MI POWER GRID

Making the Most of Michigan's Energy Future

Energy Programs & Technology Pilots

Stakeholder Meeting 3

April 30, 2020

2 – 4:30 PM

Web Meeting

MPSC

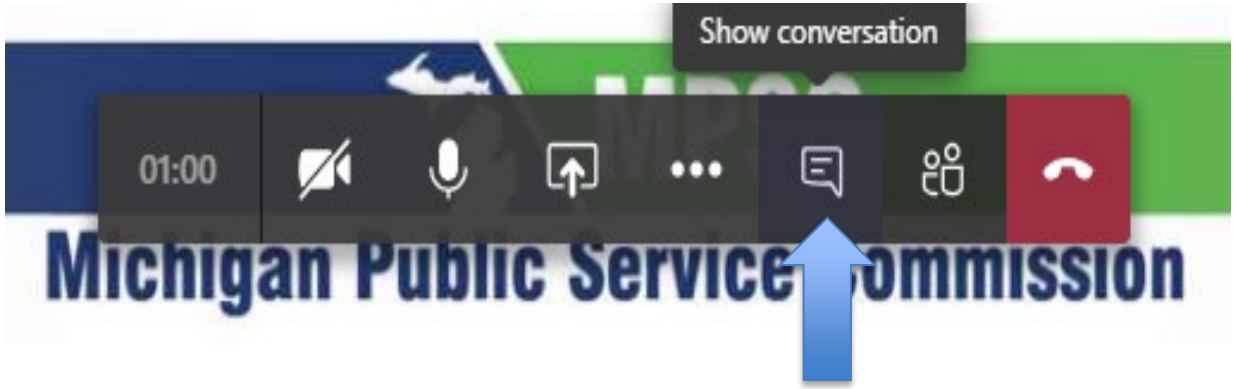
Michigan Public Service Commission

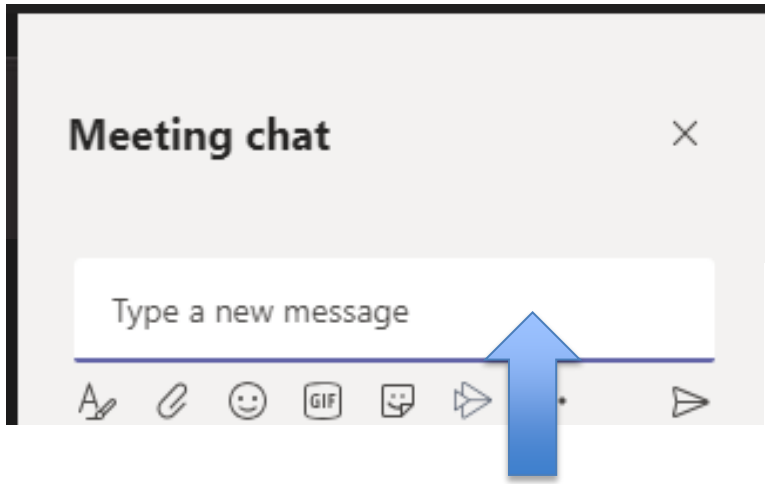
Agenda

2:00 p.m.	Welcome & Overview of Last Meeting	Joy Wang, MPSC Staff
2:05 p.m.	Pilot Design Best Practices and Lessons Learned from Pricing and Technology Pilots	Sanem Sergici, Brattle
3:05 p.m.	Industry Insights: Pilot Design and Best Practices	Stephen George, Nexant
4:05 p.m.	Community EWR Pilots in Detroit	Ben Dueweke, Walker-Miller Energy Services
4:15 p.m.	Closing Comments	Joy Wang, MPSC Staff
4:30 p.m.	Adjourn	

Housekeeping

- Some participants had difficulty with Teams because of their web browser. Some browsers that may work better are:
  - Google Chrome, Internet Explorer, and Mozilla Firefox
- All audience members will be muted
- Please type questions into the chat box
  - To access chat box:





Housekeeping, cont.

- In addition to typed questions, the chat box notes when audience member enter and exit the meeting.
  - These notices are automatic:

MI POWER GRID

Making the Most of Michigan's Energy Future

Welcome and Overview

Joy Wang
wangj3@Michigan.gov
MPSC Staff
Smart Grid Section

MPSC
Michigan Public Service Commission

Second Meeting: March 16

- First fully online meeting
  - Thank you for your patience
  - 73 people attended
- Three presentations
- Soren Anderson, Jan Beecher, and Justin Kirkpatrick (MSU)
  - Designing and Evaluating Utility Pilot Projects: an Academic Perspective
    - Academics ready and willing to assist with energy pilots
      - Can provide insights from design through evaluation
    - Important to have pilot data available and readily accessible
      - Value in reanalyzing data → further insights or answer new questions

Second Meeting: March 16

- Marco Padula (New York State Department of Public Service)
  - REV Demos – Process and Experience
    - NY REV to:
      - Enable self-sustaining clean energy markets
      - Support a cleaner, more reliable and affordable energy system
      - Provide flexibility
    - Helpful lessons learned and best practices
    - Demonstration projects distinct from pilots in NY
      - Demonstration projects focused on technologies removing current barriers to achieve REV objectives and providing flexibility
      - Pilots focus on rate and tariff design

Second Meeting: March 16

- Ahmad Faruqui (Brattle)
  - Bridging the Chasm: From Pilots to Full-Scale Deployments
    - Only small percentage of customers on time of use (TOU) rate (4% in 2018)
    - TOU pilots began in 1975, with four generations of pilots through now
    - Most pilots lead to more pilots
      - Some pilots lead to full-scale deployment
      - Full deployment took place without pilots at least once
    - Though historical pilot findings allows prediction of ongoing TOU pilot results, more TOU pilots are being conducted
      - A need to test in specific service area or utility system
    - Recommendations on bridging the chasm between TOU pilots and full deployment
- Recording and presentation slides available at workgroup website

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A Blueprint to Pilot Design: Best Practices and Lessons Learned

PRESENTED TO

MI Power Grid: Energy Programs and Technology Pilots Stakeholder Meeting

PRESENTED BY

Sanem Sergici, Ph.D.

April 30, 2020

THE Brattle GROUP

Introduction

Many utilities and jurisdictions have been testing innovative rate designs and/or technologies over the past two decades

- These innovative/alternative rate designs address one or more deficiencies of the current flat and volumetric rate construct
- Customer response and experience with these rates should be understood before offering these rates to the broader population

Brattle has been maintaining a database of the pricing and technology pilots conducted in the U.S. to track customer responsiveness to these rates, as well as to improve the state of the art for the next generation of pilots

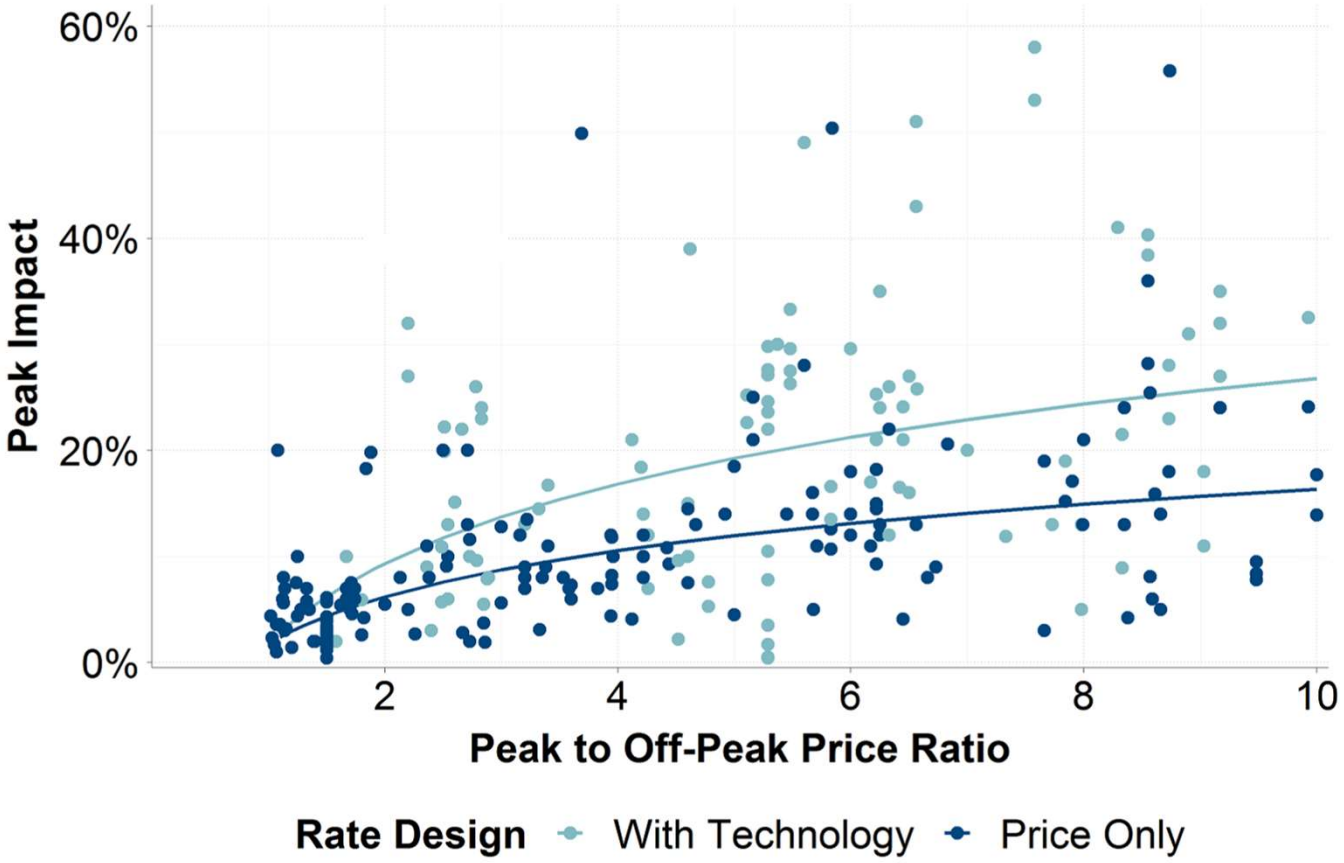
Customer response to time varying rates is well understood

Based on the experimentation over the past decade, we have conclusive evidence that customers respond to time varying rates (TVRs)

Source: Results from 349 pricing experiments in Arcturus database.

Brattle developed tools to estimate the impact of TVRs using data from previous pilots

We have built a model called **"PRISM"** to estimate the impacts using price elasticities and also developed an **impact curve** that approximate the peak impact as a function of peak/off-peak ratio



Given the existing evidence on customer responsiveness, do we need more pilots?

There are high level takeaways one can glean from other pilots, however it is rarely the case that the deployment and design scenarios are identical across different jurisdictions, For instance:

- Opt-in vs. Opt-out
- RCT vs. randomly selected control group

In the event that you decide to do your own pilot, there are critical questions to answer:

- How would you articulate the objective of the pilot?
- What types of rates should you test in the pilot?
- What is the likely approach to offering these rates to the broader population (i.e. opt-in, opt-out, mandatory)?
- How should you design the experiment given the likely deployment approach?
- Should you also bundle some enabling technologies and information treatments along with the rates?
- Are you interested in measuring impact for sub-populations of interest (i.e. low income, NEM customers, etc.)

How should you proceed with the pilot?

1. Plan to run it **at least for a year** and plan on spending real money on it but no more than the value of information you hope to gain from the pilot
2. If the objective is to estimate customer behavior to dynamic pricing in addition to understanding customer acceptance, you will need to do an experiment that follows the **scientific principles of pilot design**
3. Prepare a **comprehensive pilot proposal** that should address the following:
   - Rate design details
   - Pilot design details (i.e. design approach, sample size calculations)
   - Marketing, customer education and recruitment plan
   - Evaluation, measurement and verification plan
   - Budget and cost recovery
   - Pilot timeline
4. Incorporate **stakeholder input** to the pilot proposal

Checklist for a Scientifically Valid Pilot Design

1. Clear articulation of pilot objectives
2. Internal validity, meaning a cause and effect relationship can be established between the treatment being tested (the TOU rate) in the pilot and the outcome of interest (change in peak usage)

   requires a robust control group and pre-treatment data
3. External validity, meaning that the results from the pilot program can be extrapolated to the population of interest

   requires pilot recruitment to mimic potential wide scale deployment; can be ensured by selecting appropriate design approach
4. Determine sampling frame/eligible population for the pilot
5. Undertake "statistical power calculations" to determine minimum size requirement for treatment and control groups to detect statistically significant impacts
6. Incorporate attrition assumptions in the final sample sizes

Scientifically Valid Pilot Design Approaches (and control group strategy)

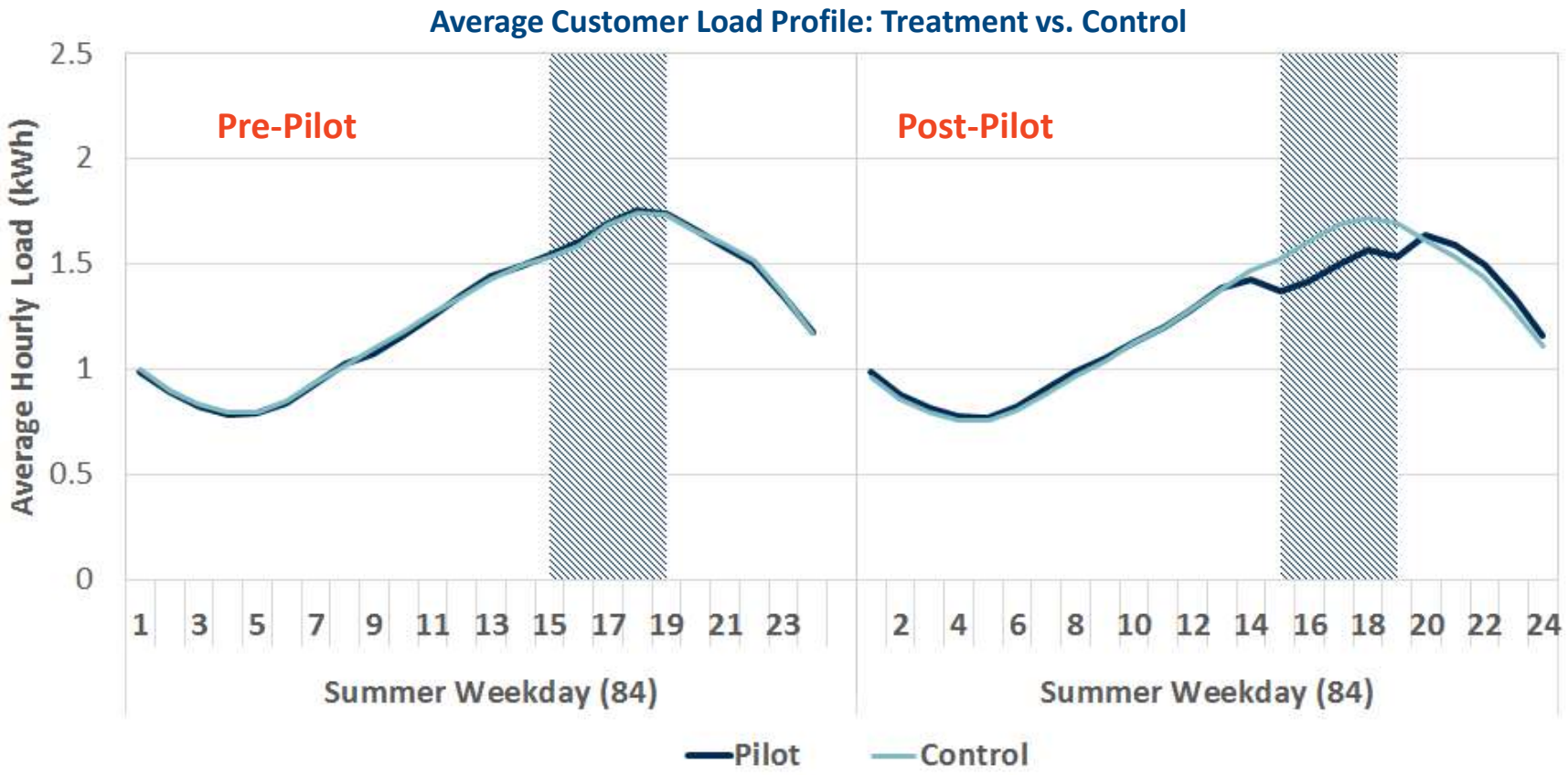
There are three widely accepted pilot design approaches

Possible Pilot Design Approaches	Description and Pros/Cons
Randomized Controlled Trial ("RCT")	Involves a random assignment of the recruited customers into the treatment and control groups. While this is the most rigorous approach from a measurement perspective, it is rarely used by electric utilities due to a potentially adverse impact on customer satisfaction (as it would involve either "recruit-and-deny" or "recruit-and-delay" approaches for some portion of the recruited customers).
Randomized Encouragement Design ("RED")	Allows the researcher to construct a valid control group, maintaining the benefits of an RCT design by not negatively affecting the customer experience. However, it requires much larger sample sizes, relative to the RCT approach, in order to be able to detect a statistically significant impact. Large sample sizes increase pilot implementation costs.
Random Sampling with Matched Control Group	Involves recruiting treated customers from a randomly selected sample, and using regression analysis to identify and match customers from the rest of the population that are most similar to the treatment customers. This matched control group approach strikes a good balance between achieving statistically valid results and requiring a manageable level of pilot participants.

Source: Sergici *et al., "Evaluation, Measurement and Verification Plan for the PC44 TOU Pilots," prepared for PC44 Rate Design Work Group, June 2018.*

A statistically valid pilot design yields comparable treatment and control groups

This is an essential requirement in order to be able to attribute the difference between the two groups to the treatment impact



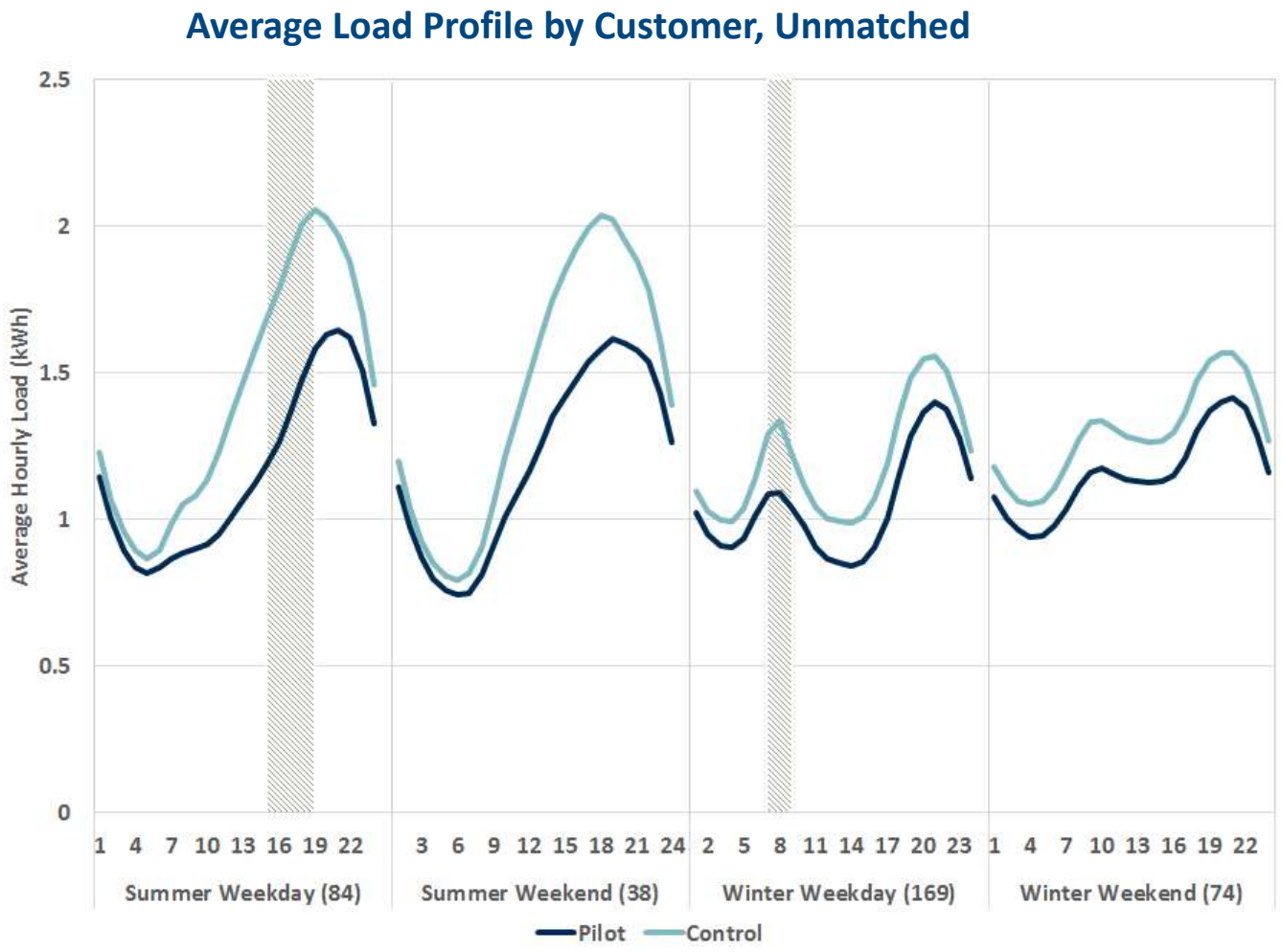
Note: The shaded regions indicate peak hours. Control group was constructed using a matching analysis

While RCT and RED are the most rigorous design options, implementation considerations may call for matched control groups

Propensity score matching is a widely-used statistical matching method in economics and other social sciences

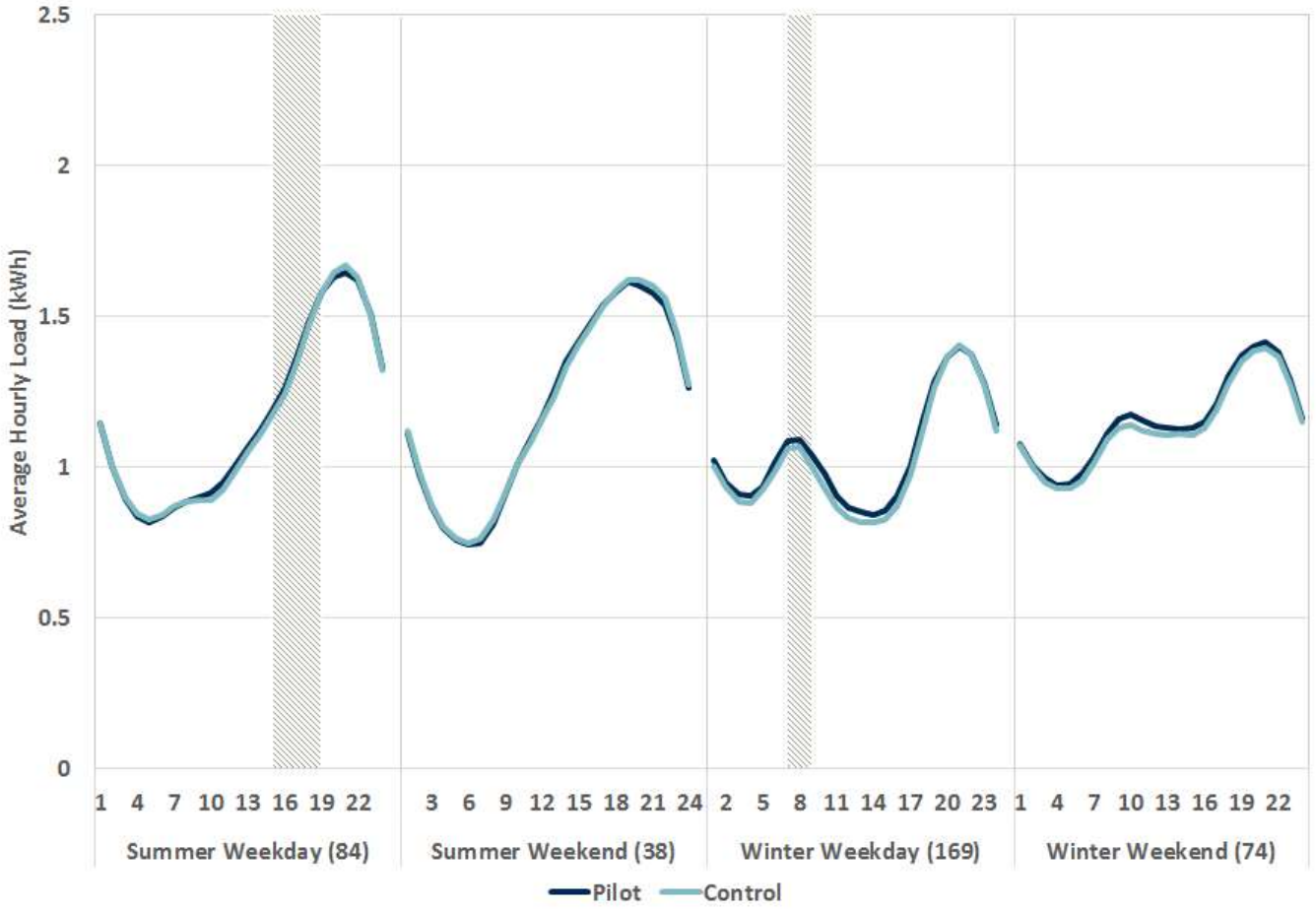
- Uses statistical analysis to identify the variables that are most closely correlated with enrollment in the pilot
- Using the results of that analysis, "predicts" the probability of participation for both enrollees and control group
- Identifies, for each enrollee, a control group member who is "most similar" with respect to the observed covariates
- The ultimate goal is "covariate balance" – we want the control group averages to be as close as possible to the pilot group averages, particularly on the variables that "matter" the most
- Achieving "perfect" balance is rare, but this approach is usually successful, on net, in generating a control group that "looks like" the "treatment" group

Treatment vs. Control groups (Before Matching)



Treatment vs. Control groups (After Matching)

Average Load Profile by Customer, Matched

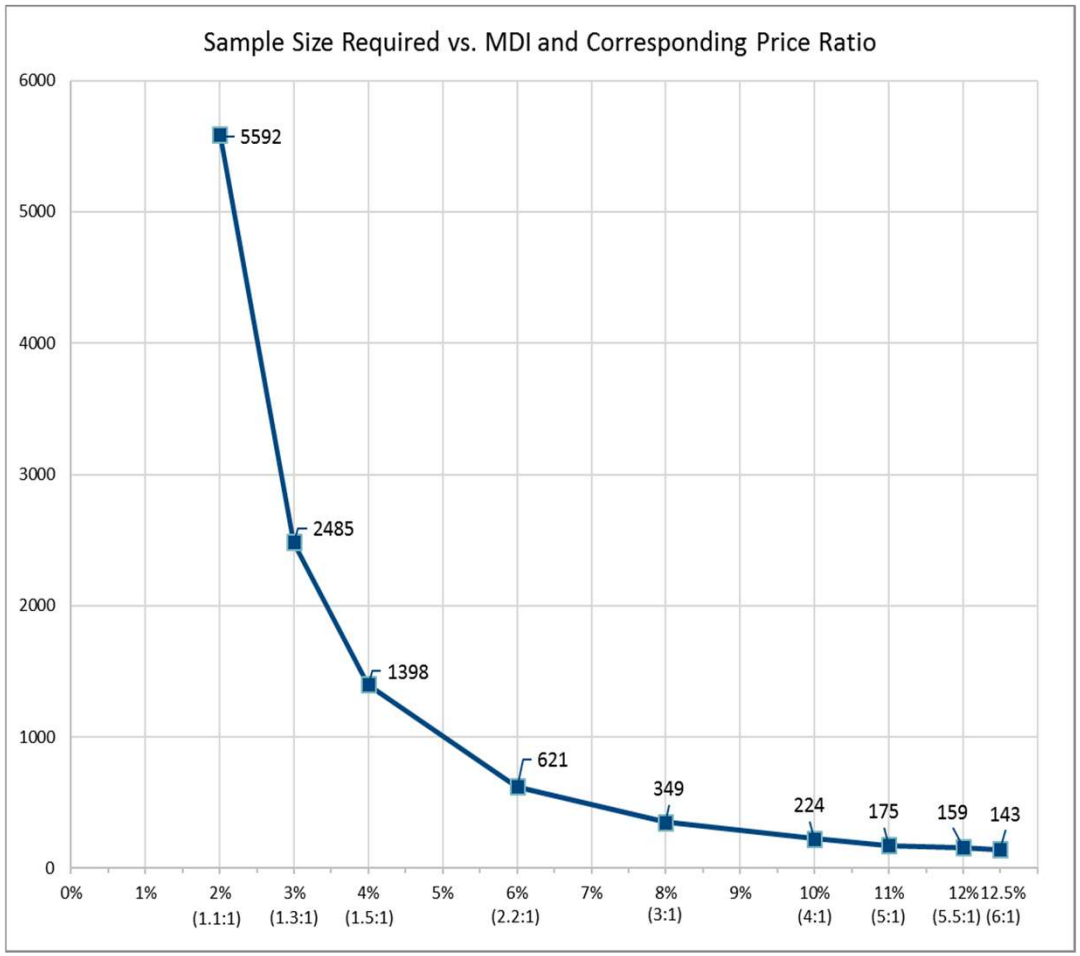


How big of a sample size needed?

In order to determine the pilot's impact in a statistically significant fashion, the sample size should be large enough. There are several parameters that affect the sample size

Parameter	Description of parameter
Group means	Average amount of electricity consumed by each group
Standard deviations	Amount that electricity consumption varies across households within each group
Number of repeat observations	Number of observations per household
Correlation coefficients	Degree to which electricity consumption is similar over time for a given household in the treatment and/or control group(s)
Statistical significance	Degree of certainty that the program reduces usage [one-sided test]
Statistical power	Degree of certainty that the statistical test gives the correct answer

Statistical power calculations are necessary to determine the sample size



Statistical power calculations are necessary to ensure sample size is large enough to detect statistically significant impacts

- As the minimum detectable impact (MDI) increases (i.e. due to higher peak to offpeak ratio), sample size requirement decreases
- As the statistical power and statistical significance requirements increase, the sample size increases
- As the resolution of the analysis increases (i.e. hourly vs. monthly), sample size requirement decreases

Pilot Design Approaches Used in Other Pilots

Early pilots typically relied on *random sampling with voluntary participation + randomly selected control groups*

- California Statewide Pricing Pilot, 2003; Baltimore Gas and Electric Smart Energy Pricing Pilot, 2007)

Some of the more recent pilots used *RCT and RED*

- SMUD SmartPricing Pilot, 2014; Ontario RPP Pilots, 2018

However, practical considerations (i.e., denying participation to the recruited customers in the RCT or large sample size requirements of RED) were not surmountable for other recent pilots. These pilots opted to use *random sampling with matched control group*

- PC44 TOU Pilot in Maryland, 2019; PowerPath DC Pepco Residential TOU Pilot, 2020; Alectra Advantage Power Pricing Pilot, 2017.

Checklist for the Recruitment Process

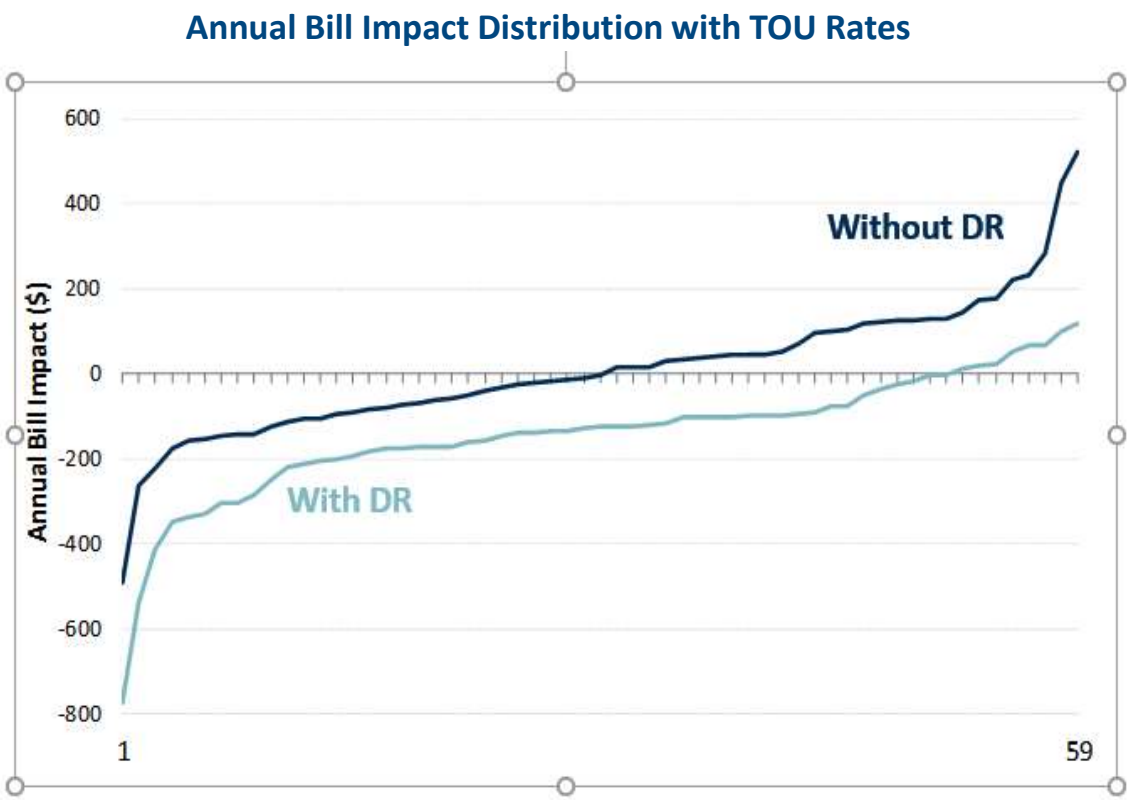
Practices followed in the recruitment process play a key role in maintaining the validity of the pilot design and offer important insights for broader deployments

- Follow best practices in developing customer education and outreach materials (including samples of effective vs. ineffective marketing materials)
- Consider different recruitment strategies through different channels based on the type of treatment offered and recruitment for special interest groups
- Identify approaches to minimize marketing costs while maximizing the number of recruited customers;
- Develop strategies to improve retention rates
- Be aware of correct and incorrect ways to introduce incentives to the recruitment process
- Incorporate new information that becomes available during the recruitment process to improve the success of recruitment
- Provide robust training to the marketing team to ensure that they don't inadvertently compromise
- Design pre- and post-treatment customer experience surveys aligned with pilot objectives

Common Mistakes during Recruitment

- Recruitment team deviating from the pilot design plan to meet the sample size targets
- Nonexistent or infrequent communication between the recruitment and design teams that might introduce inefficiencies to the overall pilot management
  - Loss of marketing cost savings
  - Loss of valuable course correction opportunities
- Misuse of incentive payments
- Recruitment starting around the holiday times
- Recruitment process that necessitates too many touch points with the customers before sign up
- Not capturing useful customer interactions/communications that might inform future program deployment strategies

Bill impact analyses are useful to understand the distributional impacts of the new rates



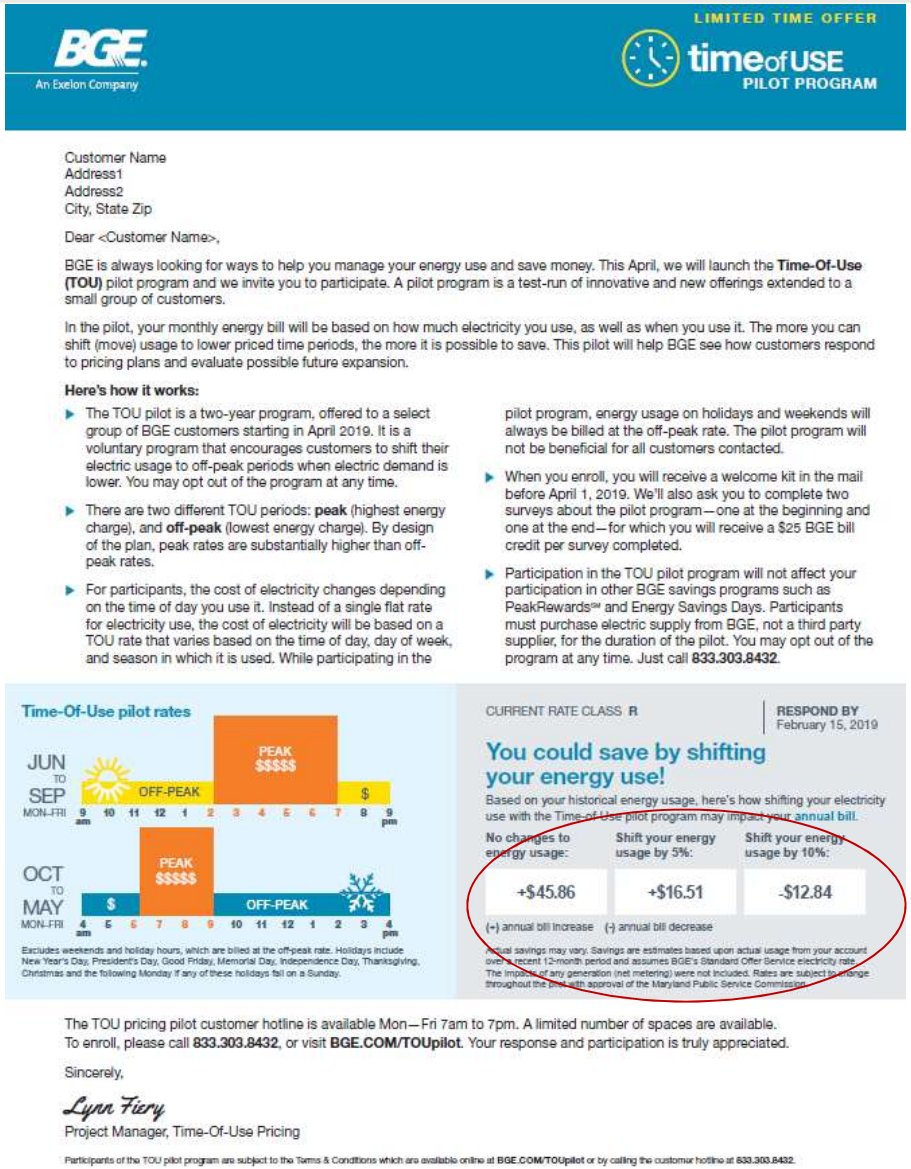
Under this rate, 51% of customers experience *lower bills* without DR compared to 86% with demand response

It is useful to undertake a bill impact analysis of the eligible customer population under the new rates

The bills would be calculated twice: before load response and after load response

Some utilities/jurisdictions choose to include this information for individual customers in the recruitment materials

Bill Impact Analysis Presentment to the Customers



BGE
An Exelon Company

LIMITED TIME OFFER
timeofUSE PILOT PROGRAM

Customer Name
Address1
Address2
City, State Zip

Dear <Customer Name>,

BGE is always looking for ways to help you manage your energy use and save money. This April, we will launch the **Time-Of-Use (TOU)** pilot program and we invite you to participate. A pilot program is a test-run of innovative and new offerings extended to a small group of customers.

In the pilot, your monthly energy bill will be based on how much electricity you use, as well as when you use it. The more you can shift (move) usage to lower priced time periods, the more it is possible to save. This pilot will help BGE see how customers respond to pricing plans and evaluate possible future expansion.

Here's how it works:

- The TOU pilot is a two-year program, offered to a select group of BGE customers starting in April 2019. It is a voluntary program that encourages customers to shift their electric usage to off-peak periods when electric demand is lower. You may opt out of the program at any time.
- There are two different TOU periods: **peak** (highest energy charge), and **off-peak** (lowest energy charge). By design of the plan, peak rates are substantially higher than off-peak rates.
- For participants, the cost of electricity changes depending on the time of day you use it. Instead of a single flat rate for electricity use, the cost of electricity will be based on a TOU rate that varies based on the time of day, day of week, and season in which it is used. While participating in the pilot program, energy usage on holidays and weekends will always be billed at the off-peak rate. The pilot program will not be beneficial for all customers contacted.
- When you enroll, you will receive a welcome kit in the mail before April 1, 2019. We'll also ask you to complete two surveys about the pilot program—one at the beginning and one at the end—for which you will receive a $25 BGE bill credit per survey completed.
- Participation in the TOU pilot program will not affect your participation in other BGE savings programs such as PeakRewards℠ and Energy Savings Days. Participants must purchase electric supply from BGE, not a third party supplier, for the duration of the pilot. You may opt out of the program at any time. Just call **833.303.8432**.

Time-Of-Use pilot rates

JUN TO SEP MON-FRI: OFF-PEAK 9 am–2 pm; PEAK $$$$$ 2 pm–7 pm; $ 7 pm–9 pm

OCT TO MAY MON-FRI: $ 4 am–6 am; PEAK $$$$$ 6 am–9 am; OFF-PEAK 9 am–4 pm

Excludes weekends and holiday hours, which are billed at the off-peak rate. Holidays include New Year's Day, President's Day, Good Friday, Memorial Day, Independence Day, Thanksgiving, Christmas and the following Monday if any of these holidays fall on a Sunday.

CURRENT RATE CLASS R

RESPOND BY February 15, 2019

You could save by shifting your energy use!

Based on your historical energy usage, here's how shifting your electricity use with the Time-Of-Use pilot program may impact your annual bill.

No changes to energy usage:	Shift your energy usage by 5%:	Shift your energy usage by 10%:
+$45.86	+$16.51	-$12.84

(+) annual bill increase (-) annual bill decrease

Actual savings may vary. Savings are estimates based upon actual usage from your account over a recent 12-month period and assumes BGE's Standard Offer Service electricity rate. The impacts of any generation (net metering) were not included. Rates are subject to change throughout the pilot with approval of the Maryland Public Service Commission.

The TOU pricing pilot customer hotline is available Mon—Fri 7am to 7pm. A limited number of spaces are available. To enroll, please call **833.303.8432**, or visit **BGE.COM/TOUpilot**. Your response and participation is truly appreciated.

Sincerely,

Lynn Fiery
Project Manager, Time-Of-Use Pricing

Participants of the TOU pilot program are subject to the Terms & Conditions which are available online at **BGE.COM/TOUpilot** or by calling the customer hotline at 833.303.8432.

PC44 pilot currently underway in Maryland included each customer's bill impact analysis in the recruitment letter

Customers were informed of the bill impact if:

- They did not change their usage
- Shift their peak usage by 5%
- Shift their peak usage by 10%

Since the Joint Utilities decided that they would present this information in a full scale rollout, this implementation did not compromise external validity

Maryland PC44 TOU Pilot overview

BGE, Pepco and DPL (“JUs") are implementing the pilots

- For all three utilities, the TOU rate is applied to both energy and delivery charges
- Two year pilot which started in June 1, 2019.
- The peak to off-peak ratio is very pronounced and varies from ~5-to-1 to 6-to-1 across the JUs
- The peak hours vary by season
  - HE 15-19 on summer weekdays (June 1 – September 30)
  - HE 7-9 on winter weekdays (October 1 – May 31)
- The treatment customers also get behavioral messaging to reinforce the pricing signal
- The pilots were designed to allow impacts to differ between low- and medium-income (“LMI”) and non-LMI customers
- Interim impact evaluation (using Summer 2019 data) yielded promising results; first year analysis will be completed in the summer of 2020

Checklist for the Impact Evaluation

The experimental design of each pilot dictates the optimal evaluation method: differences-in-differences (ANOVA or ANCOVA); panel regressions (fixed-effects or random-effects); individual customer regressions

- Decide on the **evaluation approach** based on the experimental design
- Identify **load impact metrics** to be quantified (i.e. peak, mid-peak, off-peak impacts, average daily conservation impact, etc.)
- Estimate alternative models and select the one that leads to most accurate predictions
- Decide whether quantifying customers' overall price responsiveness would be useful in the form of **price elasticities**, beyond the ex-post load impacts quantified in the pilot
  - Own/daily price elasticity (captures the change in the level of overall consumption due to the changes in the average daily price
  - Substitution price elasticity (captures customer's ability to substitute inexpensive off-peak consumption for more expensive peak consumption)

Is price elasticity estimation necessary?

Most pilot studies test a single price level for a given rate design

- As a result, impact evaluation quantifies the impact associated with that particular rate

If the Company is likely to offer other rate designs, or different price levels for the same rate design, it is very useful to estimate the own price and substitution price elasticities

Estimating elasticities using the pilot data **allow computation of the load impacts from other rate designs**, and have the benefit of reflecting utility's own customers' price responsiveness

Checklist for the Process Evaluation

A process evaluation consists of an assessment of the implementation of the program, with the goal of producing better and more cost-effective programs in the future

- Typically be conducted by surveying or soliciting feedback from the various groups involved in the pilot program, including both participants, implementers and administrators of the program

Data collection efforts include but are not limited to:

- Customer recruitment and outreach (pre-treatment survey)
- Customer acceptance and interest in treatment (post-treatment survey)
- Understanding the reasons for non-participation and attrition
- Quality control practices
- Time, schedule and budget management
- Lessons learned
- Project resource constraints and staff training
- In-field and back-office challenges with implementation

Recap I

Upfront investment in pilot planning is absolutely critical for the success of the pilot

- Well-developed EM&V plans, customer education and recruitment plans increase the likely success of the pilot

Seeking stakeholder input during the pilot design process and incorporating this input to the design increase the acceptability of the pilot results

Resist designing overly complex pilots that could easily interfere with meeting the essential objectives of the pilot

It is advisable to test treatments and functionality **only if they are likely to be offered in full scale deployments** (i.e., bill impacts, shadow bills, etc.)

Recap II

Avoid siloing the pilot design and marketing teams during the recruitment stage , as deviations from the recruitment plan may compromise the validity of the pilot

Estimation of price elasticities is desirable as part of an impact evaluation study to allow estimation of the impacts from alternative rates

It is important to **calculate sample sizes** consistent with the pilot design approach that will yield statistically significant results

An **interim impact evaluation** after the first season of the pilot is useful to gauge initial results and allow course-correction if needed

References I

Sanem Sergici, Ahmad Faruqui, and Nicholas Powers, EM&V Plan for the PC44 TOU Rate Pilots, prepared for the PC44 Rate Design Workgroup, June 2018.

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PRESENTED BY

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Dr. Sanem Sergici is a Principal in The Brattle Group's Boston, MA office specializing in program design, evaluation, and big data analytics in the areas of energy efficiency, demand response, smart grid and innovative pricing. She regularly supports electric utilities, regulators, law firms, and technology firms in their strategic and regulatory questions related to retail rate design and grid modernization investments.

Dr. Sergici has been at the forefront of the design and impact analysis of innovative retail pricing, enabling technology, and behavior-based energy efficiency pilots and programs in many states and regions including District of Columbia, Connecticut, Florida, Illinois, Maryland, Michigan, Ontario, CA and New Zealand. She has led numerous studies in these areas that were instrumental in regulatory approvals of Advanced Metering Infrastructure (AMI) investments and smart rate offerings for electricity customers. She has significant expertise in resource planning; economic analysis of distributed energy resources (DERs); their impact on the distribution system operations and assessment of emerging utility business models and regulatory frameworks.

Dr. Sergici is a frequent presenter on these matters and regularly publishes in academic and industry journals. She was recently featured in Public Utility Fortnightly Magazine's "Fortnightly Under 40 2019" list. She received her Ph.D. in Applied Economics from Northeastern University in the fields of applied econometrics and industrial organization. She received her M.A. in Economics from Northeastern University, and B.S. in Economics from Middle East Technical University (METU), Ankara, Turkey.

THE POWER OF **ECONOMICS**

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THE Brattle GROUP

Industry Insights
Pilot Definition and Best Practices

Prepared by:
Dr. Stephen George
Dr. Eric Bell

MI Power Grid Energy Programs and Technology Pilots
Stakeholder Meeting

April 30, 2020

Nexant
Reimagine tomorrow.

Agenda

- Pilot definition and objectives
- Pilot design objectives
- Pilot design is an exercise in tradeoffs
- Making adjustments during implementation
- Be aware of false conclusions
- Recommendations for pilot submissions to the Commission
- Summary
- References and bios

Nexant

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Pilot Definition and Objectives

What are pilots?

- The term pilot is used very loosely in the utility industry and often means different things to different people
  - Some define small scale technology tests or proof-of-concept projects as pilots
  - Some equate pilots and experiments while others see experiments as one way, but not the only way, to conduct a pilot
  - Some equate pilots and demonstration projects, while others see pilots as precursors to demonstration projects which in turn focus more on validating the business case for moving from small-scale tests to fully integrated market deployment
- To our knowledge, there is no widely accepted definition for these terms that are too often used synonymously
- For purposes of today's discussion, we define pilot in terms of objectives – a test to determine the ***impact*** of an ***intervention*** on one or more ***outcomes of interest***

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Pilot Design Objectives

Pilots can be used to assess a wide variety of interventions on a wide variety of outcomes of interest

Examples of Interventions	Possible Outcomes of Interest
▪ Alternative rate ▪ New technology ▪ Information feedback ▪ Marketing incentive ▪ Communication channel ▪ Marketing content ▪ Enrollment channel ▪ Ongoing education and outreach ▪ Enrollment approach (e.g., opt-in vs. default) ▪ Program concepts that combine several of the above features	▪ Usage (kWh, peak demand, load shifting, etc.) ▪ Customer acceptance ▪ Customer enrollment ▪ Customer attrition ▪ Underlying change in usage behavior (e.g., change in a/c use, change in lighting use, etc.) ▪ Customer satisfaction ▪ Economic/health burden ▪ How outcomes of interest vary across segments of interest (e.g., low income, seniors, a/c owners, etc.)

Good pilot design begins with clear objectives

- What interventions are to be tested and what are the outcomes of interest
- Do you just want to know what happened or do you also want to understand why it happened?
  - e.g., How much did peak demand fall? How much was conservation versus shifting? How much was due to a/c usage changes versus other behavioral modifications?
  - e.g., To what degree is a low opt-out rate for default enrollment due to customer preference versus lack of awareness?
- Internal validity only?
  - Did the intervention cause a change in the outcome of interest for the population being tested?
- External validity as well?
  - What would the impact be if the intervention was offered to the full population or to an alternative population of interest?
- Stand alone pilot versus first phase of multi-step process of continuous improvement and innovation.

Good pilot design seeks to determine causality

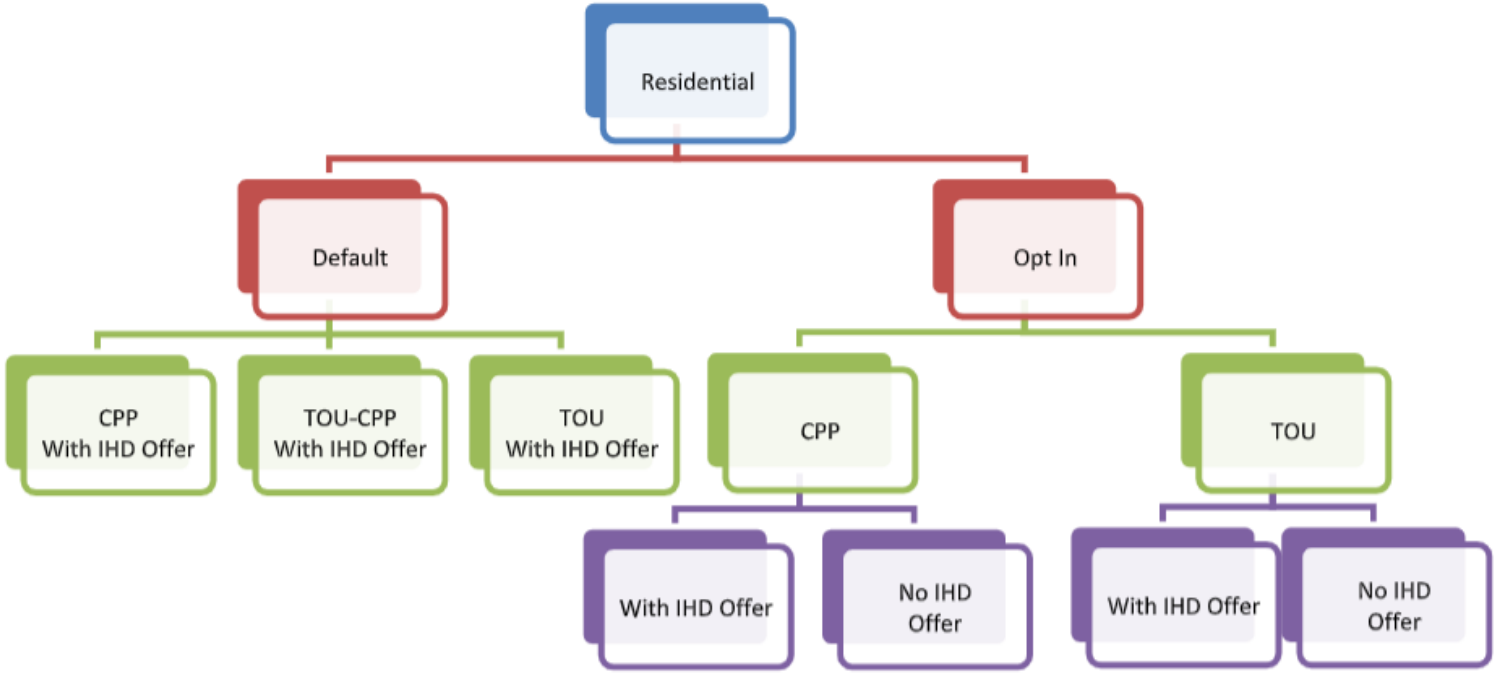
- RCTs and REDs with before and after treatment observations are the gold standards for experimental design and have the highest degree of internal validity
  - These should almost always be the starting point for pilot design, even if practical considerations eventually thwart the best of intentions
    - The wave of pricing and behavioral conservation pilots conducted starting with the ARRA funded pilots in 2009 proved that it is possible to do rigorously sound behavioral experiments in the utility industry
    - Recruit and delay and recruit and deny can be done without significant damage to customer satisfaction
    - REDs can be done but primarily only for default pilots where participation rates are large (and default enrollment has been used numerous times with little fall out)
- When rigorous experiments are not feasible, methods such as statistical matching can be used to create pseudo-control groups after the fact
  - To be feasible, statistical matching requires pretreatment data on a large sample of customers in addition to those being treated

Isolating potential causal factors is the key to internal validity

- Control groups, properly chosen, are designed to control for the impact of all factors other than the treatment of interest (and random chance during the selection process)
  - With pretreatment data on variables of interest (e.g., kWh, kW), even random chance during selection can largely be controlled for through difference-in-differences analysis
  - Large samples also help
- When testing multiple treatment options, it is essential to ensure that only a single variable of interest differs across treatments
  - See examples on slides 10 and 11

SMUD SmartiPricing Options Pilot

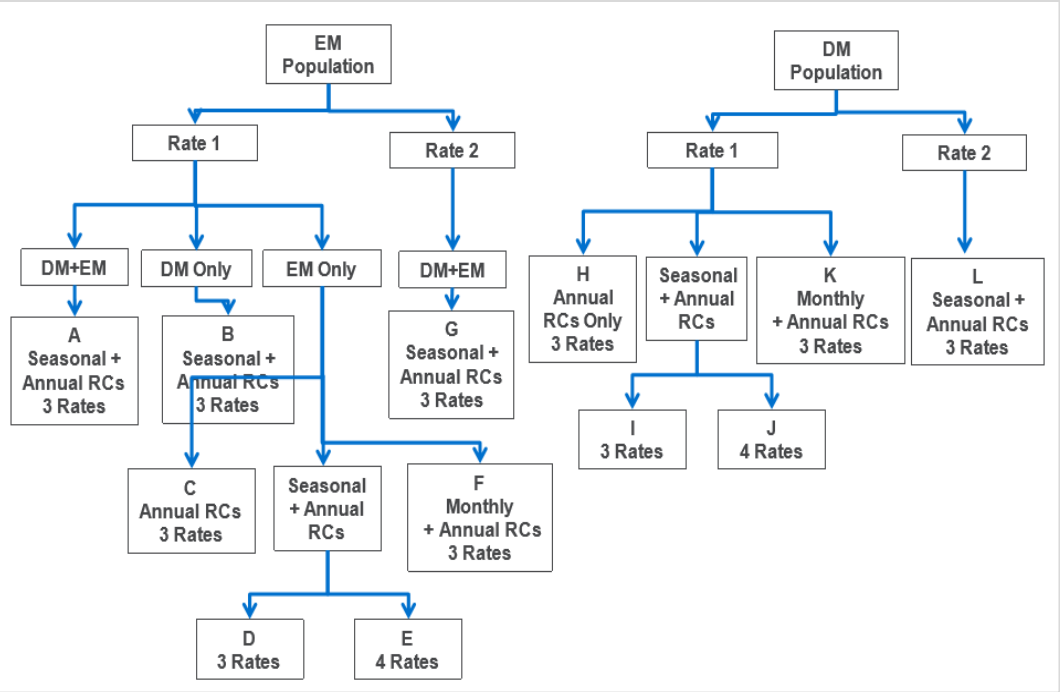
- Widely recognized as one of the best designed and implemented pilots ever done in the industry
- Isolated the impact of enrollment approach (opt-in versus default), different rate options and the offer of technology to encourage enrollment on kWh, kW by rate period and customer acceptance



California's default TOU pilots sought to isolate the impact of numerous factors within and across utilities

- The example below is from SDG&E's pilot design submission and shows the treatment groups established to test how awareness and kWh impacts vary with notification options
- The column on the right outlines the research questions and evaluation approach to be used to answer each question

SDG&E Research Design for Notification Options for Default TOU



Research Questions and Evaluation Approach

Research Question	How Addressed
For EM customers, how do opt-out rates, call volume and awareness vary with communication channel and frequency?	Compare opt out rates, call volume and awareness (measured through surveys) for test A with B, A with D, and B with D.
How do opt-out rates, call volume and awareness vary with respect to the granularity of rate comparisons provided?	Compare relevant metrics for tests C with D, C with F, D with F, H with I, H with K and I with K. If SDG&E wishes to estimate values for the performance metrics for EM customers based on DM or DM+EM communication, the differences between tests H, I and K can be applied to the outcomes for tests A and B.
How do relevant metrics compare between default notifications that include 3 rate comparisons versus 4 rate comparisons.	Compare outcomes for tests D and E and for tests I and J.
How do opt-out rates compare for Rate 1 and Rate 2.	Compare opt-out rates for tests A and G and I and L.
How do load impacts vary between Rate 1 and Rate 2.	Estimate load impacts using a RED analysis for test cell A plus test cell I (properly weighted) with load impacts for test cells G plus L. The RED analysis will use a randomly selected control group of customers not enrolled on the TOU rates to estimate reference loads.

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Pilot Design is an Exercise in Tradeoffs

Pilot design is an exercise in tradeoffs

- There is almost always more that you want to know than you can afford to test
  - Do fewer things well rather than more things poorly
  - Think of the pilot as the first step in a multi-step process (a phased launch) and set priorities with on ramps and off ramps based on interim outcomes
  - Resist nice to know (curiosities) versus need to know (things that are likely to matter in a big way)
  - Over sampling small but important subpopulations of interest for treatment and surveys can be important when seeking approval for full scale application – If something could impact low income, seniors or other politically savvy stakeholders, pay attention
  - Short cuts can backfire
  - Limiting communication and enrollment channels to save money during a pilot can lead to false conclusions and/or limit external validity – e.g., using email only because it's fast and cheap will undercut the external validity of the pilot for full scale program that offers multiple channels

Pilots and experiments don't necessarily have to be large or time consuming to be quite useful

- Very useful experiments can be done quickly and relatively inexpensively
  - Testing whether a marketing incentive or variation in the content of marketing collateral significantly impacts customer acceptance can involve small samples (much smaller than when estimating kWh impacts) and the results can be known within a couple of months (see example on slide 16)
  - Testing the impact of variation in control strategies for technology that is already in place (e.g., load control devices, smart thermostats), can be done inexpensively under selected circumstances and results can be known the next day (see example on slide 17)
- Some utilities have adopted a continuous improvement/innovation philosophy in which multiple experiments are conducted over time (see example on slide 18 & 19)

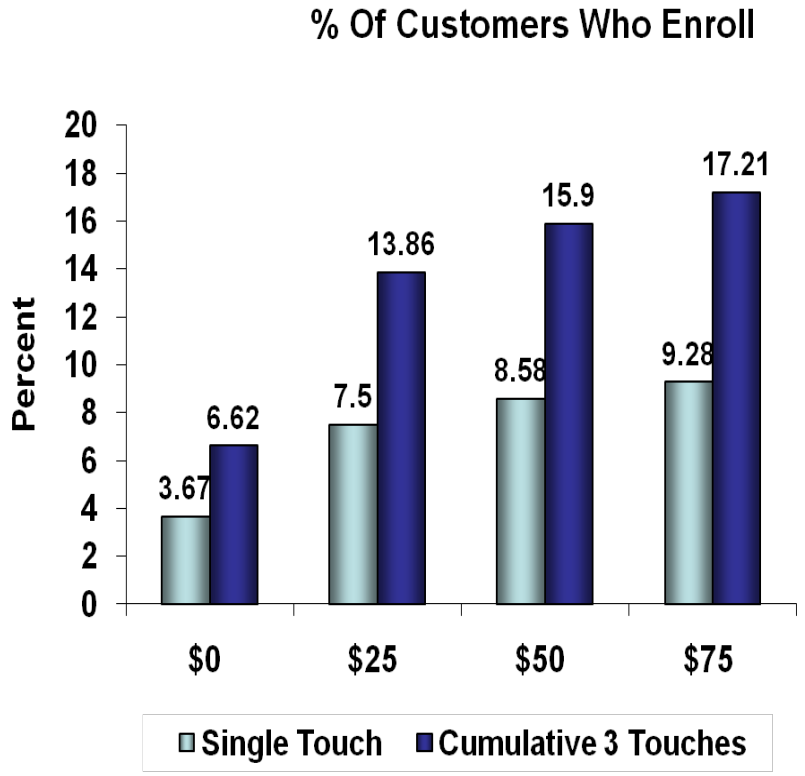
Multiple marketing tests can be run on small samples with results obtained quickly

- In 2009, PG&E ran a number of small tests to determine the impact of various factors on customer acceptance, including the number of marketing touches, a marketing incentive, message content, communication format, and whether or not customers were already enrolled in SmartAC (PG&E's load control program)

Marketing Tests for PG&E SmartRate Program

Marketing Attribute	Description
Wave	7 initial mailings to different customer groups, at different times between February and September 2009
Touches	Follow-up mailings (2) to subsets of customers in waves 1 and 2
Format	#10 letter with business reply envelope
	Folded brochure with tear-off reply postcard
Message	"using less energy isn't the only way to shrink your bill"
	"shrink your bill and save more for your family"
	"a smaller impact on the planet. A smaller bill for you."
Incentive	None
	$25 (Wave 0)
	$50 (Wave 1, 3rd touch, Wave 2, 3rd touch, Wave 6)
Target Segment	No Targeting
	SmartAC Participants (Wave 0 and Wave 1 subset)
	Psychometric Personas (Waves 3, 4, and 5)

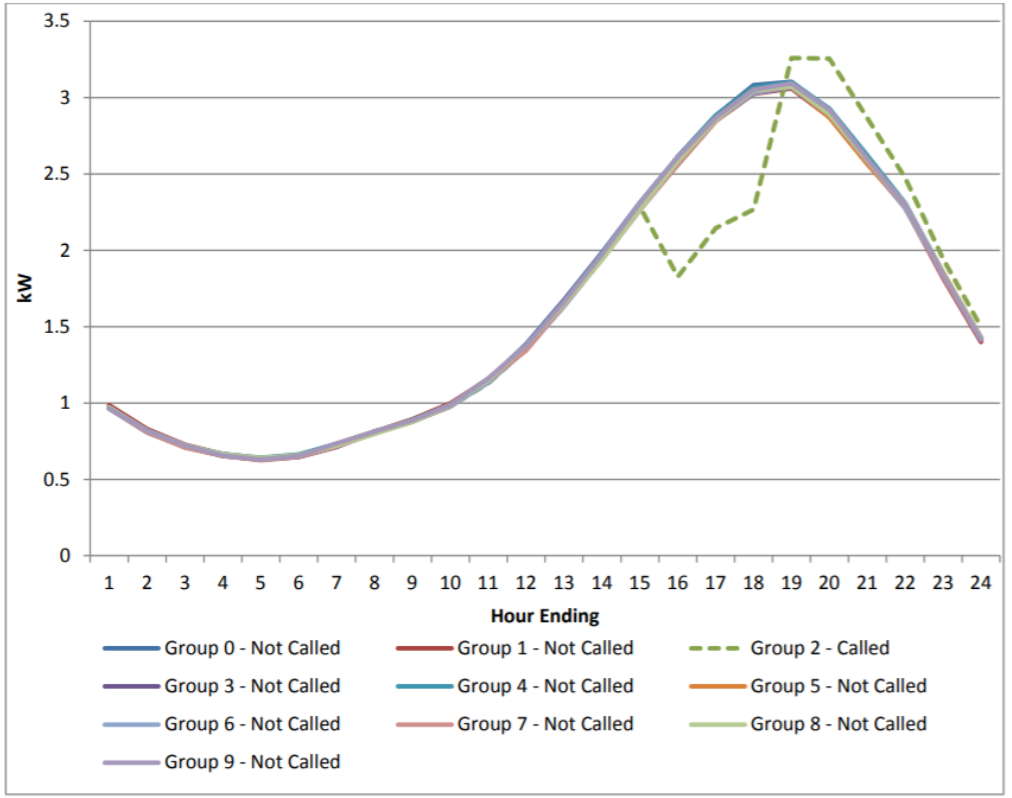
Impact on Customer Acceptance



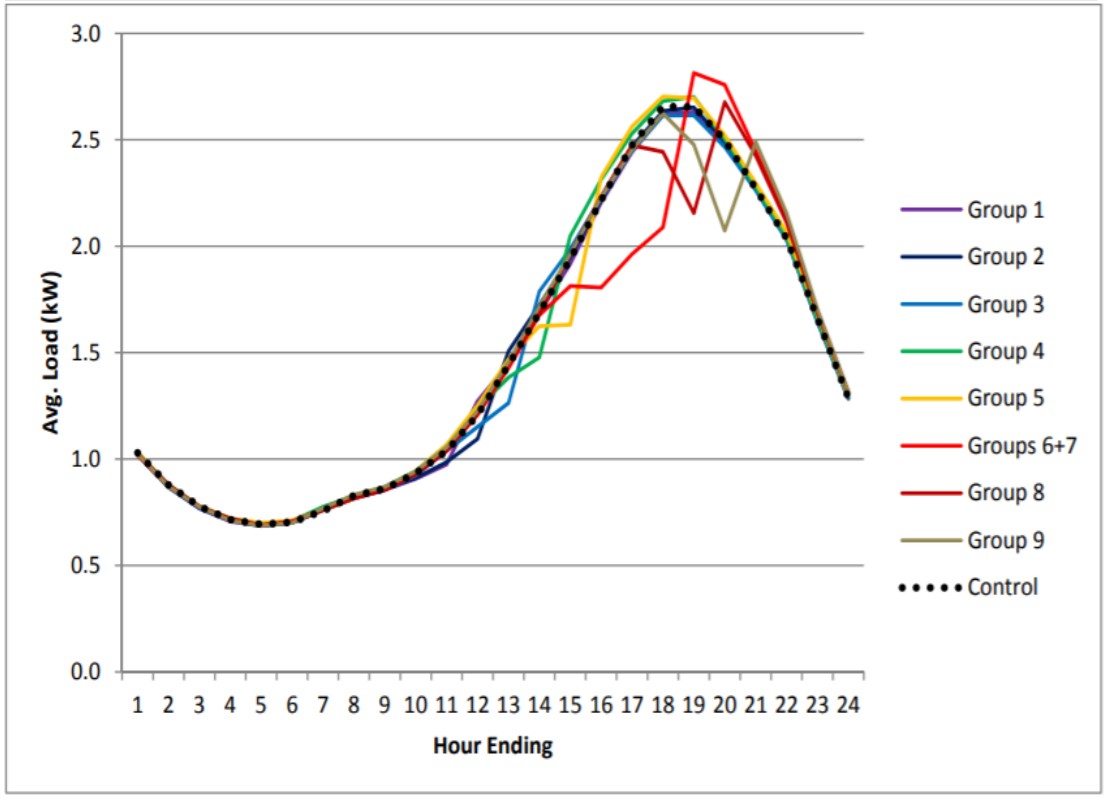
Dividing your load control or smart thermostat population into multiple groups and varying the control strategy can produce highly accurate results almost instantaneously

- Examples from PG&E's SmartAC program where there were 10 large, randomly selected groups and where one could be held out as a control for each event and different control strategies could be tested across events

Testing Impact of 4 Hour Event

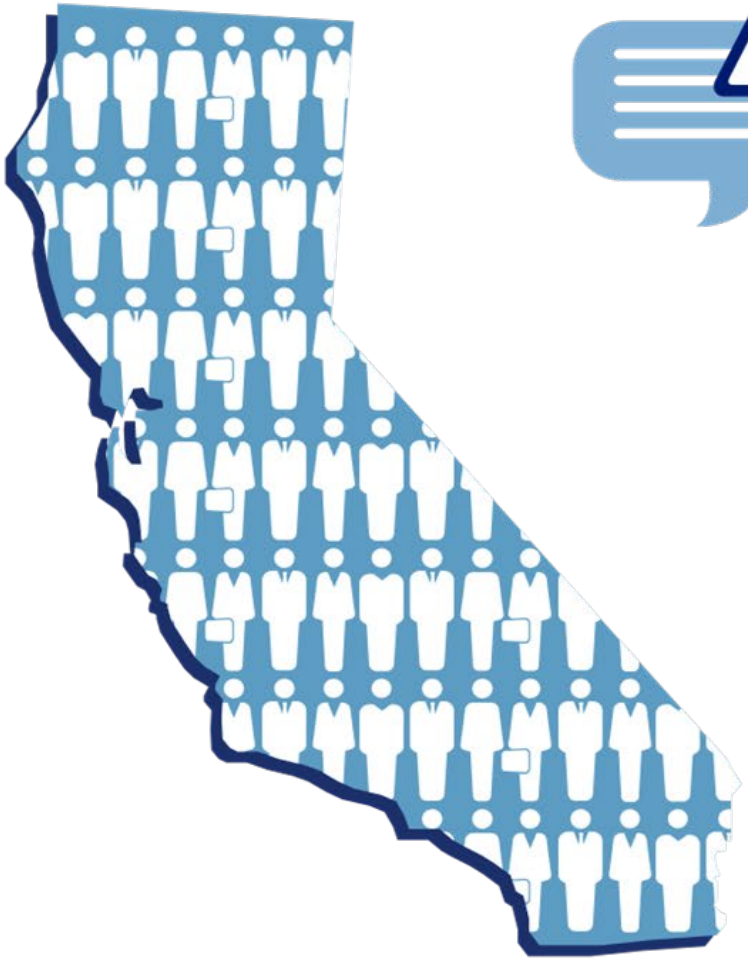


Testing Impact of 1 Hour Events with Different Start Times



Over four years, SoCal Gas tested 25 different types of information feedback on gas usage on more than 1.2 million customers

OVER
1.2 Million
CUSTOMERS



7 Bill Tracker Alerts

3 Seasonal Energy Updates

15 Home Energy Reports

3 Providers

While average impacts were small, each test employed default enrollment so aggregate impacts were large.

CARE	My Account	Treatment	Group	Number of Treatment Customers	% Reduction
No	Yes	BTA w/Tips + Paper Opower HER	T-31	38,815	2.21%
		BTA w/o Tips	T-36	30,994	0.77%
		BTA w/ Tips	T-37	30,761	0.88%
	No	Paper Opower HER	T-32	51,691	1.37%
		Paper Aclara HEU	T-40	31,877	1.47%
		Paper In-House HER	T-39	13,471	1.25%
		SEU	T-34	19,680	3.18%
		SEU (Weatherize)	T-35	19,718	3.43%
Yes	Yes/No	Opower HER	T-30	50,142	1.78%
		SEU	T-33	18,414	2.24%
Yes/No	Yes/No	Bi-lingual HER	T-41	13,507	0.60%

- **All residential treatments** initiated in **2016-2017 produced measurable savings**
- **Seasonal Energy Update (SEU)** paper report treatments produced the **highest savings rates**
- **BTA w/Tips + Paper Opower HER produced higher savings** than the **BTA or HER treatments alone**

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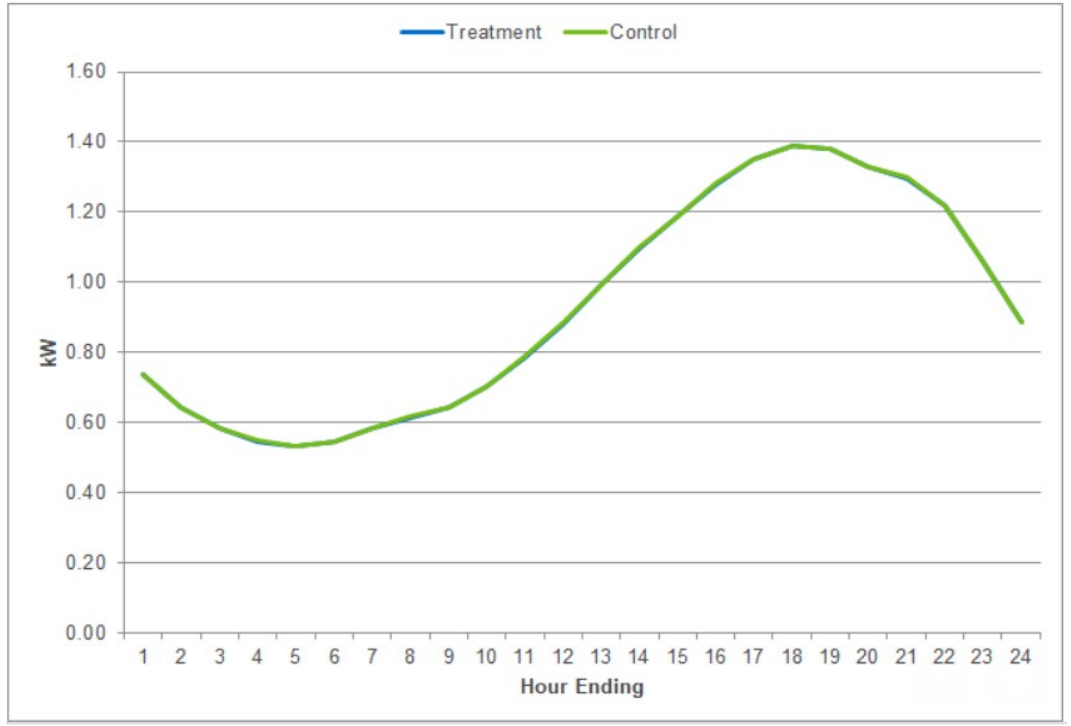
Making Adjustments During Implementation

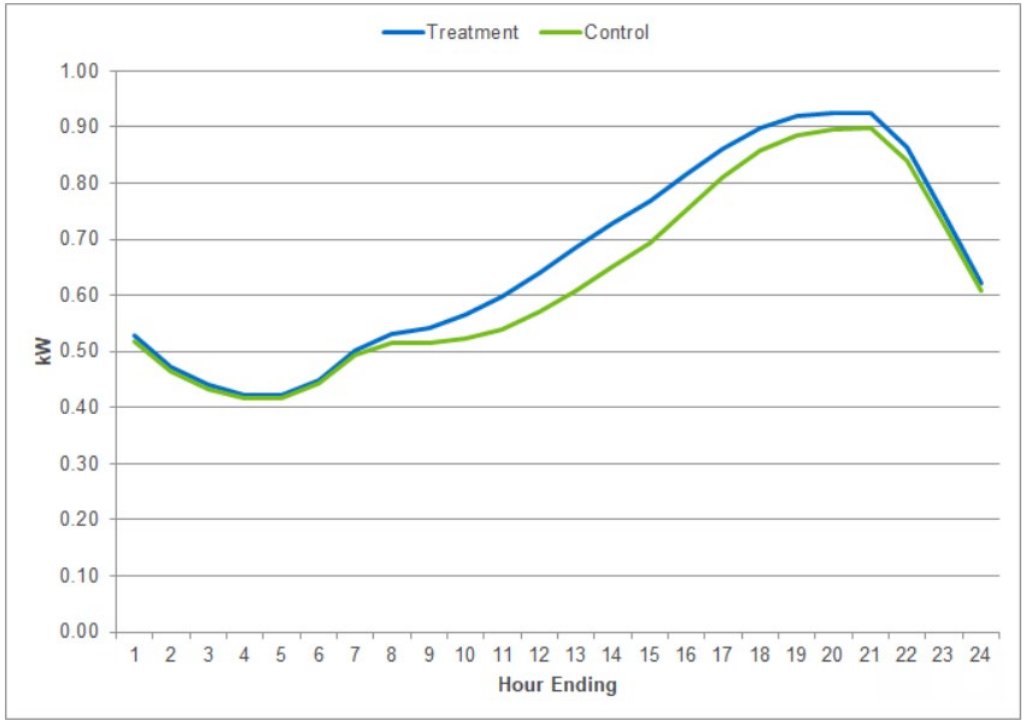
Even the best designed pilot can go terribly wrong if pilot implementation is not carefully monitored and managed

- The graphs below show validation tests done using pretreatment data for two pilots with identical designs and objectives using a RED
- In the 2nd example, pilot implementers did not consult designers when making adjustments to treatment and control groups after initial randomization

Implemented as Planned



Not Implemented as Planned



It's okay to adjust along the way, but input from the design and evaluation experts is essential

- A primary reason to do a pilot is to test something important about which the outcome is uncertain
  - Unexpected outcomes are not uncommon and, even if disappointing, are not a sign of failure (As Edison said, "I haven't **failed** -- I've just found 10,000 ways that won't work.")
  - When monitoring and interim evaluations identify negative outcomes, adjustments are appropriate – but when making adjustments, it's critical to assess their impact on the integrity of the pilot design and evaluation – it's relatively easy to turn a well designed experiment into a quasi-experiment or even a failed experiment
  - Design and evaluation experts should be consulted when any significant change is being contemplated
  - Design and evaluation experts should educate pilot implementation managers and other key personnel prior to implementation to ensure they know when to bring something to the expert's attention

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Be Aware of False Conclusions

When evaluating pilots, always be careful not to draw false conclusions

- Is a low opt-out rate for default enrollment due to customer preferences for the new option or lack of awareness?
  - Need customer surveys to determine awareness
- Is a low opt-in rate due to lack of customer acceptance or because of problems with the marketing and enrollment methods used during a pilot
  - Limiting enrollment to online options only during a pilot to save money can significantly reduce what enrollment would be if telephone and BRC enrollment were available
  - Multi-step enrollment procedures can significantly impact enrollment – there can be a significant difference between customer preferences/acceptance and customer enrollment, ESPECIALLY WHEN TECHNOLOGY IS INVOLVED
  - Ineffective marketing collateral, unfortunate timing (e.g. seasonality or pilots during pandemics), and ineffective channel strategies can all lead to conclusions that customers don't like what is being offered when in fact some of the low acceptance is due to these other critical factors

Be careful not to draw false conclusions (continued)

- Are lower response rates for critical peak pricing programs for low income customers due to less capability to respond, a lower probability of receiving event notifications, or a language barrier in ME&O materials?
  - Low income customers have fewer notification channels and are less likely to see notifications compared to higher income customers
  - English only ME&O can lead to limited understand of how to respond
- Are differences in response rates for households with and without enabling technology (e.g., smart thermostats, other load control devices for a/c) due to the technology or to other factors?
  - All households with technology typically have central a/c whereas not all households without technology have central a/c (unless that is ensured through pilot design).
  - Selection effects are an inherent element of any pilot involving technology – technology cannot be forced onto anyone and installation failures (which may be correlated with customer characteristics), are endemic and can equal 50 to 75% of all installation attempts. As such, even RCT designs involving technology should be analyzed as a RED if possible.

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Recommendations for Pilot Submissions to the Commission

What should the Commission expect to see in a good pilot design report or request for funding?

- A detailed design and implementation plan, to include, but not necessarily be limited to
  - A detailed description of all treatments being tested (see slide 6) and why those treatments are of interest
  - A detailed description of the outcomes of interest (see slide 6) including whether these outcomes will be assessed for different segments of the population
  - A summary of the basic pilot/experimental design and why that design is appropriate (e.g., RCT, RED, quasi-experiment using statistical matching, etc.)
  - A detailed summary of the target population, including identification of any special customer segments of interest (e.g., limited income, seniors, etc.) and why that population is appropriate (and why some segments are being excluded)
  - A summary of the sample sizes being targeted for each treatment/segment and the basis for those sample sizes
  - Marketing strategy, including communication channels, enrollment options (e.g., online, phone, BRC)
  - Schedule
  - What is being done in-house versus outsourced

What should the Commission expect (continued)

- A detailed evaluation plan including
  - A description of the evaluation objectives
  - A description of the statistical analysis and/or other methods that will be used to determine each outcome of interest given the pilot design
  - The survey strategy and sampling plan that will be used if any, including survey mode, expected response rate, etc.
  - The number and timing of interim and final reports and summary of what will be conveyed in each report

What should utilities and other pilot implementers expect from the Commission

- Based on our experience **(NOT BASED ON ANY DISCUSSION WITH THE MPSC)**, we believe utilities and other pilot implementers should expect several things from the Commission, including:
  - Strategic guidance regarding the issues of interest to the Commission for which pilots can provide valuable insight
  - Constructive feedback on the detailed plan submitted
  - Clear direction regarding subpopulations of interest and recognition that obtaining statistically valid results for multiple populations requires greater funding
  - Recognition that outcomes that don't meet expectations from a well designed pilot do not reflect failure but success
  - Flexibility to make adjustments during the pilot period within boundaries and quick turnaround for any adjustments that require Commission approval so as not to significantly extend the pilot duration

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Summary

Summary

- Pilots can measure the impact of an intervention on one or more outcomes of interest
- Good pilot design begins with clear objectives
- Good pilot design should focus on determining causality (internal validity)
  - Isolating potential causal factors is a key to internal validity
- The most rigorous approach to design are RCTs and REDs and it is feasible to implement such designs
  - When such designs can't be implemented, creating pseudo-control groups using statistical matching is arguably the best alternative for kWh/kW impact estimation
- Pilot design is an exercise in tradeoffs
  - Do fewer things well rather than more things poorly
  - Not all pilots must be large, time consuming and expensive
- When making adjustments during implementation (post design), check with the experts to avoid undermining the experimental design

Summary (continued)

- When evaluating pilots, be careful not to draw false conclusions
- Requests for pilot funding should include, at a minimum
  - A detailed description of the treatments being tested, the outcomes of interest and the subpopulations for which outcome metrics will be determined
  - A summary of the basic pilot/experimental design
  - A summary of sample sizes being targeted and the basis for those targets
  - A detailed implementation schedule
  - A detailed evaluation plan

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References and Bios

References

- For an example of multiple small experiments focused on determining marketing effectiveness using different channels, content, incentives, etc., see:
  - S. George, J. Bode, M. Perry and A. Goett. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate Peak Day Pricing and Tou Tariffs and SmartAC Programs (Volume 2: Ex Ante Load Impacts)*. April 1, 2010. (www.calmac.org)
- For an example using RCTs to estimate load impacts for different control strategies for an air conditioning cycling program, see:
  - S. George, M. Perry, C. Hartmann and L. Hartman. 2012 *Load Impact Evaluation for Pacific Gas and Electric Company's Smart AC Program.* April 2, 2013 (www.calmac.org)
- For detailed guidance on pilot design with a particular focus on information feedback programs, see:
  - M. Sullivan and S. George. *Guidelines for Designing Effective Energy Information Feedback Pilots: Research Protocols.* EPRI 1020855. April 2010.
- For guidance on experimental design methods for evaluating energy efficiency programs, see:
  - M. Sullivan. *Using Experiments to Foster Innovation and Improve the Effective3ness of Energy Efficiency Programs.* California Institute for Energy and Environment and the California Public Utilities Commission. March 2009.

References (continued)

- For information on using experiments within the context of adaptive design for information feedback options at Southern California Gas Company, see:
  - J. Schellenberg. *Insights from California's Very Own "Nudge Unit".* Presented at the 2017 Behavior, Energy & Climate Change Conference. October 17, 2017.
- For a detailed evaluation of the SMUD SmartPricing Options Pilot, see:
  - S. George, J. Potter and L. Lopez. *SmartPricing Options Final Evaluation*. September 5, 2014. See also SmartPricing Options Interim Evaluation. October 23, 2013.
- For information on the design and evaluation of California's statewide opt-in TOU pilot, a pilot designed in part to assess the impact of TOU rates on low income and senior populations, see:
  - S. George, E. Bell and A. Savage. *California Statewide Opt-in Time-of-Use Pricing Pilot – Final Report.* 2018.
- For a detailed evaluation of the California default TOU pricing pilots for Southern California Edison and San Diego Gas and Electric, which were precursors to the full scale roll out of default TOU pricing in California, see:
  - E. Bell, A. Savage T. Lehman and S. George. *Default Time-of-Use Pricing Pilot Final Evaluation. Southern California Edison Co.* November 1, 2019.
  - E. Bell, A. Savage T. Lehman and S. George. *Default Time-of-Use Pricing Pilot Final Evaluation. San Diego Gas and Electric Co.* November 1, 2019.

Dr. Stephen S. George, Senior Vice President

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Dr. George has 44 years of experience in the energy field, nearly all of it involving consulting to electric and gas utilities or government entities. His areas of expertise include pricing strategy, pilot and experimental design, benefit/cost analysis, program design and evaluation, electric industry restructuring, strategic and marketing planning, market research, and energy demand modeling.

In recent years, Dr. George has worked extensively on issues associated with electricity pricing, behavioral conservation and advanced metering. He was a member of the DOE/LBNL Technology Advisory Group overseeing the design and evaluation of pilot studies of dynamic rates conducted by a number of U.S. utilities. He was also the lead evaluator of SMUD's SmartPricing Options pilot, which is widely recognized as one of the best pricing pilots ever done in the electricity industry. Dr. George has provided analysis and/or testimony on the benefits of time-based pricing enabled by advanced metering for SDG&E, PG&E, ComEd, Xcel Energy, RG&E, NYSEG, CMP, Nova Scotia Power and the Department of Public Service in Vermont.

Dr. George was the lead author of California Demand Response Load Impact Estimation Protocols and Protocols for Estimating Load Impacts Associated with Demand Response Resources in Ontario. He was also one of the principal authors of EPRI's Guidelines for Designing Effective Information Feedback Pilots: Research Protocols. Since writing the CPUC Protocols in 2008, Dr. George has overseen or managed many dozens of evaluations of pricing, demand response and behavioral conservation programs in California and elsewhere. Dr. George has worked extensively internationally on issues related to advanced metering, time-based pricing and electricity market restructuring. His international work includes projects in New Zealand, Australia, Singapore, Hong Kong, Canada, Spain, England and Scotland.

Dr. Eric Bell, Principal

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Dr. Bell specializes in load impact evaluations of Demand Side Management (DSM) programs, including pricing pilots, demand response, and energy conservation. He has more than 10 years of experience in the industry and has managed evaluations for numerous clients including the three California Investor Owned Utilities (IOUs): PG&E, SCE, and SDG&E; SoCalGas; ComEd in Chicago; OG&E in Oklahoma; Con Ed in New York, and IESO in Ontario, Canada. Dr. Bell has extensive experience with experimental and quasi-experimental design; and econometric modeling of customer characteristics, billing, and advanced metering interval usage data for both residential and non-residential customers. In total, projects led by Dr. Bell have required applying data analytics to approximately 550,000 businesses ranging from large commercial and industrial to small and medium businesses, and over 4 million residential customers. He led impact evaluations for the California Statewide Opt-in Residential TOU Pilot, SCE and SDG&E Default TOU Pilot Evaluations, Con Ed's Innovative Pricing Pilot Evaluation, and the evaluation of the first residential gas demand response program in the country at SoCalGas. Additional projects include load impact evaluations of the California Statewide Critical Peak Pricing non-residential demand response program, ComEd's Peak Time Savings Direct Load Control Pilot, and the SoCalGas Conservation Campaign Evaluation. Dr. Bell completed his Ph.D. in Economics at the Claremont Graduate University; MBA at the Peter F. Drucker and Masatoshi Ito Graduate School of Management; and BA in Economics from the University of Southern California.

Neighborhood-Based Efficiency Programs

Identifying Opportunities and Collaborating with Communities

MPSC: MI Power Grid Pilot Presentation
April 30, 2020

walker miller Energy Services

Presentation Overview

- O'Shea Solar Park Project Background
- Walker-Miller Energy Services: 2016 Program Snapshot
- Approach
- Results

Highlights:

- Community Engagement
- Customer Education
- Communication Strategies
- Relationship Building

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O’Shea Park Solar Array

Late in 2015, the City of Detroit embarked on a project that would award a long-term lease of 20 acres of city-owned land to DTE Energy, 10 acres of which would be covered in solar panels.

O’Shea Park was to become the site of an urban solar farm, totaling 2 megawatts of generation capacity. This array would be one of the largest urban solar arrays in the country, and the first of its kind in Detroit.

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O’Shea Park Solar Array

As the details of the design and construction were developing, the city via the Planning and Development Department began a dialogue with the residents of the adjacent Grandale neighborhood.

Early on, residents were vocally opposed to the development of their park into what was seen as a power plant which had no direct benefit to their community.

Walker-Miller Energy Services (WMES) recognized the dissonance, and realized the opportunity to bring energy, energy efficiency, and renewable energy to the forefront of these residents’ lives in a positive way.

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Walker-Miller Energy Services Snapshot (2016)

- Prime Implementer
  - DTE Energy Efficiency Assistance (EEA) Limited Income Program
  - DTE Home Energy Consultation (HEC) Single Family DI Program

- Sharpening our focus on engaging hard-to-reach customer bases

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Approach

Community Engagement

WMES quickly established ourselves as a stakeholder within the community and used our understanding of both the community's concerns and the more technical details of the solar project to help educate customers.

- Attended and participated directly in community project meetings

Communication

Worked with and educated local community leaders including faith based and community development organizations on ancillary benefits of the RE project, and the potential to provide widespread energy efficiency resources.

- Trusted community leaders are far more capable of effectively communicating with their constituents than EWR program representatives.

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Approach

Community Engagement

Despite outreach and program marketing from the beginning of the O'Shea Park project, trust levels were initially very low, and program uptake (HEC, EEA) was sluggish.

By the end of the approximately 12 months of engagement with this community, we had neighbors chasing down the HEC trucks asking if they could get signed up for the program

walker miller Energy Services

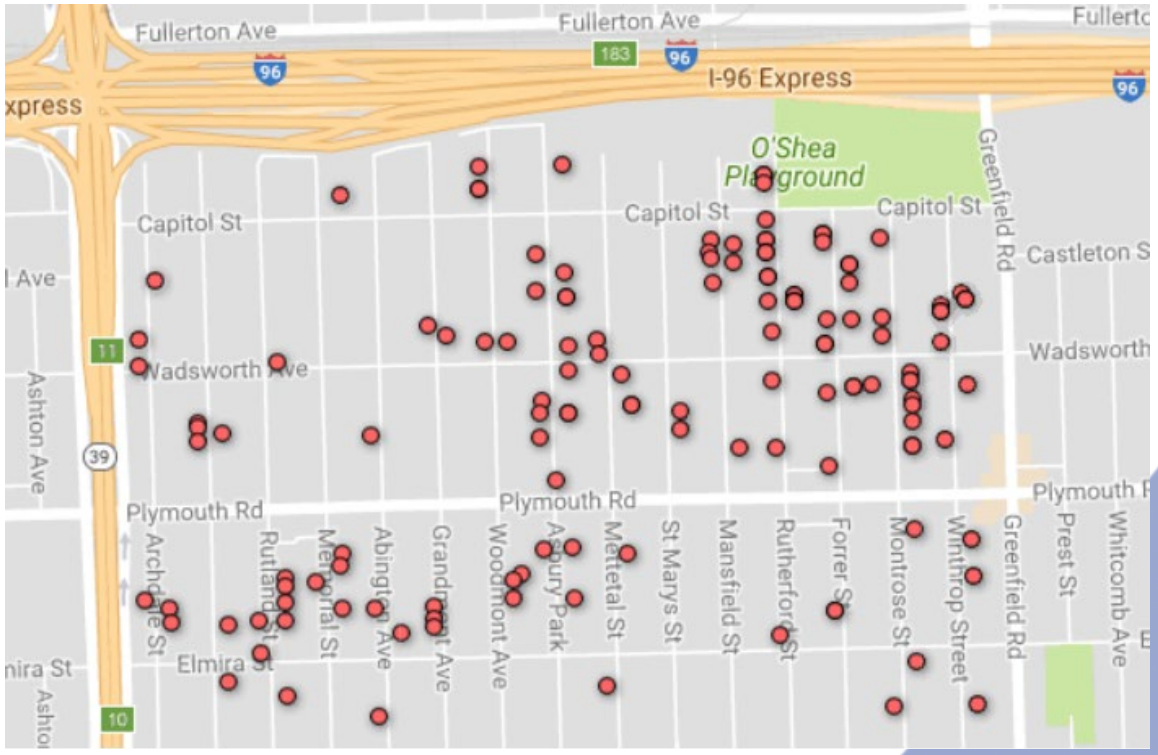
Results

1. Interfaced directly with 100 households in the Grandale community by way of the DTE Residential Energy Efficiency Programs

2. Educated residents about how to decrease utility bills through energy waste reduction

3. Coordinated and helped facilitate regular community meetings to discuss solar array and park design

4. Assisted in the coordination of Community Resource Fairs and Career Fairs



129 ENERGY
HOME IMPROVEMENTS

- **31** Insulation/Air Sealings
- **31** Furnace Replacements
- **20** Refrigerator Replacements
- **4** Water Heater Replacements
- **24** Furnance Tune-Ups

$235 TOTAL
AVERAGE ANNUAL SAVINGS PER HOMEOWNER

Opportunities and Lessons

- Coupling EWR with RE Projects
  - Leveraging targeted and comprehensive EWR projects as a tool for providing value, bridging gaps, and reaching communities during RE project development
- Driving community engagement through intentional integration into project resource stack
  - To the extent possible the outreach representative / team should be more than another booth at a meeting. Intentional engagement in dialogue help builds trust and drives program uptake.
- WMES has been able to build off this community engagement experience in several subsequent initiatives including NEED Days and EWR programs in other utility territories.

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Going Forward

Additional Community-Based Pilot(Currently On Hold)

- Detroit Health Department – Understanding Water Shutoffs in Detroit
  - Energy Burden

- Bridging Digital Divide to Achieve Energy Savings
  - Fostering behavior-based energy savings in Income Limited communities using digital engagement strategies

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MI POWER GRID

Making the Most of Michigan's Energy Future

Energy Programs & Technology Pilots
Closing Comments

Stakeholder Meeting 3

April 30, 2020

MPSC

Michigan Public Service Commission

Thank You and Please Stay Engaged

- Thank you for your participation.
- Please stay engaged:
  - Sign up for the listserv if you have not already
    - Go to www.michigan.gov/MIPowerGrid → Customer Engagement → Energy Programs and Technology Pilots → Scroll to bottom to add email
  - Attend future meetings
    - Every other Thursday.
      - May 14: 1 – 3:30 PM
        - Tom Stanton (NRRI)
          - Facilitating Utility and Regulatory Innovation: Implementing Hubs, Links, Sandboxes, and More
        - Douglas Jester (5 Lakes Energy)
          - Agility, Prudence, and the Commission's Approach to Pilot Projects
        - Consumers, DTE, and I&M
          - Utility Pilot Definitions: Case Studies
          - Panel Discussion: Agility and Accountability
        - RSVP with Linda Brauker at BraukerL@michigan.gov.
      - May 28: Time TBD
      - June 11: Time TBD

Thank You and Please Stay Engaged

- Please stay engaged:
  - Speak at a future meeting
    - Limited slots available for stakeholder input/experiences on important pilot topics and best practices.
    - If interested or have suggested speakers, email: Joy Wang at WangJ3@Michigan.gov

Thank you!