SMARTPHONE BEHAVIOR APPLICATION: ELECTRIC SAVINGS 2017 CALIBRATION

PRESENTATION ON WHITE PAPER FOR THE MICHIGAN ENERGY MEASURES DATABASE

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The evaluation team (Navigant) recommends including a single-family and multi-family electric savings rate of 1.63% for the smartphone behavior app in the 2017 MEMD.
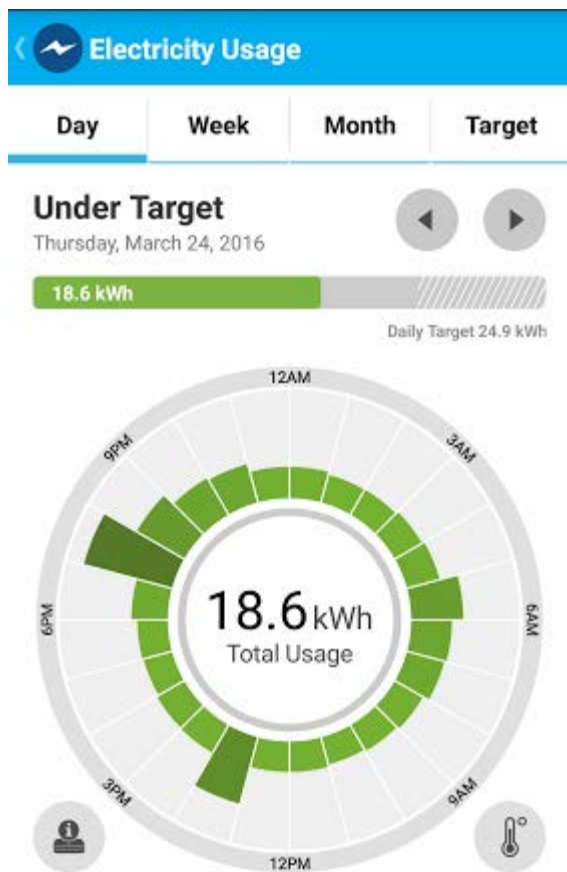

Source: DTE Energy

The DTE Insight app first became available for download in July 2014. Electric savings from the smartphone behavior app were accepted as a new measure in the weather-sensitive portion of the 2016 Michigan Energy Measures Database (MEMD). Compared to the new measure submission, this calibration includes customers who have had the smartphone behavior app for at least one year.

Based on the calibration analysis results, the evaluation team recommends including a single-family and multi-family electric savings rate of 1.63% for the smartphone behavior app in the 2017 MEMD.

The calibration analysis included 11,178 customers who downloaded the app between July and December 2014 and included data for the first 12 months after each customer downloaded the app in our analysis. However, not every customer had 12 bills in this 12 month period.

Post Program Period Bills
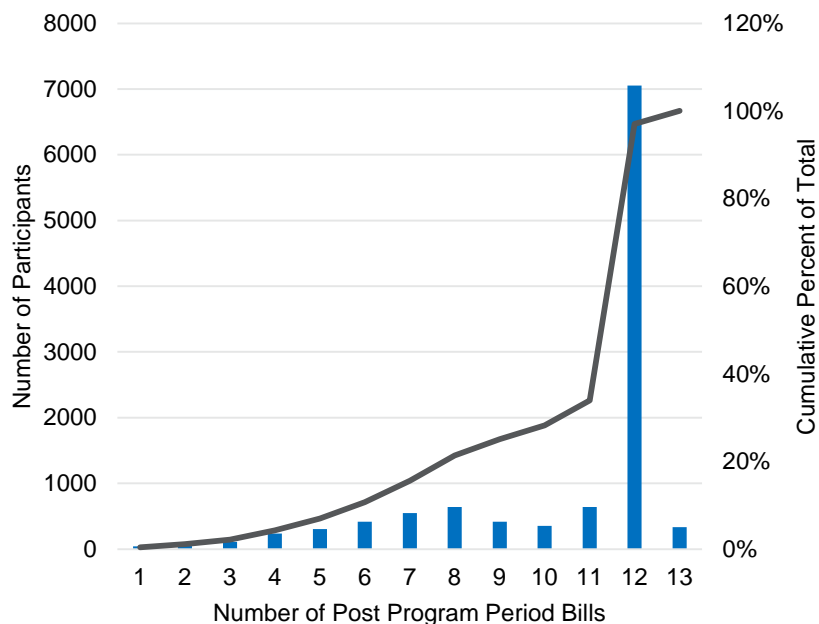
Source: Navigant analysis of customer billing data

- 7,052 (63%) of the customers had 12 post program period bills in our analysis.

- 8,376 (75%) of the customers had 10 or more bills.

There are three reasons a customer would not have 12 bills in a 12 month period:

1. A billing anomaly where a customer received, for example, 11 bills covering a 12 month period

2. A relocation where the customer moved out of their home during the 12 month period after they downloaded the app and thus only had bills in the analysis up until they moved

3. The customer installed the real time data add-on to the smartphone app and bills after the installation were dropped from this app only analysis; any bills that occurred after a customer installed the real time data add-on to the smartphone app were dropped so that the estimate in this analysis represents savings from the app alone

Navigant kept customers that fall in these categories in the analysis to avoid biasing the savings estimate by only including certain groups in the analysis, such as those who do not move in the one year period after downloading the app or those who do not install the real time data add-on. Keeping these customers in the analysis results in an accurate, unbiased estimate of the savings from the smartphone app for the population of interest.

As with the original MEMD submission, Navigant selected the control group matches by identifying the non-participant that had the closest electric use to the participant in the 12 months before the participant joined the program.
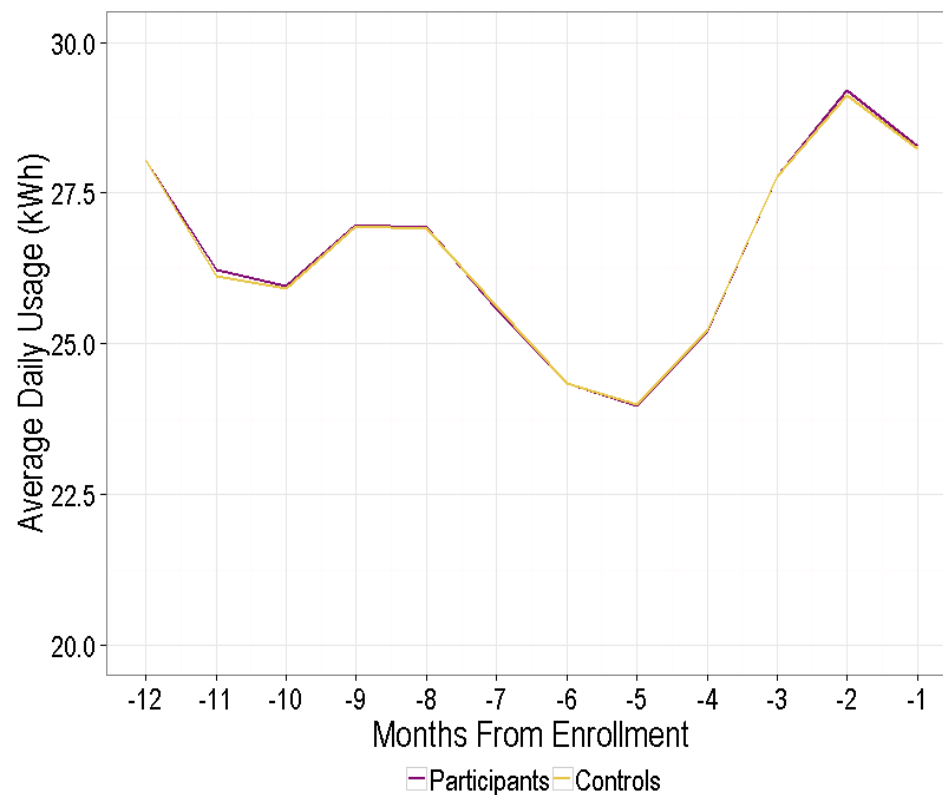
If two customers (match and participant) have very similar electric use profiles in the 12 months before a program begins, then the match will provide a good approximation of the participant's counterfactual electric use during the program period.

The average percent difference in electricity usage (participants minus matched controls) between the two groups across the 12 months was -0.4%.

An evaluation protocol report authored at Lawrence Berkeley National Laboratory cites this approach as a reasonable alternative to establishing baseline conditions when the "gold standard" of program evaluations, an experimental design, is not an option.[1]

Matching Results

Source: Navigant analysis of customer billing data
This includes the 11,178 participants and 10,233 unique matched controls

[1] State and Local Energy Efficiency Action Network. 2012. Evaluation, Measurement and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations. Prepared by A. Todd, E. Stuart, S. Schiller, and C. Goldman, Lawrence Berkeley National Laboratory.

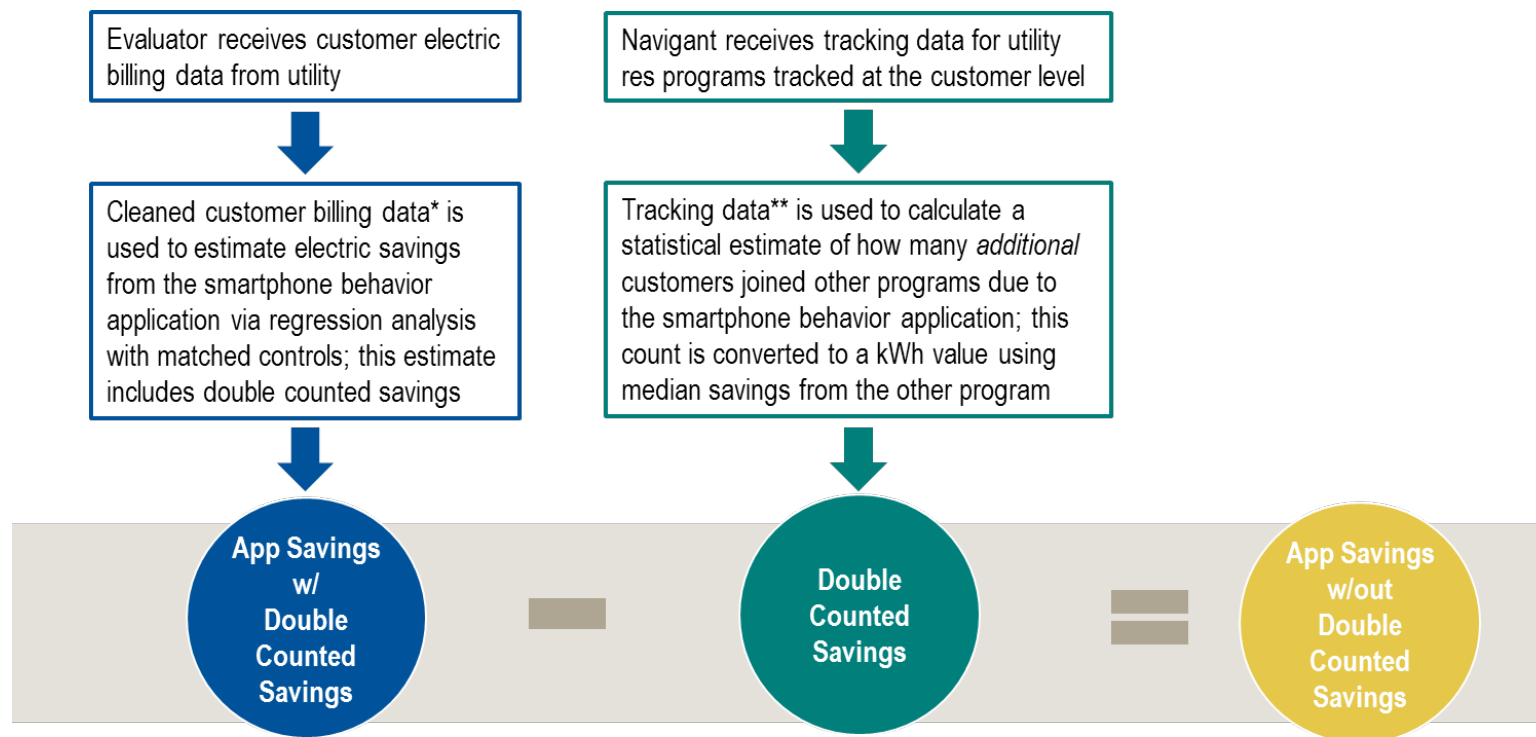Navigant conducted analysis using two regression models to estimate daily per participant electric savings for the smartphone app using the participants and matched controls. Running both models acts as a robustness check on the estimate of savings.

Approach 1 Regression with Pre-Program Matching (RPPM)	Approach 2 Matching with Bias Correction (MBC)
The first approach follows Ho et al. (2007), who argue that matching a comparison group to the treatment group is a useful "pre-processing" step in a regression analysis to assure that the distributions of the covariates (i.e., the explanatory variables on which the output variable depends) for the treatment group are the same as those for the comparison group that provides the baseline measure of the output variable. This minimizes the possibility of model specification bias. The regression model is applied only to the post-treatment period, and the matching focuses on those variables expected to have the greatest impact on the output variable.	Matching with bias correction (MBC) was introduced by Abadie and Imbens (2011). In this model, the effect of the program in month t is the difference between the energy use of participant k and their estimated counterfactual (baseline) consumption. The estimated counterfactual consumption is the average consumption of the matched household amended to reflect differences between participants and their matches in pre-period electric consumption and spatial location (i.e., zip code). The amendment of consumption and spatial location is based on a post-enrollment regression equation involving matched comparison customers only.

Source: Navigant

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If the smartphone app drives customers into DTE's other energy efficiency programs, then the joint savings with those programs must be subtracted from the App in order to avoid double counting savings.

Evaluator receives customer electric billing data from utility

Navigant receives tracking data for utility res programs tracked at the customer level

Cleaned customer billing data* is used to estimate electric savings from the smartphone behavior application via regression analysis with matched controls; this estimate includes double counted savings

Tracking data** is used to calculate a statistical estimate of how many *additional* customers joined other programs due to the smartphone behavior application; this count is converted to a kWh value using median savings from the other program

App Savings w/ Double Counted Savings — **Double Counted Savings** = **App Savings w/out Double Counted Savings**

During the data cleaning process we remove customer bills (observations) that occur after a customers installs the real time data add-on. This ensures that our savings estimates captures savings from the app only and does not capture any savings from the real time data add-on.

Tracking data is included regardless of whether customer installed a real time data add-on. Meaning, **these joint savings capture channeling from the smartphone behavior application and from the real time data add-on to a smartphone behavior application.

This is the value recommended for inclusion in the MEMD.

Source: Navigant

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The estimate of average annual double counted savings per participant was approximately 6 kWh. This value was subtracted from the annual savings estimate shown earlier to account for double counting.
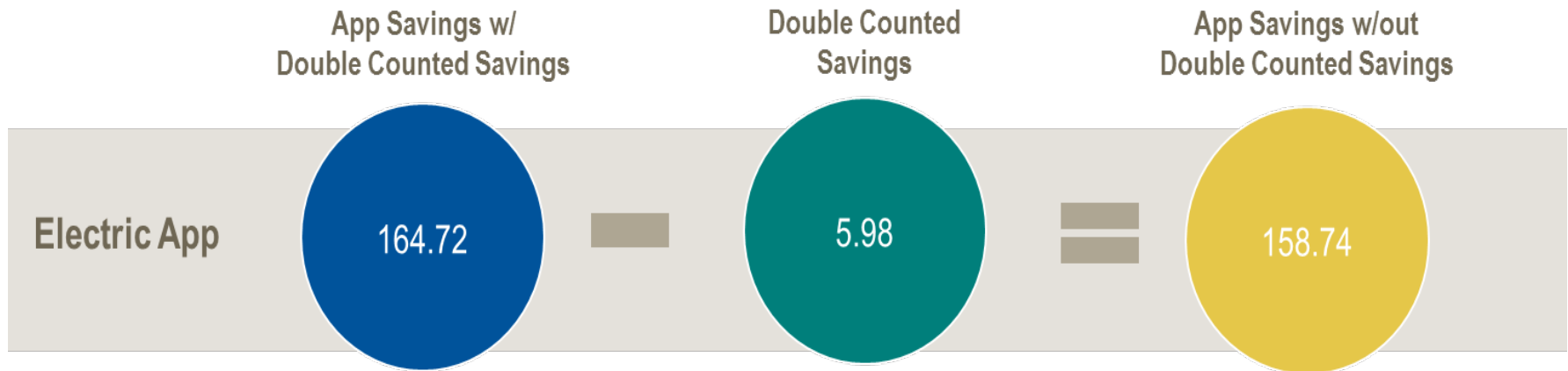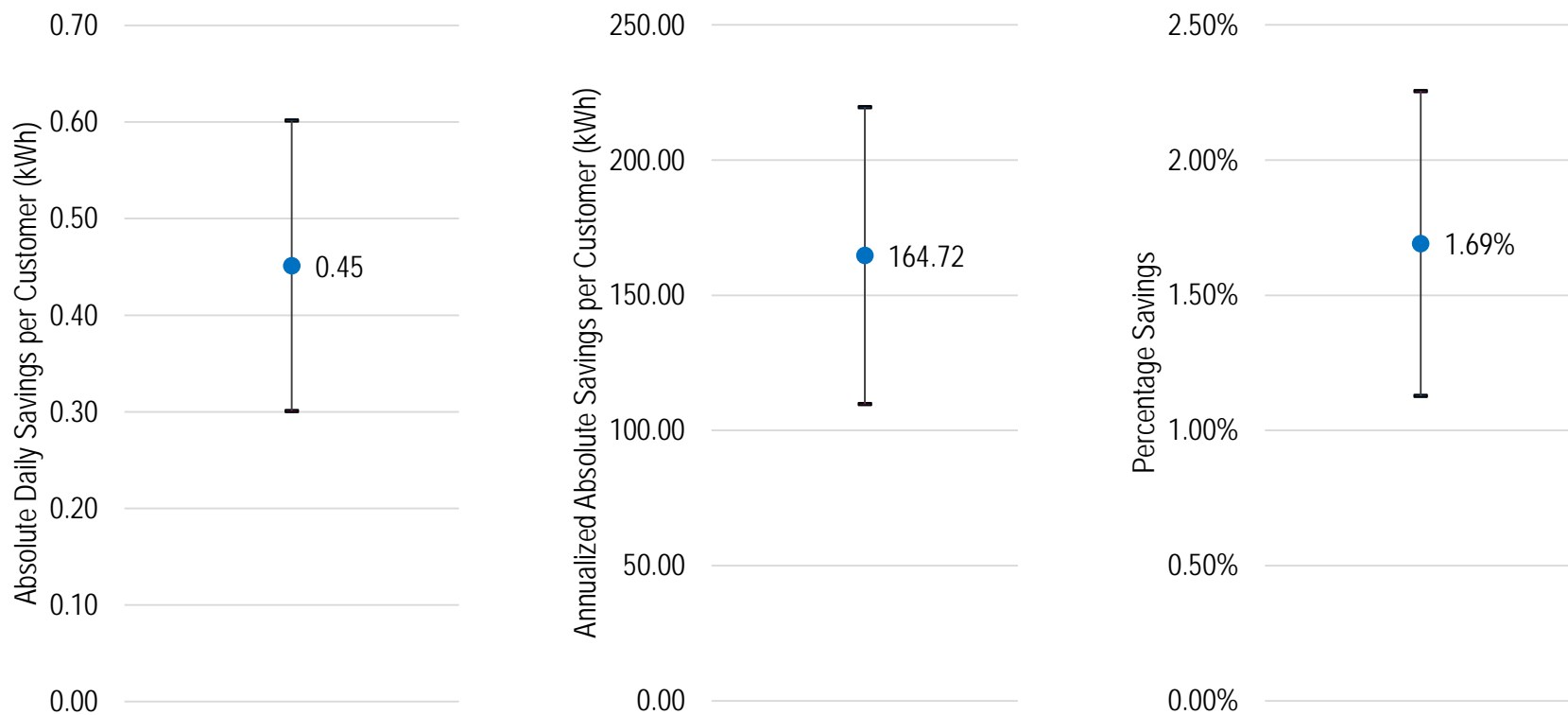

Source: Navigant analysis of customer billing and tracking data

Prior to adjusting for double counting, savings from the app were 1.69% or approximately 165 kWh per year.

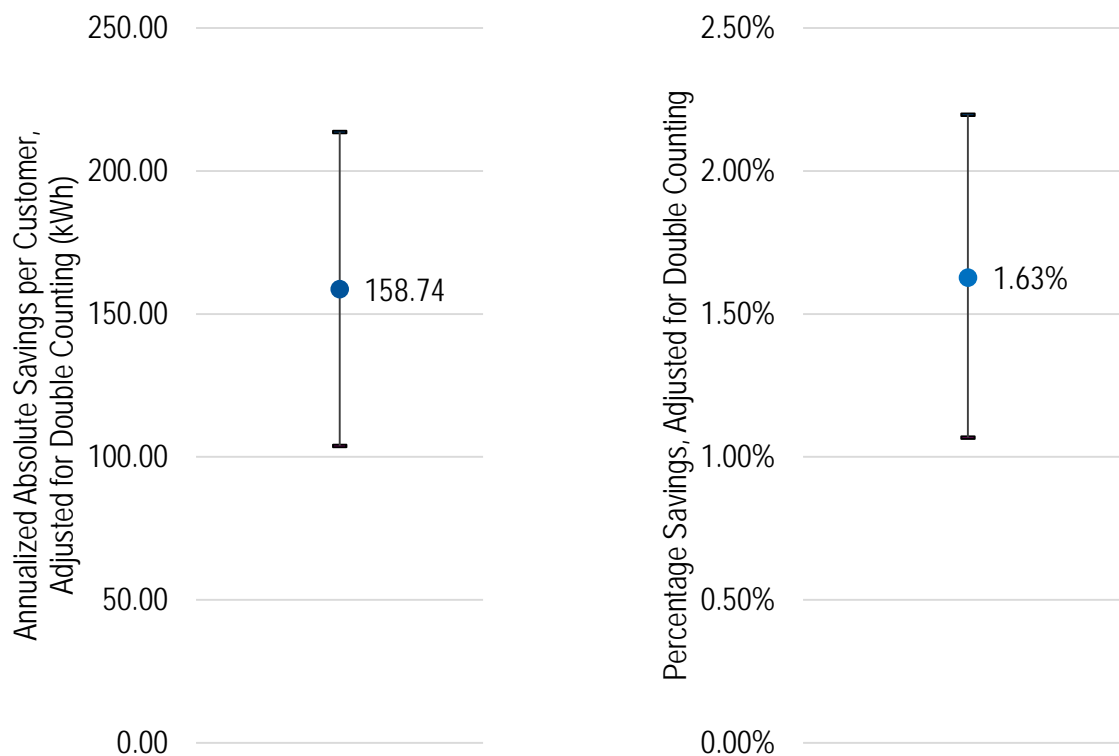### Electric savings from the smartphone app, prior to double counting adjustment

Source: Navigant analysis of customer billing data
Note: The error bounds in this figure show 90% confidence bounds which mean that if we pulled 10 samples from the same population we would expect our estimate of savings to fall within this range 9 out of 10 times.

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After the adjustment for double counting, savings from the app were 1.63% or approximately 159 kWh per year. Navigant recommends that the 2017 MEMD include a savings value of 1.63%.

Electric Savings from the smartphone app, after uplift adjustment

Source: Navigant analysis of customer billing and tracking data
Note: The error bounds in this figure show 90% confidence bounds which mean that if we pulled 10 samples from the same population we would expect our estimate of savings to fall within this range 9 out of 10 times.

The evaluation team recommends including a single-family and multi-family electric savings rate of 1.63% for the smartphone behavior app in the 2017 MEMD.

- The evaluation team recommends including single-family and multi-family electric savings of 1.63% for the DTE Insight App in the 2017 MEMD.

- Annual savings would be calculated using the formula below:

Annual Savings = Savings Rate

  x Number of Active Participants

  x Average Usage from Controls for the Prior Program Year

where:
  - the number of active participants is defined as electric or combo single or multi-family customers with AMI meters who download the app, linked the app to their DTE account, and had an active account with DTE on the last day of the program year
  - matched controls are defined as a group of non-participants selected for the control group using the matching method described on slide 4 of this presentation.

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The need for further calibration and the appropriate cadence of calibration will be determined through future discussions between DTE, Navigant, the Michigan Energy Optimization Collaborative, and other interested stakeholders.

- The savings value presented in this paper should be calibrated again for the 2018 MEMD as the smartphone app underwent significant changes in the release of version 2.0 early in 2016. The 2018 calibration will include all participants who have had the app for at least one year at that time and thus will include a larger sample than this analysis.

- Several reasons why the electric savings from the smartphone behavior app may change in future are captured in the table below.

Considerations	
Self-Selection Bias	Self-selection bias refers to the result that program savings are over- or under-estimated because participants behave differently than their matches due to unobservable factors that affect both the decision to participate *and* energy use. There is no way to control for self-selection bias in an opt-in program, which is why experimental design is considered the "gold standard". In the absence of an experimental design, matching represents one of the best available evaluation techniques for evaluating opt-in programs.
Seasonal Effects	Although this analysis is based on a full year of data for most participants, it is possible that savings will differ from what was estimated in this evaluation when weather differs from the conditions observed in the analysis period.
Savings Life Cycle	If savings ramp-up or down over time based on customer engagement with the smartphone behavior app, the deemed savings value may be an over- or under-estimate. Additionally, changes to the app may change engagement patterns and the ability of the app to drive savings.
Cohort Effects	If early adopters achieve higher or lower savings than those customers that download the smartphone behavior app later, the deemed savings value may be an over- or under-estimate.