

# Memorandum

 To: Jonathon Jackson and Kim Ballard, Ameren Illinois Company; Jennifer Morris, Illinois Commerce Commission
 From: Olivia Patterson, Seth Wayland and Hannah Arnold, Opinion Dynamics

Date: September 22, 2016

Re: Research Design to Assess Behavior Persistence

This memo outlines the research approach required to assess persistence for the Ameren Illinois Company (AIC) Behavior Modification Program.

### **Program Description**

AIC developed the Behavioral Modification program to reduce its residential customers' energy consumption primarily through opt-out delivery of home energy reports to program participants. OPower implements the program, which launched in August 2010. The program is jointly funded through AIC (8-104) and the IPA.

The Behavioral Modification Program reached about a third of AIC's approximately 1 million residential customers in PY8, and nearly 320,000 participants received reports (including both dual-fuel and gas-only customers), the majority of whom are in their fifth year with the program (Table 1).

Cohort Name	Fuel Type	Number of Treated Customers in PY8	Start Date	Program Year
Original Cohort	Dual-Fuel	37,243	August 2010	6th year in the program
Expansion Cohort 1	Dual-Fuel	56,788	April 2011	5th year in the program
Expansion Cohort 2	Dual-Fuel	85,893	November 2011	5th year in the program
Expansion Cohort 3	Gas-Only	13,621	November 2011	5th year in the program*
Expansion Cohort 4	Dual-Fuel	25,506	June 2013	3rd year in the program
Expansion Cohort 5	Dual-Fuel	62,996	September 2014	2nd year in the program
Expansion Cohort 6	Dual-Fuel	37,800	April 2015	2nd year in the program
	Total	319,847		

Table 1. Approximate Behavioral Modification Program Participation in PY8

\* Expansion Cohort 3 (the gas-only cohort) stopped receiving program offerings in April 2012 and resumed receiving reports in April 2013. This cohort continued receiving treatment in PY6 through PY8.

Below we discuss how to estimate persistence of program related savings after discontinuing program treatment by stopping delivery of home energy reports (both paper and email), as well as removing portal access.

## Study Objectives

This study seeks to address an important issue for behavioral programs, which is whether energy savings from these programs continue after discontinuing reports to participants. Further, it will serve as a utility specific input for the Illinois Statewide Technical Reference Manual (IL-TRM) cross-cutting behavioral measure for calculating first-year savings, measure life, and cost-effectiveness results.

Persistence rate studies are critical to understanding whether and how savings degrade in the absence of a program intervention and providing accurate lifetime savings results. The potential AIC persistence study will seek to answer the following research questions:

- Primary research question: What are the gas and electric savings<sup>1</sup> persistence ratios<sup>2</sup> for customers experiencing a stoppage in treatment?
- What is the difference in savings persistence between customers who have received the reports for different durations?<sup>3</sup>
- What is the difference in savings persistence between customers who have different savings levels?

Specifically, the persistence analysis will address the effect of a treatment stoppage on energy savings. Our hypothesis is that the treatment group experiencing a discontinuation of reports will show measurable reduction in savings in the first year after reports are stopped, compared to an equivalent group of customers who continue to receive reports.

### **Research Design**

The analysis will focus on estimating persistence by fuel type. It will also assess persistence by cohort (which can help provide inputs related to duration of treatment) and savings group (from the multilevel modeling effort). We will use statistical analysis of energy use from customer bills to determine the persistence of energy impacts.

#### **Power Analysis**

We performed a power analysis<sup>4</sup> to assess the required sample size needed to separately measure persistence of gas and electric savings for the Behavioral Modification Program. For this analysis, we assumed that the sample sizes for each cohort will be equal, and that the number of participants who have their treatments continued (the control group) will be approximately five times the number of participants who have their treatment stopped (the treatment group). Table 2 contains the sample requirements.

Table 2. Recommended Number of Participants with Stopped and Continued Treatment by Cohort

Cohort	Stopped Treatment Group (n)	Continued Treatment Group (n)		
Original Cohort	5,000	32,243		

#### opiniondynamics.com

<sup>&</sup>lt;sup>1</sup> Studies suggest that there may be differences in persistence based on fuel type (i.e., gas or electric). A study should test savings persistence for participants at the same program maturity (i.e., same duration of treatment) for electric and gas.

<sup>&</sup>lt;sup>2</sup> We define savings persistence as the ratio of savings for customers experiencing a *stoppage* in treatment to the savings for those who continue to receive regular treatment.

<sup>&</sup>lt;sup>3</sup> Studies indicate that the duration of treatment has implications on persistence. For example, a study that stopped treatment after 6 months of reports resulted in a precipitous decline in savings, whereas studies that stopped treatment after two years resulted in smaller declines in savings.

<sup>&</sup>lt;sup>4</sup> We used *Measurement and Verification Principles for Behavior-Based Efficiency Programs*. The Brattle Group. May 31, 2011 as the source for our calculation methodology.

Cohort	Stopped Treatment Group (n)	Continued Treatment Group (n)		
Expansion Cohort 1	5,000	51,788		
Expansion Cohort 2	5,000	80,893		
Expansion Cohort 4	5,000	20,506		
Expansion Cohort 5	5,000	57,996		
Expansion Cohort 6	5,000	32,800		
Total	30,000	276,226		

The power analysis assumes we will use monthly consumption data within the impact analysis. We considered multiple scenarios based on (a) the effect size (persistence) and (b) un-modeled variation in energy usage (reflected in the normalized standard error of savings).<sup>5</sup> We designed the power analyses to detect a 0.90 or smaller persistence ratio with 80% statistical power at a 90% statistical confidence level for both electric and gas. We assume a normalized standard error of 0.1, based on information from prior studies. For each cohort, the sample size is sufficient to detect a persistence rate of 0.8 or smaller with 80% statistical power at a 90% statistical confidence level.<sup>6</sup>

### **Study Execution**

Opinion Dynamics will identify a random sample of treatment customers who will stop receiving HERs and eHERs in PY10 We will provide this list of customers to AIC and OPower. OPower will then discontinue delivery of HERs and eHERs for those customers, continuing reports and portal access as usual for the rest of the participants in each wave, and maintaining the original control groups in an untreated state without HERs, eHERs, and portal access. When we perform the randomization, we will insure that the continued treatment group and the discontinued treatment group are equivalent, checking gas and electric consumption, location, duration and type (HER vs eHER) of treatment, and third-party household information.

Six months after report and portal stoppage for the selected participants, Opinion Dynamics will work with AIC and OPower to insure that stoppage actually occurred for those participants and the experimental design has been followed. If this is not the case, we will work with AIC and OPower to correct any disparity.

#### Impact Estimation Approach

We will estimate the effects of the discontinuation of reports (e.g., persistence of savings over time) by conducting regression analyses of billing data and applying results from these regressions for those customers who continue to receive reports and those who have stopped receiving reports. Notably, we will use the same model specifications for this analysis as we do for each evaluation cycle (original model, weather adjusted, lagged dependent variable model)<sup>7</sup> in addition to any new models we develop specifically for calculating persistence. This assessment will not include a channeling analysis to remove participant savings for those customers who participated in other program efforts since the channeling adjustment has historically been

<sup>&</sup>lt;sup>5</sup> The normalized standard error is a measure of variance in the data that is normalized by the associated mean of the measure of interest, calculated as the ratio of the standard error to the mean. A higher normalized standard error reflects more variation.

<sup>&</sup>lt;sup>6</sup> We based our effect size based on the persistence among studies of similar programs (see attached Appendix A). The current IL TRM value suggests a persistence factor of 82% for electric customers, and 45% for gas customers.

<sup>&</sup>lt;sup>7</sup> For more information, refer to PY8 Evaluation Plan.

very small, and there is unlikely to be any measurable difference in channeling between the continuing and stopped participants.

#### Next Steps

We suggest pursuing the following activities to support the recommended research design and implementation strategy:

- Meet with AIC to finalize strategy and core research objectives
- Provide list of randomized customers to AIC, Leidos and OPower for implementation of the persistence study
- Meet six months through the program period to verify that these customers are no longer receiving treatment
- Conduct study of effects in PY11

## Appendix A. Reference Documents

The following table was sourced from the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0 Volume 4: Cross-Cutting Measures and Attachments, Final, February 11th, 2016.

Persistence: Reference Studies <sup>8</sup>								
Utility/Location	Frequency of Reports when in program	Number of Months in Program Before Terminated	Number of Post- Treatment Savings Analysis Months	Average Annual savings decay	Persistence (= 100% - decay)	Source	Electric or Gas	
Upper Midwest	Monthly & quarterly	24-25	26	21%	79%	1	Electric	
West Coast	Monthly & quarterly	24	29	18%	82%	1	Electric	
West Coast	Monthly & quarterly	25-28	34	15%	85%	1	Electric	
SMUD	Monthly & quarterly	27	12	32%	68%	1	Electric	
Puget Sound Energy	Monthly & quarterly	24	36	11%	89%	1	Electric	
MASS	Monthly & quarterly	26	15	33%	67%	2	Electric	
Illinois (ComEd)	Bimonthly	52	12	4%	96%	3	Electric	
Illinois (ComEd)	Bimonthly	30	12	2%	98%	3	Electric	
Illinois (ComEd)	Bimonthly	16	12	22%	78%	3	Electric	
Average Annual Electric Savings Persistence:					82%			
MASS	Monthly & quarterly	15	17	64%	36%	2	Gas	
Illinois (Nicor)	Bimonthly	12	12	46%	54%	4	Gas	
Average Annual Gas Savings Persistence:					45%			

### Table 3: Reference Persistence Studies

Sources:

1: <u>http://www.cadmusgroup.com/wp-content/uploads/2014/11/Cadmus\_Home\_Energy\_Reports\_Winter2014.pdf</u> 2: <u>http://ma-eeac.org/wordpress/wp-content/uploads/Home-Energy-Report-Savings-Decay-Analysis-Final-Report1.pdf</u>

<sup>&</sup>lt;sup>8</sup> These persistence studies done to date capture effects only through a limited time frame and only for the specific program characteristics of the study programs. They may not accurately represent conditions in Illinois or those for all Illinois programs. It is recommended that this protocol continue to be updated as further longer term and Illinois-specific evaluations are undertaken.

3:http://ilsagfiles.org/SAG\_files/Technical\_Reference\_Manual/Version\_5/Sources/Nicor\_Gas\_HER\_Persistence\_Study\_Part\_2\_DRAFT\_20 16-01-28.pdf 4:http://ilsagfiles.org/SAG\_files/Technical\_Reference\_Manual/Version\_5/Sources/ComEd\_HER\_Opower\_Persistence\_and\_Decay\_

4:http://ilsagfiles.org/SAG\_files/Technical\_Reference\_Manual/Version\_5/Sources/ComEd\_HER\_Opower\_Persistence\_and\_Decay\_ Study\_DRAFT\_2016-01-28.pdf