



SMART GRID INVESTMENT GRANT

CONSUMER BEHAVIOR STUDY ANALYSIS

Summary of Utility Studies

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Presentation Overview

- **Objectives and Approach**
- Details of CBS Projects
- Summary and Conclusions



Background on Smart Grid Investment Grant's Consumer Behavior Studies

- The U.S. DOE's Smart Grid Investment Grant (SGIG) program includes projects studying the response of mass market consumers (i.e., residential and small commercial customers) to time-based rate programs
- DOE is seeking to apply a consistent study design and analysis framework for these Consumer Behavior Studies (CBS)
- The goal is to conduct comparative analysis of the impacts of AMI, time-based rate programs and enabling technologies that facilitate customer control, automation and information/feedback on customer energy usage



DOE Requirements of CBS Projects

- DOE is requiring the ten utilities undertaking such Consumer Behavior Studies to apply randomized controlled experimental methods in their studies
- Meter and demographic data about the customers included in the studies is being collected for the sake of understanding how accurately the estimated effects can be extrapolated to broader populations
- DOE has encouraged consistency in the research topics included in each of the CBS projects in order to increase the depth of knowledge that will be garnered from these studies





List of Study-Related Acronyms

- **CPP: Critical Peak Pricing**
- **CPR: Critical Peak Rebate**
- **TOU: Time-of-Use**
- **VPP: Variable Peak Pricing**
- **IHD: In-home Display**
- **PCT: Programmable Communicating Thermostat**
- **RCT: Randomized Control Trial**
- **RED: Randomized Encouragement Design**
- **WS: Within-Subjects**



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Oklahoma Gas & Electric (OG&E)

Utility Overview

OG&E is a summer peaking investor-owned electric utility with ~756,000 customers in its ~30,000 square mile service territory that covers large parts of Oklahoma and western Arkansas.

Study Participants

AMI-enabled residential and small commercial customers in parts of Norman and Oklahoma City, OK.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP	●	IHD	●
TOU	●	PCT	●
VPP	●	Web	●
CPR		Ed	



Marblehead Municipal Light Department (MMLD)

Utility Overview

MMLD is a summer peaking municipal electric utility with ~10,000 customers (90% are residential) in its 4.5 square mile service territory that covers this coastal suburb north of Boston, MA.

Study Participants

Residential customers throughout the entire service territory.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP	●	IHD	
TOU		PCT	
VPP		Web	
CPR		Ed	



Sacramento Municipal Utility District (SMUD)

Utility Overview

SMUD is a summer peaking municipal electric utility with ~600,000 customers in its ~900 square mile service territory that covers the Sacramento, CA metropolitan area.

Study Participants

AMI-enabled residential customers throughout the entire service territory.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	●
Rate		Non-Rate	
CPP	●	IHD	●
TOU	●	PCT	
VPP		Web	
CPR		Ed	



Detroit Edison Company (DECo)

Utility Overview

DECo is a summer peaking investor-owned electric utility with ~2.1 million customers in its ~7,600 square mile service territory that covers Detroit, MI and its environs

Study Participants

AMI-enabled residential customers with at least six months historical interval meter data prior to recruitment; customers who use more electricity and have higher incomes than the average DECo customer.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP	●	IHD	●
TOU	●	PCT	●
VPP		Web	
CPR		Ed	



Cleveland Electric Illuminating Company (CEI)

Utility Overview

CEI, a FirstEnergy company, is a summer peaking investor-owned utility with ~750,000 customers in its ~1,680 square miles service territory that covers Cleveland, OH and its environs

Study Participants

AMI-enabled residential customers in the suburbs east of Cleveland, OH.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP		IHD	●
TOU		PCT	●
VPP		Web	
CPR	●	Ed	



Green Mountain Power (GMP)

Utility Overview

GMP is a summer peaking investor-owned electric utility with ~250,000 customers in its service territory that covers most of Vermont.

Study Participants

AMI-enabled residential customers in Rutland, VT; a county with a slightly older and lower-income population than the rest of the state.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP	●	IHD	●
TOU		PCT	
VPP		Web	
CPR	●	Ed	



Lakeland Electric (LE)

Utility Overview

LE is a winter peaking municipal electric utility with ~120,000 customers in its ~260 square mile service territory that covers the city of Lakeland, FL.

Study Participants

AMI-enabled residential customers throughout the service territory.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	●
Rate		Non-Rate	
CPP		IHD	
TOU	●	PCT	
VPP		Web	
CPR		Ed	



Minnesota Power (MN Power)

Utility Overview

MN Power is a winter peaking investor-owned electric utility with ~145,000 customers in its ~26,000 square mile service territory that covers central and northeastern Minnesota.

Study Participants

Residential customers in the Duluth and Hermantown areas for both phases of the study; an area with a slightly older and higher-income population than the rest of the state.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP	●	IHD	
TOU	●	PCT	
VPP		Web	●
CPR		Ed	



Vermont Electric Cooperative (VEC)

Utility Overview

VEC is a winter peaking electric cooperative with ~34,000 customers in its ~2,100 square mile service territory that covers northern Vermont.

Study Participants

Residential customers throughout the service territory.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP		IHD	
TOU		PCT	
VPP	●	Web	
CPR		Ed	



Nevada Energy (NVE)

Utility Overview

NVE is a summer peaking investor-owned electric utility with ~2.4 million customers in its ~46,000 square mile service territory.

Study Participants

AMI-enabled residential customers in both its northern Nevada (i.e., Sierra Pacific Power or SPP) and southern Nevada (Nevada Power or NVP) service territories.

Study Elements

Enroll		Enroll	
Opt-In	●	Opt-Out	
Rate		Non-Rate	
CPP	●	IHD	
TOU	●	PCT	●
VPP		Web	
CPR		Ed	●



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Enrollment Approaches Used in Studies

	Opt-In	Opt-Out
Cleveland Electric Illuminating Co.	●	
Detroit Edison	●	
Green Mountain Power	●	
Lakeland Electric	●	●
Marblehead Municipal	●	
Minnesota Power	●	●
NV Energy – Nevada Power	●	
NV Energy – Sierra Pacific Power	●	
Oklahoma Gas & Electric	●	
Sacramento Municipal	●	●
Vermont Electric Cooperative	●	
TOTAL	11	3

- All 11 utility studies include some form of opt-in enrollment approach
- 3 studies augment this with an opt-out enrollment approach



Rate Treatments Included in Studies

	CPP	TOU	VPP	CPR
Cleveland Electric Illuminating Co.				●
Detroit Edison	●	●		
Green Mountain Power	●			●
Lakeland Electric		●		
Marblehead Municipal	●			
Minnesota Power	●	●		
NV Energy – Nevada Power	●	●		
NV Energy – Sierra Pacific Power	●	●		
Oklahoma Gas & Electric	●	●	●	
Sacramento Municipal	●	●		
Vermont Electric Cooperative			●	
TOTAL	8	7	2	2

- **8 studies implementing CPP; 6 of them have a CPP overlaid on a TOU**
- **1 study looking at both CPP & CPR**
- **2 studies using different forms of VPP**



Non-Rate Treatments Included in Studies

	IHD	PCT	Education	Web
Cleveland Electric Illuminating Co.	●	●		
Detroit Edison	●	●		
Green Mountain Power	●			
Lakeland Electric				
Marblehead Municipal				
Minnesota Power				●
NV Energy – Nevada Power		●	●	
NV Energy – Sierra Pacific Power		●	●	
Oklahoma Gas & Electric	●	●		
Sacramento Municipal	●			
Vermont Electric Cooperative				
TOTAL	5	5	2	1

- 3 studies included both IHDs and PCTs
- 2 studies developed an education curriculum

