MI POWER GRID

Making the Most of Michigan's Energy Future

Energy Programs & Technology Pilots

Stakeholder Meeting 2

April 16, 2020

10 AM – 12 PM

Web Meeting

MPSC

Michigan Public Service Commission

Agenda

10:00 a.m.	Welcome & Overview of Last Meeting	Joy Wang, MPSC Staff
10:05 a.m.	Designing and Evaluating Utility Pilot Projects: an Academic Perspective	Soren Anderson, Jan Beecher, and Justin Kirkpatrick, Michigan State University
10:15 a.m.	REV Demos – Process and Experience	Marco Padula, New York State Department of Public Service
10:55 a.m.	Bridging the Chasm: From Pilots to Full-Scale Deployments	Ahmad Faruqui, Brattle
11:55 a.m.	Closing Comments	Joy Wang, MPSC Staff
12:00 p.m.	Adjourn	

MI POWER GRID

Making the Most of Michigan's Energy Future

Welcome and Overview

Joy Wang
MPSC Staff
Smart Grid Section

MPSC
Michigan Public Service Commission

U-20645

- Focused, multi-year stakeholder initiative to maximize the benefits of the transition to clean, distributed energy resources for Michigan residents and businesses.
- Engages utility customers and other stake-holders to help integrate new clean energy technologies and optimize grid investments for reliable, affordable electricity service

- Includes outreach, education, and regulatory reforms

Motivations: Workgroup Tasks

- Engage with utilities and stakeholders
- Investigate past Commission-approved pilots
- Understand outcomes and apply lessons learned from existing pilot projects
- Identify pilot best practices
- Propose objective criteria for the Commission to utilize when evaluating proposed utility pilot projects

Kickoff Meeting: February 27

- Opening statements
  - Commissioner Tremaine Phillips
  - Anne Armstrong-Cusack, Director Customer Service Division
- Summary of Grid Mod Programs Nationally
  - Tom Stanton, NRRI
- Staff summary:
  - Workgroup tasks and timeline
  - MPSC case review and utility survey results
- Current Pilot Processes
  - Consumers, DTE, and I&M

Kickoff Meeting: February 27, cont.

- Utility Pilots: Issues and Best Practices
  - Annika Todd-Blick, Lawrence Berkeley National Lab
- From Pilot to Product: Viewpoints on Utility Pilot Design
  - Nekabari Goka, Oracle
- Utility and Stakeholder Input on Process and Content
  - Tamara Dzubay, Ecobee
  - Jeremy Kraft, EMI Consulting,
  - Amy Ellsworth, Cadmus

Meeting Overview

- More agile and flexible structure needed
  - Utilities would like:
    - To implement pilots in response to customer needs
    - Policy structure to provide funding for pilot areas beyond EWR
  - Regulatory sandbox
    - Mentioned by DTE , AEE, & NRRI
- Stakeholder support for independent entity to collect third-party solutions and share with utilities for consideration

Meeting Overview, cont.

- Data sharing needs but also concerns
  - Utilities concerned about sharing customer and third-party tech provider's data
  - 3rd party tech developer in audience not concerned about data sharing
    - Would like to broadly advertise regardless of outcome
  - Customer privacy can be addressed through:
    - Database where aggregate data together
    - Opt-in sharing of customer data

Meeting Overview, cont.

- Objective criteria
  - Utilities need flexibility for pilots in terms of evaluation
    - Flexibility to adjust if reach a dead end
  - Hard to find one set of criteria that fits all
    - Pilots differ substantially
      - Vary in what they can report
  - Pilots should include finite time periods
- Definition of pilot undetermined currently but possibly necessary

Revised Meeting Timeline

- Previously planning three all-day stakeholder meetings
- Revised to shorter webinars every two weeks
  - April 16
  - April 30
  - May 14
  - May 28
  - June 11

Questions?

Email:

Joy Wang (staff lead) at

WangJ3@Michigan.gov

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MI POWER GRID

Making the Most of Michigan's Energy Future

Energy Programs & Technology Pilots
Closing Comments

Stakeholder Meeting 2

April 16, 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. Time TBD.
      - April 30
      - May 14
      - May 28
      - June 11

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!

Designing and Evaluating Utility Pilot Projects: An Academic Perspective

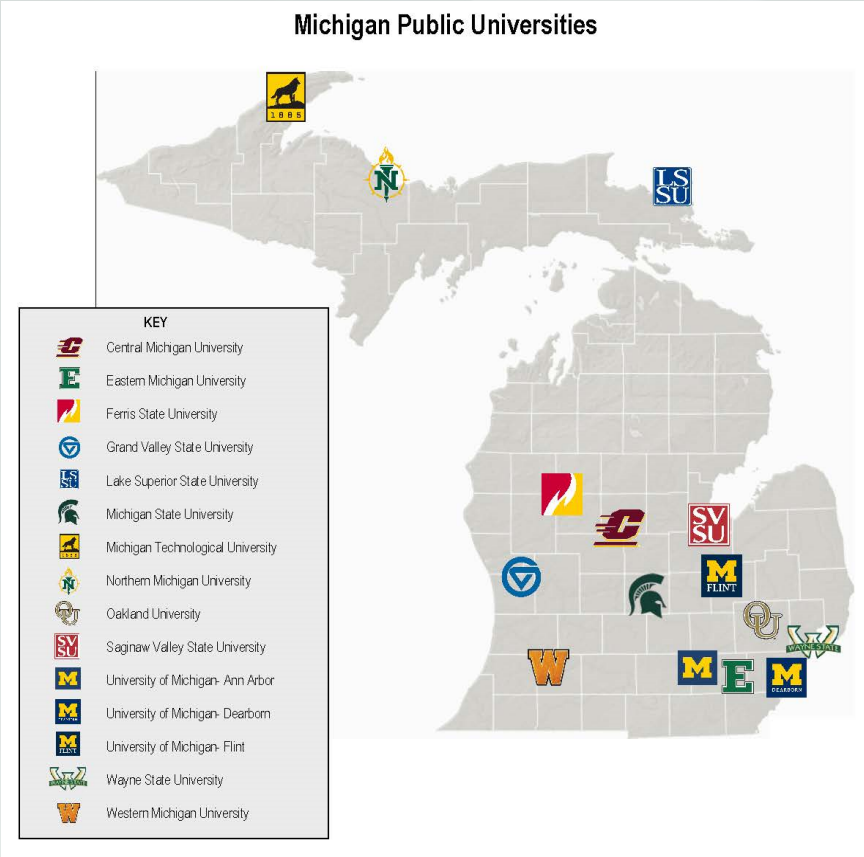
Soren Anderson

Janice Beecher

Justin Kirkpatrick

Michigan State University

Within driving (walking?) distance …



- **Dozens** of universities
- **Scores** of faculty
- **Hundreds** of graduate students

- **Deeply interested** in utility issues

- **Relevant skills**
  - Applied statistics
  - Behavioral economics
  - Psychology
  - Sociology

What universities have to offer

- **Researchers** ... faculty & students with skills
- **Low cost** ... public research & teaching mission
- **Independence** ... less financial & ideological stake
- **Peer review & publication** ... promotes credibility

What industry & government can provide

- **Relevance** ... grounding research in actual needs
- **Expertise** ... deep knowledge of problem and setting
- **Data** ... frequent missing ingredient
- **Scientific platform** ... testing hypotheses

2 ½ recommendations

1. Design pilots for evaluation and possible scaling
   - Get academics involved early

2. Make data access predictable and transparent

Design pilots for evaluation and scaling

- Academic researchers may have ideas to improve precision and generalizability at low cost
- Recruit a representative sample and/or study selection into sample
- Randomized pilot participation and control (or versions)

Example: Fowlie (2017) et al. with SMUD

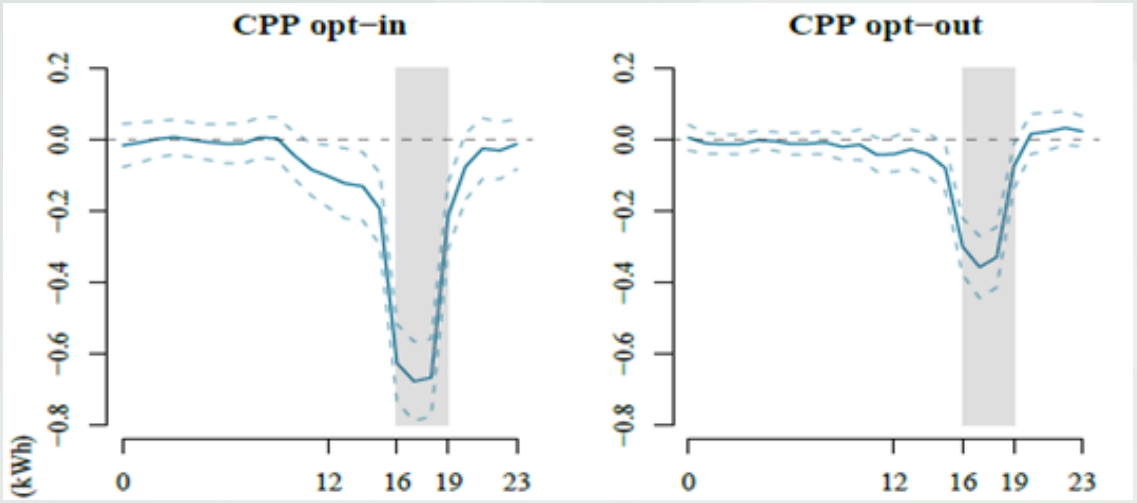
Question: How do opt-in versus opt-out enrollment designs compare?

Method: Randomized assignment to opt-in vs. opt-out, then pricing treatments.

Result: Opt-out enrolls more people. Opt-in customers more price responsive.

Opt-in: 20% enroll

Opt-out: 95% stay enrolled



- Collaboration began early
- Large sample + randomization
  - Precise results
  - Generalizable
- Focus on enrollment tells us how program scales
- Credible results with real-world relevance
- Likely publication in a top-tier journal

Significant difference in response to pricing

Make pilot data available for (re)analysis

- All empirical studies have limitations
  - Narrow scope
  - Time and personnel constraints
  - Dated empirical methods
  - Potential errors

- Future researchers can (re)analyze pilot data to ...
  - Answer new questions
  - Apply latest methods
  - Correct errors

Example: Allcott (2011) and ComEd

Question: How do consumers respond to real-time electricity prices?

Method: Reanalysis of a 2003 real-time pricing pilot (700 households) that featured random assignment to pricing and a control group.

Result: Consumers conserve during peak periods but do not load shift.

Original consulting report did not use the randomized control group!

Alcott's (2011) reanalysis generates new and more credible knowledge from an existing pilot program.

Regular utility data also highly valuable

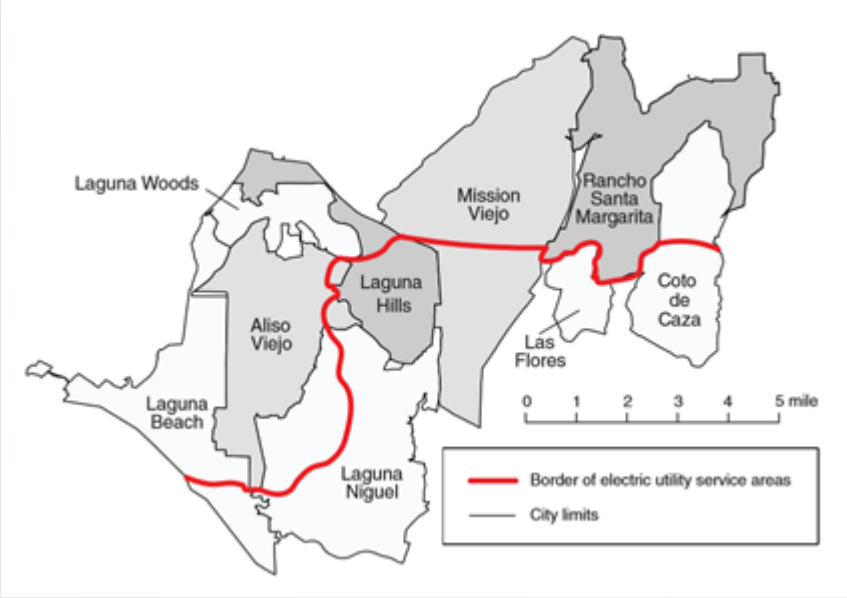
- Utility prices, rate structures, technologies, and programs change over time and differ across utility areas
- These "natural experiments" offer many opportunities for researchers to evaluate program impacts
- Such studies can complement research based on pilot programs ... but this also requires data access

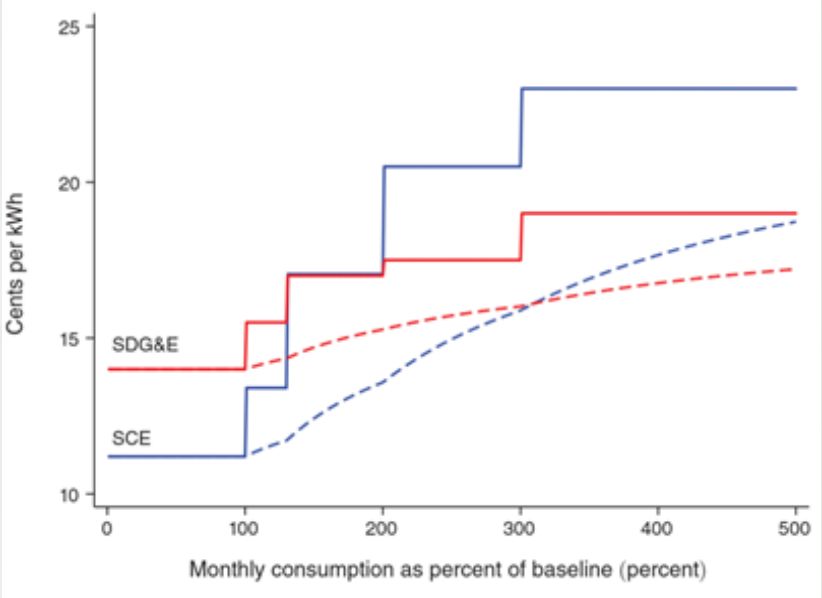
Example: Ito (2014) and SCE & SDG&E

Question: Do electricity consumers respond to marginal or average price?

Method: Compare changes in consumption for SCE and SDG&E customers from before versus after changes in block-rate pricing schedules.

Result: Consumers respond to <u>average</u> prices.





Three models of data access (not exhaustive)

- MSU's Education Policy Innovation Collaborative (EPIC)
  - MSU + MDOE + local districts partner to craft tailored research agenda
  - Data provided on project-by-project basis
- California Energy Data Request Program
  - Formalized, transparent, streamlined, predictable process
  - Academic researchers + local, state, and federal agencies
  - Researchers must meet high standards of data protection
  - Record of benefits from research results (e.g., Auffhammer and Rubin 2018)
- 3rd party repository/arbitrator
  - Researchers run analyses without seeing full data (secure)

Energy Data Request Program

Current and Prior Data Requests

Request ID	Complete Request Received	Requestor Name	Requestor Type	Request Description	Comment	Status*	Date Closed
rn1590558202	12/14/2017	City of Hayward	Local Government	Customer Class, Number of Customers, City, Zip Code, Commodity (Gas or Electricity), Month Start Day, Month End Day, Monthly Billed Usage, Heat Type. Data is aggregated to Zip Code level.	Data delivery is complete; was re-posted at Hayward's request. Reported on 1Q18 Quarterly Notification Advice Letter.	Completed	03/09/2018
rn8700082351	11/29/2017	City of Cupertino, Sustainability Div.	Local Government	Disaggregated, randomized, and anonymized meter level gas and electric energy usage data in monthly intervals, and data flags, grouped by census block group for specified block groups.	Data delivery is complete. Reported on 1Q18 Quarterly Notification Advice Letter.	Completed	01/25/2018
rn6806076159	10/17/2017	Duke University	Academic Researcher	2011 - 2017 annual household usage for residential customers by ZIP codes as provided by the requester, with flags for customers on Net Energy Metering rate.	Data downloaded on 6/14/2018	Completed	03/14/2018
rn1853459519	10/06/2017	Energy Institute at Haas	Academic Researcher	DR Aggregator study: 2014 - 2017 residential billing and and interval usage; participation in Community Choice Aggregation, EE and DR SmartRate programs for random sample of residential customers, and total count of customers per ZIP code	Was available for download 11/20 and was reported 4Q17 notification letter, but system doesn't show download till Jan 2018.	Completed	11/20/2017
rn1535558943	08/23/2017	Energy Institute at Haas	Academic Researcher	Reliability study combining customer specific outage data with other customer characteristics for selected zip codes and a random, control sample.	Final data downloaded on 6/28/2018	Completed	03/13/2018

Additional Resources

- Contact Us
- California Public Utilities Commission
- CPUC Decision 14-05-016
- EDRP User Guide
- Data Element Descriptions

Customer Data Access Programs

For more information on PG&E's customer data access programs, see pge.com/data

Energy Data Access Committee (EDAC)

The Energy Data Access Committee helps set direction for release of usage data under D.14-05-016. Learn more >>.

Designing and Evaluating Utility Pilot Projects: An Academic Perspective

Soren Anderson sta@msu.edu	Justin Kirkpatrick jkirk@msu.edu	Jan Beecher beecher@msu.edu

References

- Fowlie, Meredith, Catherine Wolfram, C. Anna Spurlock, Annika Todd, Patrick Baylis, and Peter Cappers. *Default effects and follow-on behavior: evidence from an electricity pricing program*. No. w23553. National Bureau of Economic Research, 2017.

- Ito, Koichiro. "Do consumers respond to marginal or average price? Evidence from nonlinear electricity pricing." *American Economic Review* 104, no. 2 (2014): 537-63.

- Allcott, Hunt. "Rethinking real-time electricity pricing." *Resource and Energy Economics* 33, no. 4 (2011): 820-842.

- Auffhammer, Maximilian, and Edward Rubin. *Natural gas price elasticities and optimal cost recovery under consumer heterogeneity: Evidence from 300 million natural gas bills*. No. w24295. National Bureau of Economic Research, 2018.

NEW YORK STATE OF OPPORTUNITY. Department of Public Service

REV Demos – Process and Experience

Marco Padula
Director, Office of Markets and Innovation

April 16, 2020

Agenda

- Regulatory Model for REV Demonstration Projects
- REV Demonstration Project Funding and Cost
- Interplay with REV Connect
- Lessons Learned and Best Practices

REV Demonstration Projects

- Demonstrate the potential of various aspects of the *Reforming the Energy Vision* (REV) initiative launched by the Commission as part of Governor Cuomo's comprehensive energy strategy for New York

- February 26, 2015 REV Order (14-M-0101), Demo project Goals:
  - Demonstrate new business models and revenue streams
  - Inform decisions with respect to developing Distibuted System Platform (DSP) functionalities
  - Measuring customer response to programs and prices associated with DER markets
  - Inform regulatory changes, rate design, and the most effective means to integrate DER on a larger scale
  - Test new technologies and approaches to assessing value

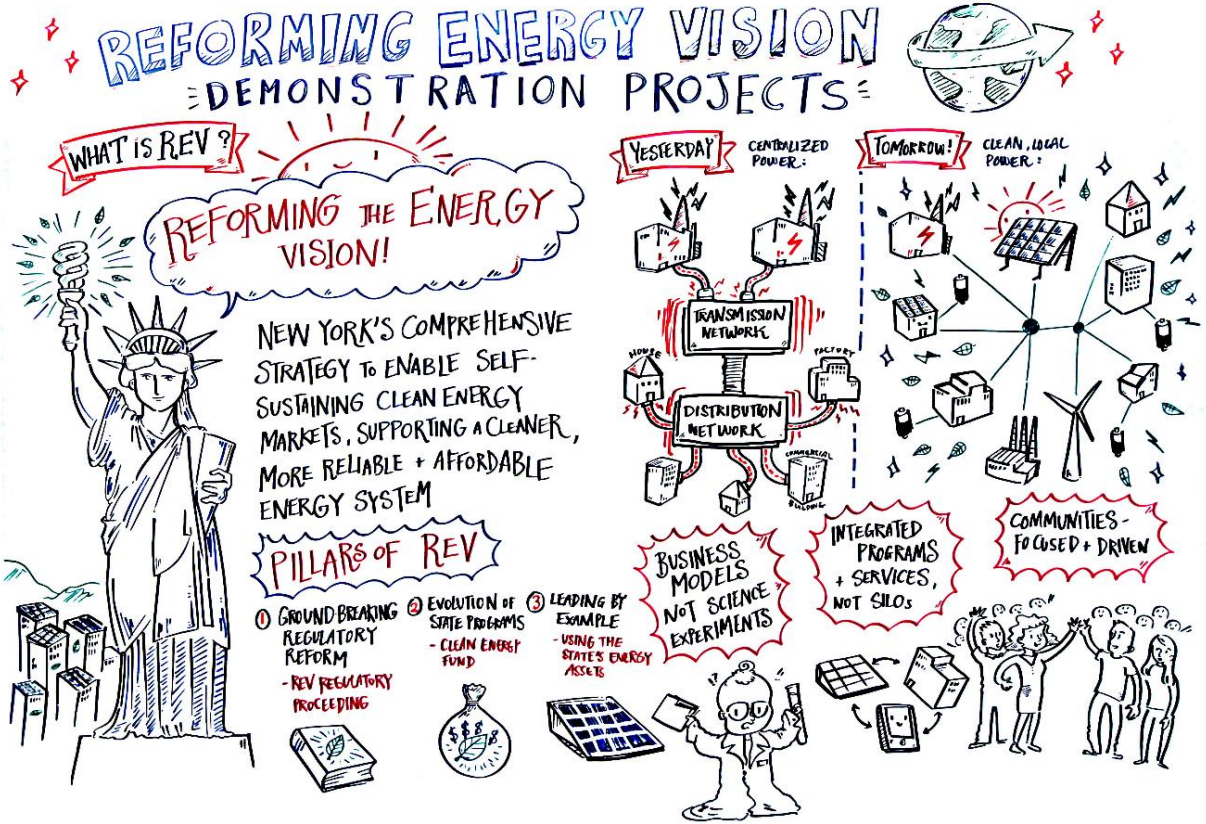
REV Policy Objectives

- Enhanced Customer Knowledge
- Market Animation
- Leveraging Customer Contributions / 3rd Party Capital
- System-Wide Efficiency
- Fuel and Resource Diversity
- System Reliability and Resiliency
- Reduction of Carbon Emissions

REV Demonstration Project Principles

- Customer and Community Engagement including LMI Customers
- Identification of Economic Value
- Pricing and Rate Design
- Transactive Grid
- Scalability
- Market Rules and Standards
- System Benefits
- Cost Effectiveness
- Timeliness

Visual of the REV Demo Project Process



REV Demonstration Project Funding

- Ratepayer support for all demonstration projects of a utility not to exceed 0.5 percent of its delivery service revenue requirement (estimated by assuming ten year recovery period and a return on unrecovered costs at the utility's current authorized weighted average pre-tax cost of capital) or the revenue requirement associated with capital expenditures of $10 million, whichever is greater, unless a higher amount is specifically approved by the Commission.

	Total Allowable REV Demonstration Project Expenditures ($ millions)
Con Edison	$135
National Grid	$36
NYSEG	$18
RG&E	$11
Orange & Rockland	$10
Central Hudson	$10

REV Demo Review Process

- DPS Staff and Utility meet to discuss potential REV Demo
- Utility submits written proposal to the Commission
- DPS Staff reviews identified strengths/weaknesses of each proposal
  - Several meetings/interactions with utilities to understand their goals and partnership arrangements and resolve any concerns
- Weaknesses in the projects are corrected via addendum filings
- DPS Staff issues compliance letter / assessment report
- Assessment report requires utilities to file Implementation Plan
- Quarterly reports are filed, and in-person meetings held to discuss
- Utility has the flexibility to modify the demo at any time, failure is not a bad thing; encouraged to document learning and move on to next opportunity

Interplay with REV Connect

- REV Connect was initiated to be a central forum for project ideas to be submitted and expert guidance, feedback and facilitation to be received; ultimately, matching ideas with customers, communities, and utilities.

- REV Connect is not limited to REV Demonstration projects, it is platform for revealing NWA, RFP and RFI opportunities, and provides resources to third parties to develop proposed responses.

REV Connect Innovation Sprints

- Developed as a response to voice of customer assessments
- More clear targeting and identification of utility need
- Create time sensitive urgency
- Submitter's desire to interreact/develop relationship with Utility
- Submitter's desire to make their own presentation and get direct, real-time feedback from Utilities (Shark-Tank moment)
- Past Innovation Sprint Examples:
  - Clean Heating and Cooling
  - Electrifying Transportation
  - Innovative Energy Efficiency
  - Energy Storage
  - Connected Communities

Categories of REV Demo Projects

Customer Engagement	Modifying Grid Operations	Community / LMI Engagement	Battery Storage
CenHub Marketplace	Clean Virtual Power Plant	Fruit Belt Neighborhood Solar	Con Ed Commercial Battery Storage
CONnectED Homes Platform	Buffalo Niagara Medical Campus Distributed System Platform Engagement	Demand Reduction Demonstration in Clifton Park	Con Ed Storage on Demand
O&R Residential Customer Marketplace	Resiliency Demonstration in Potsdam	Community Energy Coordination	O&R Storage / PV
RG&E Energy Marketplace	Flexible Interconnect Capacity Solution	NGRID Smart Cities Schenectady	RGE FOM Storage
Con Ed Building Efficiency Marketplace	NGRID DG Interconnection		RGE EV Charging
Smart Home Rates	ORU Hosting Capacity		NYSEG FOM Storage
			NYSEG BTM Storage
			Con Ed EV Charging

Lessons Learned and Best Practices

- Building a culture of innovation at utilities and the DPS takes time
- Encourage the formation of a new office / section to champion innovation
- Clearly define specific project goals and hypotheses
- Clearly define measurable metrics for each stated goal to quantify whether stated goals have been met and hypotheses proven/disproven
- Require a forecast / vision of what the project looks like at-scale
- Be aware of regulatory barriers beyond the control of the PSC – e.g. City codes
- Limit the number of policies and principles attempting to be addressed in one project to ease the execution and evaluation – be realistic
- Outreach and offerings must be attractive to customers
- Focus on partnerships not vendor relationships

Thanks!

- Questions and Answers

Moving From Pilots to Full-Scale Deployments of Time-of-Use Rates

BRIDGING THE CHASM

PRESENTED BY
Ahmad Faruqui, Ph.D.
Principal

PRESENTED TO
MI Power Grid: Energy Programs and Technology Pilots Stakeholder Meeting

April 16, 2020

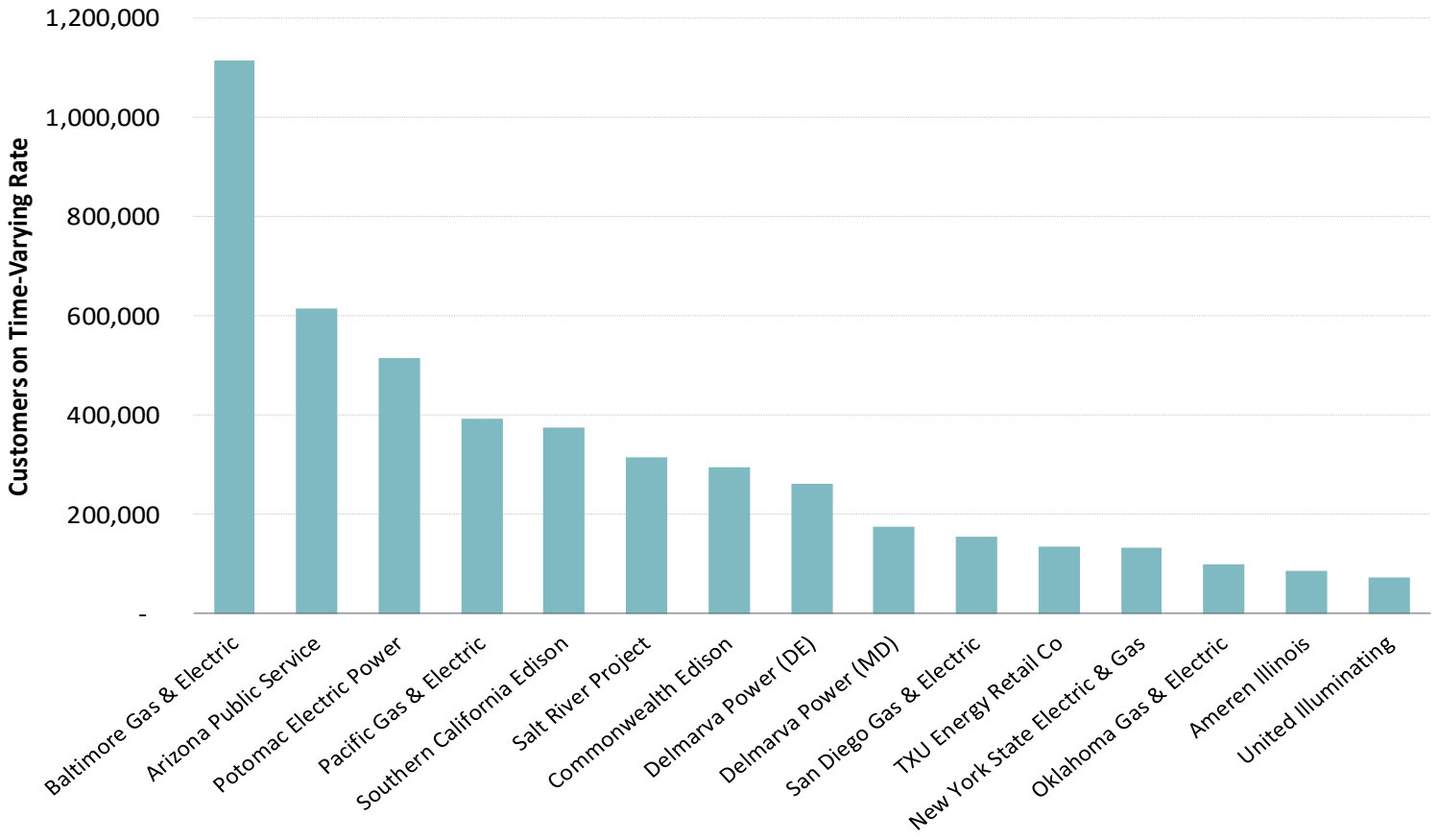
THE Brattle GROUP

Consumers encounter TOU pricing in many walks of life

ACTIVITY	EXAMPLES
Driving their car	Toll bridges, roads, parking meters
Entertainment	Movies, operas, plays, happy hour at restaurants
Ride sharing	Uber, Lyft, Kareem
Sporting events	Baseball, basketball, football
Vacation and business travel	Airlines, hotels, car rentals

But in 2018 only ~4% of residential electric customers were on TOU rates

15 utilities in 8 states and DC accounted for 86% of all TOU deployments



What will it take to get to 25%?

More pilots?

More deployments?

Both pilots and deployments?

Between 1975 and 2020, we have witnessed four generations of pilots with time-of-use (TOU) rates

Generation	Year
First Generation	1975 - 2002
Second Generation	2003 - 2009
Third Generation	2010 - 2016
Fourth Generation	2017 - Onwards

The first generation of TOU pilots: 1975-2002

The global energy crisis 1974 led to a dozen TOU pilots being funded in the US by the Federal Energy Administration (later subsumed into the US DOE)

The pilots were carried out in Arizona, Arkansas, California (LADWP and SCE), Connecticut, North Carolina, Ohio, Oklahoma, Puerto Rico, Rhode Island, and Wisconsin

With Dennis Aigner and Bob Howard, I reviewed the results for EPRI's Electric Utility Rate Design Study in 1981. Two years later, I co-authored a paper with Bob Malko

What happened next?

EPRI created a model for predicting customer response to TOU rates by drawing upon the five top experiments (RETOU)

PG&E did a TOU pilot which eventually led to the E7 rate which enrolled ~100,000 customers (I was on it for 10 years)

Yet TOU rates remained an exotic product since utilities were concerned about revenue loss with optional offerings and preferred mandatory deployments, which ran afoul of commission preferences

A few mandatory deployments took place for very large residential customers in the Mid-Atlantic region

Consequences of the global energy crises of 1974 and 1979

Oil prices rose and since generation was quite oil-dependent, electricity prices rose as well, slowing down load growth

As customer bills rose, utilities deployed DSM programs

Retail competition was introduced in the mid-to-late 1990s to further lower rates

Lack of smart meters posed a major barrier to deploying TOU rates

The second generation of TOU pilots: 2003-2009

California was rocked by an energy crisis in 2000-01, which was exacerbated by the absence of price-responsive demand

California carried out a landmark pricing pilot jointly with three investor-owned utilities in 2003-04. This was followed by pilots in Connecticut, District of Columbia, Michigan and Florida

In 2010, I co-authored an article with Sanem Sergici which summarized the results of several pilots

What happened next?

Smart meters began to be rolled out, since their presence was deemed to be a necessary condition to roll out TOU rates

Pennsylvania's PPL was the first utility to roll out smart meters, courtesy of a visionary CEO

California was the next state to roll them out, and its lead was followed by several others, including Alabama, Florida and Georgia

The third generation of TOU pilots: 2010-2016

The Great Recession of 2008-09 triggered the passage of the ARRA legislation which provided $4.5B of funding for Smart Grid Investment Grants (SGIG), about half of which went to smart meter deployments

SGIG also funded 10 Customer Behavior Studies in California, Massachusetts, Michigan, Minnesota, Nevada, Ohio, Oklahoma, and Vermont

A summary report was published in November 2016

Several different rate designs were tested in DOE's Customer Behavior Studies

Table ES-1. Scope of the Consumer Behavior Studies										
	CEIC	DTE	GMP	LE	MMLD	MP	NVE	OG&E	SMUD	VEC
Rate Treatments										
CPP		●	●		●	●	●	●	●	
TOU		●		●		●	●	●	●	
VPP								●		●
CPR	●		●							
Non-Rate Treatments										
IHD	●	●	●					●	●	
PCT	●	●					●	●		
Education							●			
Recruitment Approaches										
Opt-In	●	●	●	●	●	●	●	●	●	●
Opt-Out				●					●	

Utility Abbreviations: Cleveland Electric Illuminating Company (CEIC), DTE Energy (DTE), Green Mountain Power (GMP), Lakeland Electric (LE), Marblehead Municipal Light Department (MMLD), Minnesota Power (MP), NV Energy (NVE), Oklahoma Gas and Electric (OG&E), Sacramento Municipal Utility District (SMUD), Vermont Electric Cooperative (VEC)

The fourth generation of TOU pilots: 2017 onwards

Scores of pilots are underway throughout the globe, in places such as Australia, Hong Kong and New Zealand, in Canada and in California, Maryland, Michigan, North Carolina and other US states

We have been summarizing these results in a database called Arcturus

As of today, it contains information on nearly 350 deployments, mostly experimental, from many countries around the globe

While TOU rates were being piloted, a digital revolution transformed the globe …

Generation	Year	Technology Development
First Generation	1975 - 2002	1975: IBM introduces the PC, Microsoft founded 1976: Apple founded 1984: Cisco founded 1994: Amazon, Yahoo founded 1997: Netflix founded 1998 : Google founded 1999: Salesforce founded
Second Generation	2003 - 2009	2003: Tesla founded 2005: YouTube founded 2006: Twitter, Solar City founded 2007: iPhone introduced
Third Generation	2010 - 2016	2011: Nest, Zoom introduced 2014: Google acquires Nest
Fourth Generation	2017 - Onwards	2017: iPhone X released 2019: iPhone 11 released

…and customers changed their energy lifestyles and the technologies in their homes

Today, smart thermostats are so widespread you cannot buy a plain old thermostat

LEDs lights are ubiquitous in homes and offices

2 million homes have PV panels on their roofs and the number is trending upwards at a fast rate; some customers are also installing battery storage

Some 1.4 million EVs are on the roads and the number is trending upwards

Have pilots always led to deployments of TOU rates?

In numerous cases, they have simply led to more pilots and in more than a few cases, they have led to nowhere

In at least one case, full-scale deployment took place without any pilots preceding it

In some cases, pilots led to full-scale deployment which was opt-in in some cases, opt-out (default) in others, and mandatory in at least one case

Ontario, Canada
Time-of-Use Rates

The Ontario Energy Board mandated the installation of smart meters for all customers to promote a culture of conservation. The C$ 2 billion rollout of 4.7 million smart meters was complete by 2014

Alongside smart meters, without doing a pilot, Ontario introduced default TOU rates in 2011-12 for residential and small commercial customers

- Some 90% of Ontario's 4 million residential customers have been buying their energy through a regulated supply option, which features a three-period TOU rate
- The TOU rates only apply to the energy portion of the customer's bill
- Off-peak, mid-peak, and on-peak prices are defined by season
- A small number of customers without smart meters are on Tiered Pricing rates with seasonally differentiated tiers and prices
- Large commercial and industrial customers pay wholesale prices

California
TOU rates

Multiple pilots were carried out over two decades by the three-investor owned utilities and by SMUD

As of today, SMUD has 542,000 residential customers on default TOU rates, 98% of all its residential customers

SDGE has ~670,000 customers on default TOU rates; SCE has ~500,000 customers and PG&E 515,000 on opt-in TOU rates

The latter two utilities are expected to begin default deployments for new service connections in October, eventually encompassing all customers in a few years

Maryland
Peak Time Rebates

BG&E carried out pilots with TOU rates, critical-peak pricing rates and peak-time rebates over a four year period

Eventually it rolled out peak-time rebates on a default basis to all residential customers

Nearly 80% of customers are on these rebates today and most of them are saving money by earning them

Last year TOU pilots were initiated at BGE, Delmarva and Pepco under the sponsorship of the PSC; separate samples have been created for LMI and non-LMI customers and the pilots will run for two years

Oklahoma
Variable Peak Pricing

After conducting a pilot with TOU rates through the DOE/SGIG/CBS program, OGE rolled out a dynamic pricing rate coupled with a smart thermostat to its residential customers a few years ago

- "Smart Hours" features variable peak pricing, or four levels of peak pricing depending on what day type it happens to be (Low, Standard, High, Critical)
- There are fixed summer and winter peak hours
- Prices during peak hours vary depending on system conditions, and are communicated by 5:00 pm the previous day. Critical periods can be communicated with as little as two hours notice
- The expectation is that there would be 10 Low price days, 30 Standard price days, 36 High price days, and 10 Critical price days in a typical year.
- Is also offered to Small GS customers whose annual demand is less than 10 kW or less than 400 kW with a load factor of less than 25%

Some 130,000 customers out of 650,000 (20%) are on that rate today; they control their thermostat setting, not OGE

- Average peak load has dropped by ~40%
- Average bill savings amount to ~20% of the customer's bill

Colorado

Fort Collins carried out a one-year pilot with TOU rates and rolled out TOU rates last October on a mandatory basis

Xcel Energy carried out a two-year pilot with TOU rates and demand rates. It has proposed offering TOU rates to the Colorado PUC with an alternative being the demand rate

	Schedule R		Modified RE-TOU		
	Winter / Summer Tier 1	Summer Tier 2	Off-Peak	Shoulder	On-Peak
Time Periods	Winter All Sales Summer 0kWh - 500kWh	Summer > 500kWh	Summer Weekdays 10:00 pm - 11:00 am Summer Weekends & Holidays All Winter Hours	Summer Weekdays 11:00 am -3:00 pm & 7:00 pm - 10:00 pm	Summer Weekdays 3:00 pm - 7:00 pm
% of Residential Sales	85.1%	14.9%	84.8%	9.2%	6.0%
S&F Charge	$5.41	$5.41	$5.41	$5.41	$5.41
Base Rates	$0.05461	$0.09902	$0.05539	$0.08309	$0.11078
GRSA	-4.19%	-4.19%	-4.19%	-4.19%	-4.19%
ECA	$0.02674	$0.02674	43.66%	43.66%	43.66%
DSMCA	$0.00162	$0.00162	2.65%	2.65%	2.65%
PCCA	$0.00401	$0.00401	6.55%	6.55%	6.55%
TCA	$0.00203	$0.00203	3.31%	3.31%	3.31%
CACJA	$0.00301	$0.00301	4.92%	4.92%	4.92%
RESA	2%	2%	2%	2%	2%
Average Energy Rate	$0.09153	$0.13493	$0.08865	$0.13298	$0.17729

As we look at the future, two new rationales have emerged for deploying TOU rates…

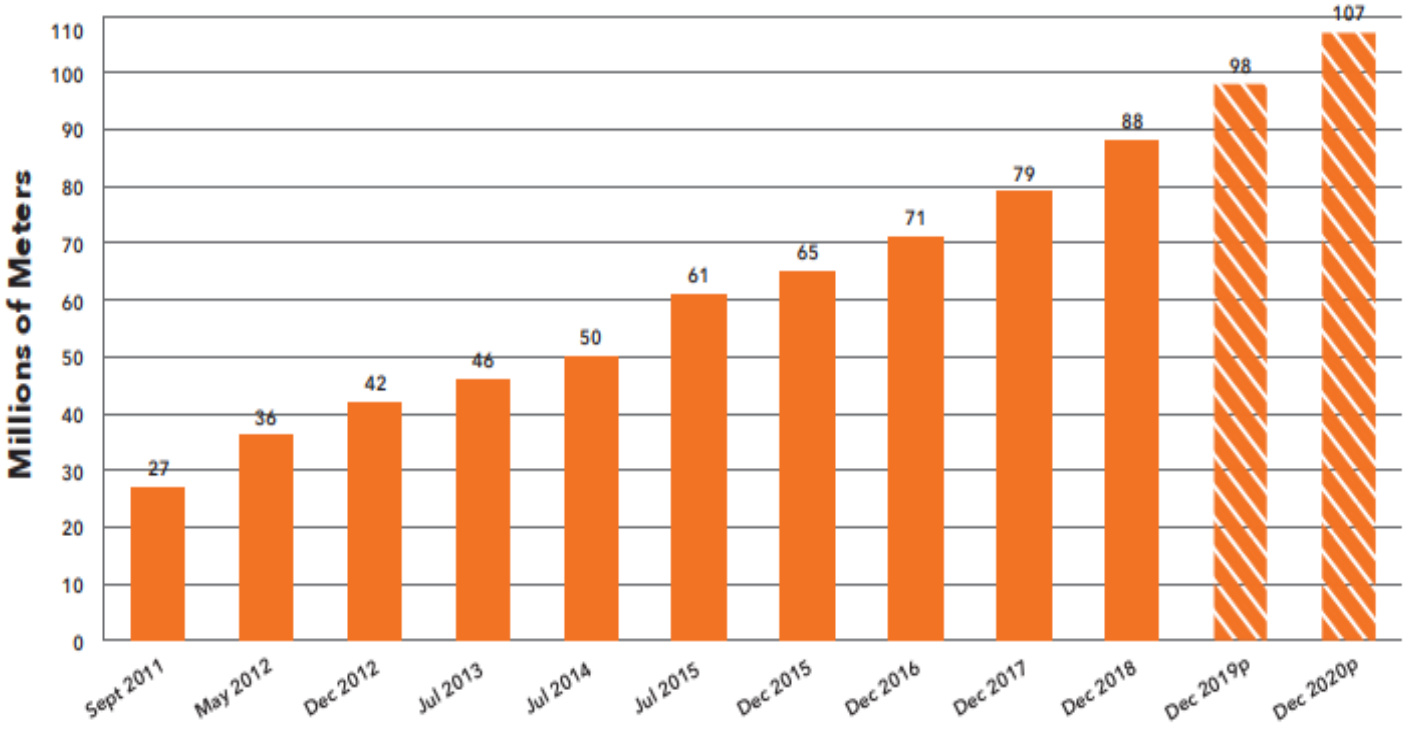
With increasing amounts of renewable energy resources coming into the grid, load flexibility enabled via TOU rates can preserve system reliability while ensuring lower costs for everyone

A new generation of customers has emerged with organic tastes; it wants to have better control over the impact of its energy life style on the climate of the planet

Many customers are acquiring EVs whose adoption and charging would benefit from the availability of TOU rates

…and a major barrier to TOU deployment has been lifted with the nationwide deployment of smart meters

Figure 1: U.S. Smart Meter Installations Approach 98 Million; Projected to Reach 107 Million by December 2020



Five steps for "bridging the chasm" between pilots and deployment

Step	Task
One	Design cost-reflective rates but make sure they are customer friendly; consider offering choices
Two	Learn how customers think and market the rates using the customer's language
Three	Educate the customers on how to benefit from the rates
Four	Use enabling technologies and behavioral messaging to enhance the price signal
Five	Transition gradually and consider providing bill protection

The total number of customers on TOU rates is likely to triple by 2025 but it will still be <15% of the national total

California is likely to have more than 10 million customers on default TOU rates

Colorado may have some 1.5 million customers on default TOU rates

Michigan may have 2 to 3 million customers on default TOU rates

Other states such as Georgia, Maryland and Missouri may add a million or two customers on opt-in TOU rates

TOU rates will lay the foundation for the universal deployment of technology-enabled real-time pricing

Driven by legislation to decarbonize the grid, commissions are directing utilities to rapidly increase the share of renewable energy resources

As wind and solar begin to dominate the resource mix, the grid will face unprecedented reliability issues due to the intermittency of these resources

Load flexibility, enabled by technology-enabled real-time pricing, will become an imperative as will battery storage systems

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Ahmad Faruqui is an internationally recognized authority on the design, evaluation and benchmarking of tariffs. He has analyzed the efficacy of tariffs featuring fixed charges, demand charges, time-varying rates, inclining block structures, and guaranteed bills. He has also designed experiments to model the impact of these tariffs and organized focus groups to study customer acceptance. Besides tariffs, his areas of expertise include demand response, energy efficiency, distributed energy resources, advanced metering infrastructure, plug-in electric vehicles, energy storage, inter-fuel substitution, combined heat and power, microgrids, and demand forecasting. He has worked for nearly 150 clients on 5 continents, including electric and gas utilities, state and federal commissions, governments, independent system operators, trade associations, research institutes, and manufacturers.

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MI POWER GRID

Making the Most of Michigan's Energy Future

Energy Programs & Technology Pilots
Closing Comments

Stakeholder Meeting 2

April 16, 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. Time TBD.
      - April 30
      - May 14
      - May 28
      - June 11

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!