:26 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Big distinction between two programs?
10:09:37 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	May be good reasons, looking at different sides of the ledger, critical peak pricing backwards looking, and peak time rebate conceptually way to avoid future costs for system?
10:10:22 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	As proposed, if you just look at critical peak pricing cover revenue requirement, where in determination continuing program does avoiding future costs for system come in?
10:11:08 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Not incentivizing them reduce usage, are making yourself indifferent to usage?
10:11:33 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	It's a trailing amount, cost of service amount, imbedded cost avoiding paying their fraction of, not avoiding future investments to serve system in same way calculating rate based off avoided costs be?
10:12:11 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Exclusively energy rate?
10:12:28 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Critical peak pricing have anything to do with distribution or production or transmission expenses?
10:13:00 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What price signal is that?
10:13:23 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Asking about correlation, how are real time LMPs correlated to imbedded distribution, transmission, and production expenses?
10:14:25 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What is the benefit of sending LMP price signal in relation to imbedded expenses?
10:14:59 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Not incurring any additional distribution, transmission, or production expenses fixed in short-term expenses as result of peaks, not reflecting in cost amount would be avoiding for costs, just recovering greater percentage of expenses in peak times?
10:15:42 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Keep saying price signal and service is more expensive, in real time transmission and fixed production expenses not vary on LMP?
10:16:47 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Supported an increased customer charge in a number of rate cases?
10:16:59 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Why is that?

10:17:10 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Under proposal that customer charge expenses formed a customer charge are fixed in nature?
10:17:28 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Don't vary based off usage?
10:17:46 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Insofar as a customer used more or less, argument was fixed expenses do not increase or decrease based on usage?
10:18:00 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	For expenses, forget customer charge, underlying expenses included in imbedded cost of service study?
10:18:13 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	For imbedded customer-related expenses, compare those to poles and transformers, vary between rate cases based off of customer usage or fixed in nature?
10:19:13 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	If use more electricity, ten percent in given month, cost to send bill not go up?
10:19:28 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Imbedded cost of transformers not go up?
10:19:39 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Imbedded cost of East Bend not go up?
10:19:55 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Not building another unit based off ten percent increase usage month to month, up ten down ten not driven any fixed expenses that be recovered?
10:20:42 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	If looking at critical peak pricing covering imbedded expenses, recovering amount of imbedded expenses recover through rate, only real comparison between two programs or similarity both applied during defined peak events?
10:21:52 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Is the only similarity between critical peak pricing and peak time rebate both apply rate during determined peak events?
10:22:23 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	The obvious, that they both apply to Duke Energy?
10:22:57 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Proposing rate case couple a time of use and CPP?
10:23:13 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Just CCP or time-of-use rate component as well?
10:23:31 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Just difference between CPP portion of that and PTR portion, comparison fact it applies to peak events, could also pair peak time rebate with time-of-use rate?
10:24:14 AM	Chairman Chandler Note: Sacre, Candace	Take 15-minute break, back at 10:40.
10:24:36 AM	Session Paused	
10:43:39 AM	Session Resumed	
10:43:47 AM	Chairman Chandler Note: Sacre, Candace	Back on the record in Case No. 2022-00251.
10:44:11 AM	Chairman Chandler Note: Sacre, Candace	Mr. Cook?

10:44:22 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Cross Examination (cont'd). Back to comparison PTR to CPP, might discourage customers signing up for PTR if confuse it with critical peak pricing rate?
10:45:11 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Has Duke set a participation target/goal for CPP rate?
10:45:27 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Accurate conclude customers pay higher rate under CPP than under PTR?
10:45:42 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Under PTR, participating customers rewarded for using less energy during peak times?
10:46:01 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Which think customers preferring more, the PTR carrot or CPP stick?
10:47:36 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Participation rate critical factor for PTR?
10:48:02 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Discussed how higher participation rate lead to more demand response?
10:48:15 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Reduction in demand during critical peak events another determinant of PTR success?
10:49:08 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Could you turn to EM&V beginning at page 73 and let me know when there?
10:49:41 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	See on page 73 Table 4-30?
10:49:58 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Continuing over to next page Table 4-31?
10:50:11 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Is it not true these tables provide list of 18 for-profit and nonprofit utilities other than Duke Kentucky offer PTR program with descriptions of program characteristics and marketing?
10:50:43 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Did Duke or EM&V consultant or you contact managers of any of PTR programs to obtain participation rates?
10:51:29 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Sounds like you yourself did or did not contact any of these people?
10:51:47 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	EM&V contractor spoke with a few of them?
10:51:56 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Go to page 77, table shows peak time demand reductions from various PTR programs?
10:52:34 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Given importance of PTR participation, explain why Duke or its consultant secured demand reductions from programs but not participation rates?
10:53:25 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Pull up rebuttal testimony and let me know when it's ready?
10:54:25 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Turn to page 8 and let me know when there?
10:55:02 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Line 18, read sentence that starts with "There is no basis?"

10:55:51 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Have with you Alvarez testimony, if not could read something to you?
10:56:47 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Turn to page 21, let me know when there?
10:57:14 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Line 16, read that passage up to where carries over to line 19?
10:58:04 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Examine study that Alvarez referenced?
10:58:15 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Rebuttal testimony does not address study though?
10:58:31 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Know where that occurred so would know?
10:59:09 AM	Asst Atty General Cook Note: Sacre, Candace	Should just say to Sailers and to Chairman, AG introduced that study on redirect with Alvarez.
10:59:23 AM	Chairman Chandler Note: Sacre, Candace	Exhibit in record? (Click on link for further comments.)
11:00:03 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Could ask in post-hearing data request, if take too much time?
11:01:02 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Point is in rebuttal did not discuss that particular study, you disagreed with Alvarez statement but did not cite anything in study, you said Alvarez did not cite any?
11:01:26 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Object, counsel is testifying. (Click on link for further comments.)
11:01:52 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	If I recall correctly, rebuttal criticized Alvarez for not citing any studies?
11:02:23 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Objection, witness was attempting to respond. (Click on link for further comments.)
11:03:39 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Examination. What do you say about Alvarez support on the issue?
11:04:10 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Cross Examination (cont'd). PTR program had research extension summer of last year?
11:04:22 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Was to study impact increasing kilowatt hour credit from 60 cents to \$1.20?
11:04:33 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Duke received new EM&V report pertaining to research extension segment?
11:04:59 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Examination. Clarify, study supposed to be received in August?
11:05:21 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Going to get it, supposed to already have received it, informed Commission about it in August?
11:06:08 AM	Asst Atty General Cook Note: Sacre, Candace	Wondering if be helpful company file it as a post-hearing document? (Click on link for further comments.)
11:07:00 AM	Asst Atty General Cook Note: Sacre, Candace	Will ask in post-hearing data request to be submitted when available.

11:07:12 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Will provide when EV&V report finally available.
11:07:13 AM	POST-HEARING DATA REQUEST Note: Sacre, Candace	CHAIRMAN CHANDLER - WITNESS SAILERS RESEARCH EXTENSION SEGMENT OF EM&V REPORT
11:07:26 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Cross Examination (cont'd). Any indications EM&V for research extension who any greater conservation by recipients receive \$1.20 incentive as opposed to 60-cent level?
11:08:38 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	If company make PTR available to any customers, open possibilities utilizing social media and other mass media marketing?
11:09:14 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Turn to EM&V report do know about, page 3 and let me know when there?
11:09:45 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Under heading overall findings, read first sentence?
11:10:10 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Page 4, turn there?
11:10:21 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Listed there are research questions, see question was marketing campaign successful?
11:10:36 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Read second sentence under column titled results?
11:10:55 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Sentence that starts "The lack of any perceived down sides?"
11:11:13 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Same page, second question, does company agree with these findings average amounts conserved by participants summer of 2020 1.52 kW hours per participant per CPE, summer of 2021 0.56 kW hours?
11:11:50 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Company agrees with those?
11:11:59 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Can you turn to page 6?
11:12:12 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Table 1-2?
11:12:16 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Read first bullet point?
11:12:44 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Turning to page 8, let me know when there?
11:12:56 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Second bullet point, read first sentence?
11:13:08 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Sentence reads "Most of the participants responded?"
11:13:36 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Is it not true company's main concern based on California test known as total resource cost test as DSM program PTR proven not be cost effective?
11:14:22 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Turn to response to Commission Staff First Data Request, and let me know when there?
11:14:52 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	In first item, let me know when there?

11:15:06 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Subpart A, see where company responded that no other Duke service area offers peak time rebate which restricts ability to allocate/reduce costs of program?
11:15:27 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Will any of Duke operating utilities other states adopting PTR program?
11:15:57 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Is it not true whether program continues, company will recover its costs whether through DSM surcharge or base rates?
11:16:14 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Calls for speculation. (Click on link for further comment.)
11:16:54 AM	Chairman Chandler Note: Sacre, Candace	Withdraw question? (Click on link for further comments.)
11:16:57 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Company's goal to recover costs for program, if DSM through surcharge or, if tariff program through base rates?
11:18:19 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	If company wanted to attain higher PTR participation rate, be logical allow current participants continue new program Alvarez recommended?
11:19:10 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Would allowing current participants participate in program reduce recruiting costs?
11:19:23 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Tend to mitigate dissatisfaction with the program?
11:19:53 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Would allowing them to continue being could recruit new participants since exhibited willingness recommend to other customers?
11:20:08 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Would allowing current participants continue in future program mean could recruit new participants?
11:21:18 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Earlier, opened company responses to Commission First Data Request, turn there?
11:21:40 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	While looking, part of response did contain confidential information, not asking anything confidential?
11:22:00 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	On last page of response, page 4, see company states agreeable do first phase of E Source proposal assuming Commission grants approval?
11:22:30 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Is company still agreeable?
11:23:05 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Would this be as new DSM program, new pilot program, or how characterized?
11:23:56 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Can you tell me whether Duke could email customers link to PTR description/registration page once or twice a year?
11:24:31 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	If Commission orders expansion full program, Duke commit to this type promotion?

11:24:41 AM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Objection. (Click on link for further comments.)
11:26:06 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	Would Duke commit to this type of promotion, emailing program description and registration page once or twice a year, assuming Commission orders expansion to full program?
11:27:11 AM	Asst Atty General Cook - witness Sailers Note: Sacre, Candace	In line with qualification, several questions, all based on assumption that Commission order expansion to full program?
11:27:28 AM	Chairman Chandler Note: Sacre, Candace	Going to stop you there. (Click on link for further comments.)
11:28:12 AM	Chairman Chandler Note: Sacre, Candace	Ms. Frederick?
11:28:39 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	Cross Examination. Historically, could Duke Kentucky have met fixed resource requirements without DSM programs?
11:29:47 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	Weather forecast notwithstanding, day-ahead market alert Duke Kentucky of pending peak event day before?
11:30:32 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	Be in Duke Kentucky discretion to label that day as a peak time event for PTR program?
11:30:58 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	If day-ahead market indicates what consider peak time event occur next day, be in Duke Kentucky discretion label day or portion of day as peak time event?
11:31:33 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	The application and this proceeding indicates times when Duke Kentucky notify customers with one-hour notice of peak event, explain scenario when occur?
11:32:47 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	Text messaging, what would cost for Duke Kentucky to send mass text messages to everyone enrolled in program?
11:33:13 AM	Asst Gen Counsel Frederick PSC - witness Sailers Note: Sacre, Candace	Calculated cost to send mass text messages footprint wide?
11:33:25 AM	Chairman Chandler Note: Sacre, Candace	Commissioner?
11:33:28 AM	Commissioner Regan - witness Sailers Note: Sacre, Candace	Examination. Reason why Duke not using text message?
11:34:30 AM	Commissioner Regan - witness Sailers Note: Sacre, Candace	Why take position be option and not requirement when enrolling?
11:35:00 AM	Commissioner Regan - witness Sailers Note: Sacre, Candace	If trying to increase participants, would not Duke try to notify more people?
11:35:31 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Examination. But will never know now?
11:35:38 AM	Chairman Chandler - witness Sailers Note: Sacre, Candace	Counterfactual there, impossible comparison to make, that ship has already sailed?
11:37:00 AM	Vice Chairman Hatton - witness Sailers Note: Sacre, Candace	Examination. Practical effect if Commission grant what asking, terminate a program supposed to be two years from July 2020 to July 2022, program was popular, reduced usage peak time, but not cost effective because of participation rate?

11:38:36 AM	Vice Chairman Hatton - witness Sailors Note: Sacre, Candace	Main objection was 20 percent participation rate was not possible, 20 percent would have made it cost effective, am I mischaracterizing reason finding it not cost effective is, is not participation level?
11:40:12 AM	Vice Chairman Hatton - witness Sailors Note: Sacre, Candace	If study ineffective, not cost effective, we knew that when we started, wondering if we determined not cost effective and did terminate, what is practical effect, just trash it?
11:41:44 AM	Vice Chairman Hatton - witness Sailors Note: Sacre, Candace	Practical effect is program is just over unless we order you to make changes and start over again?
11:42:21 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Examination. Taking a step back, you oversee or involved in a number of DSM programs?
11:42:58 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Conduct EM&V at end of program or defined interval of a program?
11:43:19 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Aware of programs defined length of program and EM&V conducted during program?
11:43:47 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Are you aware of programs where EM&V was conducted in middle of program?
11:44:21 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	In other peak time rebate or demand response programs, did EM&V after each single season?
11:44:41 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Just asking what your experience has been?
11:45:11 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	When doing, did annual EM&V review, cost of doing annually play into cost effectiveness of program?
11:45:43 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	In the DR programs, know whether annual review of effectiveness included in cost effectiveness tests?
11:46:07 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	One thing not get from EM&V study, and ask, In your experience in EM&V, gave scores between one to tens, remember that, asked people rate things one to ten?
11:46:29 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	One through six detractor from program, seven to eight considered passives, only nine to ten considered promoters?
11:46:52 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	In your experience with EM&V, interesting to you sixty percent of responses deemed to be detractors and person has to answer between nine or ten for score to be a promoter?
11:47:42 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Find interesting have to be in 90th percentile of respondents for satisfaction to be deemed happy with program, odd to you?
11:48:17 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	An eight is somewhere between passive and promoter, have seen responses for type of programs as high as this program?
11:48:47 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	One of items, going back, given your CV got a fair amount of experience with how utilities work?

11:49:17 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	One of the items when people indicate why not respond, response is feel like did everything they could, generally aware of that perception?
11:50:22 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Most common reasons participants giving not reducing usage, based on experience, do you think necessarily true, think their perception is reality?
11:51:36 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Is not how participants responding imperative to having appreciation for whether effective?
11:52:06 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What is largest use of electricity average Duke Kentucky residence during peak time events?
11:52:59 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	HVAC pretty high, electric stove, electric oven pull quite a bit of demand?
11:53:18 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Even worse than HVAC, strip heating, resistance heating worse than heat pump?
11:53:35 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Hot water heater takes a bit of demand when operating?
11:53:45 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	How about lights, agree with turning off lights has a negligible demand?
11:55:02 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	If a person has LEDs across their home, comparison with not having HVAC going and having all lights on verse having HVAC going and HVAC and all lights off, agree demand just lights compared to running HVAC lights off is miniscule?
11:56:04 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Feel it interesting knowing turning off lights has negligible demand find interesting most common action participants taking during winter events?
11:56:36 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Based on my experience, turning off lights agree not actually helping?
11:57:18 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Aware most utilities gotten rid of free light bulb programs related to DSM?
11:57:30 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Almost exclusively whatever savings were eroded because deep penetration with LED?
11:57:46 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Agree not seem customers participated not have appreciation how little lights use compared to increase significant demand other appliances use?
11:58:05 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	That's fine, if that's not your takeaway from EM&V, that's a fine answer.
11:58:41 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	A big part of this program or, at least, indicates these questions be answered by this, is informing customers what able to do in response to price signal?

11:59:00 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Were those provided to participants in notifications?
11:59:40 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Sign up for program, web site program click through has savings tips?
11:59:56 AM	Chairman Chandler - witness Sailors Note: Sacre, Candace	When sign up for program, give all information necessary participate, after signed up, if want to notify by message, have click through different area and in separately provide phone number in order received updates by text?
12:01:32 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Nothing described was inaccurate as you understand peak time rebate program?
12:01:40 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	DSM background, if Duke runs into conservation situation where Duke needs to voltage reductions on circuits or opening circuits for short time reduce demand, aware Duke has backstop plan to ask customers voluntarily reduce usage?
12:02:34 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Given experience in demand response, get greater load reduction told people reduce demand or told reduce demand and simultaneously told them best ways?
12:03:54 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Agree telling people exact same time informing people exact same time asking reduce demand how best reduce demand will reduce more demand than if just ask reduce demand?
12:04:29 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Think demand reduction requests work better when asking people do it verse saying if reduce usage right now will pay you, which one result in greater reduction?
12:05:24 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What are rate savings from a CPP program projected be?
12:05:35 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Using your quote, discussing cost effectiveness of peak time rebate program based off savings compared to cost?
12:05:57 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What are benefits of proposed CPP?
12:07:04 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	With CCP, savings from conservation signal?
12:07:15 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What saving, any shortfall from CPP, shortfall of revenue requirement, supposed to be deferred subsequent proposal for recovery?
12:07:30 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	System not saving those monies as much as taking from one pocket and putting in the other, for conservation only save costs that are avoidable?
12:08:26 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	The sum of it seeking whatever revenue requirement shortfall through implementation be deferred for subsequent proposal for recovery?
12:09:06 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Savings as result of CPP not actual savings, costs not recovered from rates current time period but proposed be recovered subsequent period, cannot avoid revenue requirement amount?

12:10:25 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Something asked earlier with Cook, free ridership, why care what did to reduce that demand, gave price signal, customer used less, that's great, right?
12:12:51 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Saying that free ridership is anybody reduces demand who not reduce demand based on single notification?
12:13:21 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Only looking at reduction in short term, time receiving notification and end of critical period whether free rider or not, how make sense?
12:15:42 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Clarify, what are talking about time of use not CCP?
12:15:53 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	I said CPP, think focused on specific proposal of time of use CPP as opposed just CPP portion of proposal.
12:16:07 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Why followed up with not agree that PTR also be coupled with time of use, trying to compare so have better appreciation for issue, is RTS-dash-time of use-dash-CPP, take out RTS-time of use part, just asking about critical peak pricing program and peak time rebate program conceptually?
12:19:00 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Goes back to experience with utility-operated demand response programs, what could be easier customer save money than be paid annual amount, (click on link for further comments), not agree more steps customer take to save for DSM program less likely will save?
12:23:18 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	If now have appreciation what worked well and what not work well, done pilot, know what was good and what bad, perspective now instead of fixing, try to get rid of it?
12:24:46 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Distinction between continuing cost ineffective programs and doing experimental/pilot programs determine subsequent cost?
12:25:13 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	What cost effective on CCP program?
12:25:47 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	How would you perform cost effectiveness test for CCP?
12:26:12 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Is that your intention?
12:26:42 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Just so we have as part of case explain, trying to use your words, explained other cases difference between pilot program and experimental rate, discuss similarities, distinction between two?
12:28:51 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Experimental rate open ended and not based on whether cost effective?
12:29:10 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Any shortcomings from rate recovered cost of service from remaining rates so utility whole?
12:29:36 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	In event rate not meet system cost of service return, not something proposing to eat, just caught up in other rate classes, said revenue neutral so has to come from somewhere?

12:30:22 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Be same dollars recovered whether comes from that class or not, would be expectation?
12:31:00 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	How, if primary amount of costs are savings and avoidance of costs of that time of use rate fixed in nature, what degree would avoiding those paying reduce fixed costs in embedded class COS study?
12:32:01 PM	Chairman Chandler Note: Sacre, Candace	Procedural discussion. (Click on link for further comments.)
12:33:05 PM	Chairman Chandler Note: Sacre, Candace	Question?
12:33:14 PM	Commissioner Regan - witness Sailors Note: Sacre, Candace	Examination. If program terminated, what are proposing to replace it with?
12:34:44 PM	Vice Chairman Hatton - witness Sailors Note: Sacre, Candace	Examination. Customers asked did everything could, determination terminate this pilot program, almost seems it was a failure from start, do you think Duke did best to make this program work?
12:36:15 PM	Vice Chairman Hatton - witness Sailors Note: Sacre, Candace	Did you make best effort?
12:36:34 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Examination. Last meters installed and placed into service in Feb 2019, AMI meters?
12:36:55 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Subject to check, post-hearing data request confirm pursuant to Duke previous filings with Commission, rollout ended 2019, 83,000 customers enrolled in customer usage alert program, company began AMI deployment in Aug 2017 and completed Feb 27 2019, agree newest meter now more than four years old?
12:39:19 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Newest meter four years old, oldest put in would be five and a half years old, separately in that case, based on current industry trend, appreciable life is 15 years, sound right?
12:40:01 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Mean already third of way through having AMI meters, between quarter and third of way having them?
12:40:31 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Saying have a depreciable life, expected in service, if 15 years, newest one is four years one month, oldest ones five and a half years old, agree meter system between third and quarter through its life?
12:41:15 PM	Chairman Chandler - witness Sailors Note: Sacre, Candace	Four years and a month, between that and five and a half years, agree between third and fourth of 15?
12:41:52 PM	Chairman Chandler Note: Sacre, Candace	Counsel? (Click on link for further discussion.)
12:42:10 PM	Chairman Chandler Note: Sacre, Candace	Break until 1:15 and come back and do redirect.
12:42:47 PM	Session Paused	
1:18:58 PM	Session Resumed	
1:19:08 PM	Chairman Chandler Note: Sacre, Candace	Back on the record in Case No. 2022-00251.
1:19:43 PM	Chairman Chandler Note: Sacre, Candace	Questions?

1:20:08 PM	Chairman Chandler Note: Sacre, Candace	Next witness?
1:20:11 PM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Timothy Duff.
1:20:27 PM	Chairman Chandler Note: Sacre, Candace	Witness is sworn.
1:20:32 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Examination. Name and address?
1:20:55 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Direct Examination. Title?
1:21:05 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Cause certain response to be filed?
1:21:14 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Adopting additional responses?
1:21:26 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Corrections or changes?
1:21:33 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Asked same questions, responses be same?
1:21:43 PM	Chairman Chandler Note: Sacre, Candace	Questions?
1:21:52 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Examination. What falls under your purview as general manager of portfolio analysis and regulatory strategy?
1:22:07 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Been in hearing room this morning?
1:22:10 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Heard my questions to Sailors?
1:22:16 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Anything said or asked question take issue with, disagree with making it easier, the more steps require consumer take the less likely able end up reducing usage?
1:22:20 PM	Video Conference Deactivated	
1:23:16 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Default inclusion verse opt in/opt out, studies indicate far more participate when have to take affirmative steps to leave the program than if have to take steps to join?
1:24:16 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Only makes sense, already engaged and interested party, same people who participate more heavily?
1:24:48 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Specifically this program, efforts taken to maximize output?
1:26:07 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Only 8.2 percent actually enrolled in text but third said preferred methodology been text?
1:26:18 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Not what you said but what EM&V said?
1:26:37 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Have got here notifications on page 7 one-third respondents who provided recommendations requested text message alerts and more time prepare for events?
1:27:03 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	It does, but was not number respondents in EM&V determined statistically significant representative of entire group of participants?
1:27:19 PM	Chairman Chandler Note: Sacre, Candace	By extrapolating across program?

1:27:30 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Not appreciate benefit of EM&V if not representative of program as a whole?
1:28:11 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Ask post-hearing data request, nearly third of participants were covered by the EM&V, means of total participants EM&V responses statistically significant?
1:28:12 PM	POST-HEARING DATA REQUEST Note: Sacre, Candace Note: Sacre, Candace	CHAIRMAN CHANDLER - WITNESS DUFF EM&V REPORT THIRD OF PARTICIPANTS COVERED AND MEANS TOTAL PARTICIPANTS' RESPONSES STATISTICALLY SIGNIFICANT
1:28:52 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Participant number 899 chosen because enough people statistically significant review of what be for customers Duke has, asking whether 200+ responses to survey able take survey data as statistically significant in terms of entire 899 participants?
1:29:37 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Weight of evidence how helpful EM&V in terms of survey?
1:30:43 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Know what numbers were in terms of cost effectiveness of program?
1:30:51 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Then ask yourself what could have done make it more cost effective, what do in terms of these programs?
1:31:05 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Determined not to implement those determinations to enhance program design?
1:31:27 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Not the question, question was have chosen not to actually enhance it, proposal get rid of it in lieu of enhancement?
1:32:16 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	That's a fine reason, does it make my question yes or no, question was determination not enhance program based off feedback and instead proposed to end program?
1:32:39 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Reason was other answer?
1:32:43 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Frustrating, when ask very direct question, nobody wants to say yes or no, chose not enhance it because determined enhancements not make cost effective?
1:33:22 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Systemically or as a program, if required text messaging, easier to get hold of to cell phone than email, appreciation in terms of cost effectiveness upfront costs one time, what is it that is systemic makes you think not be enhancements make it cost effective?
1:35:52 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	What were different methodologies could receive notifications?
1:36:01 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Default one email, 8.2 percent took extra step do text messaging, nothing to compare to, received notification by preferred methodology, if default and only methodology aware of, how answer in the alternative?
1:36:53 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Question asked two-plus years after initial enrollment?
1:36:59 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	What mean, not necessarily?

1:37:02 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Opportunity to sign up for text messages stopped at three months?
1:37:21 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	For some folks six months later, some folks a year later, maybe two years?
1:37:28 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Know whether question noted other methodologies and said was yours preferred one?
1:37:36 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Some love email single response but maybe like allegory of cave, don't know the whole world exists, live in cave, not know what's better or worse, what's the alternative?
1:38:18 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	First was size of benefit verse participation, anything else that is shortfall of program that contributed to perspective not be enhanced and gotten rid of?
1:40:47 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Got smart meters in, third depreciated, how maximize investment for consumers, cost of service based rate not necessarily look at calculus?
1:41:17 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Cost of service based rate not looking at cost effectiveness in sense of benefits outweighing costs?
1:41:35 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	In many of jurisdictions, is utility vertically integrated and own production?
1:41:47 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Do or don't?
1:41:49 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Who are two that own own generation?
1:42:00 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	In Carolinas?
1:42:03 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Think part of record, anyone else?
1:42:06 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Like LG&E/KU situation, is two?
1:42:10 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	DEC/DEP is what you're saying?
1:42:18 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	DEP and DEC had them, or only one of utilities?
1:42:25 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Both utilities but only in North Carolina?
1:42:28 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Have them in South Carolina?
1:42:33 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Heard maybe dozen or ten utilities have this program or significant number tried?
1:42:47 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	A number in California, different but not own own generation?
1:43:05 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	BG&E in PJM but restructured in Maryland?
1:43:13 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Applicant owns own generation?
1:43:20 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Different from being a restructured utility?

1:43:26 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Have input on DSM portion of Duke Kentucky FRR plan?
1:43:34 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Who on DSM side provides inputs when Duke coming up with fixed resource requirement plan for PJM?
1:43:52 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Who in charge of DSM programs for DEK?
1:44:08 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Got a DSM problem, who go to?
1:44:15 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Below Huber?
1:44:22 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Coming up with programs be your side or operational side?
1:44:40 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Why I ask, understand FRR plan Duke come up with for PJM, capacity self-supply program, PJM tells here's what determined be fixed resource requirement, what come up with in terms of capacity ahead of delivery, tell them how meet that plan?
1:45:18 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	At highest level, part can be generation, part can be transmissionish with constraints, and part can be demand response and energy efficiency?
1:45:41 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Couple years ago, Commission looking at and you referencing earlier concerned about cost effectiveness of different programs, Duke said hold on, please stop, depend on number of programs to meet FRR plan?
1:45:58 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Big deal, emergency motion, a lot of please have to keep these, like power manager these demand response programs?
1:46:12 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Without programs, your understanding Duke could not meet FRR plan solely with supply side resources?
1:46:31 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Going forward, we need flexibility, who is person instigating ideas, who come to at Duke in NC to reduce demand side because not make up plan on supply side?
1:47:53 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Who driving that process?
1:48:11 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Duke has its rate base, smart meters, maximize benefit for benefit of customers, who drives that ship?
1:48:50 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	What is disconnect in interests that driving operational benefits is different than driving consumer benefits?
1:49:26 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	If benefit of programs avoiding truck rolls and new investment, new investment in production and in transmission, agree an appreciation what costs are and which costs be avoided, sounds like things siloed, saying not?
1:50:13 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Who sits there and says X million dollar investment Kentucky, go drive programs that benefit consumers, align interest of utility and consumers to reduce overall rates, who sitting in room and saying that?

1:51:01 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Spell last name?
1:51:31 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Utility in different place today than 2016, DEOK zone broken out twice in base residual auctions, capacity price signal triple and DEO case more than triple than in rest of PJM RTO, avoided capacity values direct input determination of cost effectiveness DSM and EE and DR programs?
1:53:12 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Know whether changes in circumstance drive changes in cost effectiveness of program, things changed since EMV done?
1:53:43 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Proposal amend useful depreciable life of East Bend and Woodsdale CTs other jurisdictions use that maybe not have capacity markets, expected retirement/upgrade also fine proxy for avoided capacity values?
1:54:20 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Movement of retirement dates of generation retirement of generation requires reinvestment can often useful in determining avoided capacity values?
1:54:37 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	If need build generator next couple years because have to retire another one, avoiding having to build new generator could be good proxy for avoided capacity values?
1:55:02 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Last update 2016 avoided capacity values been slowly indexed, escalation rate, 2016 values, know whether DEK calculated new capacity value other than escalating 2016 amount?
1:55:54 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Integral determination of cost effectiveness?
1:56:06 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	For avoided energy for utilities part of RTOs, like previous year's average LMP?
1:56:17 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	For programs like this, run through DSM, CPP or peak time rebate, be given consideration LMP highest points used as avoided energy value rather than average base amount?
1:57:04 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Maybe not even LMP but last year's ten highest day-ahead prices?
1:57:29 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Instead of using different avoided energy for all DSM program, could it be reasonable to use different avoided energy values for different DSM/EE programs that interact differently, useful to use specific avoided energy values to that program?
1:58:29 PM	Chairman Chandler - witness Duff Note: Sacre, Candace	Should already be taken into account where effective on load, assumed load level?
1:58:38 PM	Chairman Chandler Note: Sacre, Candace	Redirect?
1:58:43 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Redirect Examination. Sample size, have copy of application?
1:58:57 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Appendix E, the EM&V, very good, if could turn to page 53?
1:59:12 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	See Table 4-15 a top of that page?

1:59:20 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	See paragraph of text under table?
1:59:25 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Read second sentence in paragraph?
1:59:40 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Skipping next sentence, read sentence that begins with "A third?"
1:59:58 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Proportion of one-third, see that in Table 4-16?
2:00:08 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Which row is that?
2:00:24 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	See at top of table sample size given?
2:00:29 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	What is that sample size in?
2:00:43 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	What is full sample of survey participants?
2:00:55 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Fifty-three?
2:01:11 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Turn to page 38 of Appendix E?
2:01:29 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	At bottom of page 38, how participants in program rate preference for email communication?
2:01:55 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Figure 4-1 at top of page?
2:02:01 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Tell me what rating participants gave to email communication?
2:02:12 PM	Asst Atty General Cook Note: Sacre, Candace	Going to object. (Click on link for further comments.)
2:02:40 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	What rating did participants give to text messages?
2:02:54 PM	Atty Vaysman Duke Kentucky - witness Duff Note: Sacre, Candace	Is 6.8 considered to be in EM&V industry a superb rating of satisfaction, a 6.8 out of ten?
2:03:29 PM	Chairman Chandler Note: Sacre, Candace	Anything else?
2:03:38 PM	Chairman Chandler Note: Sacre, Candace	Next witness?
2:03:44 PM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	John Swez.
2:05:31 PM	Chairman Chandler Note: Sacre, Candace	Witness is sworn.
2:05:40 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Examination. Name and address?
2:05:54 PM	Atty Vaysman Duke Kentucky - witness Swez Note: Sacre, Candace	Direct Examination. Title?
2:06:02 PM	Atty Vaysman Duke Kentucky - witness Swez Note: Sacre, Candace	Cause certain responses to be filed?
2:06:09 PM	Atty Vaysman Duke Kentucky - witness Swez Note: Sacre, Candace	Corrections or changes?
2:06:13 PM	Atty Vaysman Duke Kentucky - witness Swez Note: Sacre, Candace	Asked same questions, responses be the same?
2:06:22 PM	Chairman Chandler Note: Sacre, Candace	Questions?

2:06:29 PM	Asst Atty General Cook - witness Swez Note: Sacre, Candace	Cross Examination. When peak time rebate program produced conservation and/or demand response savings, this resulted in off-system sale into PJM?
2:07:17 PM	Asst Atty General Cook - witness Swez Note: Sacre, Candace	And that's a savings, not pay as much to PJM?
2:07:29 PM	Asst Atty General Cook - witness Swez Note: Sacre, Candace	Something would just reflect in the FAC?
2:07:51 PM	Chairman Chandler Note: Sacre, Candace	Staff?
2:07:52 PM	Asst General Counsel Frederick PSC - witness Swez Note: Sacre, Candace	Cross Examination. Present in hearing room hear Chairman exchange with Duff regarding fixed source requirement?
2:08:08 PM	Asst General Counsel Frederick - witness Swez Note: Sacre, Candace	Confirm historically Duke not met FRR without DSM programs?
2:09:09 PM	Chairman Chandler Note: Sacre, Candace	Questions?
2:09:12 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Examination. How much did that cost?
2:09:25 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Either get bilateral subject to transmission constraints risk of breaking out or barely short can buy from BRA?
2:09:56 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Mismatch in demand and supply for capacity in DEOK zone?
2:10:28 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Supposed to be price signal for market to respond to minimum?
2:10:53 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Or transmission?
2:10:56 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Either more supply, less demand, or greater transmission capacity given times for transfers?
2:11:12 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Got those three options, Duke Kentucky fairly indifferent to situation unless issue of being short for FRR plan and having transmission concerns not get capacity outside?
2:11:49 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Not price signal for you, separate retail service obligation, not a merchant generator, capacity situation not looking to cash in increases in capacity values?
2:12:49 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Compare other zones in Kentucky, AEP zone and EKPC zone, little more condensed?
2:13:02 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Transferable making harder to build new generation/new supply, less land?
2:13:21 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Land you have a little hillier than rest of Kentucky, not a flat area to serve?
2:13:37 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Had to take additional efforts meet FRR plan past few years, market signals issue with supply and demand or transmission concerns or combination, DR/DSM programs/energy efficiency should be solution or part of solution?
2:14:22 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Big part of it?

2:14:30 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	On that, if program reduces aggregate demand, could be a benefit in meeting FRR plan?
2:14:57 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Way around the rules, also reduce aggregate demand?
2:15:30 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Insofar as determination of demand based off summer CPs, if producing behind PJM meter generation, looks like overall wholesale demand lower?
2:16:01 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Now got situation with PJM, critical issues fast pass, looking at increased loss of load expectations/probabilities in winter months?
2:16:28 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Should be looking at summer and winter peaks, greater benefit than status quo demand side management program that provide savings during peaks winter and summer months?
2:16:56 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Heard questions to Duff, DEOK zone breaking out, changes in depreciation rates current generation, aware of Duke system-wide goal coal retired by 2035?
2:17:29 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Agree Duke Kentucky owns coal plant?
2:17:35 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Less than 15 years from now?
2:17:43 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Aware use of 2016 avoided capacity values increased every year by some factor?
2:17:52 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Think is reasonable, think what knew about Duke Kentucky in 2016 and what know now, think 2016 figures still reasonable to use even if increased by defined factor?
2:19:14 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Have recommendation bringing Scott Parks group in or IRP folks and using what expert expectation IRP is using to drive avoided capacity values or avoiding energy values, perception on reasonableness of that?
2:19:53 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Duke not planning system to meet PJM requirements, doing IRPs looking at meeting retail demand, should that be driving investment and operations decisions or should market?
2:20:43 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Curious if have concern or perspective on that?
2:21:15 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	As general matter, East End and Woodsdale, increase or
2:22:04 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Offer a day ahead of those?
2:22:08 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Accepted or not?
2:23:07 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Run those kind of factuials to make sure what doing cost beneficial?
2:23:33 PM	Chairman Chandler - witness Swez Note: Sacre, Candace	Concern is keep looking forward plowing in wrong direction never know if wrong in past?
2:24:03 PM	Chairman Chandler Note: Sacre, Candace	Discussion of process. (Click on link for further comments.)

2:26:17 PM	Chairman Chandler Note: Sacre, Candace	Recess until 2:35.
2:26:32 PM	Session Paused	
2:45:26 PM	Session Resumed	
2:45:36 PM	Chairman Chandler Note: Sacre, Candace	Mr. Cook, call your witness.
2:45:45 PM	Asst Atty General Cook Note: Sacre, Candace	Paul Alvarez.
2:46:01 PM	Chairman Chandler Note: Sacre, Candace	Witness is sworn.
2:46:07 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Examination. Name and address?
2:46:28 PM	Asst Atty General Cook - witness Alvarez Note: Sacre, Candace	Direct Examination. Same Paul Alvarez that filed testimony?
2:46:34 PM	Asst Atty General Cook - witness Alvarez Note: Sacre, Candace	Changes or corrections?
2:46:46 PM	Asst Atty General Cook - witness Alvarez Note: Sacre, Candace	If asked same questions, answers be same?
2:46:48 PM	Asst Atty General Cook - witness Alvarez Note: Sacre, Candace	Explain materials have with you on stand?
2:47:10 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	Counsel?
2:47:12 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	Cross Examination. Recommend Commission order Duke Kentucky implement full PTR program by Jun 1 2023?
2:47:27 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	By full PTR program, referring to opt-in peak time rebate program would be available to all customers without numerical cap on enrollment?
2:47:46 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	Project 26,616 participants opt in to program first year of operation?
2:48:34 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	Standing by 26,616?
2:48:50 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	This number 26,616 based on belief 20 percent eligible customers opt in to program first year?
2:48:53 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	Aware any other electric utility in Kentucky offering PTR program?
2:49:24 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	No cost effectiveness data available from any full PTR program in Kentucky?
2:49:38 PM	Atty Vaysman Duke Kentucky - witness Alvarez Note: Sacre, Candace	No participation rate data from PTR program in Kentucky?
2:49:47 PM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Mark as DE Exhibit 1 and have entered copy of article Alvarez cites.
2:50:32 PM	Chairman Chandler Note: Sacre, Candace	For record, identify document?
2:50:39 PM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Titled Residential Customer Enrollment in Time-Based Rate and Enabling Technology Programs: Smart Grid Investment Grand Consumer Behavior Study Analysis, Alvarez cited page 21, footnote 28.
2:51:07 PM	Chairman Chandler Note: Sacre, Candace	Will mark for identification. (Click on link for further comments.)

2:51:08 PM DEK EXHIBIT 1 MARKED FOR IDENTIFICATION
Note: Sacre, Candace ATTY VAYSMAN DUKE KENTUCKY - WITNESS ALVAREZ
Note: Sacre, Candace RESIDENTIAL CUSTOMER ENROLLMENT IN TIME-BASED RATE AND
ENABLING TECHNOLOGY PROGRAMS: SMART GRID INVESTMENT
GRANT CONSUMER BEHAVIOR STUDY ANALYSIS MAY 2013

2:51:24 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Recognize article marked Duke Energy Kentucky Exhibit 1?

2:51:55 PM Chairman Chandler - witness Alvarez
Note: Sacre, Candace Examination. Just want to be clear, this is the document cite in
testimony or not?

2:52:05 PM Asst Atty General Cook
Note: Sacre, Candace If I may, the one Duke to introduce is dated May 2013, and the one
I believe Alvarez cites is June 2013, so not sure what difference is.
(Click on link for further comments.)

2:59:19 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Cross Examination (cont'd). What marked as Duke Energy Kentucky
Exhibit 1 look familiar and similar to article on which relied?

2:59:37 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Appears be very late draft or identical version of same article?

2:59:55 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Assumption 20 percent participation full PTR program based on June
edition?

3:00:12 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Based 20 percent assumption on participation rates achieved in
three PTR programs of programs reviewed in this article?

3:00:26 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Those three have participation rates of ten percent, 19 percent, and
28 percent?

3:00:41 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace All three programs included technology offer?

3:00:47 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Program with 28 percent participation rate was described as "flat
with CPR or flat with CPP, IHD?"

3:01:14 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace CPP in review abbreviation for critical peak pricing?

3:01:23 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Flat with CPP in review shorthand critical peak pricing overlaid onto
flat retail rate?

3:01:38 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Some participants recruited for flat with CPP option?

3:01:51 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Did not participate in flat with CPR option?

3:01:59 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Know what amount?

3:02:06 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Because did not review individual studies of each program?

3:02:26 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Review individual reports on programs collected and reviewed here?

3:02:41 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Know whether any of three programs implemented in Kentucky?

3:02:50 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Review reports or underlying data for any of three programs?

3:03:06 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Have copy of application in Appendix E?

3:03:14 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Contend, if more participants enrolled in text message notification, increased impact per event?

3:03:30 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace In support of this assertion, you claim "one in three survey respondents" noted notification method or timing as a recommendation?

3:03:55 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Page 13, line 19?

3:04:16 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Turn to page 53, Appendix E, see table 4-16, summary of peak time credit program recommendations?

3:04:51 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Statement that one in three survey respondents noted notification method or timing, was that based on first data row in that table, notification method or timing and 33 percent?

3:05:13 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace What is sample size of that table?

3:05:27 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace See in paragraph, above table, read second sentence?

3:05:59 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace So 63 out of 253 customers provided a written free response recommendation?

3:06:11 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Out of those 63 customers, 33 percent mentioned notification method?

3:06:19 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace And 33 percent of 63 is 21 individuals?

3:06:27 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Total number of customers who responded that 63 was out of 253 total responses?

3:06:56 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace From your one in three survey respondents wording in testimony, a person not reading carefully conclude meant one-third of 253 respondents?

3:07:12 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Feel that would be a correct conclusion?

3:07:38 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Asked if person reading phrasing, claim one in three survey respondents noted notification of method or timing, consider that to mean one-third of all survey respondents?

3:08:01 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Sentence in same paragraph, sentence that starts "A third of the respondents," read that?

3:08:22 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Was qualifier of who provided recommendation in testimony?

3:08:30 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Agree only 21 people mentioned notification method or timing as recommendation?

3:08:44 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Less than 10 percent of survey respondents?

3:08:56 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Less than ten percent?

3:09:05 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Also contend, with full PTR program additional event notification channels offer "potential for greater impact?"

3:09:22 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Is this increase in impact per CPE per event quantified in projection?

3:09:32 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Dispute conclusion of EM&V report that the results from pilot program were in line with other programs?

3:09:54 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Back to Appendix E, page 8, second bullet under event response, reading (click on link for further comments, correct?)

3:11:06 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Read first sentence under bullet?

3:11:29 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Taking action to reduce load during event indicates awareness of event?

3:12:09 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace 75 percent report doing so for winter event?

3:12:16 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace 81 percent in summer events?

3:12:25 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace For those events, each statistic is four?

3:13:10 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Appendix B to testimony, have that in front of you?

3:13:17 PM Atty Vaysman Duke Kentucky
Note: Sacre, Candace Contains confidential, can ask about data without numbers. (Click on link for further comments.)

3:14:23 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Appendix B prepared by you?

3:14:30 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Reflects five-year cost benefit projection full PTR program you recommend?

3:14:39 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Claim projections Appendix B based on actual data from pilot program?

3:14:52 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Identify which rows not based on actual data?

3:16:10 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Also agree value of energy conservation was your estimate and not based on data?

3:16:22 PM Atty Vaysman Duke Kentucky - witness Alvarez
Note: Sacre, Candace Pretty important in terms of weight?

3:16:28 PM Atty Vaysman Duke Kentucky
Note: Sacre, Candace At this time, switch to confidential record.

3:16:42 PM Private Mode Activated

3:16:42 PM Private Recording Activated

3:24:25 PM Atty Vaysman Duke Kentucky
Note: Sacre, Candace Do not have further questions for Alvarez.

3:24:28 PM Chairman Chandler
Note: Sacre, Candace Ms. Frederick? (Click on link for further comments.)

3:24:35 PM Chairman Chandler
Note: Sacre, Candace Go on to public record.

3:24:45 PM Normal Mode Activated

3:24:45 PM Public Recording Activated

3:24:46 PM	Chairman Chandler Note: Sacre, Candace	Done with cross? (Click on link for further comments.)
3:24:49 PM	Chairman Chandler Note: Sacre, Candace	Ms. Frederick?
3:24:52 PM	Asst Gen Counsel Frederick PSC - witness Alvarez Note: Sacre, Candace	Cross Examination. In professional opinion, if PTR program continue, better continue as summer-only program or year round?
3:27:27 PM	Chairman Chandler Note: Sacre, Candace	Commissioner?
3:27:33 PM	Vice Chairman Hatton - witness Alvarez Note: Sacre, Candace	Examination. The 20 percent participation rate, criticism not relevant to service area, address that?
3:29:02 PM	Vice Chairman Hatton - witness Alvarez Note: Sacre, Candace	Are there differences in methods used to recruit participants Duke Energy and some of others that had higher participation rates?
3:31:09 PM	Vice Chairman Hatton - witness Alvarez Note: Sacre, Candace	Basing decision not cost effective based on participation rate fair way determine cost effectiveness when rate artificially low because pilot?
3:31:53 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Examination. Live in Colorado?
3:31:57 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Lived in any other states?
3:32:02 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Anywhere in northeast or west coast?
3:32:08 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Illinois great example, Chicagoland or elsewhere?
3:32:17 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	What about usage, Kentucky use across the board more electricity than national average?
3:32:33 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	National average 2021 per EIA 880 kWh per month U.S. residential customer, in Kentucky average over a thousand, (click on link for further comments), those are facts, California electricity 25-30 kWh?
3:33:53 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Not even necessarily peak rate, just expensive?
3:34:02 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Makes sense in areas electricity expensive, folks on average use less?
3:34:18 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Looking at CV, in utility sphere, from started doing utility work till now, easier to build generation or harder?
3:34:43 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	What types those be?
3:34:47 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Natural gas infrastructure?
3:34:55 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Prospect of future of gas generation in Colorado, PUC looking at reducing incentives expand heating like natural gas?
3:35:10 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Expect constriction continue or stay same or be reduced?
3:36:22 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	All occurring same time other side of coin actual electrification increases, also push to increase electrification?

3:36:44 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Get to point, thinking about Sailers rebuttal and your testimony, would seem cost effectiveness determined on backwards-looking analysis, benefit cost analysis heard testimony?
3:37:30 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Programmatic costs, implementation costs verse avoiding costs, benefit, calculation of cost effective for programs?
3:37:43 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	What trying to ask less options for generations from perspective for firm capacity, add constraints, reduce options, increase costs?
3:38:15 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Have perspective inputs in cost effectiveness increase, decrease, restrictions, or stay same when comes to DSM programs?
3:39:07 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Without advance metering infrastructure, peak-time rebate program possible?
3:39:48 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	In terms of enabling costs, advance metering infrastructure biggest hurdle?
3:40:08 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Started anew, create program, CPR technically not a rate but say call it a rate, peak time rebate perfect offering, pilot it first, know what harms are, beginning to end to all agree and full implementation, what looking at in terms of time?
3:43:25 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	People that have tested that?
3:43:43 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Gentleman recently retired from Brattle, Faruqui, done two dozen of these tests?
3:44:04 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Any fixed costs not necessarily incurred here otherwise hurdles or cost to implementation of rollout in sense you proposed?
3:44:51 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	Other comes to mind back office system, differences in usage, billing, conduct discovery Duke ever be able to undertake efforts or have infrastructure do that?
3:46:35 PM	Chairman Chandler - witness Alvarez Note: Sacre, Candace	One thing we know is how to spread out fixed costs?
3:46:51 PM	Chairman Chandler Note: Sacre, Candace	Move to introduce this? (Click on link for further comments.)
3:46:52 PM	DEK EXHIBIT 1 Note: Sacre, Candace Note: Sacre, Candace	ATTY VAYSMAN DUKE KENTUCKY - WITNESS ALVAREZ RESIDENTIAL CUSTOMER ENROLLMENT IN TIME-BASED RATE AND ENABLING TECHNOLOGY PROGRAMS: SMART GRID INVESTMENT GRANT CONSUMER BEHAVIOR STUDY ANALYSIS MAY 2013
3:47:21 PM	Chairman Chandler Note: Sacre, Candace	Mr. Cook?
3:47:28 PM	Asst Atty General Cook - witness Alvarez Note: Sacre, Candace	Redirect Examination. Did discuss how this report discusses participation levels in three PTR programs?
3:47:36 PM	Asst Atty General Cook Note: Sacre, Candace	All I have and move to admit as AG 1. (Click on link for further comments.)

3:47:56 PM	Chairman Chandler Note: Sacre, Candace	Don't know what document is, identify the document? (Click on link for further comments.)
3:48:06 PM	Chairman Chandler Note: Sacre, Candace	AG Hearing Exhibit 1.
3:49:07 PM	AG EXHIBIT 1 Note: Sacre, Candace Note: Sacre, Candace	ASST ATTY GENERAL COOK - WITNESS ALVAREZ SMART GRID INVESTMENT GRANT CONSUMER BEHAVIOR STUDY ANALYSIS: RESIDENTIAL CUSTOMER ENROLLMENT IN TIME-BASED RATE AND ENABLING TECHNOLOGY PROGRAMS JUNE 2013
3:49:10 PM	Chairman Chandler Note: Sacre, Candace	Next witness?
3:49:16 PM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Melissa Adams.
3:49:30 PM	Chairman Chandler Note: Sacre, Candace	Witness is sworn.
3:49:36 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Examination. Name and address?
3:49:53 PM	Atty Vaysman Duke Kentucky - witness Adams Note: Sacre, Candace	Direct Examination. Title?
3:50:01 PM	Atty Vaysman Duke Kentucky - witness Adams Note: Sacre, Candace	Cause certain responses to be filed?
3:50:06 PM	Atty Vaysman Duke Kentucky - witness Adams Note: Sacre, Candace	Corrections or changes?
3:50:12 PM	Atty Vaysman Duke Kentucky - witness Adams Note: Sacre, Candace	Asked same questions, responses be same?
3:50:23 PM	Chairman Chandler Note: Sacre, Candace	Questions? (Click on link for further comments.)
3:51:33 PM	Asst Gen Counsel Frederick PSC - witness Adams Note: Sacre, Candace	Cross Examination. Question about Duke Kentucky DSM Case No. 2019-00277, Duke proposed pilot program for PTR, Duke use 2016 dollars for capacity values?
3:52:22 PM	Asst Gen Counsel Frederick PSC - witness Adams Note: Sacre, Candace	Is what happened in this case as well, used 2016 dollars and escalated to 2022 or 2021?
3:52:36 PM	Asst Gen Counsel Frederick PSC - witness Adams Note: Sacre, Candace	Why? Why was that done instead of updating to current values?
3:52:59 PM	Asst Gen Counsel Frederick PSC - witness Adams Note: Sacre, Candace	Not sure understand answer?
3:53:26 PM	Asst Gen Counsel Frederick PSC - witness Adams Note: Sacre, Candace	Had 2021 numbers, had 2021 avoided cost in 2021 dollars, had available, but because amendment used 2016 with escalator?
3:54:08 PM	Chairman Chandler Note: Sacre, Candace	Commissioners?
3:54:10 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Examination. What's the difference, higher, lower, are 2022 numbers higher than the 2016 escalated to 2021?
3:54:35 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Surprised if T&D not go up because seems like T&D numbers escalated Andy Whitman and, as one person said, if you think CPI goes up fast should look at the Handy Whitman Index, some increase five, eight, ten percent?
3:55:01 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	How was avoided capacity values calculated, overnight kW of peaker unit?

3:55:38 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Just overnight kW cost from NREL is cost in year or say, well, we expect need to occur in a year in the future and discount to current value, get absolute identity what next marginal unit be, trying to ask how that expense turned into avoided capacity value?
3:56:36 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Who sitting here at Duke, Kentucky or North Carolina, on horizon, expenses can avoid through DSM programs, just asking for values every six years from IRP group and asking for escalation value and sending to EE and DSM folks for input, Hoover coming up with DSM programs and just applying numbers, who looking at numbers to determine whether reasonable approximations of cost utility avoiding?
3:58:35 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	People who know right answer not in room to question it, just taking what Parker in IRP is handing you, not know the reasonableness or whether a program is going to avoid that cost?
3:58:55 PM	Atty Vaysman Duke Kentucky Note: Sacre, Candace	Follow up in post-hearing data request. (Click on link for further comments.)
3:59:00 PM	POST-HEARING DATA REQUEST Note: Sacre, Candace Note: Sacre, Candace	CHAIRMAN CHANDLER - WITNESS ADAMS HOW DSM PROGRAMS CALCULATED OR DETERMINED
3:59:42 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Aware in current open rate case Duke anticipates coal plant retiring earlier than CTs?
3:59:57 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	If coal plant, large coal plant, retires before CTs, think reasonable assume unit replacing that, the marginal unit, be peaker?
4:00:14 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Reasonable to assume Duke Kentucky propose replace base load coal plant with one or series of peakers?
4:00:51 PM	Chairman Chandler - witness Adams Note: Sacre, Candace	Utility, itself, says anticipates life of coal plant be something less than 15 years that avoided capacity value reflect utility plans?
4:01:21 PM	Chairman Chandler Note: Sacre, Candace	Redirect?
4:01:43 PM	Chairman Chandler Note: Sacre, Candace	Data requests and responses. (Click on link for further comments.)
4:03:28 PM	Chairman Chandler Note: Sacre, Candace	Briefs. (Click on link for further comments.)
4:05:53 PM	Chairman Chandler Note: Sacre, Candace	Case submission. (Click on link for further comments.)
4:08:15 PM	Chairman Chandler Note: Sacre, Candace	Anything else?
4:08:22 PM	Chairman Chandler Note: Sacre, Candace	Hearing adjourned.
4:09:23 PM	Session Ended	



Name:	Description:
AG EXHIBIT 1	SMART GRID INVESTMENT GRANT CONSUMER BEHAVIOR STUDY ANALYSIS: RESIDENTIAL CUSTOMER ENROLLMENT IN TIME-BASED RATE AND ENABLING TECHNOLOGY PROGRAMS JUNE 2013
DEK EXHIBIT 1	RESIDENTIAL CUSTOMER ENROLLMENT IN TIME-BASED RATE AND ENABLING TECHNOLOGY PROGRAMS: SMART GRID INVESTMENT GRANT CONSUMER BEHAVIOR STUDY ANALYSIS MAY 2013



SMART GRID INVESTMENT GRANT

CONSUMER BEHAVIOR STUDY ANALYSIS

Residential Customer Enrollment in Time-based Rate and Enabling Technology Programs

AUTHORS:

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Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory

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Glossary of Acronyms, Abbreviations, and Terms

AMI	Advanced Metering Infrastructure – All components that allow two-way communication between meters and the electric utility’s meter data management system to collect electricity usage and related information from customers and to deliver information to customers.
CA	California
CAC	Central Air Conditioning
CEIC	Cleveland Electric Illuminating Company
CBS	Consumer Behavior Study
CBSP	Consumer Behavior Study Plan
CPP	Critical Peak Pricing – A time-based rate component that increases the price on electricity consumed for participating customers during the hours included in a declared critical event. This higher price is overlaid onto the existing retail rate. Critical events are called either on a day-ahead or in-day basis in response to forecasted or achieved, respectively, high wholesale market electricity prices, short-term system reliability problems, or both. The primary objective of this rate design is to promote reductions in the peak demand of electricity.
CPR	Critical Peak Rebate – A demand response program that pays participating customers for reducing electricity consumed in relation to a baseline during the hours included in a declared critical event. Critical events are called either on a day-ahead or in-day basis in response to forecasted or achieved, respectively, high wholesale



market electricity prices, short-term system reliability problems, or both. The primary objective of this program design is to promote reductions in the peak demand of electricity.

Descriptive Results - A finding based on summary statistics. These results may be informative, but do not allow us to draw any causal conclusions.

DECo **Detroit Edison Company**

DOE **Department of Energy**

DOE-OE **DOE Office of Energy Delivery and Electricity Reliability**

DLC **Direct Load Control**

Experimental Design - A method of controlling the way that a program is designed and evaluated in order to observe outcomes and infer whether or not the outcomes are caused by the program.

Experimental Results - A finding based on statistical estimates derived from experimentally designed tests. These results enable us to draw conclusions about the causal effect of the treatments being tested.

External Validity - The ability for one to more confidently extrapolate the study findings to the larger population from which the sample was drawn.

FOA **Funding Opportunity Announcement**

GMP **Green Mountain Power**

Hard Launch - A type of release for a campaign where the product or service being offered is released to a broad and



complete audience.

HEMS

Home Energy Management System

IBR

Inclining Block Rate – A rate program design that charges customers for electricity usage based on the how much they consume. Blocks of usage are defined and the price for each block of usage increases as the amount of consumed electricity increases. The primary objective of this rate design is to promote overall conservation of electricity.

ISO

Independent System Operator

Internal Validity – The ability for one to more confidently identify the observed effect of treatment as an unbiased estimate of that effect.

IHD

In-Home Display

kWh

Kilowatt-hour

LE

Lakeland Electric

LBNL

Lawrence Berkeley National Laboratory

Lessons Learned – Findings based on anecdotal information collected from utilities. They enable us to understand context surrounding the Experimental and Descriptive Results, but not to definitively state findings.

MMLD

Marblehead Municipal Light Department

MN

Minnesota

NDPT

Nevada Dynamic Pricing Trial

NVP

Nevada Power



NVE

NV Energy

OK

Oklahoma

OG&E

Oklahoma Gas & Electric

Program Offer - Different types of time-based rate, technology, and opt-in versus opt-out proposals made to customers when they are solicited to enroll in a study (e.g., an offer of a TOU rate, an offer that includes enabling technology, or an opt-in offer).

PCT

Programmable Communicating Thermostat

RCT

Randomized Controlled Trial - A research strategy in which customers who volunteer to be exposed to a treatment are randomly assigned to treatment and control conditions.

RED

Randomized Encouragement Design - A research design in which two groups of customers are selected from the same population at random and one is offered a treatment while the other is not. Not all customers offered the treatment are expected to take it but, for analysis purposes, all those who are offered the treatment are considered to be in the treatment group.

SMUD

Sacramento Municipal Utility District

SPP

Sierra Pacific Power

SGIG

Smart Grid Investment Grant

Soft Launch - A type of release for a campaign where the product or service being offered is incrementally released to a small and limited audience.



Solicitation Effort – One complete set of offers made to one group of customers (e.g., one solicitation effort may have an opt-out offer, a TOU rate offer, and no technology offer).

TAG **Technical Advisory Group**

TOU **Time-Of-Use** - A time-based rate program design that charges customers for electricity usage based on the block of time it is consumed. The price schedule is fixed and predefined, based on season, day of week, and time of day. The primary objective of this rate design is to promote overall shifting of electricity away from the peak period to other periods.

VPP **Variable Peak Pricing** – A time-based rate program design that charges customers for electricity usage based on the block of time it is consumed. The price schedule is variable and differs daily, based on bulk power system conditions during that period of the day. The primary objective of this rate design is to promote targeted shifting of electricity away from the peak period to other periods.

VT **Vermont**

VEC **Vermont Electric Cooperative**



Foreword

As far back as the 1890s, the electric industry has been debating the issue of how to efficiently and optimally charge customers for consuming electricity (Hausman and Neufeld 1984). At that time, there were emerging but very contentious discussions among economists about the merits of pricing the new commodity differentially based on time. The challenge with such pricing schemes revolved around metering—cost-effective technology did not exist at that time to allow electricity consumption to be captured at the required level of detail. Thus, virtually all customers were charged for their electricity consumption at a rate that was time-invariant (i.e., flat).

By the 1970s, the debate had moved beyond issues of economic efficiency and instead turned towards more practical concerns about consumer behavior—could mass-market (i.e., residential and small commercial) customers manage their electricity consumption under time-based rate programs? The results of studies undertaken by the Federal Energy Administration, the predecessor to the U.S. Department of Energy (DOE), indicated such customers were, in fact, capable of managing their electricity consumption by moving it away from the expensive “peak” period to the less-expensive “off-peak” period (see Faruqui and Malko 1983 for a meta-analysis of these experiments). In spite of this evidence, the lack of low-cost interval or period-based metering technology continued to limit the industry’s ability to expand the application of time-based rate programs at the residential level through the end of the 20th century.

Over the past ten years, however, the costs of interval meters, the communications networks to connect the meters with utilities and the back-office systems necessary to maintain and support them (i.e., advanced metering infrastructure or AMI) have dramatically decreased. The implementation of AMI and interval meters by utilities, which allows electricity consumption data to be captured, stored and reported at 5 to 60-minute intervals in most cases, provides an opportunity for utilities and policymakers to once again seriously consider the merits of the widespread deployment of time-based rate programs. However, many regulators and other key policymakers have determined that more definitive answers to key policy questions must be addressed before they will fully support a paradigm shift in the way retail electricity providers charge residential and small commercial customers for consuming electricity.



The American Recovery and Reinvestment Act of 2009 included \$3.4B for the Smart Grid Investment Grant (SGIG) program with the goal of creating jobs and accelerating the transformation of the nation's electric system by promoting investments in smarter grid technologies, tools and techniques (DOE 2012a). Among other topics, the Funding Opportunity Announcement (DE-FOA-0000058) identified interest in AMI projects that examined the impacts and benefits of time-based rate programs and enabling control and information technologies through the use of randomized controlled experimental designs.

Based on responses to this FOA, DOE decided to co-fund ten utilities to undertake eleven experimentally-designed Consumer Behavior Studies (CBS) that proposed to examine a wide range of the topics of interest to the electric utility industry. Each chosen utility was to design, implement and evaluate their own study in order to address questions of interest both to itself and to its applicable regulatory authority, whose approval was generally necessary for the study to proceed. The DOE Office of Energy Delivery and Electricity Reliability (DOE OE), however, did set guidelines, both in the FOA and subsequently during the contracting period, for what would constitute an acceptable study under the Grant.

To assist in ensuring these guidelines were adhered to, DOE OE requested that LBNL act as project manager for these Consumer Behavior Studies to achieve consistency of experimental design and adherence to data collection and reporting protocols across the ten utilities. As part of its role, LBNL formed technical advisory groups (TAG) to separately assist each of the utilities by providing technical assistance in all aspects of the design, implementation and evaluation of their studies. LBNL was also given a unique opportunity to perform a comprehensive, cross-study analysis that uses the customer-level interval meter and demographic data made available by these utilities due to SGIG-imposed reporting requirements, in order to analyze critical policy issues associated with AMI-enabled rates and control/information technology. Over the next several years, LBNL will publish the results of these analyses in a series of research reports that attempt to address critical policy issues including customer acceptance, retention and load response to time-based rates and various forms of enabling control and information technologies. This report is the second in that series and provides a preliminary analysis of customer enrollment issues.



Executive Summary

Introduction

The U.S. Department of Energy's (DOE's) Smart Grid Investment Grant (SGIG) program is working with a subset of the 99 SGIG projects undertaking Consumer Behavior Studies (CBS), which examine the response of mass market consumers (i.e., residential and small commercial customers) to time-varying electricity prices (referred to herein as time-based rate programs) in conjunction with the deployment of advanced metering infrastructure (AMI) and associated technologies. The effort presents an opportunity to advance the electric industry's understanding of consumer behavior.¹

With the increased deployment of advanced meters with two-way communication networks that can record and provide at least hourly interval data spurred in part by DOE's SGIG program, electric utilities are now able to more easily offer and implement time-based rate and enabling technology programs for residential and smaller commercial customers. These time-based rate programs are fairly new for residential customers, and utilities, with some exceptions, have had limited success in enrolling mass market customers on these tariffs (FERC 2011). Because AMI business cases often rely on the benefits from customer demand response enabled by these investments, there is increasing interest among policymakers, regulators, utilities and stakeholders in understanding how many customers are likely to enroll and continue in such a program, and which factors can affect these recruitment and retention rates.

While there have been numerous evaluations of the peak demand and energy impacts of time-based rate programs (e.g., Critical Peak Pricing) and enabling technology (e.g., programmable communicating thermostats), there has been limited examination to date of the customer recruitment rates that these types of programs can achieve. Currently, utility program evaluation reports that are focused on providing impact estimates of energy savings and load shifting rarely mention anything other than aggregate customer recruitment rates (e.g., Charles River Associates 2005; Summit Blue Consulting 2007; Hydro One Networks 2008; Connecticut Light and Power 2009; Faruqui and Sergici 2009;

¹ See www.smartgrid.gov for more information about the goals and objectives of the SGIG CBS effort.



eMeter Strategic Consulting 2010; EPRI 2011). The U.S. Energy Information Administration (EIA) and the Federal Energy Regulatory Commission (FERC) both collect and report on time-based rate enrollment information from all utilities in the United States on an annual basis. However, it is difficult to interpret this data or analyze results across utilities because utilities are not required to report information on the number of customers that were solicited or provide information that may explain factors that influenced their recruitment rates. As such, there is limited information in the public sphere that could help utilities, regulators or other policymakers understand what reasonable recruitment rates would be and what may explain currently observed differences in recruitment rates.

Objectives and Scope

In this preliminary report, we begin to fill this need by providing an initial summary of experiences of the different phases of the enrollment process (qualification, solicitation, recruitment, and selection) across nine of the ten SGIG utilities, who collectively are undertaking a total of 11 consumer behavior studies.ⁱⁱ We report three types of key findings: Experimental Results, Descriptive Results, and Lessons Learned.

- **Experimental Results** are statistical estimates derived from experimentally designed tests. These results enable us to draw conclusions about the causal effect of the treatments being tested.
- **Descriptive Results** are based on summary statistics. These results may be informative, but do not allow us to draw any causal conclusions.
- **Lessons Learned** are based on anecdotal information collected from utilities. They enable us to understand context surrounding the Experimental and Descriptive Results, but not to definitively state findings.

The primary focus of the CBS utilities was to experimentally test time-based rates and enabling technology; only a subset of the studies chose to experimentally test enrollment rates. Therefore, the Experimental Results in this report focus on a narrow subset of the CBS utility studies. Although these results have strong internal validity, they were observed

ⁱⁱ In order to characterize our empirical approach, we define the term *program offer* or simply *offer* to represent the different types of time-based rate, technology, and opt-in versus opt-out proposals made to customers when solicited to enroll in a study (e.g., an offer of a TOU rate, an offer that includes enabling technology, or an opt-in offer). We define the term *solicitation effort* to represent one complete set of offers made to one group of customers (e.g., one solicitation effort may have an opt-out offer, a TOU rate offer, and no technology offer). We define the *recruitment rate* as the percentage of recruited customers out of the total number of customers solicited in one solicitation effort.



for particular populations at particular times and so may have less external validity. The Descriptive Results and Lessons Learned are based on data collected from all of the CBS utilities.

This report can help inform utilities and state regulatory commissions that are considering offering such time-based rates to mass market customers. First, it can help ensure that the number of customers enrolled in a study or pilot program is sufficient to produce valid energy impact estimates (based on statistical power calculations). If too few customers are enrolled, the evaluation effort may not be able to successfully and accurately estimate such impacts. Second, accurate recruitment rates are useful for planning and forecasting purposes when such rates are offered en masse (e.g., in order to gain a perspective on the magnitude of a particular program resource).



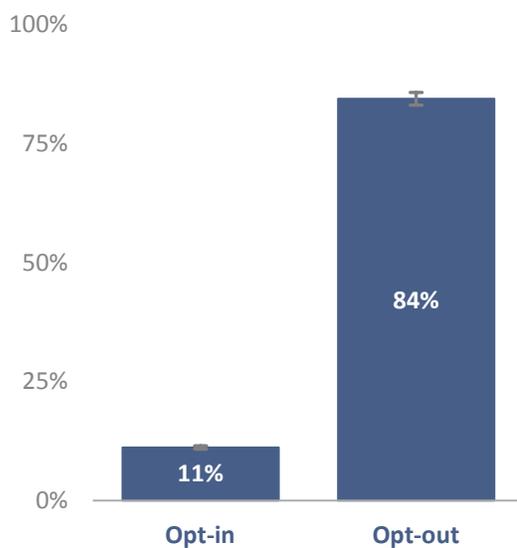
Key Findings



Key Finding: Experimental Result 1

More customers enroll into a time-based rate program with an opt-out offer than with an opt-in offer.

Only two utilities included both an opt-in and opt-out offer for randomly assigned customers to be solicited to participate in a study through either opt-in or opt-out offers. 84% of customers solicited to join a study using an opt-out recruitment approach did not reject the offer, whereas 11% of customers solicited to join a study using an opt-in recruitment method approach accepted the offer (see Figure ES-1).



Percentages include the total number of customers across the two utilities that randomized opt-in versus opt-out program offers (99.9% confidence intervals shown; N=100,000).

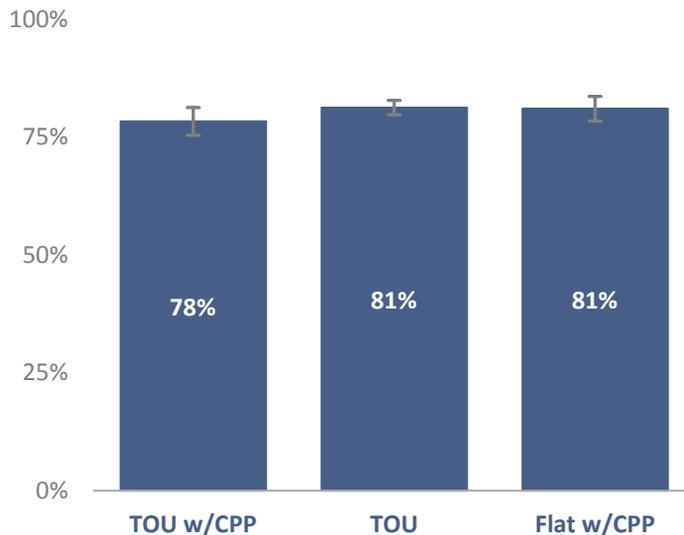
Figure ES-1. Recruitment rates for tests of opt-in versus opt-out program offers



Key Finding: Experimental Result 2

For opt-out solicitations, the type of time-based rate offer does not substantially affect the customer recruitment rate.

Only a single utility study included more than one opt-out time-based rate program offering to a group of randomly assigned customers as part of their study. The observed recruitment rates were 81% for the TOU offer, 81% for the Flat w/CPP offer, and 78% for the TOU w/CPP offer (the differences between any pairings of the rates were not statistically significant; see Figure ES-2). This suggests that customers are not more likely to opt-out of one time-based rate over the other, despite the rate differences.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive opt-out offers of one of three time-based rates (95% confidence intervals shown; N=4,000).

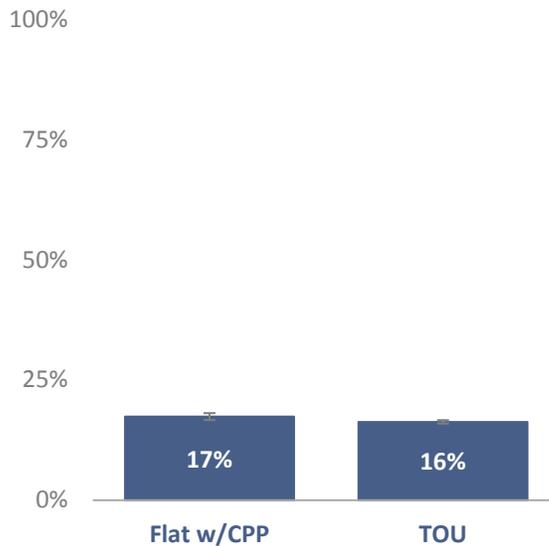
Figure ES-2. Opt-out recruitment rate results for tests of time-based rate offers



Key Finding: Experimental Result 3

For opt-in solicitations, the type of time-based rate does not substantially affect the customer recruitment rate.

Only a single utility study included more than one opt-in time-based rate program offering to a group of randomly assigned customers as part of their study. A Flat rate with a CPP overlay offer had a 17% recruitment rate while the TOU offer had a 16% recruitment rate; the difference, although small, is statistically significant (see Figure ES-3). This suggests that customers may, to a very small extent, prefer to opt-in to a Flat w/CPP over a TOU rate. However, the preference is very small.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive a CPP offer versus a TOU offer (95% confidence intervals shown; N=50,000).

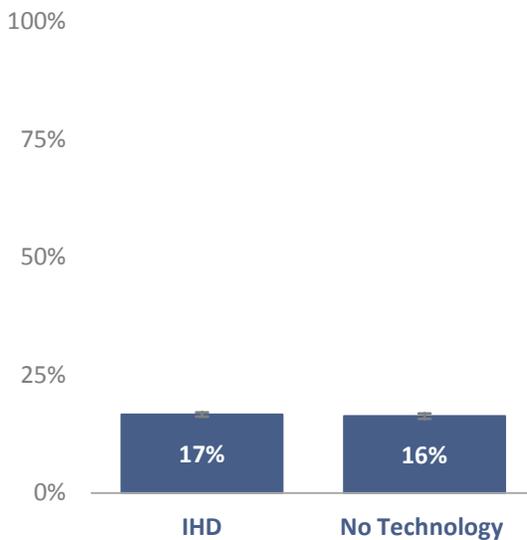
Figure ES-3. Opt-in recruitment rate results for tests of time-based rate offers



Key Finding: Experimental Result 4

For opt-in solicitations, the offer of technology does not substantially affect the customer recruitment rate.

Only a single utility study included offers of time-based rate programs (i.e., TOU, Flat w/CPP) paired with an IHD and a separate set of offers of the same time-based rates but without an IHD. As shown in Figure ES-4, recruitment rates for the offers with an IHD and without the IHD (i.e., no-technology offer) were around 16-17%; the difference is not statistically significant. Segmenting customers into CPP and TOU solicitation efforts shows similar results. This indicates that customers are not more likely to opt-in to a time-based rate if they are offered an IHD, despite the supposed monetary value of such a device.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive an IHD offer versus no technology offer (95% confidence intervals shown; N=50,000).

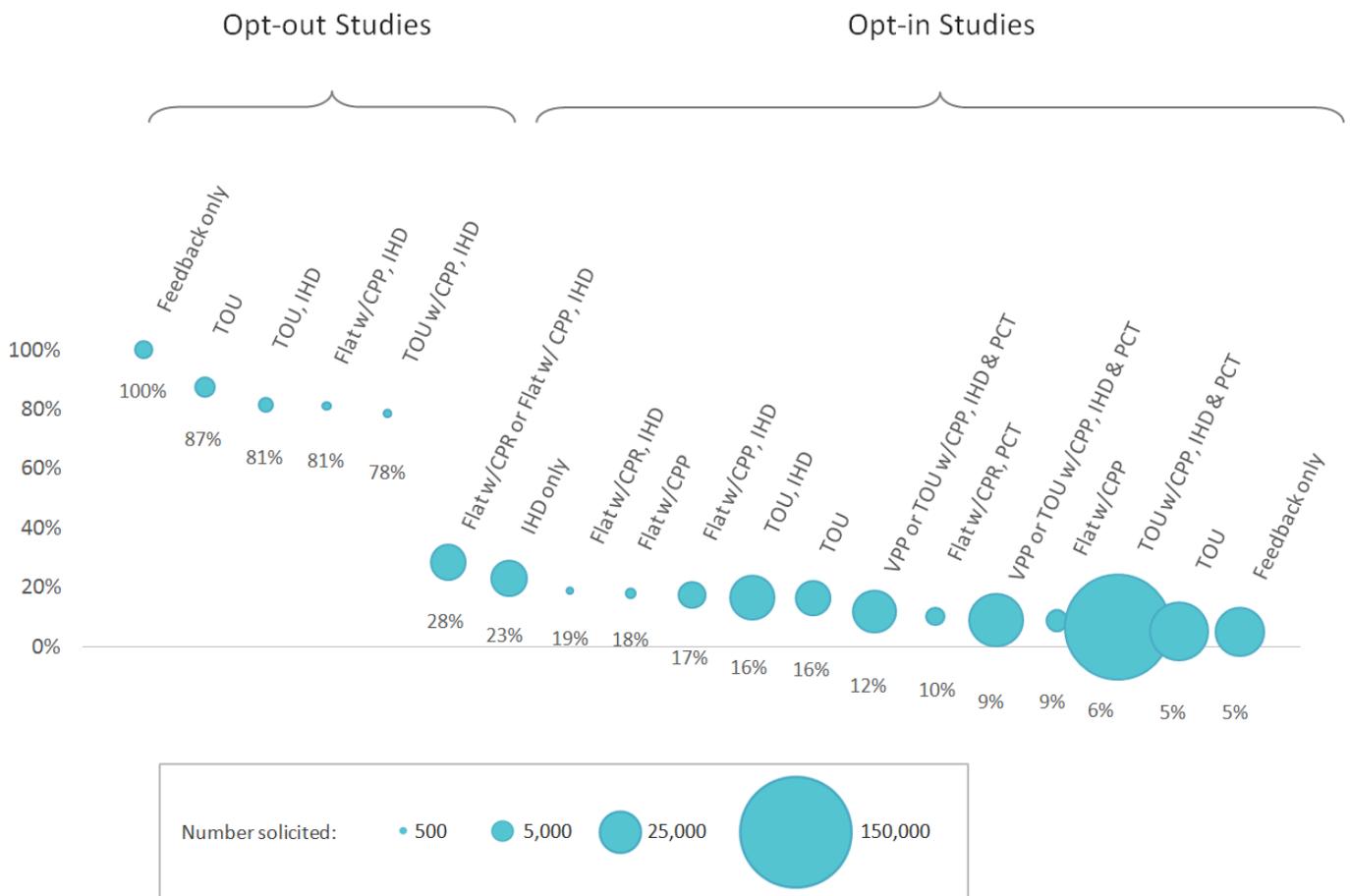
Figure ES-4. Opt-in recruitment rate results for tests of technology offers vs. no technology offers



Key Finding: Descriptive Result 1

For time-based rate and enabling technology studies that use an opt-in program offer, recruitment rates range from 5% to 28%. For those that use an opt-out program offer, recruitment rates range from 78% to 87%.

An assessment of Figure ES-5 suggests that a utility may expect to achieve at least a 5% recruitment rate for opt-in studies. Under ideal circumstances, recruitment rates into such studies could exceed 20%. However, for planning purposes assuming 10% recruitment rate seems most appropriate.



19 total solicitation efforts listed. Circle size represents the total number of customers solicited.

Figure ES-5. Recruitment rates for each solicitation effort



Key Finding: Descriptive Result 2

Most utilities did not accurately predict recruitment rates for their study solicitation efforts. Five of the twelve opt-in solicitation efforts underachieved their recruitment rates such that actual recruitment rates were 7 to 22 percentage points below the actual recruitment rate. This represents actual recruitment rates that were at least a quarter of what was planned.

Figure ES-6 shows the actual and planned recruitment rates for opt-in and opt-out solicitation efforts. Out of the six opt-in solicitation efforts that underachieved their planned recruitment rates (shown in red in Figure ES-6), five had an actual recruitment rate that was 7 to 22 percentage points lower than planned, representing an actual recruitment rate that at least a quarter of what they were planned to be. Five out of the six opt-in solicitation efforts that overachieved had an actual recruitment rate that was no more than 4 percentage points higher than planned. The sixth was 14 percentage points higher than planned, almost double the planned rate. While overachieving recruitment rates may not have severe consequences, underachievement can cause problems with the study evaluation effort which may necessitate changes to the study's design. If a study has planned to recruit a certain number of customers and the actual number of customers recruited is far less, the study may have to be re-designed (e.g., the number of treatments being tested may have to be reduced) in order to achieve statistically valid load impact estimates.ⁱⁱⁱ

ⁱⁱⁱ Power calculations are used to determine how large a sample a study needs to enroll in order to have faith that the resulting estimates of the treatment effect are credible. For more information on this topic, see Appendix A of Cappers et al. (2013).

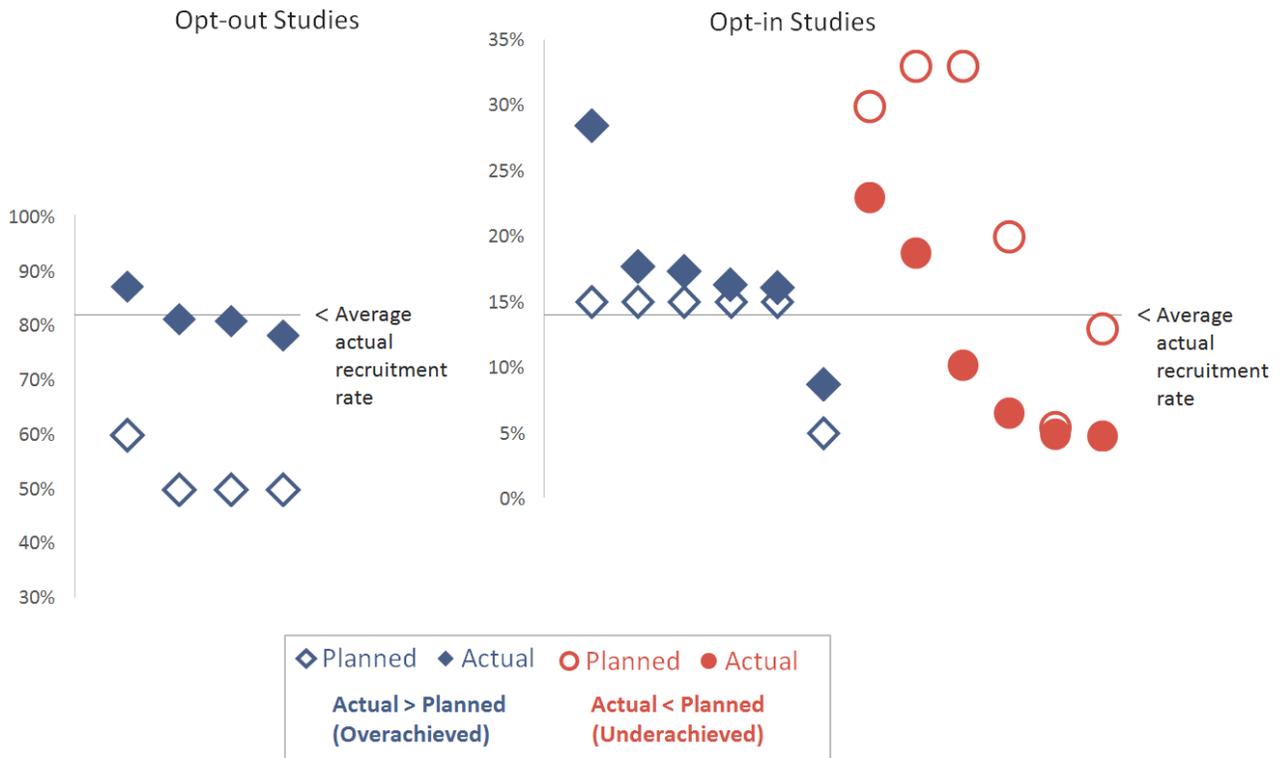


Figure ES-6 – Actual versus planned recruitment rates



Key Finding: Lessons Learned 1

Utilities found focus groups, surveys and other tools to be vital components for test marketing terms and concepts to attract customer interest and engage them to participate in the rate being offered.

Prior to test marketing materials that would be used to solicit participation into studies that included time-based rates, many utilities believed words like “critical”, “emergency”, and “events” would confer the necessary message about what the rate was trying to accomplish and how valuable a customer’s participation in that rate would be. Several utilities subsequently performed focus groups, surveys and other forms of test marketing of their recruitment material which indicated the terms and concepts utilities thought would connote positive concepts with customers actually had the opposite effect. Terms like “response”, “auto”, and “event” were construed as reactionary words that deflated personal control (e.g., “emergencies” are out of a customer’s control). Instead, some participants in focus groups appeared to prefer terms that construed a sense of personal control over one’s own energy usage and resulting bill (e.g., “control”, “choice”, “sense”).



Key Finding: Lessons Learned 2

Utilities learned the importance of validating focus groups with other test marketing efforts across a variety of customer segments and circumstances to develop the most effective messaging for their new time-based rate recruitment campaign.

Utilities also learned from focus groups that customers claimed to be primarily motivated by environmental messaging when it came to recruitment into new time-based rates. Test marketing along with observed recruitment data from various messages (e.g., “saving money”, “environmental stewardship”, “taking control”, “fun”) revealed the primary motivator for the majority of customers was actually financial.



Key Finding: Lessons Learned 3

Utilities were surprised at how much time and resources they needed to allocate between soft launch and hard launch of the solicitation effort to adjust the messaging and other details accordingly based on feedback.

Issues often arise during the recruitment phase of the study lifecycle that can threaten its overall success. Many utilities, therefore, included a two week soft launch window in their enrollment process in order to identify and address any problems that internal planning and test marketing of recruitment materials did not catch. Unfortunately, even with a two week soft launch period, one utility still did not have enough time to incorporate necessary feedback to the solicitation materials in time for the hard launch, at which point changes were very difficult and costly to make.



Key Finding: Lessons Learned 4

Utilities learned that before determining if a new rate or product offering is to be paired with a form of enabling technology, they could benefit from spending time understanding potential customer concerns with that technology and identifying the available pool of participants who would qualify for and be willing to accept such technology so that realistic expectations for recruitment can be set ahead of time.

The recruitment process can also be affected by assumptions about the number of customers capable and willing to receive certain types of enabling technology (e.g., presence of central air conditioning to receive a programmable communicating thermostat). By not accurately quantifying ahead of the study enrollment effort the size of the available population that would pre-qualify for specific enabling technology, the number of customers that would be willing/able to accept, and the number that then have it installed, some utilities substantially overestimated the level of acceptance for a new rate or product offering that was strictly paired with such enabling control technologies.



Key Finding: Lessons Learned 5

Utilities realized the need to ensure that all utility representatives and contractors that interact with customers at any level are informed, committed and enabled to make the experience a positive one for the customer. One way to do this most effectively was by focusing on communications skills as much as technical skills when hiring or recruiting people to fill these positions.

Many of the utilities who included some form of enabling technology in their study decided to enlist internal utility workers or external contractors to help install and provision this equipment at a participating customer's premise. These utilities believed that individuals responsible for installing these pieces of technology at a customer site would have little to no effect on that customer's decision to finalize and complete the enrollment process in the study.

Unfortunately, installation of technology by individuals, either internal or external to the utility, who did not have sufficient appreciation for the importance of the public relations role they played and/or were insensitive to the consequences of not playing that role well, resulted in negative ramifications for customer engagement efforts at several utilities.

Next Steps

Because this preliminary report is based on initial results from the subset of SGIG projects that are undertaking a Consumer Behavior Study, it only includes information on the first stages of a customer's choice: whether or not to enroll in a study. Equally interesting and important is information on the next stages of a customer's choice, which concern retention in the study. To address this choice, we would examine the number of customers that dropped out after the study treatment went into effect (perhaps after receiving their first bill); the number of customers that installed and subsequently used the provided enabling technology (if applicable); and the number of customers that remained in the study for its duration. Future reports will examine data for these customer retention stages, in addition to examining the factors which may help explain higher or lower recruitment and retention rates, whether certain segments of customers (e.g., low income vs. high income; high school educated vs. college educated) are more or less likely to choose to enroll, and whether



enrollment and retention choices affect the way that customers respond to time-based rates and enabling technology.^{iv}

^{iv} Understanding the retention rates of customers after the beginning of the study may be particularly important for interpreting enrollment rates for opt-out methods. For example, a customer enrolled via an opt-out method onto a TOU w/CPP rate may not have fully paid attention to the rate change until they experience a direct impact on their bill, at which point they may drop out now having fully understood what was asked of them so many months before. This may result in a recruitment rate that seems relatively high, but a low retention rate after the study has begun. On the other hand, if a customer is enrolled via an opt-out method into a program that would not result in any direct impact financially or on their quality of service (e.g., an information feedback program that allows the customer to see hourly energy use information on a daily delayed basis via a website), the customer may never drop out of the program but may also never actually experience the treatment (e.g., never access the website). In this case data may show a very high recruitment rate (potentially 100%), but future data may reveal that a much lower percentage of customers were actually exposed to the treatment.



1. Introduction

The U.S. Department of Energy's (DOE's) Smart Grid Investment Grant (SGIG) program is working with a subset of the 99 SGIG projects undertaking Consumer Behavior Studies (CBS), which examine the response of mass market consumers (i.e., residential and small commercial customers) to time-varying electricity prices (referred to herein as time-based rate programs) in conjunction with the deployment of advanced metering infrastructure (AMI) and associated technologies. The effort presents an opportunity to advance the electric industry's understanding of consumer behavior.¹

Methods for enrolling customers in programs vary widely, and different methods may lead to substantially different recruitment rates. For example, opt-in methods, in which customers must actively consent to participation in a program, are likely to lead to lower recruitment rates than opt-out methods, in which customers must actively decline or opt-out of participating in a program. Other factors may also affect customer recruitment rates, such as program differences (e.g., the specific rate and technology offered), differences in marketing approaches, the types of customers solicited, the customer-utility relationship, and many others.

With the increased deployment of advanced meters with two-way communication networks that can record and provide at least hourly interval data (i.e., AMI) spurred in part by DOE's SGIG program, electric utilities are now able to more easily offer and implement time-based rate and enabling technology programs for residential and smaller commercial customers. These time-based rate offerings are fairly new for residential customers, and utilities, with some exceptions, have had limited success in enrolling mass market customers on these tariffs (FERC 2011). Because AMI business cases often rely on the benefits from customer demand response enabled by these investments, there is increasing interest among policymakers, regulators, utilities and stakeholders in understanding how many customers are likely to enroll and continue in such a program, and which factors can affect these recruitment and retention rates.

While there have been numerous evaluations of the peak demand and energy impacts of time-based rate programs (e.g., Critical Peak Pricing) and enabling technology (e.g.,

¹ See www.smartgrid.gov for more information about the goals and objectives of the SGIG CBS effort.



programmable communicating thermostats), there has been limited examination to date of the customer recruitment rates that these types of programs can achieve. Currently, utility program evaluation reports that are focused on providing impact estimates of energy savings and load shifting rarely mention anything other than aggregate customer recruitment rates (e.g., Charles River Associates 2005; Summit Blue Consulting 2007; Hydro One Networks 2008; Connecticut Light and Power 2009; Faruqi and Sergici 2009; eMeter Strategic Consulting 2010; EPRI 2011). The U.S. Energy Information Administration (EIA) and the Federal Energy Regulatory Commission (FERC) both collect and report on time-based rate enrollment information from all utilities in the United States on an annual basis. However, it is difficult to interpret this data or analyze results across utilities because utilities are not required to report information on the number of customers that were solicited or provide information that may explain factors that influenced their recruitment rates. As such, there is limited information in the public sphere that could help utilities, regulators or other policymakers understand what reasonable recruitment rates would be and what may explain currently observed differences in recruitment rates.

In this preliminary report, we begin to fill this need by providing an initial summary of experiences of the different phases of the enrollment process (qualification, solicitation, recruitment, and selection) across nine of the ten SGIG utilities, who are undertaking a total of 11 consumer behavior study. First, we provide an overview of the consumer behavior studies co-funded by DOE's SGIG program that are included in this assessment. Next, we describe the methodology that will be applied to analyze the various stages of enrollment and recruitment rates. Lastly, we report summary statistics and results from experiments that are testing whether certain program offers affect recruitment rates, and provide lessons learned. Specifically, we report three types of key findings: Experimental Results, Descriptive Results, and Lessons Learned.

- **Experimental Results** are statistical estimates derived from experimentally designed tests. These results enable us to draw conclusions about the causal effect of the treatments being tested.
- **Descriptive Results** are based on summary statistics. These results may be informative, but do not allow us to draw any causal conclusions.
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The primary focus of the CBS utilities was to experimentally test time-based rates and enabling technology; only a subset of the studies chose to experimentally test enrollment rates. Therefore, the Experimental Results in this report focus on a narrow subset of the CBS utilities. Although these results have strong internal validity, they were observed for particular populations at particular times and so may have less external validity. The Descriptive Results and Lessons Learned are based on data collected from all of the CBS utilities.

This report can help inform utilities and state regulatory commissions that are considering offering such time-based rates to mass market customers. First, it can help ensure that the number of customers enrolled in a study or pilot program is sufficient to produce valid energy impact estimates (based on statistical power calculations). If too few customers are enrolled, the evaluation effort may not be able to successfully and accurately estimate such impacts. Second, accurate recruitment rates are useful for planning and forecasting purposes when such rates are offered en masse (e.g., in order to gain a perspective on the potential magnitude of participants and load impacts from a particular program).

Because this preliminary report is based on initial results from the subset of SGIG projects that are undertaking a consumer behavior study, it only includes information on the first stage of a customer's choice: whether or not to enroll in a study. Equally interesting and important is information on the next stages of a customer's choice, which concerns retention in the study. To address this choice, we would examine: the number of customers that dropped out after the study treatment went into effect (perhaps after receiving their first bill); the number of customers that installed and subsequently used the provided enabling technology (if applicable); and the number of customers that remained in the study for its duration. Future reports will examine data for these additional customer retention stages, in addition to examining the factors which may help explain higher or lower recruitment and retention rates, whether certain segments of customers (e.g., low income vs. high income; high school educated vs. college educated) are more or less likely to choose to enroll, and whether enrollment and retention choices affect the way that customers respond to time-based rates and enabling technology.²

² Understanding the retention rates of customers after the beginning of the study may be particularly important for interpreting enrollment rates for opt-out methods. For example, a customer enrolled via an opt-out method onto a TOU w/CPP rate may not have fully paid attention to the rate change until they experience a direct impact on their bill, at which point they may drop out now having fully understood what was asked of them so many months before. This may



2. Consumer Behavior Studies Overview

As part of the Smart Grid Investment Grant program, the U.S Department of Energy is co-funding ten utilities to undertake experimentally designed consumer behavior studies (CBS) that examine a wide range of topics of interest to the electric industry in the area of AMI-enabled time-based rates and customer systems.³ The ten utilities are undertaking 11 studies, which are designed to rigorously test the impact of time-based rates and/or technology and education treatments on customers' energy usage patterns, and in a few cases to rigorously test the impact on customer acceptance on the same set of treatments.

2.1 Treatments Tested in CBS

This section describes the different types of treatments that are being tested by utilities in their consumer behavior studies: time-based rates; technology and education; and program offers.

2.1.1 Time-based Rate Treatments

Time-based rates are attractive to utilities because they are designed to allow the prices that customers pay to consume electricity to correspond more closely to the actual cost that utilities incur when producing or procuring it. For most utilities, the cost of providing electricity increases with the demand for energy because higher-cost power plants must be brought online to accommodate the additional demand. For example, a Time of Use (TOU) rate design identifies a set of pre-determined "peak" hours of the day that consistently have higher demand and therefore higher production costs for electricity (e.g., on weekdays between 2 pm and 6 pm), and charges a pre-determined higher price during those on-peak hours (e.g., the price is \$0.12/kWh higher than at other times; see Figure 1). For other time-

result in a recruitment rate that seems relatively high, but a low retention rate after the study has begun. On the other hand, if a customer is enrolled via an opt-out method into a program that would not result in any direct impact financially or on their quality of service (e.g., an information feedback program that allows the customer to see hourly energy use information on a daily delayed basis via a website), the customer may never drop out of the program but may also never actually experience the treatment (e.g., never access the website). In this case data may show a very high recruitment rate (potentially 100%), but future data may reveal that a much lower percentage of customers were actually exposed to the treatment.

³ For a more detailed description of the treatments undertaken in each utility study, see the first report in the series of LBNL CBS reports, "Summary of Utility Studies: Smart Grid Investment Grant Consumer Behavior Studies"(Cappers et al. 2013).



based rate programs, utilities attempt to identify specific “event” hours of the year in which electricity costs are likely to be highest, and commensurately increase the price of electricity to consumers during only those event hours. Critical Peak Pricing (CPP) rates typically have a day-ahead notice of event hours, and charge a pre-determined higher price during such hours; and Critical Peak Rebate (CPR) programs provide customers with a payment if they use less electricity during event hours, compared to some baseline estimate of what their electricity use would have been. CPP and CPR rates⁴ can be overlaid on a TOU rate, which we will denote as TOU w/CPP or TOU w/CPR, but can also be applied to a standard flat rate, which we will denote as Flat w/CPP or Flat w/ CPR.⁵ A Variable Peak Pricing (VPP) rate design identifies a set of peak hours for each day in advance, and charges customers using a price schedule that is variable and differs daily, based on bulk power system conditions during the peak hours.

⁴ Technically, a Critical Peak Rebate program is not a rate offering, as it does not reflect a price that must be paid **by** customers for consuming electricity but rather a price that is paid **to** customers for not consuming electricity. However, for simplicity of exposition and to maintain consistency with industry norms, we refer to CPR as a time-based rate herein.

⁵ In this report, Flat rates denote any rate that does not change on a time-differentiated basis, including inclining/declining block/tiered rates and bulk usage rates. See Appendix A in Cappers et al. (2013) for more information on these rate designs.

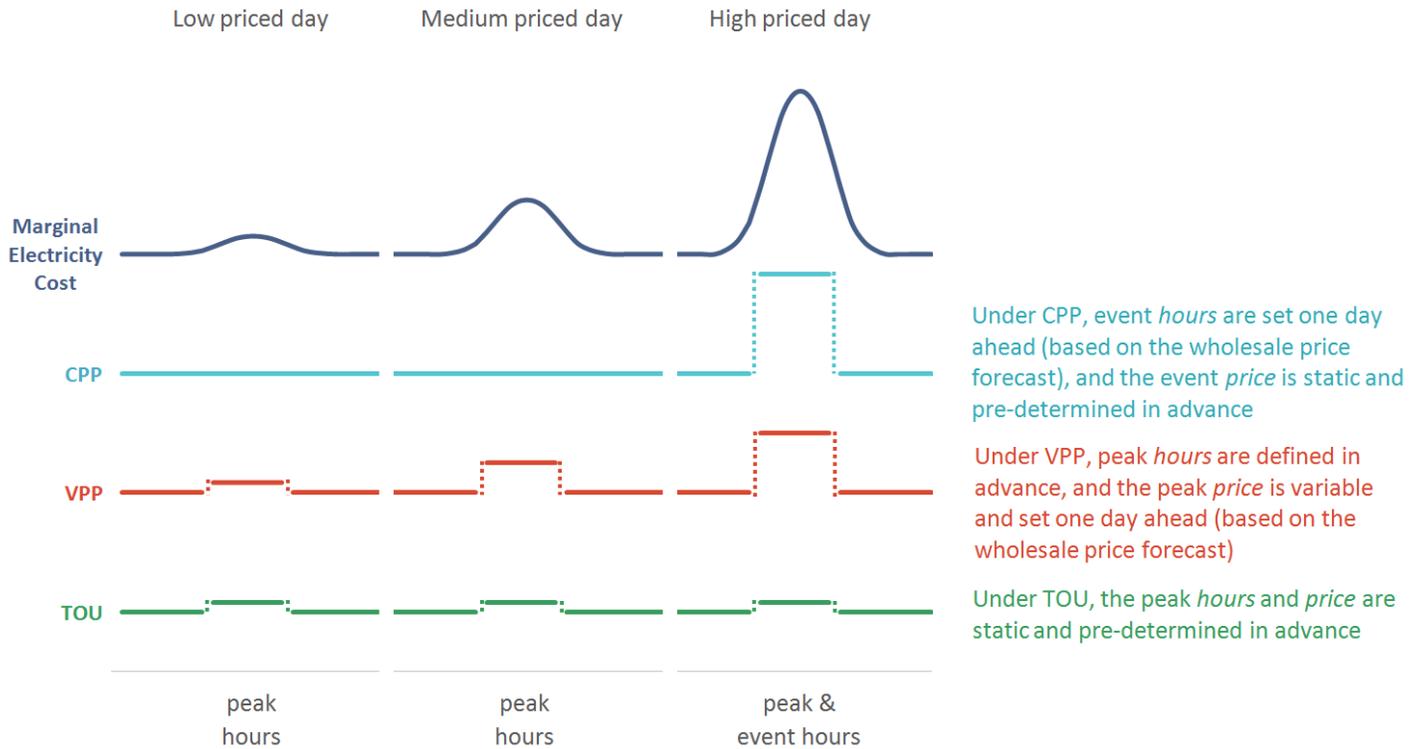


Figure 1. Time-based rate designs

At least one of these four time-based rate designs is included as an explicit treatment in each of the eleven utilities' consumer behavior studies (see Figure 2). Several utilities are testing more than one time-based rate design in their study.

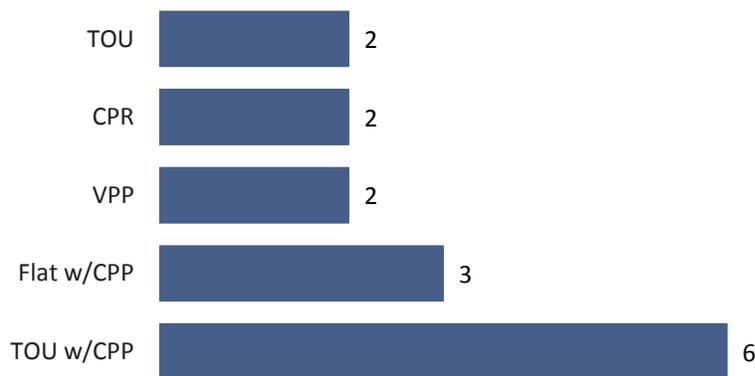


Figure 2. Number of utility studies designed to test various time-based rate treatments



2.1.2 Technology and Education Treatments

Utilities and state regulators are also interested in understanding the role of technology enabled by AMI as well as education efforts to enhance response to time-based rates and affect customers' willingness to take service under such rates. In-home displays (IHDs), programmable communicating thermostats (PCTs), and web-based energy information and feedback are all included as explicit treatments in several of the studies (see Figure 3). As with the rate treatments, some utilities have chosen to test a variety of different non-rate treatments in their study, while one utility chose to explicitly exclude enabling technology and education from their effort, focusing purely on the impacts of time-based rates.

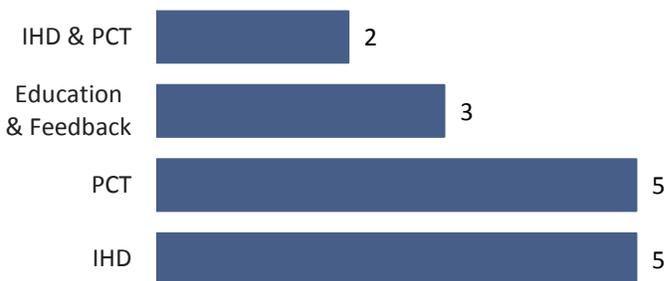


Figure 3. Number of utility studies designed to test various enabling technologies and education treatments

Some utilities included in this assessment are also testing joint applications of both rate and non-rate treatments in their study. For example, one utility study includes a treatment that tests the impact of a Flat w/CPP rate, another treatment that tests the impact of an IHD for customers remaining on the flat rate without a CPP overlay, and a third treatment that includes both a Flat w/CPP rate and an IHD.

2.1.3 Program Offer Treatments

In addition to testing the impact of time-based rates and enabling technologies on electricity consumption patterns, eight utility studies are also explicitly testing how successful different types of program offers are for recruiting customers. For example, in one study with a time-based rate program, customers were randomly assigned to receive either a technology offer of an IHD, or no technology offer, in order to determine if the technology offer enticed more customers to sign up for the rate. Figure 4 illustrates the



number of utility studies designed to experimentally test the effect of various types of offers on recruitment rates, including the type of technology offered, the type of time-based rate offered, and an opt-in versus an opt-out offer.



Figure 4. Number of utility studies designed to test various program offers

2.2 Experimental Design in CBS

All of the CBS studies testing time-based rates or technology treatments were initially designed to measure the impact of a treatment using a randomized experimental design, either a Randomized Controlled Trial (RCT) design or a Randomized Encouragement Design (RED). With RCTs, customers sign up for a study either through an opt-in method, in which customers must actively consent to participate in the study, or an opt-out method, in which customers must actively decline to participate in the study. Once they sign up, customers that opted-in (or did not opt-out) are randomly assigned to either a treatment group, which receives the treatment being tested, or a control group, which receives the treatment delayed by a year or does not receive the treatment. With REDs, customers are randomly assigned to either a treatment group, which is encouraged to sign up for the offered treatment through an opt-in or opt-out method, or a control group, which is not notified of the study and thus not encouraged to sign up for the treatment. For both RCTs and REDs, the treatment group is compared to the control group in order to determine the effect of the treatment.⁶

In addition, one utility is augmenting their randomized study with an additional aspect that uses a non-randomized, within-subjects method to test a treatment. A within-subjects

⁶ Although REDs require substantially larger sample sizes than RCTs to achieve comparable levels of power and precision for an estimation of treatment effects, a utility might prefer to implement an RED because it would not have to deny or delay any customer who wants to participate in a study.



method compares the treatment group during times when it receives the treatment to times when it does not receive the treatment. In theory, RCTs and REDs produce unbiased treatment estimates, while within subjects estimates are not. Figure 5 depicts the number of utility studies under assessment utilizing various combinations of experimental designs.

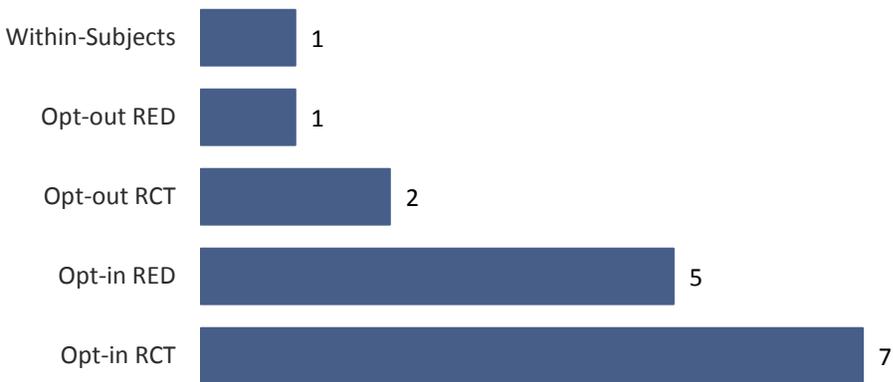


Figure 5. Number of utility studies using various experimental designs

For the studies designed to explicitly test the effect of different program offers, each one used a randomized experimental design (i.e., RCT or RED) in which customers were randomly assigned to be exposed to different types of offers. For example, customers were randomly assigned to receive either an offer of a Flat w/CPP rate, or an offer of a TOU rate.



3. Approach

Customer enrollment into a study can take on many forms. It is important to precisely characterize how the enrollment effort is undertaken to enable an accurate comparison of customer recruitment rates. In this section we describe the data collected from CBS utilities and also discuss our approach to reporting customer enrollment data.

3.1 Data Description

Customer enrollment into a study goes through many stages. Each stage of enrollment may decrease the pool of available customers (see Figure 6) for subsequent stages. First, out of the total pool of residential customers, the utility may choose a certain subset of *qualified customers* that meet certain criteria (e.g., energy use criteria, geographic criteria, presence of central air conditioning). Second, out of the pool of qualified customers, the utility may only target and market the study to a smaller subset of *solicited customers* (e.g., if marketing to too many customers is too costly). Third, once they are solicited, only some customers sign up for the study (either by opting-in or not opting-out), resulting in a yet smaller pool of *recruited customers*. Fourth, the utility may decide to screen some customers out after they signed up, leading to an even smaller subset of *selected customers* (e.g., if a survey is part of the selection process, customers may be selected based on their answers to survey questions). These stages lead to the final number of *enrolled customers* that will be part of the study.⁷ We collected data on the number of customers in each of these customer enrollment stages⁸ for each of the nine CBS studies for which enrollment data is available.⁹ The enrollment stages generally lasted a few months for each study, and mostly occurred in late 2011 and early 2012. Due to the timing of when our analysis was undertaken relative to when enrollment data was available out of the utilities studies, only nine of the eleven CBS utilities studies are included in this analysis. In spite of not having

⁷ In order to estimate customer response to time-based rates (examined in future LBNL reports), studies that are using a randomized encouragement design may also collect data from a group of control customers that were never solicited. These control customers that were never solicited are not included in the number of enrolled customers.

⁸ For this study, we only have data on the aggregate number of enrolled customers. In future reports, we will have individual customer demographic and electricity data that will allow customer segmentation analysis.

⁹ Two of the eleven utilities undertaking an SGIG co-funded consumer behavior study have not yet begun enrolling customers at the time this report was drafted. As such, they are not included in this preliminary report.



data on two of the CBS utility studies, our analysis includes around 400,000 customers who were solicited and 44,000 who were enrolled.

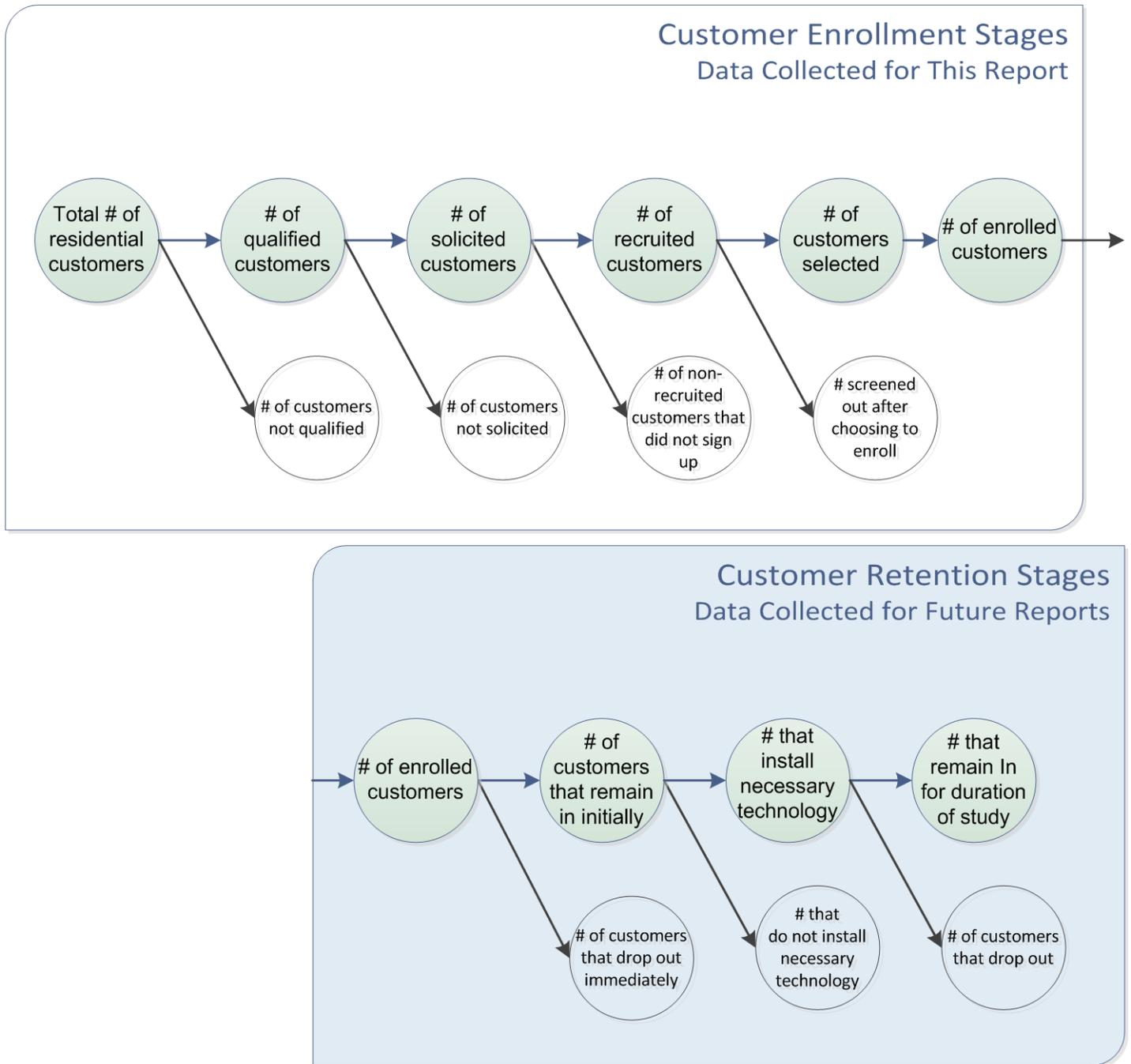


Figure 6. Data elements collected through various stages of customer enrollment and retention



Once the study begins and the treatment(s) go into effect, the customer pool goes through several additional stages of *customer retention* (see bottom panel in Figure 6). For example, an enrolled customer may drop out immediately after enrollment but before being exposed to treatment. Customers may decide not to install the required technology or they may drop out at some point before the end of the study. As mentioned previously, this report only captures data for the enrollment stages of the utility's study; future LBNL reports will examine data for the various customer recruitment stages.

In addition to this quantitative data, LBNL also collects more qualitative information from the CBS utilities on the lessons learned in a variety of areas, including customer enrollment in the CBS projects. Specifically, LBNL collects the experience of the CBS projects as a whole, identifying their initial expectations concerning a certain issue, relating how their actual experience differed, and sharing what they took away from this for future efforts. This qualitative data is collected through a variety of different channels on an ongoing basis from the CBS projects, including the CBS Utility Forum, the Technical Advisory Groups, and personal communications with LBNL staff.¹⁰

3.2 Empirical Approach

In order to characterize our empirical approach, we define the term *program offer* or simply *offer* to represent the different types of time-based rate, technology, and opt-in versus opt-out proposals made to customers when they are solicited to enroll in a study (e.g., an offer of a TOU rate, an offer that includes enabling technology, or an opt-in offer). We define the term *solicitation effort* to represent one complete set of offers made to one group of customers (e.g., one solicitation effort may have an opt-out offer, a TOU rate offer, and no technology offer). There are two types of *solicitation efforts* depending on the experimental design of the study:

1. **Recruitment into a specific treatment** (see example 1 in Figure 7): The utility first selects a group of customers that are targeted for solicitation. These customers are then split into two (or more) pools, where each is assigned to be solicited for a specific treatment pool. Once a customer signs up for the study, the customer is

¹⁰ The CBS Utility Forum provides an opportunity for the SGIG CBS utilities to share information among themselves. Each CBS Utility is provided by LBNL with a small group of industry experts (i.e., Technical Advisory Group) who provide technical assistance to the utility concerning study design, implementation and evaluation issues.



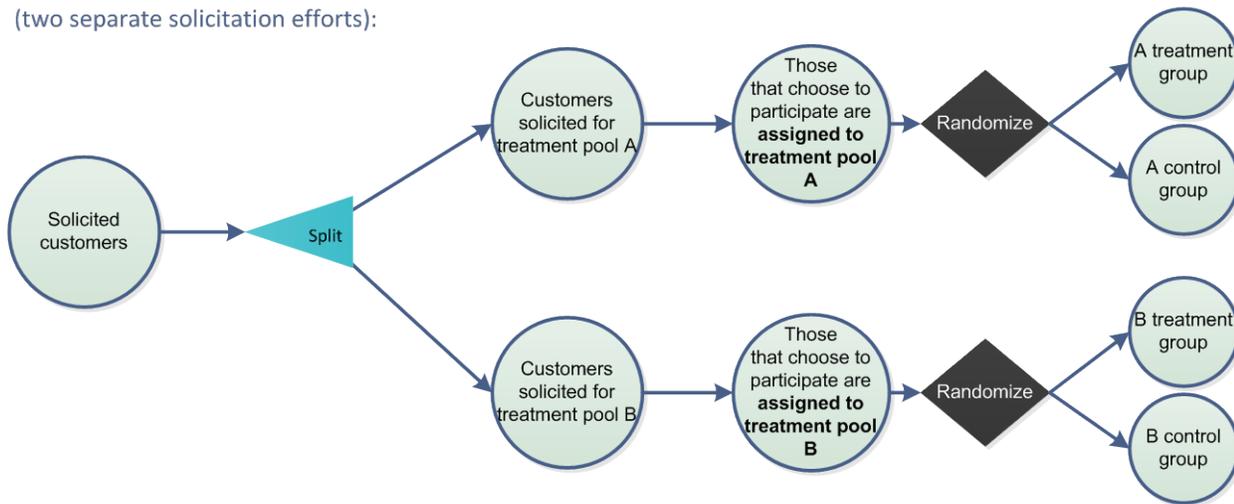
assigned to the specific treatment pool for which he or she was solicited. Customers in a specific treatment pool are then randomly assigned to either the treatment group, which receives the treatment, or the control group. For example, a utility makes the following solicitation: one group of customers is solicited specifically for a TOU rate, and customers that sign up are placed in the TOU treatment pool; a second group is solicited specifically for a Flat w/CPP rate, and customers that sign up are placed in the Flat w/CPP treatment pool. A utility would pursue this approach to recruitment if it wanted to explicitly understand customer preferences for different combinations of rate and/or technology treatments. We represent this case as two *solicitation efforts* for this utility; one TOU solicitation effort and one Flat w/CPP solicitation effort.

2. **Recruitment into a generic study** (see example 2 in Figure 7): The utility first selects a group of customers that are targeted for a solicitation. These customers are then solicited for a single, generic study that includes two or more treatments. Once a customer signs up for the study, only then does the utility split customers into specific treatment pools. Customers in a specific treatment pool are then randomly assigned to either the treatment group, which receives the treatment, or the control group, which does not receive the treatment. For example, a utility solicits a group of customers for a study in which, should they sign up, they may be placed into a TOU rate treatment pool, or they may be placed into a Flat w/CPP rate treatment pool. A utility would pursue this approach to recruitment if it wanted to ensure that customers in different treatment groups within its study are similar, so that the results can be compared (i.e., all of the customers in all treatment groups are the same type of customers that would choose to enroll in a generic study).¹¹ We represent this case as one *solicitation effort* for this utility; one “TOU or Flat w/CPP” solicitation effort.

¹¹ Results across different treatment groups cannot be directly compared when customers are recruited into specific treatments, because different types of customers may decide to sign up for different treatments. Different treatments would then have different types of customers, and so any observed differences between the treatments may be due to the difference in customers, not due to the treatments.



Example 1: customers solicited into two specific treatment pools
(two separate solicitation efforts):



Example 2: customers solicited into one generic treatment pool
(one solicitation effort):

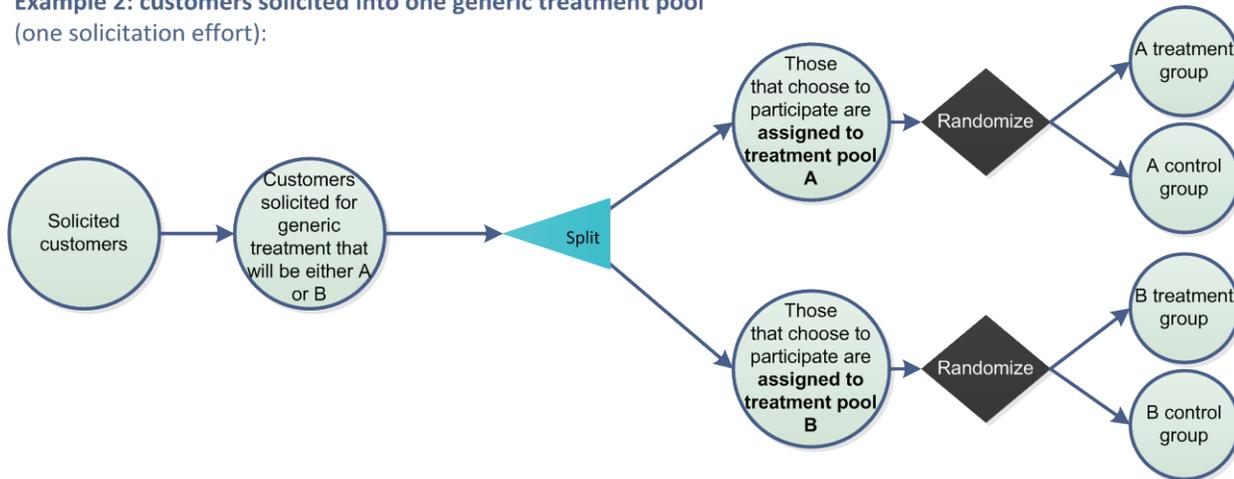


Figure 7. Example of solicitation efforts

Based on this definition of a *solicitation effort*, there are nineteen different customer solicitation efforts across the nine utilities included in this report.

3.2.1 Recruitment Rates

While the number of customers that are retained in each of the customer enrollment stages is important to understand for study planning purposes, in this report most of our analysis is focused on the number of customers that sign up for the program (i.e., recruited customers) out of those that are solicited. We define the *recruitment rate* as the percentage



of recruited customers out of the total number of customers solicited in one solicitation effort (Equation 1).

$$\text{Equation 1: Recruitment Rate} = \frac{\text{Recruited customers}}{\text{Solicited customers}}$$

We focus on the recruitment rate because this is the stage of the enrollment process in which the customer must give an affirmative indication that they will sign up for the study (and potentially be exposed to the time-based rate and/or enabling technology). When utilities are planning a study, this is likely to be the stage that is the least well known and that seems to be outside of the utility's control. We provide an overall summary of the recruitment rates for each of the nineteen solicitation efforts, and then examine three types of program offers:

- An opt-in versus opt-out offer
- Offers of different time-based rates
- Technology offers

For each of these three types of program offers, we report two findings: first, Descriptive Results that are based on summary statistics; and second, Experimental Results from explicit experimental tests of the effectiveness of different types of program offers on recruitment rates.

We also report on how accurately the utilities were able to forecast their recruitment rate. We define the actual versus planned recruitment rate as the percentage difference between the actual and the planned recruitment rate. This is helpful in determining how accurate the utilities were in planning their recruitment efforts.

$$\text{Equation 2: Actual vs. Planned Recruitment Rate} = \frac{\text{Actual Recruitment Rate} - \text{Planned Recruitment Rate}}{\text{Planned Recruitment Rate}}$$

For the Descriptive Results, we report the unweighted average recruitment rates for opt-in and opt-out studies, grouped by: the type of time-based rate offered and the type of technology offered.¹² Note that because each utility chose the type of time-based rate and

¹² We provide an unweighted average rather than a weighted average because we believe that unobservable differences across utilities may be more of a factor in a customer's choice to enroll than the variables that we are examining. For example, consider the extreme case in which one utility solicited more customers than all of the other utilities combined, and also had exceptionally high recruitment rates. Then the characteristics of that utility would drive all of the weighted



the type of technology that they deemed best to include in their own study, one cannot interpret any differences in recruitment rates across all utility studies as being caused by the recruitment characteristics.¹³ However, one can readily observe the range in recruitment rates that these utilities achieved and use them to set realistic boundaries on recruitment rates for similar efforts.

Eight of the nineteen solicitation efforts explicitly and experimentally tested the relative success of different types of offers by randomly assigning customers to receive different program offers. For these cases, it is possible to draw causal inferences about which specific types of offers would result in higher recruitment rates. We are able to provide Experimental Results from the following randomized trials:

- A test of an opt-out versus an opt-in offer
- A test of an opt-in Flat w/CPP offer versus a TOU offer
- A test of an opt-out TOU w/CPP offer versus a TOU offer versus a Flat w/CPP offer
- A test of an opt-in IHD technology offer versus no technology offer

Specifically, for each of these comparisons, we perform a two-proportion z-test of differences¹⁴ in order to determine which solicitation method resulted in a higher recruitment rate.¹⁵ For situations in which there are two or more utilities testing the same solicitation method (e.g., two utilities that randomize customers into an opt-in versus an opt-out method), we perform a test with the total number of customers aggregated across utilities as well as a separate test segmented by each utility.

3.2.2 Qualification, Solicitation, Recruitment, and Selection

We focus mainly on reporting the recruitment rate as the primary metric of interest. In addition, we provide Descriptive Results for the other enrollment stages for the fourteen

average rates, but it may be that the high recruitment rate was due to something that we are not capturing, such as a great marketing campaign or utility customers that are particularly amenable to the program.

¹³ There may be many other unobservable differences in the studies that actually cause the difference in recruitment rates (e.g., the utilities may have used different marketing materials, and the customers in the utilities may be quite different).

¹⁴ For a comprehensive book on statistics and econometrics, see Greene (2011).

¹⁵ The extent to which the results from this analysis can be extrapolated to different settings depends on the degree to which the solicitation efforts and utility characteristics are similar.



opt-in solicitation efforts.¹⁶ Specifically, we define the *qualification rate* as the percent of customers that qualified for the study out of the total pool of residential customers (Equation 3); the *solicitation rate* as the percent of customers that were solicited out of the pool of qualified customers (Equation 4); the *recruitment rate* is as defined above (the percent of customers that were recruited into the study out of the pool of solicited customers); and the *selection rate* as the percent of customers that were not screened out of the study out of the pool of recruited customers who had already signed up for the study (Equation 5).

$$\text{Equation 3: Qualification Rate} = \frac{\text{Qualified customers}}{\text{Total Residential customers}}$$

$$\text{Equation 4: Solicitation Rate} = \frac{\text{Solicited customers}}{\text{Qualified customers}}$$

$$\text{Equation 1: Recruitment Rate} = \frac{\text{Recruited customers}}{\text{Solicited customers}}$$

$$\text{Equation 5: Selection Rate} = \frac{\text{Selected customers}}{\text{Recruited customers}}$$

3.2.3 Lessons Learned

Although identifying the degree to which recruitment rates differ across different solicitation efforts is important for future utility efforts, it is equally important to understand the context that underlies those recruitment figures. Based on conversations with utility CBS project managers and TAG members, a summary of the qualitative data collected by LBNL on the lessons learned in the area of customer enrollment is presented, which can be used to help further characterize and contextualize the observed recruitment rates.

¹⁶ We did not include the five opt-out solicitation efforts, as it is hard to draw even qualitative observations from only five studies.



4. Results

In section 4.1, we provide summary statistics on the number of customers that are recruited out of the pool of solicited customers (i.e., the recruitment rate), and results from studies that are explicitly testing the effectiveness of different types of program offers through randomized trials (e.g., recruitment rates for opt-in versus opt-out offers, different types of time-based rates and technology offers). Findings on the number of customers that are maintained throughout other enrollment stages are presented in section 4.2, and lessons learned are discussed in section 4.3.

4.1 Recruitment Rates

Figure 8 displays the recruitment rates for each of the nineteen solicitation efforts, grouped into opt-out and opt-in solicitations.

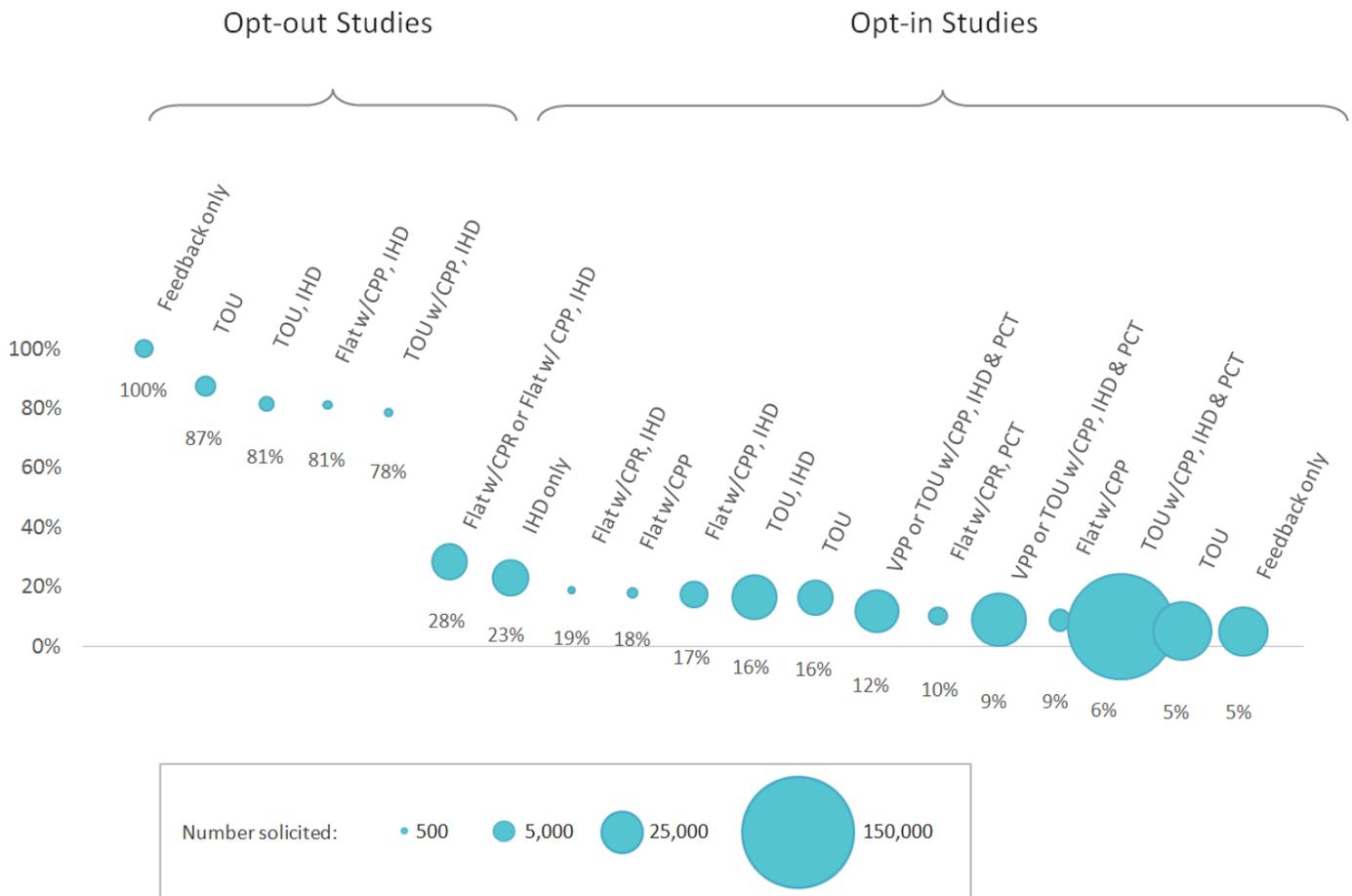


Key Finding: Descriptive Result 1

For time-based rate and enabling technology studies that use an opt-in program offer, recruitment rates range from 5% to 28%. For those that use an opt-out program offer, recruitment rates range from 78% to 87%.

One opt-out feedback study, in which customers were given access to their energy use information online, shows a 100% recruitment rate because no one opted-out of being able to access the website. For this kind of study, in which a customer who ignores the study completely will not experience any impact whatsoever, the recruitment rate may be less meaningful than the percentage of customers that actually use the treatment (e.g., website).

When utilities design their studies, they must estimate an expected recruitment rate in order to determine both the number of customers that are needed to enroll in the study as well as the number of customers who must be solicited to ensure that the energy impact estimates are valid (that they meet statistical power and precision requirements).



19 total solicitation efforts listed. Circle size represents the total number of customers solicited.

Figure 8. Recruitment rates for each solicitation effort

Although a few utilities included in this analysis were highly accurate in their predictions for recruitment, many were not. Figure 9 shows the actual and planned recruitment rates.



Key Finding: Descriptive Result 2

Most utilities did not accurately predict recruitment rates for their study solicitation efforts. Five of the twelve opt-in solicitation efforts underachieved their recruitment rates such that actual recruitment rates were 7 to 22 percentage points below the actual recruitment rate. This represents actual recruitment rates that were at least a quarter of what was planned.

Out of the six opt-in solicitation efforts that underachieved their planned recruitment rates, five had an actual recruitment rate that was seven to twenty two percentage points lower than planned, representing an actual recruitment rate that was at least a quarter of what was planned (i.e., was 24-69% lower). Five out of the six opt-in solicitation efforts that overachieved had an actual recruitment rate that was no more than four percentage points higher than planned. The sixth was fourteen percentage points higher than planned, almost double the planned rate. Interestingly, for opt-out solicitation efforts, four utilities predicted that many more customers would opt-out than what was observed.¹⁷ While overachieving recruitment rates may not have severe consequences, underachievement can cause problems with the study evaluation effort which may necessitate changes to the study's design. If a study has planned to recruit a certain number of customers and the actual number of customers recruited is far less, the study may have to be re-designed (e.g., the number of treatments being tested may have to be reduced) in order to achieve statistically valid load impact estimates.

Our results suggest that a utility may expect to achieve at least a 5% recruitment rate for opt-in studies. Under ideal circumstances, recruitment rates into such studies could exceed 20%. However, for planning purposes assuming 10% recruitment rate seems most appropriate.

¹⁷ Again, for opt-out methods, understanding the customer retention rates *after* the beginning of the study may be particularly important for interpreting the overall enrollment rates. For example, data after the study begins may show that many more customers drop out of these studies.



4.1.1 An Opt-out versus Opt-in Offer

4.1.1.1 Summary

As shown in Figure 8, studies using opt-out program offers had higher recruitment rates on average than studies using opt-in offers (the unweighted average recruitment rate is 82% for opt-out offers, and 14% for opt-in offers). We would like to determine whether the higher recruitment rates are caused by the opt-out offer, rather than due to random chance alone or to the differences between the types of customers in the utilities (statistically termed a *selection bias* issue). We examine this in the next section.

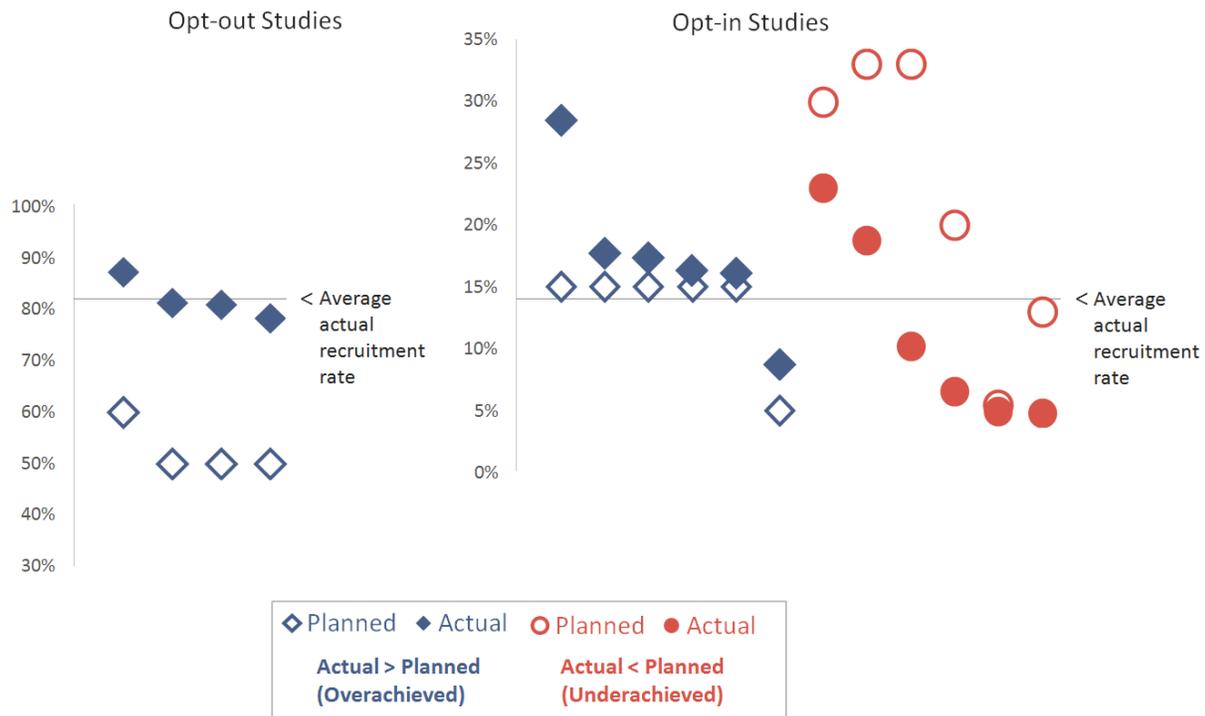


Figure 9. Actual versus planned recruitment rates

4.1.1.2 Analysis Results

Figure 10 shows the recruitment rates for the total number of customers that were **randomly** assigned to be solicited to participate in a study through either opt-in or opt-out



offers. The data come from the two utilities who explicitly tested for this in their study. One utility randomly assigned ~45,000 of its residential customers to an opt-in program offer and another ~5,000 residential customers to an opt-out offer. The other utility randomly assigned ~53,000 of its residential customers to an opt-in program offer and another ~4,000 to an opt-out offer.

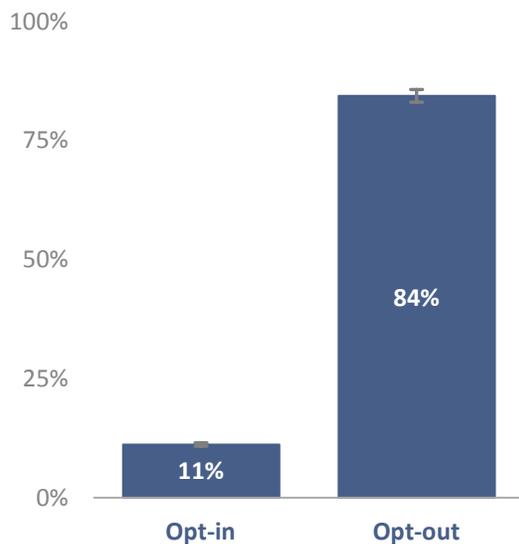


Key Finding: Experimental Result 1

More customers enroll into a time-based rate program with an opt-out offer as opposed to an opt-in offer (see Figure 10).

Segmenting customers into each of the two utilities produces similar results: 17% and 5% for opt-in, versus 81% and 87% for opt-out.¹⁸ This indicates that customers are more likely to sign up for an opt-out offer than an opt-in offer (i.e., more customers choose to not opt-out of a study than choose to opt-in).

¹⁸ One utility further separated the randomized recruitment efforts into separate time-base rate and technology offers. Segmenting into these cohorts also produced similar results: an offer of IHDs with a TOU rate had a recruitment rate of 16% for opt-in and 81% for opt-out; an offer of an IHD with a CPP rate had a recruitment rate of 17% for opt-in and 81% for opt-out. A two-proportion z-test of differences between the opt-in and opt-out recruitment rates are statistically significant in any case. However, what is more appropriate in this case is to test whether the difference is larger than what was *expected* (i.e., the null hypothesis is the a priori belief). In their study plans, the utilities' expected opt-out recruitment rates were 35% higher than the expected opt-in rates. These results show that the opt-out rates are statistically significantly higher than 35%.



Percentages include the total number of customers across the two utilities that randomized opt-in versus opt-out program offers (99.9% confidence intervals shown; N=100,000).

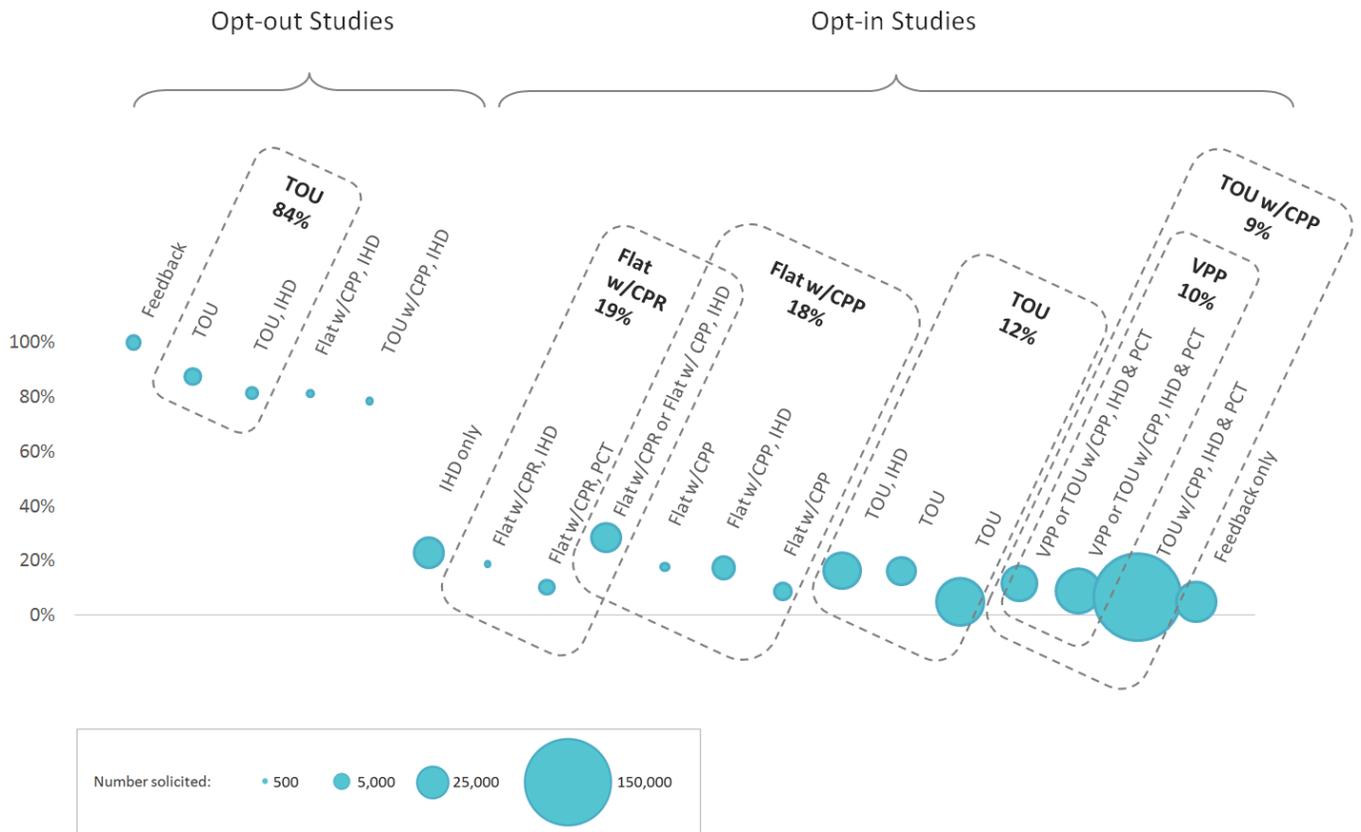
Figure 10. Recruitment rate results for tests of opt-in versus opt-out program offers

4.1.2 Offers of Different Time-Based Rates

4.1.2.1 Summary

Figure 11 shows the unweighted average recruitment rates (see Section 4.1 for more details) across the nineteen solicitation efforts, grouped into five different time-based rate offers (i.e., TOU, TOU w/CPP, Flat w/CPP, Flat w/CPR, and VPP¹⁹), and segmented between opt-out and opt-in. For opt-in solicitation efforts, solicitations that offered Flat w/CPP (18%) or Flat w/CPR (19%) had higher recruitment rates on average than those that offered TOU (12%), TOU w/CPP (9%), or VPP (10%). For opt-out solicitation efforts, those that offered TOU had slightly higher recruitment rates (84%) on average than those that offered Flat w/CPP (81%) or TOU w/CPP (78%).

¹⁹ VPP is similar to a TOU w/CPP rate in that both rates allow for the possibility for the peak period price to be altered with some notice. In the latter case, this change in the rate is very infrequent whereas in the former case it happens on a daily basis.



Unweighted average of recruitment rates across 19 solicitation efforts. Circle size represents the total number of customers solicited.

Figure 11. Summary of recruitment rates for different time-based rate offers

In Figure 11, it is important to note that because the type of time-based rates offered were not randomly assigned to different utilities; we should not interpret any observed differences as causal. For example, it may be tempting to conclude that offering a Flat w/CPP rate would result in 6% higher recruitment rates than a TOU rate. However, the utilities that decided to offer Flat w/CPP rates may simply have different types of customers, who are more willing to enroll in *any* time-based rate. Therefore, the difference in customers (or any other unobservable characteristics of the utility or the study) may be causing the difference in recruitment rates, *not* the type of rate that was offered. In fact, as seen in the next section, an analysis of explicit randomized tests of different time-based rate offers actually does not bear out the differences seen in Figure 11.



4.1.2.2 Analysis Results

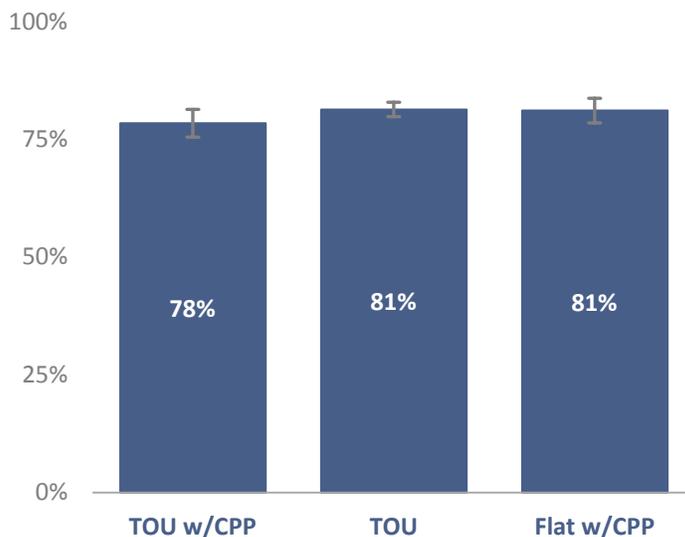
Figure 12 shows the recruitment rates for customers that were **randomly** assigned to be solicited to participate in a study using an opt-out method with an offer of either a TOU rate, a Flat w/CPP rate, or a TOU w/CPP rate. The data come from the lone utility, where customers were randomly assigned to one of these three program offers. All of these customers were offered an IHD, but were not obligated to accept it in order to enroll in the study. The number of customers solicited was ~2,500 for the TOU offer, ~900 for the Flat w/CPP offer, and ~800 for the TOU w/CPP offer.



Key Finding: Experimental Result 2

For opt-out solicitations, the type of time-based rate offer does not materially affect the customer recruitment rate (see Figure 12).

The recruitment rates were 81% for the TOU offer, 81% for the Flat w/CPP offer, and 78% for the TOU w/CPP offer. The differences between any pairings of the rates are not statistically significant (the p-value of two-proportion z-test is 0.88 for TOU vs. Flat w/CPP, 0.18 for Flat w/CPP vs. TOU w/CPP, and 0.08 for TOU vs. TOU w/CPP). This suggests that customers are not more likely to opt-out of one time-based rate over the other, despite the rate differences.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive opt-out offers of IHDs along with one of the three time-based rates (95% confidence intervals shown; N=4000).

Figure 12. Opt-out recruitment rate results for tests of time-based rate offers

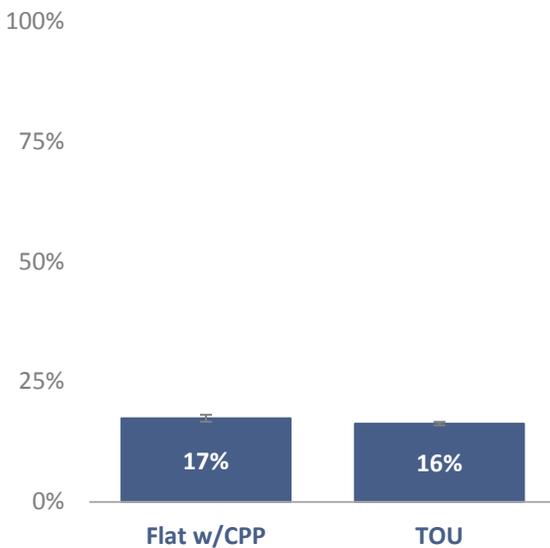
Figure 13 shows recruitment rates for customers randomly assigned to be solicited to participate in a study using an opt-in method for either a TOU rate or a Flat w/CPP rate. The data come from one utility, with four different solicitation efforts. Two solicitation efforts include the offer of an IHD but differ in the type of time-based rate offered: one with Flat w/CPP, and one with TOU. The two remaining solicitation efforts do not include a technology offer, and again differ in the type of time-based rate offered: one with Flat w/CPP, and one with TOU. Figure 13 shows the combined recruitment rates for both of the TOU offers (~26,000 customers solicited with an IHD offer, and ~16,000 solicited without a technology offer), versus both of the Flat w/CPP offers (~9,000 customers solicited with an IHD offer, and ~1,300 solicited without a technology offer).



Key Finding: Experimental Result 3

For opt-in solicitations, the type of time-based rate does not materially affect the customer recruitment rate (see Figure 13).

The Flat w/CPP offer has a 17% recruitment rate versus 16% for the TOU offer; the difference is statistically significant with a p-value <0.01. Segmenting the customers into those that were offered an IHD and those that were not offered technology, a Flat w/CPP offer is still 1% higher than a TOU offer, but the difference is only statistically significant for the customers that were offered an IHD. This suggests that customers may, to a very small extent, prefer to opt-in to a Flat w/CPP over a TOU rate. However, the preference is very small.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive a CPP offer versus a TOU offer (95% confidence intervals shown; N=50,000).

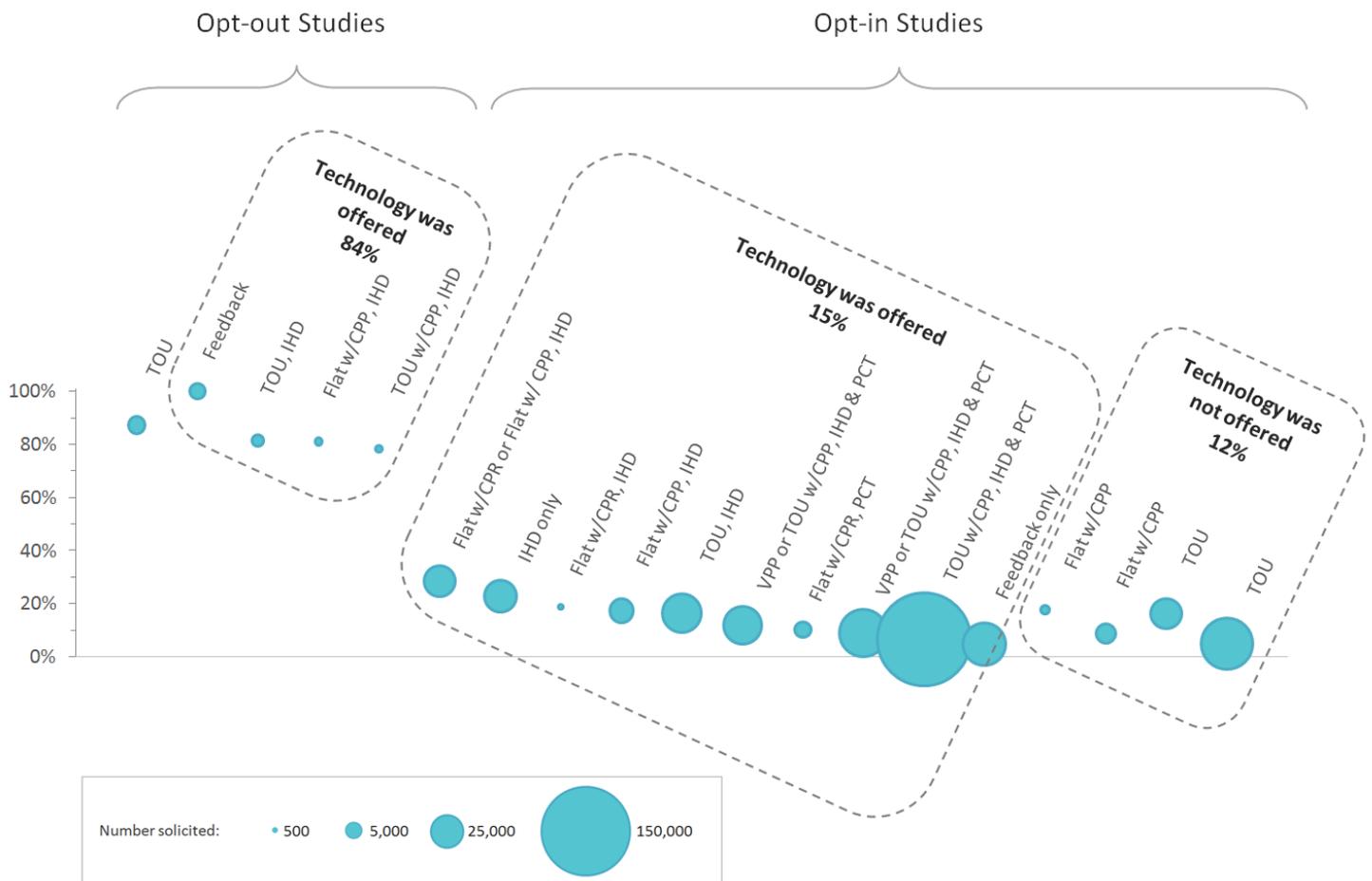
Figure 13. Opt-in recruitment rate results for tests of time-based rate offers



4.1.3 Technology Offers

4.1.3.1 Summary

Figure 14 shows the unweighted average recruitment rates across solicitation efforts, grouped according to whether technology was offered or not, and segmented between opt-out and opt-in methods. For opt-in program offers, the recruitment rates were slightly higher on average for solicitation efforts that offered technology relative to those that did not (15% vs. 12%). For opt-out methods, the recruitment rates were slightly higher on average for solicitation efforts that did not offer technology (84% vs. 87%).



Unweighted average of recruitment rates across 19 solicitation efforts. Circle size represents the total number of customers solicited.

Figure 14. Summary of recruitment rates for technology offers



In Figure 14, as with previous depictions of these summary recruitment rates, it is important to note that because the type of technology offered was not randomly assigned to different utilities, we should not interpret any observed differences in recruitment rates as causal (i.e., offering technology does not necessarily *cause* or result in higher recruitment rates). Only an analysis of explicit randomized tests of technology offers allows us to draw causal inferences, which in this case shows that in fact this difference is not born out.

4.1.3.2 Analysis Results

Figure 15 shows the recruitment rates for the total number of customers that were randomly assigned to be solicited to participate in a study using an opt-in method with either an offer of an IHD or no technology offer. The data come from the lone utility that implemented such a study, incorporating four different solicitation efforts. Two solicitation efforts include the offer of a TOU rate but differ in the offer of technology: one with an offer of an IHD and one without a technology offer. The two remaining solicitation efforts include the offer of a Flat w/CPP rate which again differs in the offer of technology: one with an offer of an IHD and one without a technology offer. Customers were randomly assigned to each of these four solicitation efforts. Figure 15 shows recruitment rates reflecting the total number of customers recruited for both of the IHD technology offers (~26,000 customers solicited for the TOU rate, ~9,000 solicited for the Flat w/CPP rate), versus both of the no technology offers (~16,000 solicited for the TOU rate, and ~1,300 solicited for the Flat w/CPP rate).



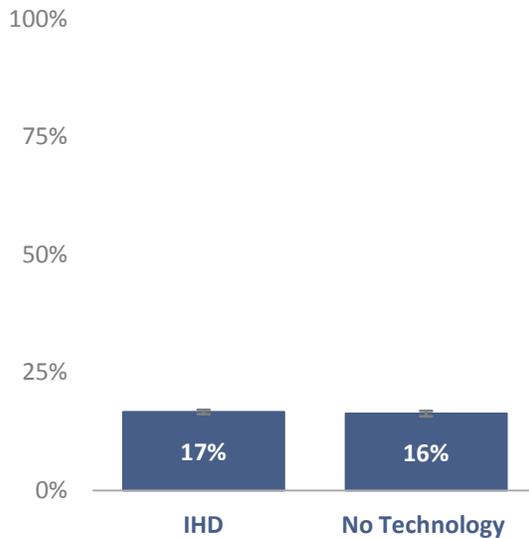
Key Finding: Experimental Result 4

For opt-in solicitations, the offer of technology does not materially affect the customer recruitment rate (see Figure 15).

As shown in Figure 15, both an IHD offer and a no-technology offer have a 16-17% recruitment rate; the difference is not statistically significant. Segmenting customers into CPP and TOU solicitation efforts shows similar results (around 16% recruitment rates for both TOU offers with and without an IHD offer, and around 17% for both Flat w/CPP offers; neither difference is statistically significant). This indicates that customers are *not* more



likely to opt-in to a time-based rate if they are offered an IHD, despite the supposed monetary value of such a device.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive an IHD offer versus no technology offer (95% confidence intervals shown; N=50,000).

Figure 15. Opt-in recruitment rate results for tests of technology offers versus no technology offers

4.2 Qualification, Solicitation, and Selection Rates

This section provides basic summary statistics on the various customer enrollment stages before and after the recruitment stage: the qualification rates, solicitation rates, and selection rates. Overall, for opt-in solicitation efforts, the qualification rate ranges from 1.3% to 83%, with an unweighted average of 32%; the solicitation rate ranges from 23% to 100% with an unweighted average of 87%; and the selection rate ranges from 54% to 100% with an unweighted average of 93% (see Table 1 and Table 2).



	Qualification rate	Solicitation rate	Recruitment rate	Selection rate
HD Only	71%	73%	23%	79%
Flat w/CPR, IHD	1%	23%	19%	100%
Flat w/CPR, PCT	3%	94%	10%	100%
VPP or TOU w/CPP, IHD & PCT	4%	100%	12%	100%
VPP or TOU w/CPP, IHD & PCT	6%	100%	9%	100%
TOU w/CPP, IHD & PCT	23%	33%	6%	73%
Feedback only	26%	100%	5%	100%
TOU, IHD	33%	100%	16%	100%
TOU	33%	100%	16%	100%
Flat w/CPP	33%	100%	18%	100%
Flat w/CPP, IHD	43%	100%	17%	100%
TOU	43%	100%	5%	100%
Flat w/CPP	61%	100%	9%	100%
Flat w/CPR or Flat w/ CPP, IHD	83%	100%	28%	100%

Table 1. Qualification, solicitation, recruitment, and selection rate for opt-in solicitation efforts

	Qualification rate	Solicitation rate	Recruitment rate	Selection rate
Feedback only	3%	100%	100%	100%
TOU w/CPP, IHD	33%	100%	78%	100%
TOU, IHD	33%	100%	81%	100%
Flat w/CPP, IHD	33%	100%	81%	100%
TOU	43%	100%	87%	100%

Table 2. Qualification, solicitation, recruitment, and selection rate for opt-out solicitation efforts

There may be multiple factors that drive some of these differences. For example, studies that include different enabling technologies may require possession of certain items of equipment to qualify as a participant (e.g., the presence of central air conditioning to receive a programmable communicating thermostat or a broadband internet connection to



receive an in-home display). Some utilities may have budgets for marketing and recruitment efforts that allow them to solicit all of their customers, while others may only be able to focus on soliciting a specific subset of customers. Some utilities have collected sufficient data prior to the solicitation effort to know which customers to target whereas others need to collect that information during the recruitment process to determine who qualifies as a participant. When we have customer level data on the enrollment effort as well as information on retention rates and load impact estimates, we may be able to draw more definitive conclusions about the effects of these enrollment stages and the factors that influence them.

4.3 Lessons Learned on Customer Enrollment

In this section, we provide a summary of the lessons learned from qualitative data collected through various channels on the utilities' customer enrollment experiences.

Prior to test marketing materials that would be used to solicit participation into studies that included time-based rates, many utilities believed words like “critical”, “emergency”, and “events” would confer the necessary message about what the rate was trying to accomplish and how valuable a customer’s participation in that rate would be. Several utilities subsequently performed focus groups, surveys and other forms of test marketing of their recruitment material which indicated the terms and concepts utilities thought would connote positive concepts with customers actually had the opposite effect. Terms like “response”, “auto”, and “event” were construed as reactionary words that deflated personal control (e.g., “emergencies” are out of a customer’s control). Instead, some participants in focus groups appeared to prefer terms that construed a sense of personal control over one’s own energy usage and resulting bill (e.g., “control”, “choice”, “sense”).



Key Finding: Lessons Learned 1

Utilities found focus groups, surveys and other tools to be vital components for test marketing terms and concepts that will attract customer interest and engage them to participate in the rate being offered.

Utilities also learned from focus groups that customers claimed to be primarily motivated by environmental messaging when it came to recruitment into new time-based rates. Test



marketing along with observed recruitment data from various messages (e.g., “saving money”, “environmental stewardship”, “taking control”, “fun”) revealed the primary motivator for the majority of customers was actually financial.



Key Finding: Lessons Learned 2

Utilities learned the importance of validating focus groups with other test marketing efforts across a variety of customer segments and circumstances to develop the most effective messaging for their new time-based rate recruitment campaign.

Once the messaging and marketing planning efforts were completed, the utilities moved into the recruitment phase of the study. Issues often arise during this time in the study lifecycle that can threaten its overall success. Many utilities, therefore, included a two week soft launch window in their enrollment process in order to identify and address any problems that internal planning and test marketing of recruitment materials did not catch. Unfortunately, even with a two week soft launch period, one utility still did not have enough time to incorporate necessary feedback to the solicitation materials in time for the hard launch, at which point changes were very difficult and costly to make.



Key Finding: Lessons Learned 3

Utilities were surprised at how much time and resources they needed to allocate between soft launch and hard launch of the solicitation effort to adjust the messaging and other details accordingly based on feedback.

The recruitment process can also be affected by assumptions about the number of customers capable and willing to receive certain types of enabling technology (e.g., presence of central air conditioning to receive a programmable communicating thermostat). By not accurately quantifying ahead of the study enrollment effort the size of the available population that would pre-qualify for a specific enabling technology, the number of customers that would be willing/able to accept, and the number that then have it installed, some utilities substantially overestimated the level of acceptance for a new rate or product offering that was strictly paired with such enabling control technologies.



Key Finding: Lessons Learned 4

Utilities learned that before determining if a new rate or product offering is to be paired with a form of enabling technology, they could benefit from spending time understanding potential customer concerns with that technology and identifying the available pool of participants who would qualify for and be willing to accept such technology so that realistic expectations for recruitment can be set ahead of time.

Many of the utilities who included some form of enabling technology in their study decided to enlist internal utility workers or external contractors to help install and provision this equipment at a participating customer's premise. These utilities believed that individuals responsible for installing these pieces of technology at a customer site would have little to no effect on that customer's decision to finalize and complete the enrollment process in the study. Unfortunately, installation of technology by individuals, either internal or external to the utility, who did not have sufficient appreciation for the importance of the public relations role they played and/or were insensitive to the consequences of not playing that role well, resulted in negative ramifications for customer engagement efforts at several utilities.



Key Finding: Lessons Learned 5

Utilities realized the need to ensure that all utility representatives and contractors that interact with customers at any level are informed, committed and enabled to make the experience a positive one for the customer. One way to do this most effectively was by focusing on communications skills as much as technical skills when hiring or recruiting people to fill these positions.



5. Conclusion

This report provides preliminary insights into customer recruitment rates for nineteen solicitation efforts offering time-based rate and technology programs. Overall, we find that recruitment rates range from 78% to 87% for opt-out studies, and 5% to 28% for opt-in studies. We also find that opt-out methods result in much higher recruitment rates (11% for opt-in versus 84% for opt-out), that offering an IHD does not result in a statistically significant difference in recruitment rates, and that the type of time-based rate does not materially affect the recruitment rate (for opt-out methods, the differences between a TOU, a Flat w/CPP, and a TOU w/CPP rate are not statistically significant; for opt-in methods, the difference between a Flat w/CPP and a TOU rate is only 1%).

It is perhaps not surprising that our results show that programs that use opt-out methods result in much higher recruitment rates. An opt-in approach essentially retains the current “default” (e.g., the default rate is a flat rate), while an opt-out approach determines a new default (e.g., a time-based rate). In general, people tend to adhere to the “status quo” or “default” choice.²⁰ Other areas have used this understanding of customer behavior to adopt policies that are deemed to improve social welfare. For example, employee participation in 401(k) plans increase from 37% to 86% under automatic enrollment (Madrian and Shea 2001). Due in part to such evidence, the Obama Administration recently passed a Retirement and Savings Initiative, which makes it easy for small businesses to automatically enroll their employees in savings plans, and to automatically increase their savings rates over time unless they opt-out (IRS 2009). The energy industry is currently grappling with what type of rate design should serve as the default rate.

One way to frame the recruitment results is through this lens of customer preferences for the default option. Based on the experience of these studies, customers overwhelmingly accept the default rate design offered to them, regardless of what it looks like: the percentage of customers that actively did not take the default rate (e.g., those that opted-out or opted-in) is between 5% and 28%. Looking at the experimental results, while a higher percentage of customers (16%) actively moved off of a time-based default rate (e.g.,

²⁰ See Kahneman, Knetsch, and Thaler (1991).



TOU, TOU w/ CPP, etc.) than the percentage (11%) that moved off of a standard rate (e.g., flat, inclining block), this difference (5%) is modest.

However, one could construe a customer's preference for the default as simply not paying attention, and making no choice at all. It may be the case that customers solicited via an opt-out method are more likely to drop-out of the time-based rate program after they experience an actual consequence of "not opting out", such as receiving their first bill on a new rate program, at which point a more affirmative and declarative choice has been made. Once future data are collected for customer recruitment numbers after the time-based rates are in effect for some time (e.g., 3 months, 6 months, 12 months), we may be able to get a more robust picture of customer preferences that could help policymakers determine which rate design enrollment approach (opt-in vs. opt-out) should be pursued by utilities.

Our second result, that customers do not prefer to sign up for one type of time-based rate program over another; or if they do, it is only by a very small amount, is somewhat surprising. This finding is important for policymakers to understand as it indicates that electricity customers are just as willing to initially accept a rate that requires pervasive behavioral changes (i.e., shifting electricity usage away from the peak period to the off-peak period every day) as they are to accept a rate that requires very infrequent, limited duration but potentially large behavioral changes (i.e., reducing electricity usage only during critical events). Again, it may be true that the type of time-based rate has a greater effect on future drop-out rates, once customers experience the consequences of one rate relative to another; we intend to perform research on this area when data become available in the future.

We also found that offering technologies seems to have little to no effect on opt-in recruitment rates. One might expect that offering customers an IHD or PCT would act as an incentive to participate in a time-based rate program. In the former case, it would allow a customer to be better informed about their own electricity consumption patterns and better understand when altering their consumption behavior would be most valuable. In the latter case, a PCT would enable a customer to automate such behavioral changes through the control technology. Based on the experience of these SGIG utility studies' solicitation efforts, however, we conclude that this does not seem to be the case for an IHD (not a single utility experimentally controlled for the offer of a PCT). Again, it may be the



case that the offer of these technologies will help retain customers longer, which is an area we intend to research further in the future.

Because these findings are based on the results of an experiment from only one or two SGIG utility studies, it is important to note that extrapolating these conclusions to other utilities is only valid to the extent in which the customers in other utilities are similar to the utilities that performed the experiments. We hope in future analysis to better characterize the types of customers that joined such studies to help clarify the conditions under which our results can be extrapolated to a broader population of customers. Nonetheless, because these are the only randomly designed and analyzed experiments to date of how rate and technology offers affect real-time program recruitment rates, the findings produce a good foundation on which to set expectations.

These results should be helpful to those electric utilities looking for guidance on reasonable recruitment rates when designing a study or pilot of their own or when rolling out these programs en masse for the first time. However, once more data is available to characterize individual customers and their experience remaining on the time-based rate or technology offer over a longer period of time, we hope to provide even greater insight for program planners that will help them better understand what may drive differences in the initial enrollment stages but also in retention stages over time. In addition, our planned analysis of data on peak demand and energy savings due to exposure to time-based rates and technology will hopefully allow us to address several additional interesting questions concerning how the type of program offer affects the savings achieved by the programs. For example, even though opt-out programs result in higher recruitment rates, it may be that opt-in programs actually result in higher savings per customer because they are targeting the customers that have the highest savings potential and are not weighted down by a lot of non-responders. Future reports will be able to shed light on these important issues.



References

- Cappers, P., Todd, A. and Goldman, C. (2013) Summary of Utility Studies: Smart Grid Investment Grant Consumer Behavior Studies Analysis Berkeley, CA. June 2013. LBNL-6248E.
- Charles River Associates (2005) Impact Evaluation of the California Statewide Pricing Pilot. Oakland, CA. March 16, 2005.
- Connecticut Light and Power (2009) Results of CL&P Plan-It Wise Energy Pilot, Filing in Response to the Department of Public Utility Control's Compliance Order No. 4, Docket No. 05-10-03RE01.
- eMeter Strategic Consulting (2010) PowerCentsDC Program Final Report. Washington, D.C. September 2010.
- EPRI (2011) The Effect on Electricity Consumption of the Commonwealth Edison Customer Application Program: Phase 2 Final Analysis. October 2011. 1023664.
- Faruqui, A. and Sergici, S. (2009) BGE's Smart Energy Pricing Pilot Summer 2008 Impact Evaluation. April 28, 2009.
- FERC (2011) 2011 Assessment of Demand Response & Advanced Metering: Staff Report. Washington, D.C. November 2011.
- Greene, W. (2011) Econometric Analysis. Prentice Hall.
- Hausman, W. J. and Neufeld, J. L. (1984) Time-of-Day Pricing in the U.S. Electric Power Industry at the Turn of the Century. *The Rand Journal of Economics*. 15(1): 116-126.
- Hydro One Networks (2008) Time-of-Use Project Results, EB-2007-0086.
- IRS (2009) Automatic Contribution Increases under Automatic Contribution Arrangements. September 2009.
- Kahneman, D., Knetsch, J. L. and Thaler, R. H. (1991) Anomalies: The Endowment Effect, Loss Aversion and Savings Behavior. *The Journal of Economic Perspectives*: 193-206.
- Madrian, B. C. and Shea, D. F. (2001) The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior. *Quarterly Journal of Economics*. 116(4): 1149-1187.
- Summit Blue Consulting, L. (2007) Final Report for the myPower Pricing Segments Evaluation. Prepared for Public Service Electric and Gas. December 21, 2007.



**ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY**

Residential Customer Enrollment in Time-based Rate and Enabling Technology Programs: Smart Grid Investment Grant Consumer Behavior Study Analysis

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Technologies Division**

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Glossary of Acronyms, Abbreviations, and Terms

AMI	Advanced Metering Infrastructure – All components that allow two-way communication between meters and the electric utility’s meter data management system to collect electricity usage and related information from customers and to deliver information to customers.
CA	California
CAC	Central Air Conditioning
CBS	Consumer Behavior Study
CBSP	Consumer Behavior Study Plan
CPP	Critical Peak Pricing – A time-based rate component that increases the price on electricity consumed for participating customers during the hours included in a declared critical event. This higher price is overlaid onto the existing retail rate. Critical events are called either on a day-ahead or in-day basis in response to forecasted or achieved, respectively, high wholesale market electricity prices, short-term system reliability problems, or both. The primary objective of this rate design is to promote reductions in the peak demand of electricity.
CPR	Critical Peak Rebate – A demand response program that pays participating customers for reducing electricity consumed in relation to a baseline during the hours included in a declared critical event. Critical events are called either on a day-ahead or in-day basis in response to forecasted or achieved, respectively, high wholesale market electricity prices, short-term system reliability problems, or both. The primary objective of this program

design is to promote reductions in the peak demand of electricity.

DECo **Detroit Edison Company**

Descriptive Results - A finding based on summary statistics. These results may be informative, but do not allow us to draw any causal conclusions.

DLC **Direct Load Control**

DOE **Department of Energy**

Experimental Design - A method of controlling the way that a program is designed and evaluated in order to observe outcomes and infer whether or not the outcomes are caused by the program.

Experimental Results - A finding based on statistical estimates derived from experimentally designed tests. These results enable us to draw conclusions about the causal effect of the treatments being tested.

FE **FirstEnergy Ohio**

FOA **Funding Opportunity Announcement**

GMP **Green Mountain Power**

HEMS **Home Energy Management System**

IBR **Inclining Block Rate** - A rate program design that charges customers for electricity usage based on the how much they consume. Blocks of usage are defined and the price for each block of usage increases as the amount of consumed electricity increases. The primary objective of this rate design is to promote overall conservation of electricity.

IHD	In-Home Display
ISO	Independent System Operator
kWh	Kilowatt-hour
LBNL	Lawrence Berkeley National Laboratory
LE	Lakeland Electric
	Lessons Learned – Findings based on anecdotal information collected from utilities. They enable us to understand context surrounding the Experimental and Descriptive Results, but not to definitively state findings.
MMLD	Marblehead Municipal Light Department
MN	Minnesota
NDPT	Nevada Dynamic Pricing Trial
NVE	NV Energy
NVP	Nevada Power
OE	DOE Office of Energy Delivery and Electricity Reliability
OG&E	Oklahoma Gas & Electric
OK	Oklahoma
	Program offer - Different types of time-based rate, technology, and opt-in versus opt-out proposals made to customers when they are solicited to enroll in a study (e.g., an offer of a TOU rate, an offer that includes enabling technology, or an opt-in offer).
PCT	Programmable Communicating Thermostat

RCT	Randomized Controlled Trial - A research strategy in which customers who volunteer to be exposed to a treatment are randomly assigned to treatment and control conditions.
RED	Randomized Encouragement Design - A research design in which two groups of customers are selected from the same population at random and one is offered a treatment while the other is not. Not all customers offered the treatment are expected to take it but, for analysis purposes, all those who are offered the treatment are considered to be in the treatment group.
SGIG	Smart Grid Investment Grant
SMUD	Sacramento Municipal Utility District
	Solicitation Effort – One complete set of offers made to one group of customers (e.g., one solicitation effort may have an opt-out offer, a TOU rate offer, and no technology offer).
SPP	Sierra Pacific Power
TAG	Technical Advisory Group
TOU	Time-Of-Use - A time-based rate program design that charges customers for electricity usage based on the block of time it is consumed. The price schedule is fixed and predefined, based on season, day of week, and time of day. The primary objective of this rate design is to promote overall shifting of electricity away from the peak period to other periods.
VEC	Vermont Electric Cooperative
VPP	Variable Peak Pricing – A time-based rate program

design that charges customers for electricity usage based on the block of time it is consumed. The price schedule is variable and differs daily, based on bulk power system conditions during that period of the day. The primary objective of this rate design is to promote targeted shifting of electricity away from the peak period to other periods.

VT

Vermont

Foreword

As far back as the 1890s, the electric industry has been debating the issue of how to efficiently and optimally charge customers for consuming electricity (Hausman and Neufeld 1984). At that time, there were emerging but very contentious discussions among economists about the merits of pricing the new commodity differentially based on time. The challenge with such pricing schemes revolved around metering—cost-effective technology did not exist at that time to allow electricity consumption to be captured at the required level of detail. Thus, virtually all customers were charged for their electricity consumption at a rate that was time-invariant (i.e., flat).

By the 1970s, the debate had moved beyond issues of economic efficiency and instead turned towards more practical concerns about consumer behavior—could mass-market (i.e., residential and small commercial) customers manage their electricity consumption under time-based rate programs? The results of studies undertaken by the Federal Energy Administration, the predecessor to the U.S. Department of Energy (DOE), indicated such customers were, in fact, capable of managing their electricity consumption by moving it away from the expensive “peak” period to the less-expensive “off-peak” period (see Faruqui and Malko 1983 for a meta-analysis of these experiments). In spite of this evidence, the lack of low-cost interval or period-based metering technology continued to limit the industry’s ability to expand the application of time-based rate programs at the residential level through the end of the 20th century.

Over the past ten years, however, the costs of interval meters, the communications networks to connect the meters with utilities and the back-office systems necessary to maintain and support them (i.e., advanced metering infrastructure or AMI) have dramatically decreased. The implementation of AMI and interval meters by utilities, which allows electricity consumption data to be captured, stored and reported at 5 to 60-minute intervals in most cases, provides an opportunity for utilities and policymakers to once again seriously consider the merits of the widespread deployment of time-based rate programs. However, many regulators and other key policymakers have determined that more definitive answers to key policy questions must be addressed before they will fully support a paradigm shift in the way retail electricity providers charge residential and small commercial customers for consuming electricity.

The American Recovery and Reinvestment Act of 2009 included \$3.4B for the Smart Grid Investment Grant (SGIG) program with the goal of creating jobs and accelerating the transformation of the nation's electric system by promoting investments in smarter grid technologies, tools and techniques (DOE 2012a). Among other topics, the Funding Opportunity Announcement (DE-FOA-0000058) identified interest in AMI projects that examined the impacts and benefits of time-based rate programs and enabling control and information technologies through the use of randomized controlled experimental designs.

Based on responses to this FOA, DOE decided to co-fund ten utilities to undertake eleven experimentally-designed Consumer Behavior Studies (CBS) that proposed to examine a wide range of the topics of interest to the electric utility industry. Each chosen utility was to design, implement and evaluate their own study in order to address questions of interest both to itself and to its applicable regulatory authority, whose approval was generally necessary for the study to proceed. The DOE Office of Energy Delivery and Electricity Reliability (OE), however, did set guidelines, both in the FOA and subsequently during the contracting period, for what would constitute an acceptable study under the Grant.

To assist in ensuring these guidelines were adhered to, OE requested that LBNL act as project manager for these Consumer Behavior Studies to achieve consistency of experimental design and adherence to data collection and reporting protocols across the ten utilities. As part of its role, LBNL formed technical advisory groups (TAG) to separately assist each of the utilities by providing technical assistance in all aspects of the design, implementation and evaluation of their studies. LBNL was also given a unique opportunity to perform a comprehensive, cross-study analysis that uses the customer-level interval meter and demographic data made available by these utilities due to SGIG-imposed reporting requirements, in order to analyze critical policy issues associated with AMI-enabled rates and control/information technology. Over the next several years, LBNL will publish the results of these analyses in a series of research reports that attempt to address critical policy issues including customer acceptance, retention and load response to time-based rates and various forms of enabling control and information technologies. This report is the first in that series and provides a description of each study.

Executive Summary

Introduction

The U.S. Department of Energy's (DOE's) Smart Grid Investment Grant (SGIG) program is working with a subset of the 99 SGIG projects undertaking Consumer Behavior Studies (CBS), which examine the response of mass market consumers (i.e., residential and small commercial customers) to time-varying electricity prices (referred to herein as time-based rate programs) in conjunction with the deployment of advanced metering infrastructure (AMI) and associated technologies. The effort presents an opportunity to advance the electric industry's understanding of consumer behavior.¹

With the increased deployment of advanced meters with two-way communication networks that can record and provide at least hourly interval data spurred in part by DOE's SGIG program, electric utilities are now able to more easily offer and implement time-based rate and enabling technology programs for residential and smaller commercial customers. These time-based rate programs are fairly new for residential customers, and utilities, with some exceptions, have had limited success in enrolling mass market customers on these tariffs (FERC 2011). Because AMI business cases often rely on the benefits from customer demand response enabled by these investments, there is increasing interest among policymakers, regulators, utilities and stakeholders in understanding how many customers are likely to enroll and continue in such a program, and which factors can affect these recruitment and retention rates.

While there have been numerous evaluations of the peak demand and energy impacts of time-based rate programs (e.g., Critical Peak Pricing) and enabling technology (e.g., programmable communicating thermostats), there has been limited examination to date of the customer recruitment rates that these types of programs can achieve. Currently, utility program evaluation reports that are focused on providing impact estimates of energy savings and load shifting rarely mention anything other than aggregate customer recruitment rates (e.g., Charles River Associates 2005; Summit Blue Consulting 2007; Hydro One Networks 2008; Connecticut Light and Power 2009; Faruqui and Sergici 2009;

¹ See www.smartgrid.gov for more information about the goals and objectives of the SGIG CBS effort.

eMeter Strategic Consulting 2010; EPRI 2011). The U.S. Energy Information Administration (EIA) and the Federal Energy Regulatory Commission (FERC) both collect and report on time-based rate enrollment information from all utilities in the United States on an annual basis. However, it is difficult to interpret this data or analyze results across utilities because utilities are not required to report information on the number of customers that were solicited or provide information that may explain factors that influenced their recruitment rates. As such, there is limited information in the public sphere that could help utilities, regulators or other policymakers understand what reasonable recruitment rates would be and what may explain currently observed differences in recruitment rates.

Objectives and Scope

In this preliminary report, we begin to fill this need by providing an initial summary of experiences of the different phases of the enrollment process (qualification, solicitation, recruitment, and selection) across nine of the ten SGIG utilities, who collectively are undertaking a total of 11 consumer behavior studies.ⁱⁱ We report three types of key findings: Experimental Results, Descriptive Results, and Lessons Learned.

- **Experimental Results** are statistical estimates derived from experimentally designed tests. These results enable us to draw conclusions about the causal effect of the treatments being tested.
- **Descriptive Results** are based on summary statistics. These results may be informative, but do not allow us to draw any causal conclusions.
- **Lessons Learned** are based on anecdotal information collected from utilities. They enable us to understand context surrounding the Experimental and Descriptive Results, but not to definitively state findings.

The primary focus of the CBS utilities was to experimentally test time-based rates and enabling technology; only a subset of the studies chose to experimentally test enrollment rates. Therefore, the Experimental Results in this report focus on a narrow subset of the CBS utilities. Although these results have strong internal validity, they were observed for

ⁱⁱ In order to characterize our empirical approach, we define the term *program offer* or simply *offer* to represent the different types of time-based rate, technology, and opt-in versus opt-out proposals made to customers when solicited to enroll in a study (e.g., an offer of a TOU rate, an offer that includes enabling technology, or an opt-in offer). We define the term *solicitation effort* to represent one complete set of offers made to one group of customers (e.g., one solicitation effort may have an opt-out offer, a TOU rate offer, and no technology offer). We define the *recruitment rate* as the percentage of recruited customers out of the total number of customers solicited in one solicitation effort.

particular populations at particular times and so may have less external validity. The Descriptive Results and Lessons Learned are based on data collected from all of the CBS utilities.

This report can help inform utilities and state regulatory commissions that are considering offering such time-based rates to mass market customers. First, it can help ensure that the number of customers enrolled in a study or pilot program is sufficient to produce valid energy impact estimates (based on statistical power calculations). If too few customers are enrolled, the evaluation effort may not be able to successfully and accurately estimate such impacts. Second, accurate recruitment rates are useful for planning and forecasting purposes when such rates are offered en masse (e.g., in order to gain a perspective on the magnitude of a particular program resource).

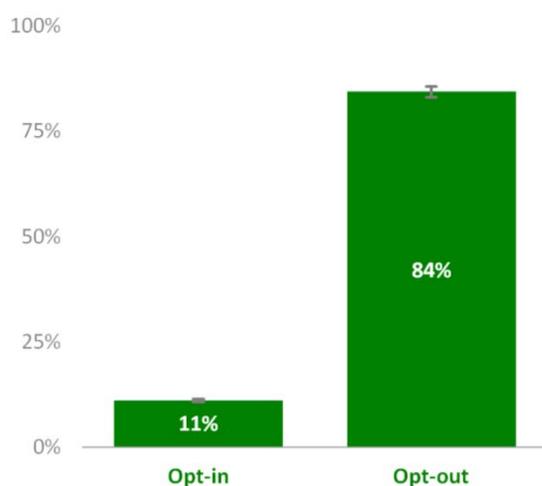
Key Findings



Key Finding: Experimental Result 1

More customers enroll into a time-based rate program with an opt-out offer than with an opt-in offer.

Only two utilities included both an opt-in and opt-out offer for randomly assigned customers to be solicited to participate in a study through either opt-in or opt-out offers. 84% of customers solicited to join a study using an opt-out recruitment approach did not reject the offer, whereas 11% of customers solicited to join a study using an opt-in recruitment method approach accepted the offer (see Figure ES-1).



Percentages include the total number of customers across the two utilities that randomized opt-in versus opt-out program offers (99.9% confidence intervals shown; N=100,000).

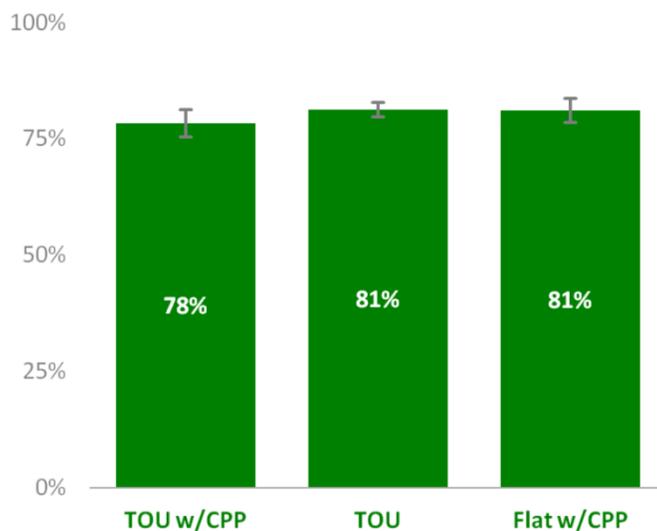
Figure ES-1. Recruitment rates for tests of opt-in versus opt-out program offers



Key Finding: Experimental Result 2

For opt-out solicitations, the type of time-based rate offer does not substantially affect the customer recruitment rate.

Only a single utility study included more than one opt-out time-based rate program offering to a group of randomly assigned customers as part of their study. The observed recruitment rates were 81% for the TOU offer, 81% for the Flat w/CPP offer, and 78% for the TOU w/CPP offer (the differences between any pairings of the rates were not statistically significant; see Figure ES-2). This suggests that customers are not more likely to opt-out of one time-based rate over the other, despite the rate differences.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive opt-out offers of one of three time-based rates (95% confidence intervals shown; N=4,000).

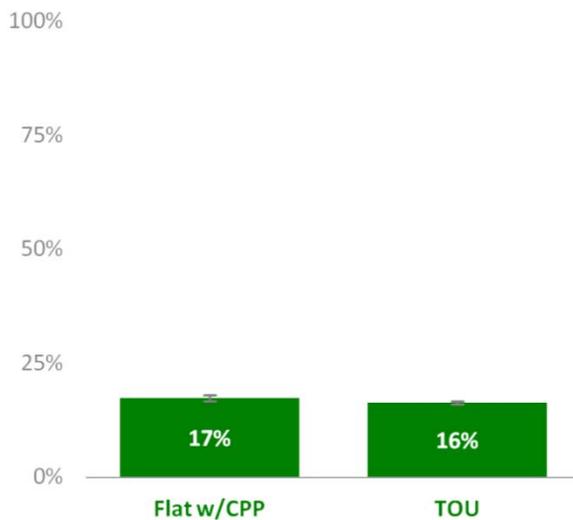
Figure ES-2. Opt-out recruitment rate results for tests of time-based rate offers



Key Finding: Experimental Result 3

For opt-in solicitations, the type of time-based rate does not substantially affect the customer recruitment rate.

Only a single utility study included more than one opt-in time-based rate program offering to a group of randomly assigned customers as part of their study. A Flat rate with a CPP overlay offer had a 17% recruitment rate while the TOU offer had a 16% recruitment rate; the difference, although small, is statistically significant (see Figure ES-3). This suggests that customers may, to a very small extent, prefer to opt-in to a Flat w/CPP over a TOU rate. However, the preference is very small.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive a CPP offer versus a TOU offer (95% confidence intervals shown; N=50,000).

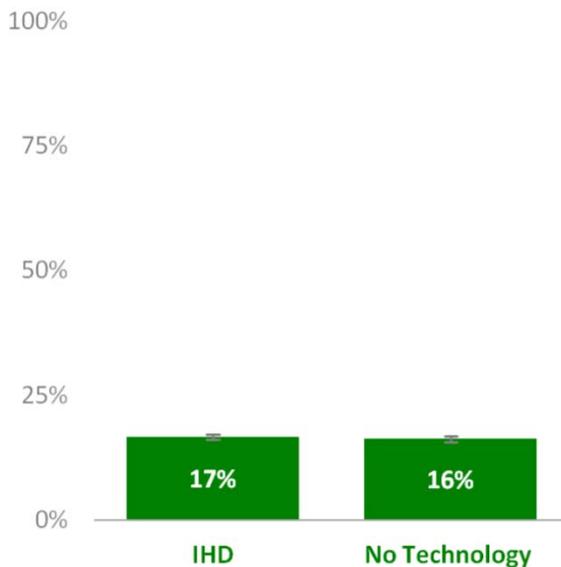
Figure ES-3. Opt-in recruitment rate results for tests of time-based rate offers



Key Finding: Experimental Result 4

For opt-in solicitations, the offer of technology does not substantially affect the customer recruitment rate.

Only a single utility study included offers of time-based rate programs (i.e., TOU, Flat w/CPP) paired with an IHD and a separate set of offers of the same time-based rates but without an IHD. As shown in Figure ES-4, recruitment rates for the offers with an IHD and without the IHD (i.e., no-technology offer) were around 16-17%; the difference is not statistically significant. Segmenting customers into CPP and TOU solicitation efforts shows similar results. This indicates that customers are not more likely to opt-in to a time-based rate if they are offered an IHD, despite the supposed monetary value of such a device.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive an IHD offer versus no technology offer (95% confidence intervals shown; N=50,000).

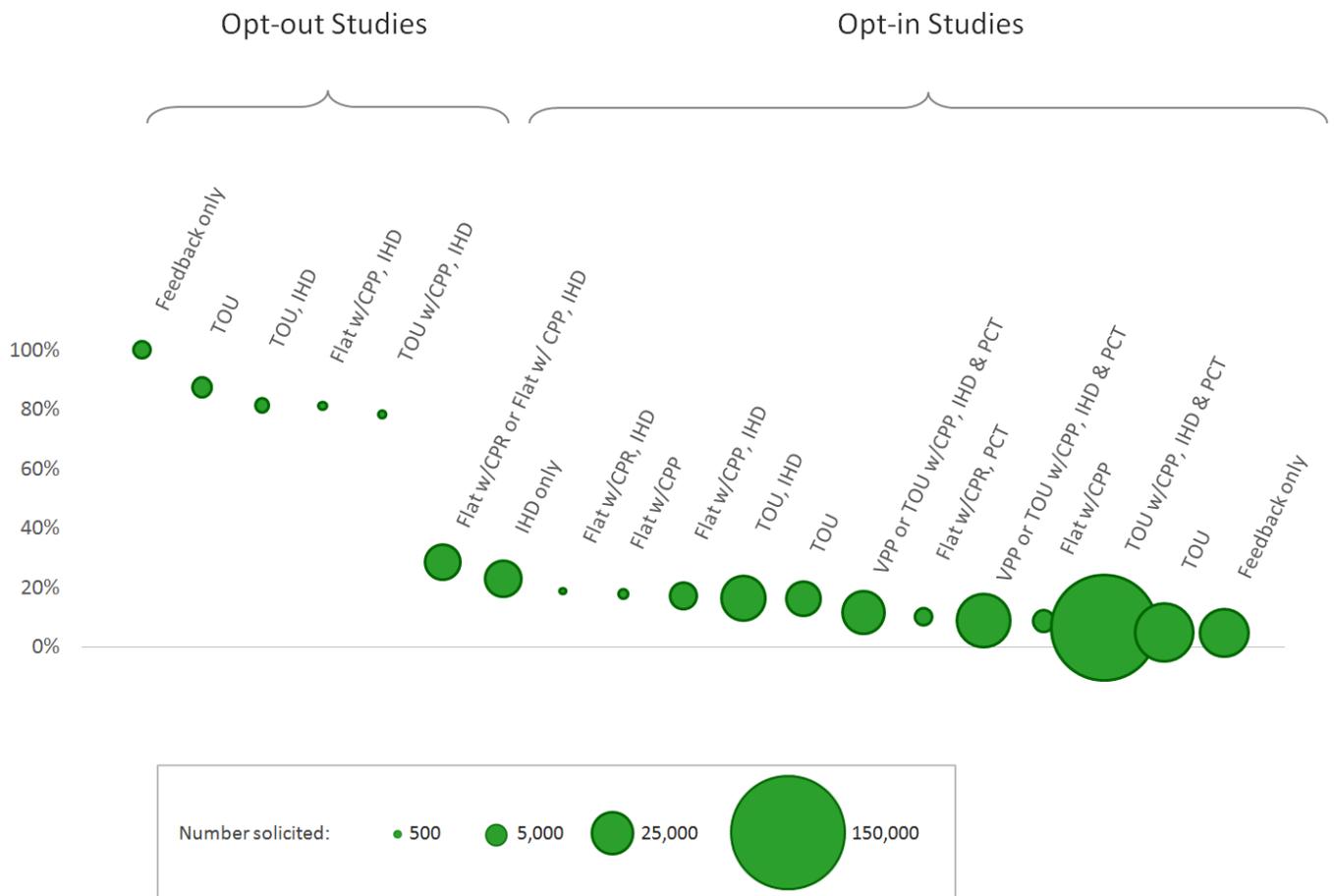
Figure ES-4. Opt-in recruitment rate results for tests of technology offers vs. no technology offers



Key Finding: Descriptive Result 1

For time-based rate and enabling technology studies that use an opt-in program offer, recruitment rates range from 5% to 28%. For those that use an opt-out program offer, recruitment rates range from 78% to 87%.

An assessment of Figure ES-5 suggests that a utility may expect to achieve at least a 5% recruitment rate for opt-in studies. Under ideal circumstances, recruitment rates into such studies could exceed 20%. However, for planning purposes assuming 10% recruitment rate seems most appropriate.



19 total solicitation efforts listed. Circle size represents the total number of customers solicited.

Figure ES-5. Recruitment rates for each solicitation effort



Key Finding: Descriptive Result 2

Most utilities did not accurately predict recruitment rates for their study solicitation efforts. Five of the twelve opt-in solicitation efforts underachieved their recruitment rates such that actual recruitment rates were 7 to 22 percentage points below the actual recruitment rate. This represents actual recruitment rates that were at least a quarter of what was planned.

Figure ES-6 shows the actual and planned recruitment rates for opt-in and opt-out solicitation efforts. Out of the six opt-in solicitation efforts that underachieved their planned recruitment rates (shown in red in Figure ES-6), five had an actual recruitment rate that was 7 to 22 percentage points lower than planned, representing an actual recruitment rate that at least a quarter of what they were planned to be. Five out of the six opt-in solicitation efforts that overachieved had an actual recruitment rate that was no more than 4 percentage points higher than planned. The sixth was 14 percentage points higher than planned, almost double the planned rate. While overachieving recruitment rates may not have severe consequences, underachievement can cause problems with the study evaluation effort which may necessitate changes to the study's design. If a study has planned to recruit a certain number of customers and the actual number of customers recruited is far less, the study may have to be re-designed (e.g., the number of treatments being tested may have to be reduced) in order to achieve statistically valid load impact estimates.ⁱⁱⁱ

ⁱⁱⁱ Power calculations are used to determine how large a sample a study needs to enroll in order to have faith that the resulting estimates of the treatment effect are credible. For more information on this topic, see Appendix A of Cappers et al. (2013).

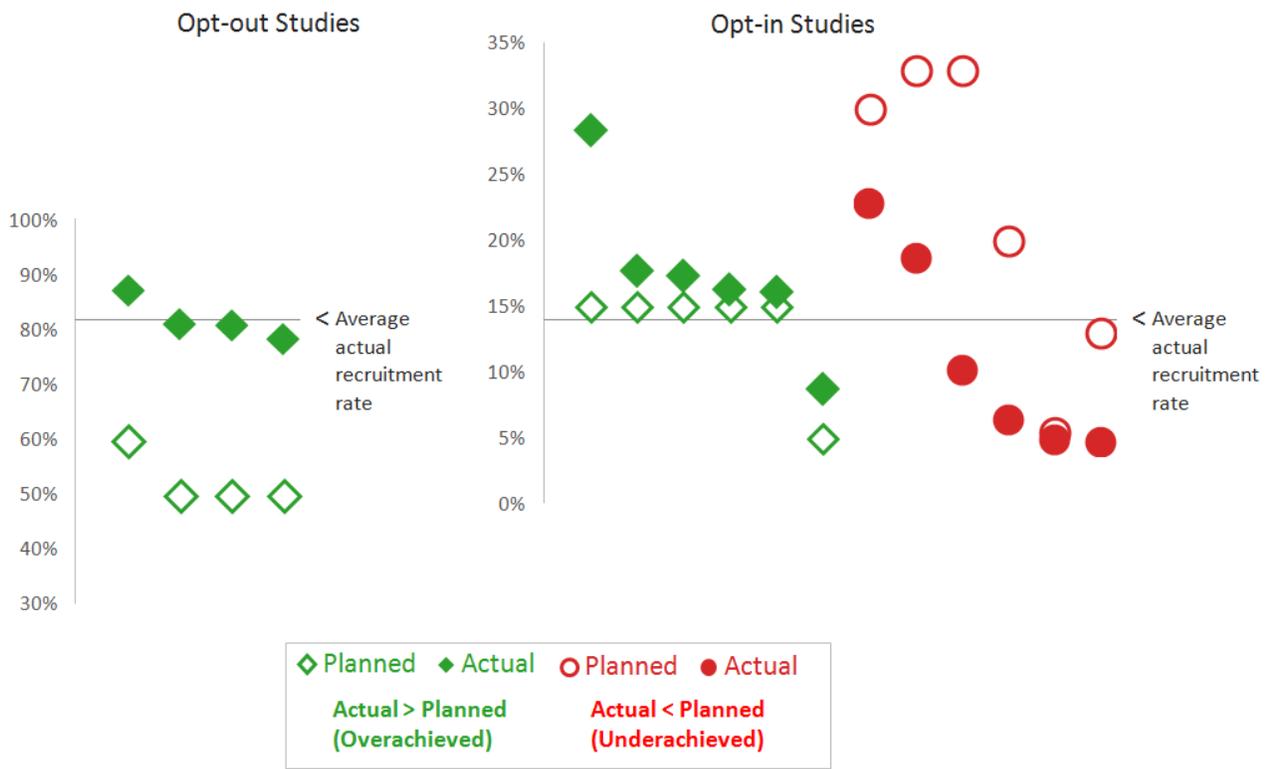


Figure ES-6 – Actual versus planned recruitment rates



Key Finding: Lessons Learned 1

Utilities found focus groups, surveys and other tools to be vital components for test marketing terms and concepts to attract customer interest and engage them to participate in the rate being offered.

Prior to test marketing materials that would be used to solicit participation into studies that included time-based rates, many utilities believed words like “critical”, “emergency”, and “events” would confer the necessary message about what the rate was trying to accomplish and how valuable a customer’s participation in that rate would be. Several utilities subsequently performed focus groups, surveys and other forms of test marketing of their recruitment material which indicated the terms and concepts utilities thought would connote positive concepts with customers actually had the opposite effect. Terms like “response”, “auto”, and “event” were construed as reactionary words that deflated personal control (e.g., “emergencies” are out of a customer’s control). Instead, some participants in focus groups appeared to prefer terms that construed a sense of personal control over one’s own energy usage and resulting bill (e.g., “control”, “choice”, “sense”).



Key Finding: Lessons Learned 2

Utilities learned the importance of validating focus groups with other test marketing efforts across a variety of customer segments and circumstances to develop the most effective messaging for their new time-based rate recruitment campaign.

Utilities also learned from focus groups that customers claimed to be primarily motivated by environmental messaging when it came to recruitment into new time-based rates. Test marketing along with observed recruitment data from various messages (e.g., “saving money”, “environmental stewardship”, “taking control”, “fun”) revealed the primary motivator for the majority of customers was actually financial.



Key Finding: Lessons Learned 3

Utilities were surprised at how much time and resources they needed to allocate between soft launch and hard launch of the solicitation effort to adjust the messaging and other details accordingly based on feedback.

Issues often arise during the recruitment phase of the study lifecycle that can threaten its overall success. Many utilities, therefore, included a two week soft launch window in their enrollment process in order to identify and address any problems that internal planning and test marketing of recruitment materials did not catch. Unfortunately, even with a two week soft launch period, one utility still did not have enough time to incorporate necessary feedback to the solicitation materials in time for the hard launch, at which point changes were very difficult and costly to make.



Key Finding: Lessons Learned 4

Utilities learned that before determining if a new rate or product offering is to be paired with a form of enabling technology, they could benefit from spending time understanding potential customer concerns with that technology and identifying the available pool of participants who would qualify for and be willing to accept such technology so that realistic expectations for recruitment can be set ahead of time.

The recruitment process can also be affected by assumptions about the number of customers capable and willing to receive certain types of enabling technology (e.g., presence of central air conditioning to receive a programmable communicating thermostat). By not accurately quantifying ahead of the study enrollment effort the size of the available population that would pre-qualify for specific enabling technology, the number of customers that would be willing/able to accept, and the number that then have it installed, some utilities substantially overestimated the level of acceptance for a new rate or product offering that was strictly paired with such enabling control technologies.



Key Finding: Lessons Learned 5

Utilities realized the need to ensure that all utility representatives and contractors that interact with customers at any level are informed, committed and enabled to make the experience a positive one for the customer. One way to do this most effectively was by focusing on communications skills as much as technical skills when hiring or recruiting people to fill these positions.

Many of the utilities who included some form of enabling technology in their study decided to enlist internal utility workers or external contractors to help install and provision this equipment at a participating customer's premise. These utilities believed that individuals responsible for installing these pieces of technology at a customer site would have little to no effect on that customer's decision to finalize and complete the enrollment process in the study. Unfortunately, installation of technology by individuals, either internal or external to the utility, who did not have sufficient appreciation for the importance of the public relations role they played and/or were insensitive to the consequences of not playing that role well, resulted in negative ramifications for customer engagement efforts at several utilities.

Next Steps

Because this preliminary report is based on initial results from the subset of SGIG projects that are undertaking a Consumer Behavior Study, it only includes information on the first stages of a customer's choice: whether or not to enroll in a study. Equally interesting and important is information on the next stages of a customer's choice, which concern retention in the study. To address this choice, we would examine the number of customers that dropped out after the study treatment went into effect (perhaps after receiving their first bill); the number of customers that installed and subsequently used the provided enabling technology (if applicable); and the number of customers that remained in the study for its duration. Future reports will examine data for these customer retention stages, in addition to examining the factors which may help explain higher or lower recruitment and retention rates, whether certain segments of customers (e.g., low income vs. high income; high school educated vs. college educated) are more or less likely to choose to enroll, and whether

enrollment and retention choices affect the way that customers respond to time-based rates and enabling technology.^{iv}

^{iv} Understanding the retention rates of customers after the beginning of the study may be particularly important for interpreting enrollment rates for opt-out methods. For example, a customer enrolled via an opt-out method onto a TOU w/CPP rate may not have fully paid attention to the rate change until they experience a direct impact on their bill, at which point they may drop out now having fully understood what was asked of them so many months before. This may result in a recruitment rate that seems relatively high, but a low retention rate after the study has begun. On the other hand, if a customer is enrolled via an opt-out method into a program that would not result in any direct impact financially or on their quality of service (e.g., an information feedback program that allows the customer to see hourly energy use information on a daily delayed basis via a website), the customer may never drop out of the program but may also never actually experience the treatment (e.g., never access the website). In this case data may show a very high recruitment rate (potentially 100%), but future data may reveal that a much lower percentage of customers were actually exposed to the treatment.

1. Introduction

The U.S. Department of Energy's (DOE's) Smart Grid Investment Grant (SGIG) program is working with a subset of the 99 SGIG projects undertaking Consumer Behavior Studies (CBS), which examine the response of mass market consumers (i.e., residential and small commercial customers) to time-varying electricity prices (referred to herein as time-based rate programs) in conjunction with the deployment of advanced metering infrastructure (AMI) and associated technologies. The effort presents an opportunity to advance the electric industry's understanding of consumer behavior.¹

Methods for enrolling customers in programs vary widely, and different methods may lead to substantially different recruitment rates. For example, opt-in methods, in which customers must actively consent to participation in a program, are likely to lead to lower recruitment rates than opt-out methods, in which customers must actively decline or opt-out of participating in a program. Other factors may also affect customer recruitment rates, such as program differences (e.g., the specific rate and technology offered), differences in marketing approaches, the types of customers solicited, the customer-utility relationship, and many others.

With the increased deployment of advanced meters with two-way communication networks that can record and provide at least hourly interval data (i.e., AMI) spurred in part by DOE's SGIG program, electric utilities are now able to more easily offer and implement time-based rate and enabling technology programs for residential and smaller commercial customers. These time-based rate offerings are fairly new for residential customers, and utilities, with some exceptions, have had limited success in enrolling mass market customers on these tariffs (FERC 2011). Because AMI business cases often rely on the benefits from customer demand response enabled by these investments, there is increasing interest among policymakers, regulators, utilities and stakeholders in understanding how many customers are likely to enroll and continue in such a program, and which factors can affect these recruitment and retention rates.

While there have been numerous evaluations of the peak demand and energy impacts of time-based rate programs (e.g., Critical Peak Pricing) and enabling technology (e.g.,

¹ See www.smartgrid.gov for more information about the goals and objectives of the SGIG CBS effort.

programmable communicating thermostats), there has been limited examination to date of the customer recruitment rates that these types of programs can achieve. Currently, utility program evaluation reports that are focused on providing impact estimates of energy savings and load shifting rarely mention anything other than aggregate customer recruitment rates (e.g., Charles River Associates 2005; Summit Blue Consulting 2007; Hydro One Networks 2008; Connecticut Light and Power 2009; Faruqi and Sergici 2009; eMeter Strategic Consulting 2010; EPRI 2011). The U.S. Energy Information Administration (EIA) and the Federal Energy Regulatory Commission (FERC) both collect and report on time-based rate enrollment information from all utilities in the United States on an annual basis. However, it is difficult to interpret this data or analyze results across utilities because utilities are not required to report information on the number of customers that were solicited or provide information that may explain factors that influenced their recruitment rates. As such, there is limited information in the public sphere that could help utilities, regulators or other policymakers understand what reasonable recruitment rates would be and what may explain currently observed differences in recruitment rates.

In this preliminary report, we begin to fill this need by providing an initial summary of experiences of the different phases of the enrollment process (qualification, solicitation, recruitment, and selection) across nine of the ten SGIG utilities, who are undertaking a total of 11 consumer behavior study. First, we provide an overview of the consumer behavior studies co-funded by DOE's SGIG program that are included in this assessment. Next, we describe the methodology that will be applied to analyze the various stages of enrollment and recruitment rates. Lastly, we report summary statistics and results from experiments that are testing whether certain program offers affect recruitment rates, and provide lessons learned. Specifically, we report three types of key findings: Experimental Results, Descriptive Results, and Lessons Learned.

- **Experimental Results** are statistical estimates derived from experimentally designed tests. These results enable us to draw conclusions about the causal effect of the treatments being tested.
- **Descriptive Results** are based on summary statistics. These results may be informative, but do not allow us to draw any causal conclusions.
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The primary focus of the CBS utilities was to experimentally test time-based rates and enabling technology; only a subset of the studies chose to experimentally test enrollment rates. Therefore, the Experimental Results in this report focus on a narrow subset of the CBS utilities. Although these results have strong internal validity, they were observed for particular populations at particular times and so may have less external validity. The Descriptive Results and Lessons Learned are based on data collected from all of the CBS utilities.

This report can help inform utilities and state regulatory commissions that are considering offering such time-based rates to mass market customers. First, it can help ensure that the number of customers enrolled in a study or pilot program is sufficient to produce valid energy impact estimates (based on statistical power calculations). If too few customers are enrolled, the evaluation effort may not be able to successfully and accurately estimate such impacts. Second, accurate recruitment rates are useful for planning and forecasting purposes when such rates are offered en masse (e.g., in order to gain a perspective on the potential magnitude of participants and load impacts from a particular program).

Because this preliminary report is based on initial results from the subset of SGIG projects that are undertaking a consumer behavior study, it only includes information on the first stage of a customer's choice: whether or not to enroll in a study. Equally interesting and important is information on the next stages of a customer's choice, which concerns retention in the study. To address this choice, we would examine: the number of customers that dropped out after the study treatment went into effect (perhaps after receiving their first bill); the number of customers that installed and subsequently used the provided enabling technology (if applicable); and the number of customers that remained in the study for its duration. Future reports will examine data for these additional customer retention stages, in addition to examining the factors which may help explain higher or lower recruitment and retention rates, whether certain segments of customers (e.g., low income vs. high income; high school educated vs. college educated) are more or less likely to choose to enroll, and whether enrollment and retention choices affect the way that customers respond to time-based rates and enabling technology.²

² Understanding the retention rates of customers after the beginning of the study may be particularly important for interpreting enrollment rates for opt-out methods. For example, a customer enrolled via an opt-out method onto a TOU w/CPP rate may not have fully paid attention to the rate change until they experience a direct impact on their bill, at which point they may drop out now having fully understood what was asked of them so many months before. This may

2. Consumer Behavior Studies Overview

As part of the Smart Grid Investment Grant program, the U.S Department of Energy is co-funding ten utilities to undertake experimentally designed consumer behavior studies (CBS) that examine a wide range of topics of interest to the electric industry in the area of AMI-enabled time-based rates and customer systems.³ The ten utilities are undertaking 11 studies, which are designed to rigorously test the impact of time-based rates and/or technology and education treatments on customers' energy usage patterns, and in a few cases to rigorously test the impact on customer acceptance on the same set of treatments.

2.1 Treatments Tested in CBS

This section describes the different types of treatments that are being tested by utilities in their consumer behavior studies: time-based rates; technology and education; and program offers.

2.1.1 Time-based Rate Treatments

Time-based rates are attractive to utilities because they are designed to allow the prices that customers pay to consume electricity to correspond more closely to the actual cost that utilities incur when producing or procuring it. For most utilities, the cost of providing electricity increases with the demand for energy because higher-cost power plants must be brought online to accommodate the additional demand. For example, a Time of Use (TOU) rate design identifies a set of pre-determined "peak" hours of the day that consistently have higher demand and therefore higher production costs for electricity (e.g., on weekdays between 2 pm and 6 pm), and charges a pre-determined higher price during those on-peak hours (e.g., the price is \$0.12/kWh higher than at other times; see Figure 1). For other time-

result in a recruitment rate that seems relatively high, but a low retention rate after the study has begun. On the other hand, if a customer is enrolled via an opt-out method into a program that would not result in any direct impact financially or on their quality of service (e.g., an information feedback program that allows the customer to see hourly energy use information on a daily delayed basis via a website), the customer may never drop out of the program but may also never actually experience the treatment (e.g., never access the website). In this case data may show a very high recruitment rate (potentially 100%), but future data may reveal that a much lower percentage of customers were actually exposed to the treatment.

³ For a more detailed description of the treatments undertaken in each utility study, see the first report in the series of CBS reports, "Smart Grid Investment Grant Consumer Behavior Studies: Summary of Projects" (Cappers et al. 2013).

based rate programs, utilities attempt to identify specific “event” hours of the year in which electricity costs are likely to be highest, and commensurately increase the price of electricity to consumers during only those event hours. Critical Peak Pricing (CPP) rates typically have a day-ahead notice of event hours, and charge a pre-determined higher price during such hours; and Critical Peak Rebate (CPR) programs provide customers with a payment if they use less electricity during event hours, compared to some baseline estimate of what their electricity use would have been. CPP and CPR rates⁴ can be overlaid on a TOU rate, which we will denote as TOU w/CPP or TOU w/CPR, but can also be applied to a standard flat rate, which we will denote as Flat w/CPP or Flat w/ CPR.⁵ A Variable Peak Pricing (VPP) rate design identifies a set of peak hours for each day in advance, and charges customers using a price schedule that is variable and differs daily, based on bulk power system conditions during the peak hours.

⁴ Technically, a Critical Peak Rebate program is not a rate offering, as it does not reflect a price that must be paid **by** customers for consuming electricity but rather a price that is paid **to** customers for not consuming electricity. However, for simplicity of exposition and to maintain consistency with industry norms, we refer to CPR as a time-based rate herein.

⁵ In this report, Flat rates denote any rate that does not change on a time-differentiated basis, including inclining/declining block/tiered rates and bulk usage rates. See Appendix A in Cappers et al. (2013) for more information on these rate designs.



Figure 1. Time-based rate designs

At least one of these four time-based rate designs is included as an explicit treatment in each of the eleven utilities' consumer behavior studies (see Figure 2). Several utilities are testing more than one time-based rate design in their study.

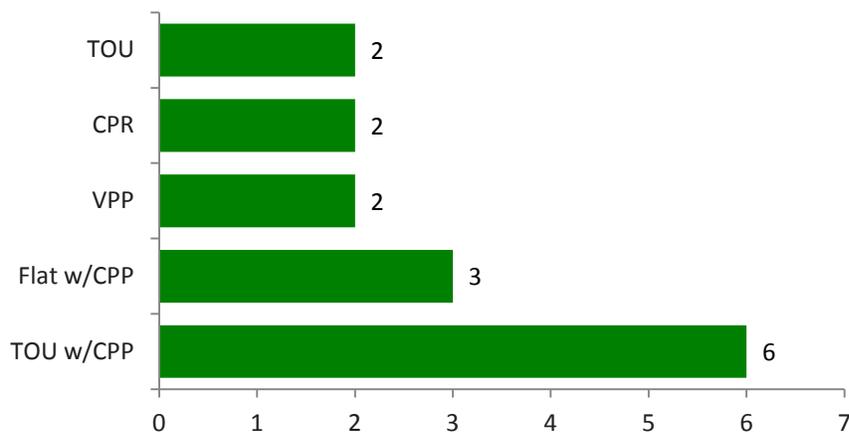


Figure 2. Number of utility studies designed to test various time-based rate treatments

2.1.2 Technology and Education Treatments

Utilities and state regulators are also interested in understanding the role of technology enabled by AMI as well as education efforts to enhance response to time-based rates and affect customers' willingness to take service under such rates. In-home displays (IHDs), programmable communicating thermostats (PCTs), and web-based energy information and feedback are all included as explicit treatments in several of the studies (see Figure 3). As with the rate treatments, some utilities have chosen to test a variety of different non-rate treatments in their study, while one utility chose to explicitly exclude enabling technology and education from their effort, focusing purely on the impacts of time-based rates.

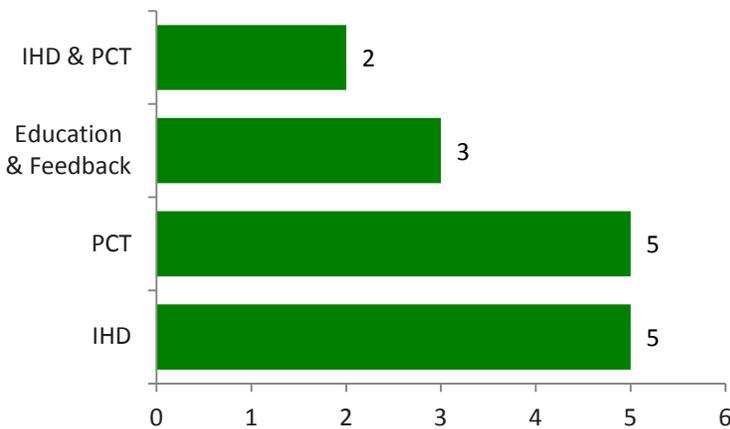


Figure 3. Number of utility studies designed to test various enabling technologies and education treatments

Some utilities included in this assessment are also testing joint applications of both rate and non-rate treatments in their study. For example, one utility study includes a treatment that tests the impact of a Flat w/CPP rate, another treatment that tests the impact of an IHD for customers remaining on the flat rate without a CPP overlay, and a third treatment that includes both a Flat w/CPP rate and an IHD.

2.1.3 Program Offer Treatments

In addition to testing the impact of time-based rates and enabling technologies on electricity consumption patterns, eight utility studies are also explicitly testing how successful different types of program offers are for recruiting customers. For example, in

one study with a time-based rate program, customers were randomly assigned to receive either a technology offer of an IHD, or no technology offer, in order to determine if the technology offer enticed more customers to sign up for the rate. Figure 4 illustrates the number of utility studies designed to experimentally test the effect of various types of offers on recruitment rates, including the type of technology offered, the type of time-based rate offered, and an opt-in versus an opt-out offer.



Figure 4. Number of utility studies designed to test various program offers

2.2 Experimental Design in CBS

All of the CBS studies testing time-based rates or technology treatments were initially designed to measure the impact of a treatment using a randomized experimental design, either a Randomized Controlled Trial (RCT) design or a Randomized Encouragement Design (RED). With RCTs, customers sign up for a study either through an opt-in method, in which customers must actively consent to participate in the study, or an opt-out method, in which customers must actively decline to participate in the study. Once they sign up, customers that opted-in (or did not opt-out) are randomly assigned to either a treatment group, which receives the treatment being tested, or a control group, which receives the treatment delayed by a year or does not receive the treatment. With REDs, customers are randomly assigned to either a treatment group, which is encouraged to sign up for the offered treatment through an opt-in or opt-out method, or a control group, which is not notified of the study and thus not encouraged to sign up for the treatment. For both RCTs

and REDs, the treatment group is compared to the control group in order to determine the effect of the treatment.⁶

In addition, one utility is augmenting their randomized study with an additional aspect that uses a non-randomized, within-subjects method to test a treatment. A within-subjects method compares the treatment group during times when it receives the treatment to times when it does not receive the treatment. In theory, RCTs and REDs produce unbiased treatment estimates, while within subjects estimates are not. Figure 5 depicts the number of utility studies under assessment utilizing various combinations of experimental designs.

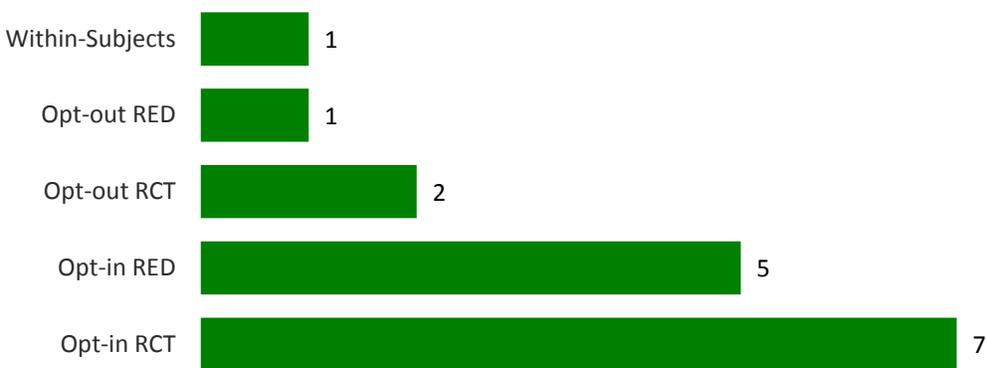


Figure 5. Number of utility studies using various experimental designs

For the studies designed to explicitly test the effect of different program offers, each one used a randomized experimental design (i.e., RCT or RED) in which customers were randomly assigned to be exposed to different types of offers. For example, customers were randomly assigned to receive either an offer of a Flat w/CPP rate, or an offer of a TOU rate.

⁶ Although REDs require substantially larger sample sizes than RCTs to achieve comparable levels of power and precision for an estimation of treatment effects, a utility might prefer to implement an RED because it would not have to deny or delay any customer who wants to participate in a study.

3. Approach

Customer enrollment into a study can take on many forms. It is important to precisely characterize how the enrollment effort is undertaken to enable an accurate comparison of customer recruitment rates. In this section we describe the data collected from CBS utilities and also discuss our approach to reporting customer enrollment data.

3.1 Data Description

Customer enrollment into a study goes through many stages. Each stage of enrollment may decrease the pool of available customers (see Figure 6) for subsequent stages. First, out of the total pool of residential customers, the utility may choose a certain subset of *qualified customers* that meet certain criteria (e.g., energy use criteria, geographic criteria, presence of central air conditioning). Second, out of the pool of qualified customers, the utility may only target and market the study to a smaller subset of *solicited customers* (e.g., if marketing to too many customers is too costly). Third, once they are solicited, only some customers sign up for the study (either by opting-in or not opting-out), resulting in a yet smaller pool of *recruited customers*. Fourth, the utility may decide to screen some customers out after they signed up, leading to an even smaller subset of *selected customers* (e.g., if a survey is part of the selection process, customers may be selected based on their answers to survey questions). These stages lead to the final number of *enrolled customers* that will be part of the study.⁷ We collected data on the number of customers in each of these customer enrollment stages⁸ for each of the nine CBS studies for which enrollment data is available.⁹ The enrollment stages generally lasted a few months for each study, and mostly occurred in late 2011 and early 2012. Due to the timing of when our analysis was undertaken relative to when enrollment data was available out of the utilities studies, only nine of the eleven CBS utilities studies are included in this analysis. In spite of not having

⁷ In order to estimate customer response to time-based rates (examined in future LBNL reports), studies that are using a randomized encouragement design may also collect data from a group of control customers that were never solicited. These control customers that were never solicited are not included in the number of enrolled customers.

⁸ For this study, we only have data on the aggregate number of enrolled customers. In future reports, we will have individual customer demographic and electricity data that will allow customer segmentation analysis.

⁹ Two of the eleven utilities undertaking an SGIG co-funded consumer behavior study have not yet begun enrolling customers at the time this report was drafted. As such, they are not included in this preliminary report.

data on two of the CBS utility studies, our analysis includes around 400,000 customers who were solicited and 44,000 who were enrolled.

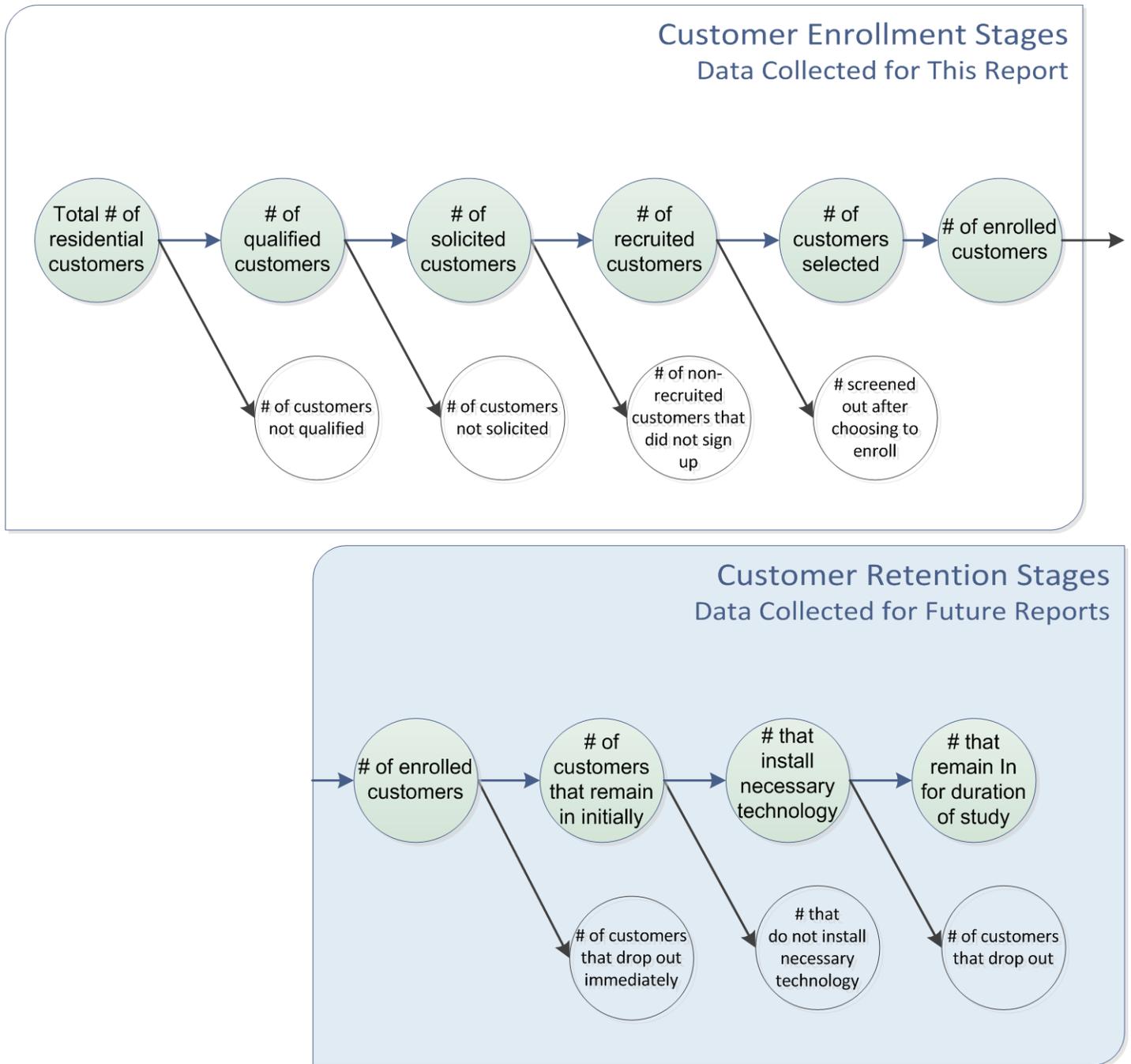


Figure 6. Data elements collected through various stages of customer enrollment and retention

Once the study begins and the treatment(s) go into effect, the customer pool goes through several additional stages of *customer retention* (see bottom panel in Figure 6). For example, an enrolled customer may drop out immediately after enrollment but before being exposed to treatment. Customers may decide not to install the required technology or they may drop out at some point before the end of the study. As mentioned previously, this report only captures data for the enrollment stages of the utility's study; future LBNL reports will examine data for the various customer recruitment stages.

In addition to this quantitative data, LBNL also collects more qualitative information from the CBS utilities on the lessons learned in a variety of areas, including customer enrollment in the CBS projects. Specifically, LBNL collects the experience of the CBS projects as a whole, identifying their initial expectations concerning a certain issue, relating how their actual experience differed, and sharing what they took away from this for future efforts. This qualitative data is collected through a variety of different channels on an ongoing basis from the CBS projects, including the CBS Utility Forum, the Technical Advisory Groups, and personal communications with LBNL staff.¹⁰

3.2 Empirical Approach

In order to characterize our empirical approach, we define the term *program offer* or simply *offer* to represent the different types of time-based rate, technology, and opt-in versus opt-out proposals made to customers when they are solicited to enroll in a study (e.g., an offer of a TOU rate, an offer that includes enabling technology, or an opt-in offer). We define the term *solicitation effort* to represent one complete set of offers made to one group of customers (e.g., one solicitation effort may have an opt-out offer, a TOU rate offer, and no technology offer). There are two types of *solicitation efforts* depending on the experimental design of the study:

1. **Recruitment into a specific treatment** (see example 1 in Figure 7): The utility first selects a group of customers that are targeted for solicitation. These customers are then split into two (or more) pools, where each is assigned to be solicited for a specific treatment pool. Once a customer signs up for the study, the customer is

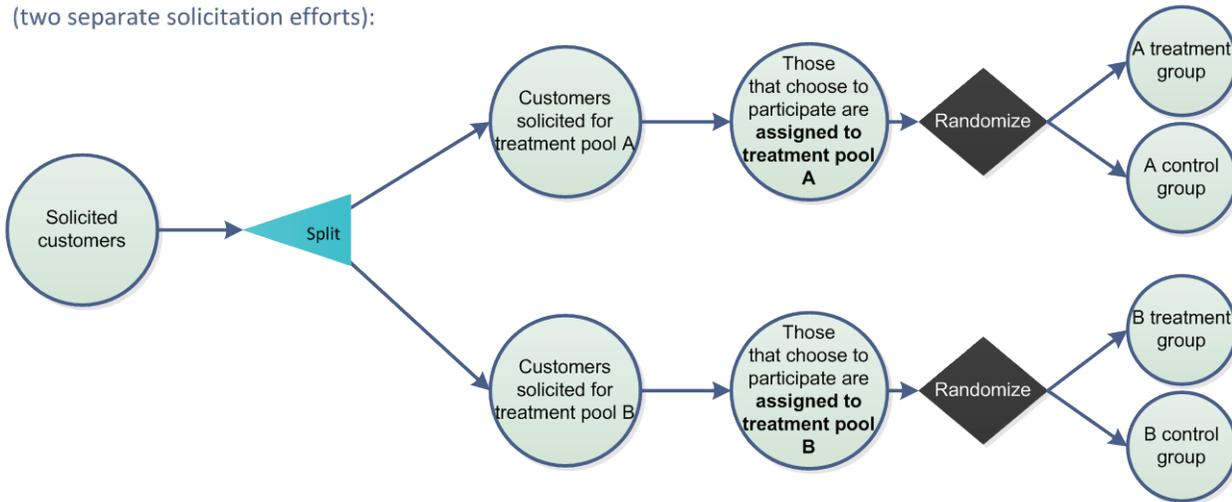
¹⁰ The CBS Utility Forum provides an opportunity for the SGIG CBS utilities to share information among themselves. Each CBS Utility is provided by LBNL with a small group of industry experts (i.e., Technical Advisory Group) who provide technical assistance to the utility concerning study design, implementation and evaluation issues.

assigned to the specific treatment pool for which he or she was solicited. Customers in a specific treatment pool are then randomly assigned to either the treatment group, which receives the treatment, or the control group. For example, a utility makes the following solicitation: one group of customers is solicited specifically for a TOU rate, and customers that sign up are placed in the TOU treatment pool; a second group is solicited specifically for a Flat w/CPP rate, and customers that sign up are placed in the Flat w/CPP treatment pool. A utility would pursue this approach to recruitment if it wanted to explicitly understand customer preferences for different combinations of rate and/or technology treatments. We represent this case as two *solicitation efforts* for this utility; one TOU solicitation effort and one Flat w/CPP solicitation effort.

2. **Recruitment into a generic study** (see example 2 in Figure 7): The utility first selects a group of customers that are targeted for a solicitation. These customers are then solicited for a single, generic study that includes two or more treatments. Once a customer signs up for the study, only then does the utility split customers into specific treatment pools. Customers in a specific treatment pool are then randomly assigned to either the treatment group, which receives the treatment, or the control group, which does not receive the treatment. For example, a utility solicits a group of customers for a study in which, should they sign up, they may be placed into a TOU rate treatment pool, or they may be placed into a Flat w/CPP rate treatment pool. A utility would pursue this approach to recruitment if it wanted to ensure that customers in different treatment groups within its study are similar, so that the results can be compared (i.e., all of the customers in all treatment groups are the same type of customers that would choose to enroll in a generic study).¹¹ We represent this case as one *solicitation effort* for this utility; one “TOU or Flat w/CPP” solicitation effort.

¹¹ Results across different treatment groups cannot be directly compared when customers are recruited into specific treatments, because different types of customers may decide to sign up for different treatments. Different treatments would then have different types of customers, and so any observed differences between the treatments may be due to the difference in customers, not due to the treatments.

Example 1: customers solicited into two specific treatment pools
(two separate solicitation efforts):



Example 2: customers solicited into one generic treatment pool
(one solicitation effort):

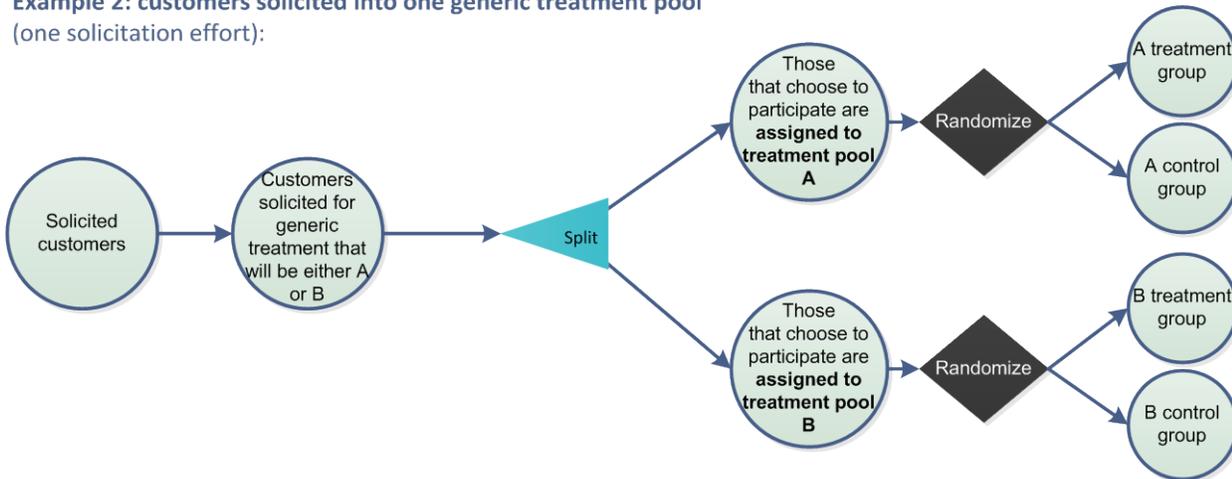


Figure 7. Example of solicitation efforts

Based on this definition of a *solicitation effort*, there are nineteen different customer solicitation efforts across the nine utilities included in this report.

3.2.1 Recruitment Rates

While the number of customers that are retained in each of the customer enrollment stages is important to understand for study planning purposes, in this report most of our analysis is focused on the number of customers that sign up for the program (i.e., recruited customers) out of those that are solicited. We define the *recruitment rate* as the percentage

of recruited customers out of the total number of customers solicited in one solicitation effort (Equation 1).

$$\text{Equation 1: Recruitment Rate} = \frac{\text{Recruited customers}}{\text{Solicited customers}}$$

We focus on the recruitment rate because this is the stage of the enrollment process in which the customer must give an affirmative indication that they will sign up for the study (and potentially be exposed to the time-based rate and/or enabling technology). When utilities are planning a study, this is likely to be the stage that is the least well known and that seems to be outside of the utility's control. We provide an overall summary of the recruitment rates for each of the nineteen solicitation efforts, and then examine three types of program offers:

- An opt-in versus opt-out offer
- Offers of different time-based rates
- Technology offers

For each of these three types of program offers, we report two findings: first, Descriptive Results that are based on summary statistics; and second, Experimental Results from explicit experimental tests of the effectiveness of different types of program offers on recruitment rates.

We also report on how accurately the utilities were able to forecast their recruitment rate. We define the actual versus planned recruitment rate as the percentage difference between the actual and the planned recruitment rate. This is helpful in determining how accurate the utilities were in planning their recruitment efforts.

$$\text{Equation 2: Actual vs. Planned Recruitment Rate} = \frac{\text{Actual Recruitment Rate} - \text{Planned Recruitment Rate}}{\text{Planned Recruitment Rate}}$$

For the Descriptive Results, we report the unweighted average recruitment rates for opt-in and opt-out studies, grouped by: the type of time-based rate offered and the type of technology offered.¹² Note that because each utility chose the type of time-based rate and

¹² We provide an unweighted average rather than a weighted average because we believe that unobservable differences across utilities may be more of a factor in a customer's choice to enroll than the variables that we are examining. For example, consider the extreme case in which one utility solicited more customers than all of the other utilities combined, and also had exceptionally high recruitment rates. Then the characteristics of that utility would drive all of the weighted

the type of technology that they deemed best to include in their own study, one cannot interpret any differences in recruitment rates across all utility studies as being caused by the recruitment characteristics.¹³ However, one can readily observe the range in recruitment rates that these utilities achieved and use them to set realistic boundaries on recruitment rates for similar efforts.

Eight of the nineteen solicitation efforts explicitly and experimentally tested the relative success of different types of offers by randomly assigning customers to receive different program offers. For these cases, it is possible to draw causal inferences about which specific types of offers would result in higher recruitment rates. We are able to provide Experimental Results from the following randomized trials:

- A test of an opt-out versus an opt-in offer
- A test of an opt-in Flat w/CPP offer versus a TOU offer
- A test of an opt-out TOU w/CPP offer versus a TOU offer versus a Flat w/CPP offer
- A test of an opt-in IHD technology offer versus no technology offer

Specifically, for each of these comparisons, we perform a two-proportion z-test of differences¹⁴ in order to determine which solicitation method resulted in a higher recruitment rate.¹⁵ For situations in which there are two or more utilities testing the same solicitation method (e.g., two utilities that randomize customers into an opt-in versus an opt-out method), we perform a test with the total number of customers aggregated across utilities as well as a separate test segmented by each utility.

3.2.2 Qualification, Solicitation, Recruitment, and Selection

We focus mainly on reporting the recruitment rate as the primary metric of interest. In addition, we provide Descriptive Results for the other enrollment stages for the fourteen

average rates, but it may be that the high recruitment rate was due to something that we are not capturing, such as a great marketing campaign or utility customers that are particularly amenable to the program.

¹³ There may be many other unobservable differences in the studies that actually cause the difference in recruitment rates (e.g., the utilities may have used different marketing materials, and the customers in the utilities may be quite different).

¹⁴ For a comprehensive book on statistics and econometrics, see Greene (2011).

¹⁵ The extent to which the results from this analysis can be extrapolated to different settings depends on the degree to which the solicitation efforts and utility characteristics are similar.

opt-in solicitation efforts.¹⁶ Specifically, we define the *qualification rate* as the percent of customers that qualified for the study out of the total pool of residential customers (Equation 3); the *solicitation rate* as the percent of customers that were solicited out of the pool of qualified customers (Equation 4); the *recruitment rate* is as defined above (the percent of customers that were recruited into the study out of the pool of solicited customers); and the *selection rate* as the percent of customers that were not screened out of the study out of the pool of recruited customers who had already signed up for the study (Equation 5).

$$\text{Equation 3: Qualification Rate} = \frac{\text{Qualified customers}}{\text{Total Residential customers}}$$

$$\text{Equation 4: Solicitation Rate} = \frac{\text{Solicited customers}}{\text{Qualified customers}}$$

$$\text{Equation 1: Recruitment Rate} = \frac{\text{Recruited customers}}{\text{Solicited customers}}$$

$$\text{Equation 5: Selection Rate} = \frac{\text{Selected customers}}{\text{Recruited customers}}$$

3.2.3 Lessons Learned

Although identifying the degree to which recruitment rates differ across different solicitation efforts is important for future utility efforts, it is equally important to understand the context that underlies those recruitment figures. Based on conversations with utility CBS project managers and TAG members, a summary of the qualitative data collected by LBNL on the lessons learned in the area of customer enrollment is presented, which can be used to help further characterize and contextualize the observed recruitment rates.

¹⁶ We did not include the five opt-out solicitation efforts, as it is hard to draw even qualitative observations from only five studies.

4. Results

In section 4.1, we provide summary statistics on the number of customers that are recruited out of the pool of solicited customers (i.e., the recruitment rate), and results from studies that are explicitly testing the effectiveness of different types of program offers through randomized trials (e.g., recruitment rates for opt-in versus opt-out offers, different types of time-based rates and technology offers). Findings on the number of customers that are maintained throughout other enrollment stages are presented in section 4.2, and lessons learned are discussed in section 4.3.

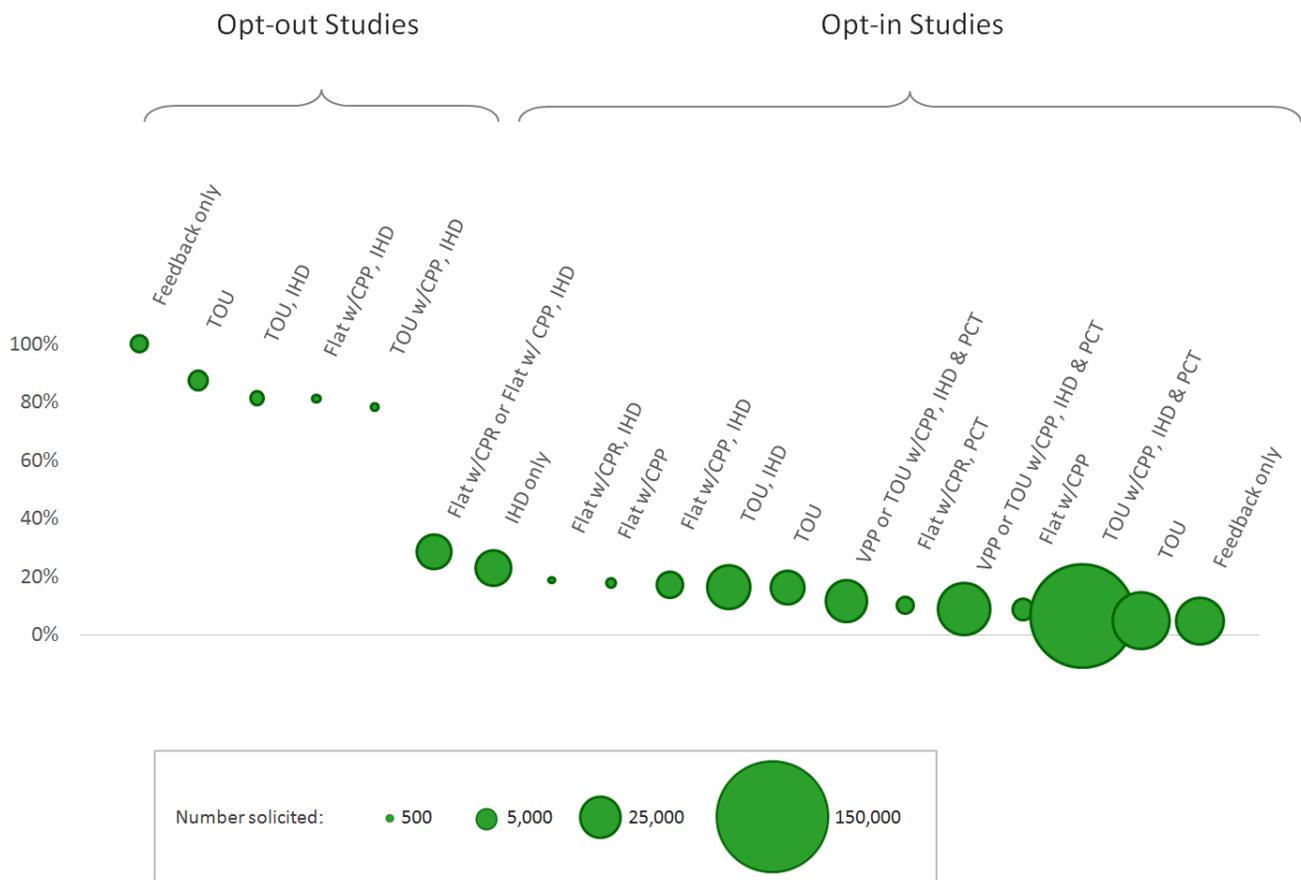
4.1 Recruitment Rates

Figure 8 displays the recruitment rates for each of the nineteen solicitation efforts, grouped into opt-out and opt-in solicitations.

Descriptive Result 1. *For time-based rate and enabling technology studies that use an opt-in program offer, recruitment rates range from 5% to 28%. For those that use an opt-out program offer, recruitment rates range from 78% to 87%.*

One opt-out feedback study, in which customers were given access to their energy use information online, shows a 100% recruitment rate because no one opted-out of being able to access the website. For this kind of study, in which a customer who ignores the study completely will not experience any impact whatsoever, the recruitment rate may be less meaningful than the percentage of customers that actually use the treatment (e.g., website).

When utilities design their studies, they must estimate an expected recruitment rate in order to determine both the number of customers that are needed to enroll in the study as well as the number of customers who must be solicited to ensure that the energy impact estimates are valid (that they meet statistical power and precision requirements).



19 total solicitation efforts listed. Circle size represents the total number of customers solicited.

Figure 8. Recruitment rates for each solicitation effort

Although a few utilities included in this analysis were highly accurate in their predictions for recruitment, many were not. Figure 9 shows the actual and planned recruitment rates.

Descriptive Result 2. *Most utilities did not accurately predict recruitment rates for their study solicitation efforts. Five of the twelve opt-in solicitation efforts underachieved their recruitment rates such that actual recruitment rates were 7 to 22 percentage points below the actual recruitment rate. This represents actual recruitment rates that were at least a quarter of what was planned.*

Out of the six opt-in solicitation efforts that underachieved their planned recruitment rates, five had an actual recruitment rate that was seven to twenty two percentage points lower

than planned, representing an actual recruitment rate that was at least a quarter of what was planned (i.e., was 24-69% lower). Five out of the six opt-in solicitation efforts that overachieved had an actual recruitment rate that was no more than four percentage points higher than planned. The sixth was fourteen percentage points higher than planned, almost double the planned rate. Interestingly, for opt-out solicitation efforts, four utilities predicted that many more customers would opt-out than what was observed.¹⁷ While overachieving recruitment rates may not have severe consequences, underachievement can cause problems with the study evaluation effort which may necessitate changes to the study's design. If a study has planned to recruit a certain number of customers and the actual number of customers recruited is far less, the study may have to be re-designed (e.g., the number of treatments being tested may have to be reduced) in order to achieve statistically valid load impact estimates.

Our results suggest that a utility may expect to achieve at least a 5% recruitment rate for opt-in studies. Under ideal circumstances, recruitment rates into such studies could exceed 20%. However, for planning purposes assuming 10% recruitment rate seems most appropriate.

4.1.1 An Opt-out versus Opt-in Offer

4.1.1.1 Summary

As shown in Figure 8, studies using opt-out program offers had higher recruitment rates on average than studies using opt-in offers (the unweighted average recruitment rate is 82% for opt-out offers, and 14% for opt-in offers). We would like to determine whether the higher recruitment rates are caused by the opt-out offer, rather than due to random chance alone or to the differences between the types of customers in the utilities (statistically termed a *selection bias* issue). We examine this in the next section.

¹⁷ Again, for opt-out methods, understanding the customer retention rates *after* the beginning of the study may be particularly important for interpreting the overall enrollment rates. For example, data after the study begins may show that many more customers drop out of these studies.

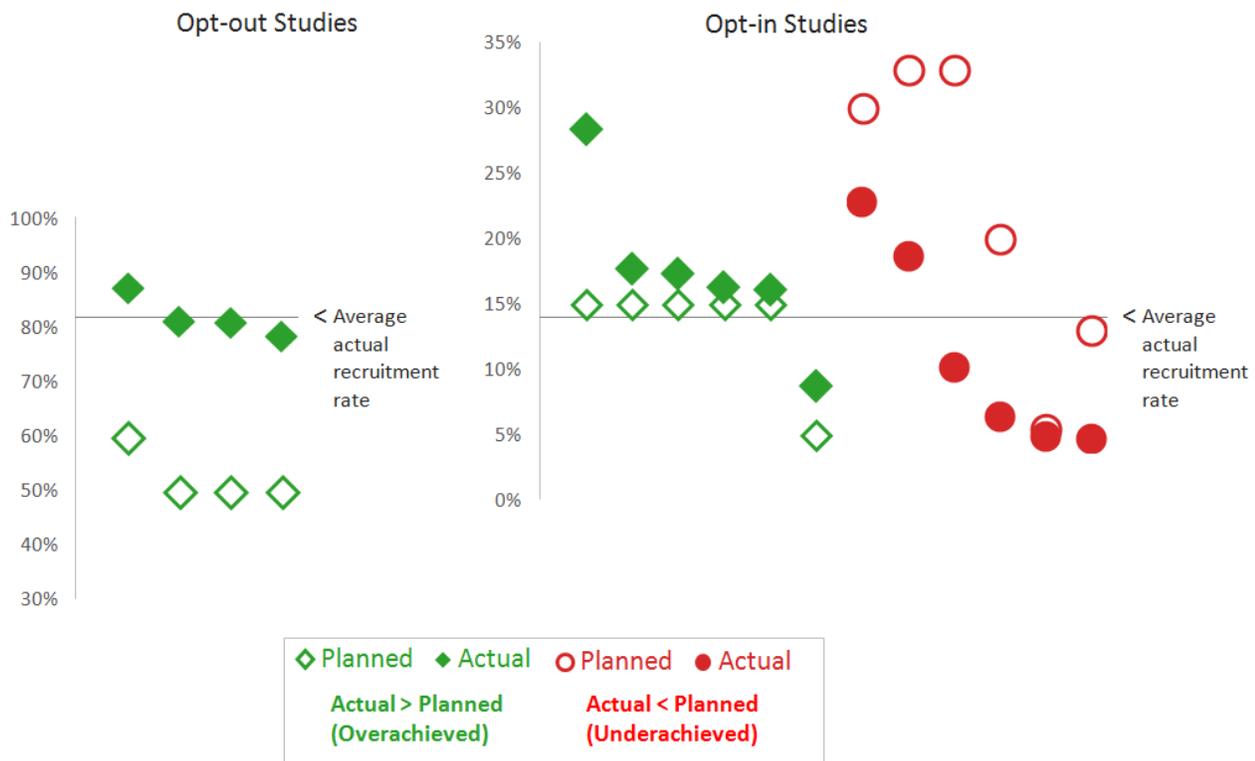


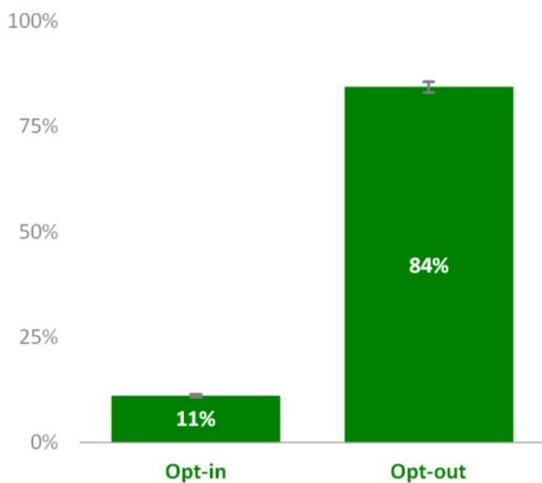
Figure 9. Actual versus planned recruitment rates

4.1.1.2 Analysis Results

Figure 10 shows the recruitment rates for the total number of customers that were **randomly** assigned to be solicited to participate in a study through either opt-in or opt-out offers. The data come from the two utilities who explicitly tested for this in their study. One utility randomly assigned ~45,000 of its residential customers to an opt-in program offer and another ~5,000 residential customers to an opt-out offer. The other utility randomly assigned ~53,000 of its residential customers to an opt-in program offer and another ~4,000 to an opt-out offer.

Experimental Result 1. *More customers enroll into a time-based rate program with an opt-out offer as opposed to an opt-in offer (see Figure 10).*

Segmenting customers into each of the two utilities produces similar results: 17% and 5% for opt-in, versus 81% and 87% for opt-out.¹⁸ This indicates that customers are more likely to sign up for an opt-out offer than an opt-in offer (i.e., more customers choose to not opt-out of a study than choose to opt-in).



Percentages include the total number of customers across the two utilities that randomized opt-in versus opt-out program offers (99.9% confidence intervals shown; N=100,000).

Figure 10. Recruitment rate results for tests of opt-in versus opt-out program offers

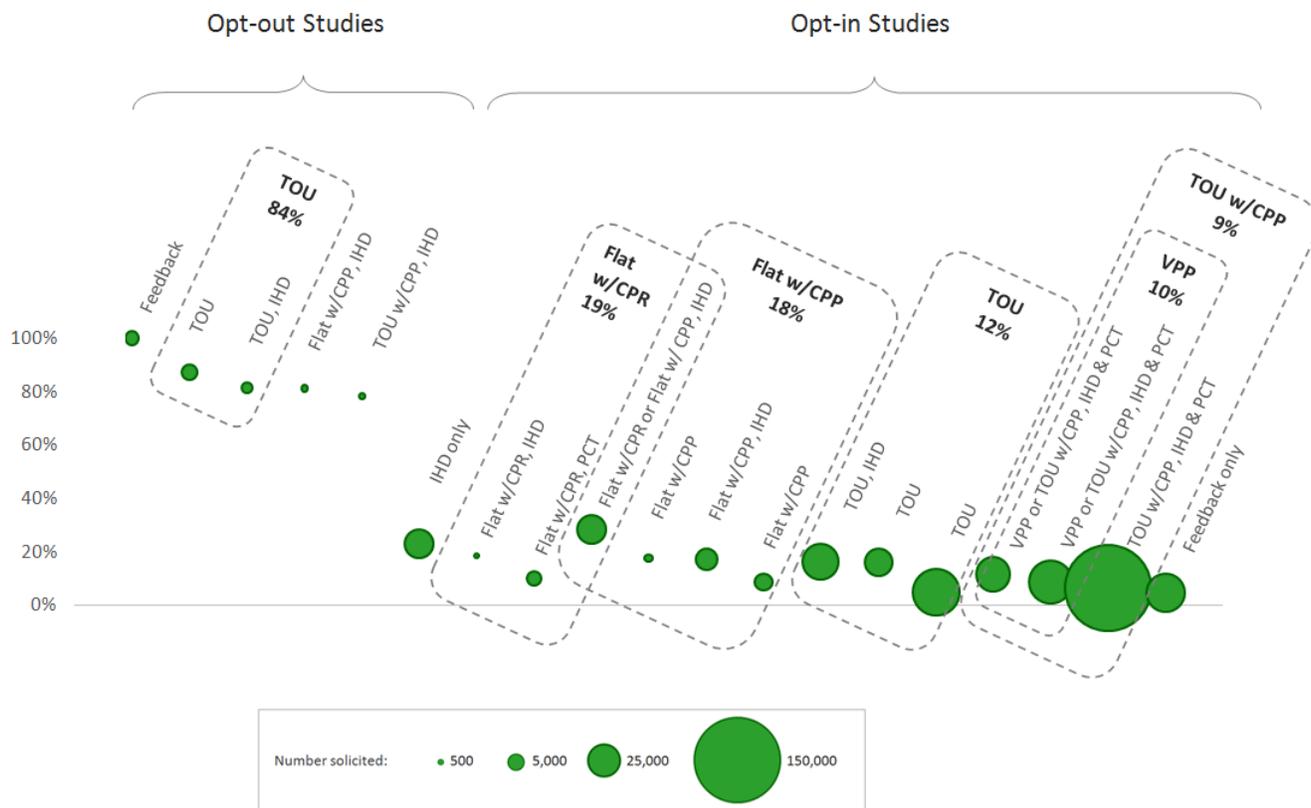
4.1.2 Offers of Different Time-Based Rates

4.1.2.1 Summary

Figure 11 shows the unweighted average recruitment rates (see Section 4.1 for more details) across the nineteen solicitation efforts, grouped into five different time-based rate

¹⁸ One utility further separated the randomized recruitment efforts into separate time-base rate and technology offers. Segmenting into these cohorts also produced similar results: an offer of IHDs with a TOU rate had a recruitment rate of 16% for opt-in and 81% for opt-out; an offer of an IHD with a CPP rate had a recruitment rate of 17% for opt-in and 81% for opt-out. A two-proportion z-test of differences between the opt-in and opt-out recruitment rates are statistically significant in any case. However, what is more appropriate in this case is to test whether the difference is larger than what was *expected* (i.e., the null hypothesis is the a priori belief). In their study plans, the utilities' expected opt-out recruitment rates were 35% higher than the expected opt-in rates. These results show that the opt-out rates are statistically significantly higher than 35%.

offers (i.e., TOU, TOU w/CPP, Flat w/CPP, Flat w/CPR, and VPP¹⁹), and segmented between opt-out and opt-in. For opt-in solicitation efforts, solicitations that offered Flat w/CPP (18%) or Flat w/CPR (19%) had higher recruitment rates on average than those that offered TOU (12%), TOU w/CPP (9%), or VPP (10%). For opt-out solicitation efforts, those that offered TOU had slightly higher recruitment rates (84%) on average than those that offered Flat w/CPP (81%) or TOU w/CPP (78%).



Unweighted average of recruitment rates across 19 solicitation efforts. Circle size represents the total number of customers solicited.

Figure 11. Summary of recruitment rates for different time-based rate offers

¹⁹ VPP is similar to a TOU w/CPP rate in that both rates allow for the possibility for the peak period price to be altered with some notice. In the latter case, this change in the rate is very infrequent whereas in the former case it happens on a daily basis.

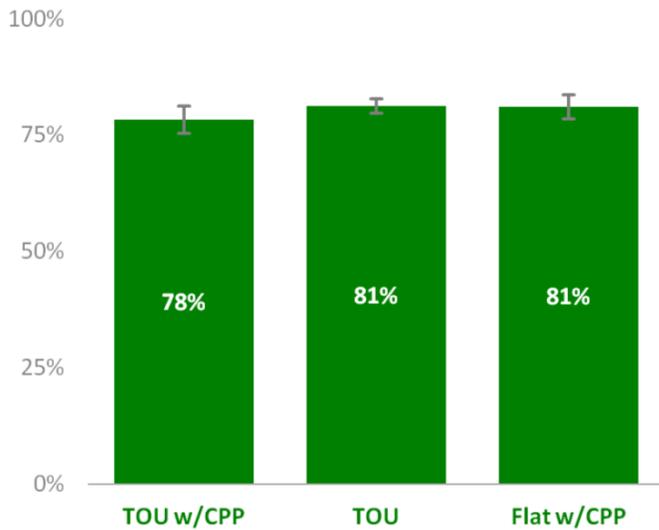
In Figure 11, it is important to note that because the type of time-based rates offered were not randomly assigned to different utilities; we should not interpret any observed differences as causal. For example, it may be tempting to conclude that offering a Flat w/CPP rate would result in 6% higher recruitment rates than a TOU rate. However, the utilities that decided to offer Flat w/CPP rates may simply have different types of customers, who are more willing to enroll in *any* time-based rate. Therefore, the difference in customers (or any other unobservable characteristics of the utility or the study) may be causing the difference in recruitment rates, *not* the type of rate that was offered. In fact, as seen in the next section, an analysis of explicit randomized tests of different time-based rate offers actually does not bear out the differences seen in Figure 11.

4.1.2.2 Analysis Results

Figure 12 shows the recruitment rates for customers that were **randomly** assigned to be solicited to participate in a study using an opt-out method with an offer of either a TOU rate, a Flat w/CPP rate, or a TOU w/CPP rate. The data come from the lone utility, where customers were randomly assigned to one of these three program offers. All of these customers were offered an IHD, but were not obligated to accept it in order to enroll in the study. The number of customers solicited was ~2,500 for the TOU offer, ~900 for the Flat w/CPP offer, and ~800 for the TOU w/CPP offer.

Experimental Result 2. *For opt-out solicitations, the type of time-based rate offer does not materially affect the customer recruitment rate (see Figure 12).*

The recruitment rates were 81% for the TOU offer, 81% for the Flat w/CPP offer, and 78% for the TOU w/CPP offer. The differences between any pairings of the rates are not statistically significant (the p-value of two-proportion z-test is 0.88 for TOU vs. Flat w/CPP, 0.18 for Flat w/CPP vs. TOU w/CPP, and 0.08 for TOU vs. TOU w/CPP). This suggests that customers are not more likely to opt-out of one time-based rate over the other, despite the rate differences.



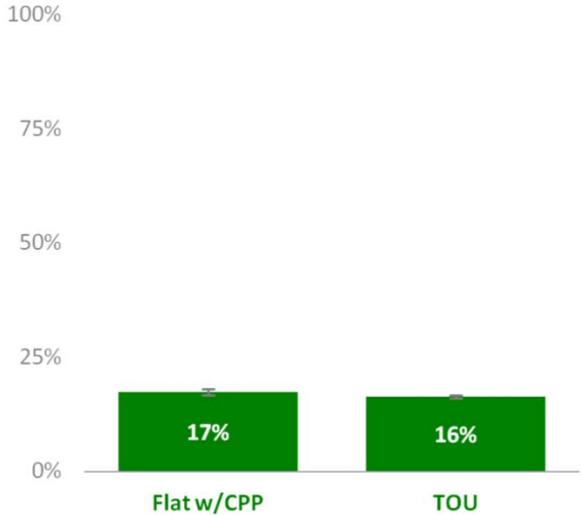
Percentages include the total number of customers within the lone utility that were randomly assigned to receive opt-out offers of IHDs along with one of the three time-based rates (95% confidence intervals shown; N=4000).

Figure 12. Opt-out recruitment rate results for tests of time-based rate offers

Figure 13 shows recruitment rates for customers randomly assigned to be solicited to participate in a study using an opt-in method for either a TOU rate or a Flat w/CPP rate. The data come from one utility, with four different solicitation efforts. Two solicitation efforts include the offer of an IHD but differ in the type of time-based rate offered: one with Flat w/CPP, and one with TOU. The two remaining solicitation efforts do not include a technology offer, and again differ in the type of time-based rate offered: one with Flat w/CPP, and one with TOU. Figure 13 shows the combined recruitment rates for both of the TOU offers (~26,000 customers solicited with an IHD offer, and ~16,000 solicited without a technology offer), versus both of the Flat w/CPP offers (~9,000 customers solicited with an IHD offer, and ~1,300 solicited without a technology offer).

Experimental Result 3. *For opt-in solicitations, the type of time-based rate does not materially affect the customer recruitment rate (see Figure 13).*

The Flat w/CPP offer has a 17% recruitment rate versus 16% for the TOU offer; the difference is statistically significant with a p-value <0.01. Segmenting the customers into those that were offered an IHD and those that were not offered technology, a Flat w/CPP offer is still 1% higher than a TOU offer, but the difference is only statistically significant for the customers that were offered an IHD. This suggests that customers may, to a very small extent, prefer to opt-in to a Flat w/CPP over a TOU rate. However, the preference is very small.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive a CPP offer versus a TOU offer (95% confidence intervals shown; N=50,000).

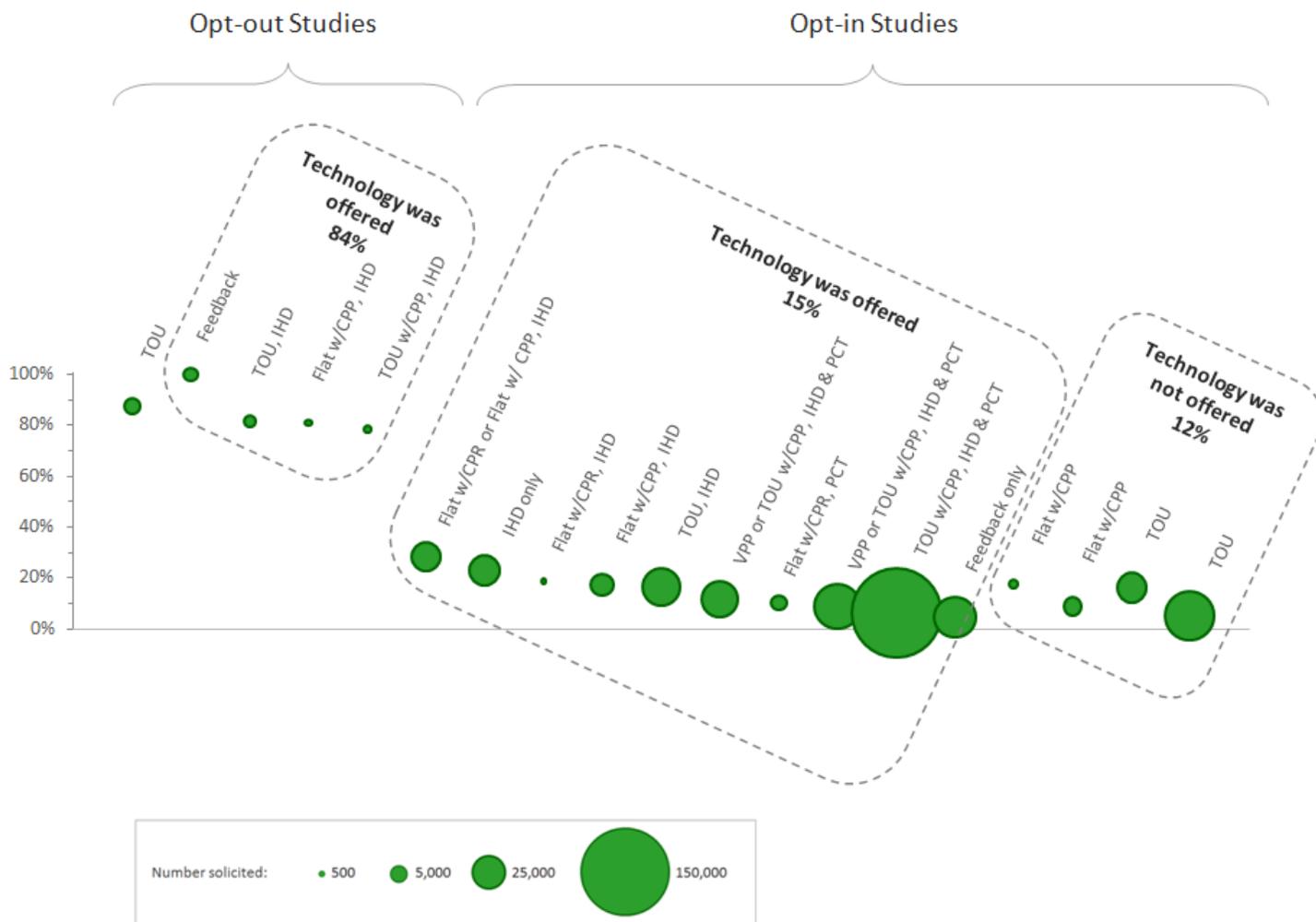
Figure 13. Opt-in recruitment rate results for tests of time-based rate offers

4.1.3 Technology Offers

4.1.3.1 Summary

Figure 14 shows the unweighted average recruitment rates across solicitation efforts, grouped according to whether technology was offered or not, and segmented between opt-out and opt-in methods. For opt-in program offers, the recruitment rates were slightly higher on average for solicitation efforts that offered technology relative to those that did

not (15% vs. 12%). For opt-out methods, the recruitment rates were slightly higher on average for solicitation efforts that did not offer technology (84% vs. 87%).



Unweighted average of recruitment rates across 19 solicitation efforts. Circle size represents the total number of customers solicited.

Figure 14. Summary of recruitment rates for technology offers

In Figure 14, as with previous depictions of these summary recruitment rates, it is important to note that because the type of technology offered was not randomly assigned to different utilities, we should not interpret any observed differences in recruitment rates as causal (i.e., offering technology does not necessarily *cause* or result in higher recruitment rates). Only an analysis of explicit randomized tests of technology offers allows

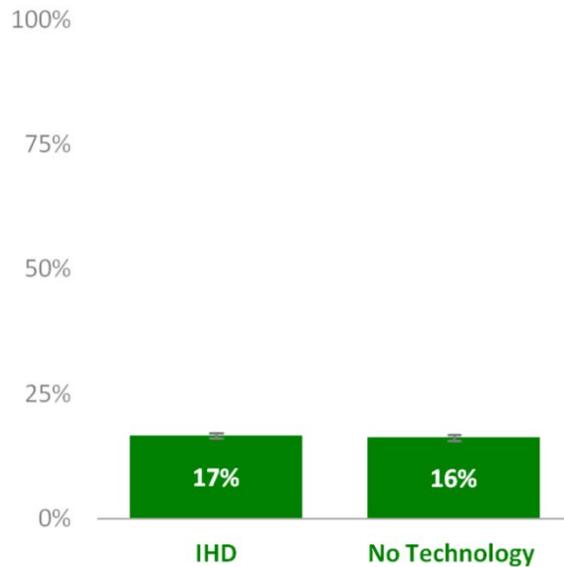
us to draw causal inferences, which in this case shows that in fact this difference is not born out.

4.1.3.2 Analysis Results

Figure 15 shows the recruitment rates for the total number of customers that were randomly assigned to be solicited to participate in a study using an opt-in method with either an offer of an IHD or no technology offer. The data come from the lone utility that implemented such a study, incorporating four different solicitation efforts. Two solicitation efforts include the offer of a TOU rate but differ in the offer of technology: one with an offer of an IHD and one without a technology offer. The two remaining solicitation efforts include the offer of a Flat w/CPP rate which again differs in the offer of technology: one with an offer of an IHD and one without a technology offer. Customers were randomly assigned to each of these four solicitation efforts. Figure 15 shows recruitment rates reflecting the total number of customers recruited for both of the IHD technology offers (~26,000 customers solicited for the TOU rate, ~9,000 solicited for the Flat w/CPP rate), versus both of the no technology offers (~16,000 solicited for the TOU rate, and ~1,300 solicited for the Flat w/CPP rate).

Experimental Result 4. *For opt-in solicitations, the offer of technology does not materially affect the customer recruitment rate (see Figure 15).*

As shown in Figure 15, both an IHD offer and a no-technology offer have a 16-17% recruitment rate; the difference is not statistically significant. Segmenting customers into CPP and TOU solicitation efforts shows similar results (around 16% recruitment rates for both TOU offers with and without an IHD offer, and around 17% for both Flat w/CPP offers; neither difference is statistically significant). This indicates that customers are *not* more likely to opt-in to a time-based rate if they are offered an IHD, despite the supposed monetary value of such a device.



Percentages include the total number of customers within the lone utility that were randomly assigned to receive an IHD offer versus no technology offer (95% confidence intervals shown; N=50,000).

Figure 15. Opt-in recruitment rate results for tests of technology offers versus no technology offers

4.2 Qualification, Solicitation, and Selection Rates

This section provides basic summary statistics on the various customer enrollment stages before and after the recruitment stage: the qualification rates, solicitation rates, and selection rates. Overall, for opt-in solicitation efforts, the qualification rate ranges from 1.3% to 83%, with an unweighted average of 32%; the solicitation rate ranges from 23% to 100% with an unweighted average of 87%; and the selection rate ranges from 54% to 100% with an unweighted average of 93% (see Table 1 and Table 2).

	Qualification rate	Solicitation rate	Recruitment rate	Selection rate
HD Only	71%	73%	23%	79%
Flat w/CPR, IHD	1%	23%	19%	100%
Flat w/CPR, PCT	3%	94%	10%	100%
VPP or TOU w/CPP, IHD & PCT	4%	100%	12%	100%
VPP or TOU w/CPP, IHD & PCT	6%	100%	9%	100%
TOU w/CPP, IHD & PCT	23%	33%	6%	73%
Feedback only	26%	100%	5%	100%
TOU, IHD	33%	100%	16%	100%
TOU	33%	100%	16%	100%
Flat w/CPP	33%	100%	18%	100%
Flat w/CPP, IHD	43%	100%	17%	100%
TOU	43%	100%	5%	100%
Flat w/CPP	61%	100%	9%	100%
Flat w/CPR or Flat w/ CPP, IHD	83%	100%	28%	100%

Table 1. Qualification, solicitation, recruitment, and selection rate for opt-in solicitation efforts

	Qualification rate	Solicitation rate	Recruitment rate	Selection rate
Feedback only	3%	100%	100%	100%
TOU w/CPP, IHD	33%	100%	78%	100%
TOU, IHD	33%	100%	81%	100%
Flat w/CPP, IHD	33%	100%	81%	100%
TOU	43%	100%	87%	100%

Table 2. Qualification, solicitation, recruitment, and selection rate for opt-out solicitation efforts

There may be multiple factors that drive some of these differences. For example, studies that include different enabling technologies may require possession of certain items of equipment to qualify as a participant (e.g., the presence of central air conditioning to receive a programmable communicating thermostat or a broadband internet connection to receive an in-home display). Some utilities may have budgets for marketing and recruitment efforts that allow them to solicit all of their customers, while others may only

be able to focus on soliciting a specific subset of customers. Some utilities have collected sufficient data prior to the solicitation effort to know which customers to target whereas others need to collect that information during the recruitment process to determine who qualifies as a participant. When we have customer level data on the enrollment effort as well as information on retention rates and load impact estimates, we may be able to draw more definitive conclusions about the effects of these enrollment stages and the factors that influence them.

4.3 Lessons Learned on Customer Enrollment

In this section, we provide a summary of the lessons learned from qualitative data collected through various channels on the utilities' customer enrollment experiences.

Prior to test marketing materials that would be used to solicit participation into studies that included time-based rates, many utilities believed words like “critical”, “emergency”, and “events” would confer the necessary message about what the rate was trying to accomplish and how valuable a customer’s participation in that rate would be. Several utilities subsequently performed focus groups, surveys and other forms of test marketing of their recruitment material which indicated the terms and concepts utilities thought would connote positive concepts with customers actually had the opposite effect. Terms like “response”, “auto”, and “event” were construed as reactionary words that deflated personal control (e.g., “emergencies” are out of a customer’s control). Instead, some participants in focus groups appeared to prefer terms that construed a sense of personal control over one’s own energy usage and resulting bill (e.g., “control”, “choice”, “sense”).

Lessons Learned 1. *Utilities found focus groups, surveys and other tools to be vital components for test marketing terms and concepts that will attract customer interest and engage them to participate in the rate being offered.*

Utilities also learned from focus groups that customers claimed to be primarily motivated by environmental messaging when it came to recruitment into new time-based rates. Test marketing along with observed recruitment data from various messages (e.g., “saving money”, “environmental stewardship”, “taking control”, “fun”) revealed the primary motivator for the majority of customers was actually financial.

Lessons Learned 2. *Utilities learned the importance of validating focus groups with other test marketing efforts across a variety of customer segments and circumstances to develop the most effective messaging for their new time-based rate recruitment campaign.*

Once the messaging and marketing planning efforts were completed, the utilities moved into the recruitment phase of the study. Issues often arise during this time in the study lifecycle that can threaten its overall success. Many utilities, therefore, included a two week soft launch window in their enrollment process in order to identify and address any problems that internal planning and test marketing of recruitment materials did not catch. Unfortunately, even with a two week soft launch period, one utility still did not have enough time to incorporate necessary feedback to the solicitation materials in time for the hard launch, at which point changes were very difficult and costly to make.

Lessons Learned 3. *Utilities were surprised at how much time and resources they needed to allocate between soft launch and hard launch of the solicitation effort to adjust the messaging and other details accordingly based on feedback.*

The recruitment process can also be affected by assumptions about the number of customers capable and willing to receive certain types of enabling technology (e.g., presence of central air conditioning to receive a programmable communicating thermostat). By not accurately quantifying ahead of the study enrollment effort the size of the available population that would pre-qualify for a specific enabling technology, the number of customers that would be willing/able to accept, and the number that then have it installed, some utilities substantially overestimated the level of acceptance for a new rate or product offering that was strictly paired with such enabling control technologies.

Lessons Learned 4. *Utilities learned that before determining if a new rate or product offering is to be paired with a form of enabling technology, they could benefit from spending time understanding potential customer concerns with that technology and identifying the available pool of participants who would qualify for and be willing to accept such technology so that realistic expectations for recruitment can be set ahead of time.*

Many of the utilities who included some form of enabling technology in their study decided to enlist internal utility workers or external contractors to help install and provision this

equipment at a participating customer's premise. These utilities believed that individuals responsible for installing these pieces of technology at a customer site would have little to no effect on that customer's decision to finalize and complete the enrollment process in the study. Unfortunately, installation of technology by individuals, either internal or external to the utility, who did not have sufficient appreciation for the importance of the public relations role they played and/or were insensitive to the consequences of not playing that role well, resulted in negative ramifications for customer engagement efforts at several utilities.

Lessons Learned 5. *Utilities realized the need to ensure that all utility representatives and contractors that interact with customers at any level are informed, committed and enabled to make the experience a positive one for the customer. One way to do this most effectively was by focusing on communications skills as much as technical skills when hiring or recruiting people to fill these positions.*

5. Conclusion

This report provides preliminary insights into customer recruitment rates for nineteen solicitation efforts offering time-based rate and technology programs. Overall, we find that recruitment rates range from 78% to 87% for opt-out studies, and 5% to 28% for opt-in studies. We also find that opt-out methods result in much higher recruitment rates (11% for opt-in versus 84% for opt-out), that offering an IHD does not result in a statistically significant difference in recruitment rates, and that the type of time-based rate does not materially affect the recruitment rate (for opt-out methods, the differences between a TOU, a Flat w/CPP, and a TOU w/CPP rate are not statistically significant; for opt-in methods, the difference between a Flat w/CPP and a TOU rate is only 1%).

It is perhaps not surprising that our results show that programs that use opt-out methods result in much higher recruitment rates. An opt-in approach essentially retains the current “default” (e.g., the default rate is a flat rate), while an opt-out approach determines a new default (e.g., a time-based rate). In general, people tend to adhere to the “status quo” or “default” choice.²⁰ Other areas have used this understanding of customer behavior to adopt policies that are deemed to improve social welfare. For example, employee participation in 401(k) plans increase from 37% to 86% under automatic enrollment (Madrian and Shea 2001). Due in part to such evidence, the Obama Administration recently passed a Retirement and Savings Initiative, which makes it easy for small businesses to automatically enroll their employees in savings plans, and to automatically increase their savings rates over time unless they opt-out (IRS 2009). The energy industry is currently grappling with what type of rate design should serve as the default rate.

One way to frame the recruitment results is through this lens of customer preferences for the default option. Based on the experience of these studies, customers overwhelmingly accept the default rate design offered to them, regardless of what it looks like: the percentage of customers that actively did not take the default rate (e.g., those that opted-out or opted-in) is between 5% and 28%. Looking at the experimental results, while a higher percentage of customers (16%) actively moved off of a time-based default rate (e.g.,

²⁰ See Kahneman, Knetsch, and Thaler (1991).

TOU, TOU w/ CPP, etc.) than the percentage (11%) that moved off of a standard rate (e.g., flat, inclining block), this difference (4%) is modest.

However, one could construe a customer's preference for the default as simply not paying attention, and making a choice at all. It may be the case that customers solicited via an opt-out method are more likely to drop-out of the time-based rate program after they experience an actual consequence of "not opting out", such as receiving their first bill on a new rate program, at which point a more affirmative and declarative choice has been made. Once future data are collected for customer recruitment numbers after the time-based rates are in effect for some time (e.g., 3 months, 6 months, 12 months), we may be able to get a more robust picture of customer preferences that could help policymakers determine which rate design enrollment approach (opt-in vs. opt-out) should be pursued by utilities.

Our second result, that customers do not prefer to sign up for one type of time-based rate program over another; or if they do, it is only by a very small amount, is somewhat surprising. This finding is important for policymakers to understand as it indicates that electricity customers are just as willing to accept a rate that requires pervasive behavioral changes (i.e., shifting electricity usage away from the peak period to the off-peak period every day) as they are to accept a rate that requires very infrequent, limited duration but potentially large behavioral changes (i.e., reducing electricity usage only during critical events). Again, it may be true that the type of time-based rate has a greater effect on future drop-out rates, once customers experience the consequences of one rate relative to another; we intend to perform research on this area when data become available in the future.

We also found that offering technologies seems to have little to no effect on opt-in recruitment rates. One might expect that offering customers an IHD or PCT would act as an incentive to participate in a time-based rate program. In the former case, it would allow a customer to be better informed about their own electricity consumption patterns and better understand when altering their consumption behavior would be most valuable. In the latter case, a PCT would enable a customer to automate such behavioral changes through the control technology. Based on the experience of these SGIG utility studies' solicitation efforts, however, we conclude that this does not seem to be the case for an IHD (not a single utility experimentally controlled for the offer of a PCT). Again, it may be the

case that the offer of these technologies will help retain customers longer, which is an area we intend to research further in the future.

Because these findings are based on the results of an experiment from only one or two SGIG utility studies, it is important to note that extrapolating these conclusions to other utilities is only valid to the extent in which the customers in other utilities are similar to the utilities that performed the experiments. We hope in future analysis to better characterize the types of customers that joined such studies to help clarify the conditions under which our results can be extrapolated to a broader population of customers. Nonetheless, because these are the only randomly designed and analyzed experiments to date of how rate and technology offers affect real-time program recruitment rates, the findings produce a good foundation on which to set expectations.

These results should be helpful to those electric utilities looking for guidance on reasonable recruitment rates when designing a study or pilot of their own or when rolling out these programs en masse for the first time. However, once more data is available to characterize individual customers and their experience remaining on the time-based rate or technology offer over a longer period of time, we hope to provide even greater insight for program planners that will help them better understand what may drive differences in the initial enrollment stages but also in retention stages over time. In addition, our planned analysis of data on peak demand and energy savings due to exposure to time-based rates and technology will hopefully allow us to address several additional interesting questions concerning how the type of program offer affects the savings achieved by the programs. For example, even though opt-out programs result in higher recruitment rates, it may be that opt-in programs actually result in higher savings per customer because they are targeting the customers that have the highest savings potential and are not weighted down by a lot of non-responders. Future reports will be able to shed light on these important issues.

References

Cappers, P., Todd, A. and Goldman, C. (2013) Smart Grid Investment Grant Consumer Behavior Studies: Summary of Projects. Berkeley, CA. May 2013.

Charles River Associates (2005) Impact Evaluation of the California Statewide Pricing Pilot. Oakland, CA. March 16, 2005.

Connecticut Light and Power (2009) Results of CL&P Plan-It Wise Energy Pilot, Filing in Response to the Department of Public Utility Control's Compliance Order No. 4, Docket No. 05-10-03RE01.

eMeter Strategic Consulting (2010) PowerCentsDC Program Final Report. Washington, D.C. September 2010.

EPRI (2011) The Effect on Electricity Consumption of the Commonwealth Edison Customer Application Program: Phase 2 Final Analysis. October 2011. 1023664.

Faruqui, A. and Sergici, S. (2009) BGE's Smart Energy Pricing Pilot Summer 2008 Impact Evaluation. April 28, 2009.

FERC (2011) 2011 Assessment of Demand Response & Advanced Metering: Staff Report. Washington, D.C. November 2011.

Greene, W. (2011) Econometric Analysis. Prentice Hall.

Hydro One Networks (2008) Time-of-Use Project Results, EB-2007-0086.

IRS (2009) Automatic Contribution Increases under Automatic Contribution Arrangements. September 2009.

Kahneman, D., Knetsch, J. L. and Thaler, R. H. (1991) Anomalies: The Endowment Effect, Loss Aversion and Savings Behavior. *The Journal of Economic Perspectives*: 193-206.

Madrian, B. C. and Shea, D. F. (2001) The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior. *Quarterly Journal of Economics*. 116(4): 1149-1187.

Summit Blue Consulting, L. (2007) Final Report for the myPower Pricing Segments Evaluation. Prepared for Public Service Electric and Gas. December 21, 2007.

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