



White Paper

The Gold Mine of Energy Efficiency Program Data

By Hassan Shaban, Haider Khan, and David Meisegeier, ICF

Shareables

- Utility energy efficiency program implementers can use program data to improve marketing, incentive structure, and operations of demand side management (DSM) programs.
- Data mining can help achieve 2–5 times lift in participation and more than 10% cost reduction for DSM programs.
- Real-time access to DSM program data allows continuous improvements to be made in a timely fashion.

Executive Summary

Data already collected for utility energy efficiency programs contain a wealth of information about program participants, buildings, equipment, energy efficiency measures, and expected savings. Such data are already being collected by utility energy efficiency programs for tracking and evaluation. Mining these datasets using machine learning and advanced analytics techniques has massive potential, as it can uncover useful but previously hidden insights, which can improve program design and delivery, customer targeting, and customer engagement. These improvements can lead to savings of up to 10%, or a 2–5 times increased adoption rate of the program. Delving deeper into the data can be used to improve an ongoing program with immediate results rather than waiting for a post-program analysis to improve subsequent iterations of the program.

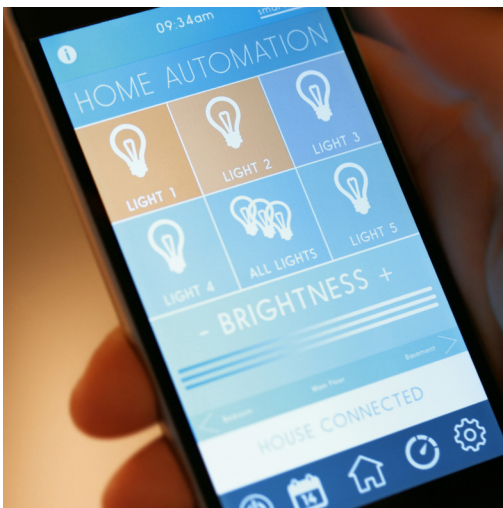
The Gold in Your Databases

Demand side management (DSM) programs collect a significant amount of information about their participants in order to check their eligibility to participate, track pre-retrofit and post-retrofit conditions, estimate savings, calculate incentives, and so on (Exhibit 1). The number of data points collected about each participant can range from a handful for simple prescriptive programs to several hundred for programs that involve an energy audit component.

Such data typically lie dormant in databases or collections of spreadsheets. Not any longer! ICF has been successful at extracting new insights and trends to improve the efficiency of our implementation programs as well as those of our utility clients.

EXHIBIT 1: DATA POINTS COLLECTED BY UTILITY DSM PROGRAMS SORTED BY THEIR AVAILABILITY

Typically Available	Sometimes Available	Rarely Available
Customer information, especially location	Smart meter data	Customer demographic/ firmographic information
Monthly billing data (gas/electric)	General building characteristics	Usage data for other fuels/ water
Baseline equipment/ pre-retrofit details	Usage/occupancy patterns	
Efficient equipment/ post-retrofit details		



Three Ways to Use DSM Program Data Effectively

Targeted Marketing

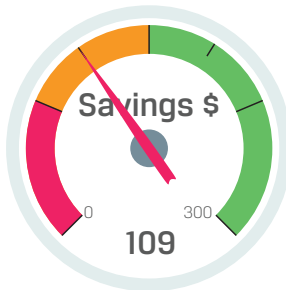
Marketing efforts benefit tremendously from the insights revealed by mining DSM program data by identifying participants who simultaneously satisfy two conditions: (1) they have a high propensity to participate in DSM programs and (2) they have a large potential for energy-savings opportunities. Demographic and firmographic data allow the analysis of propensity to participate in DSM programs. Moreover, historical program participation results can be used to correlate customer and/or building characteristics to their savings potential using statistical or machine learning techniques.

ICF recently demonstrated¹ how data collected in residential Home Performance programs can be used to provide a quick estimate of the potential financial benefits that could be identified through a comprehensive home energy audit. ICF applied machine learning algorithms to a DSM program dataset from one of ICF's major utility accounts comprising building characteristics and energy audit results for almost 10,000 homes. These algorithms were packaged as a web application aimed at residential customers who are considering participating

¹ Mining Energy Efficiency Program Data, ACEEE Summer Study on Energy Efficiency in Buildings, August 21–26, 2016, Pacific Grove, California.

in a home improvement program, informing them of the financial benefits of undergoing an energy audit (Exhibit 2).

EXHIBIT 2: MINING DSM PROGRAM DATA CAN HELP CUSTOMERS ESTIMATE THE VALUE OF PARTICIPATING IN THESE PROGRAMS.



Homes similar to yours have been assessed **\$109** on average and up to **\$271** in annual energy savings, when they underwent an energy audit.

Most of the recommended measures for similar homes involved using **better efficiency appliances**. Check out potential savings and rebate programs related to this end used [here](#).

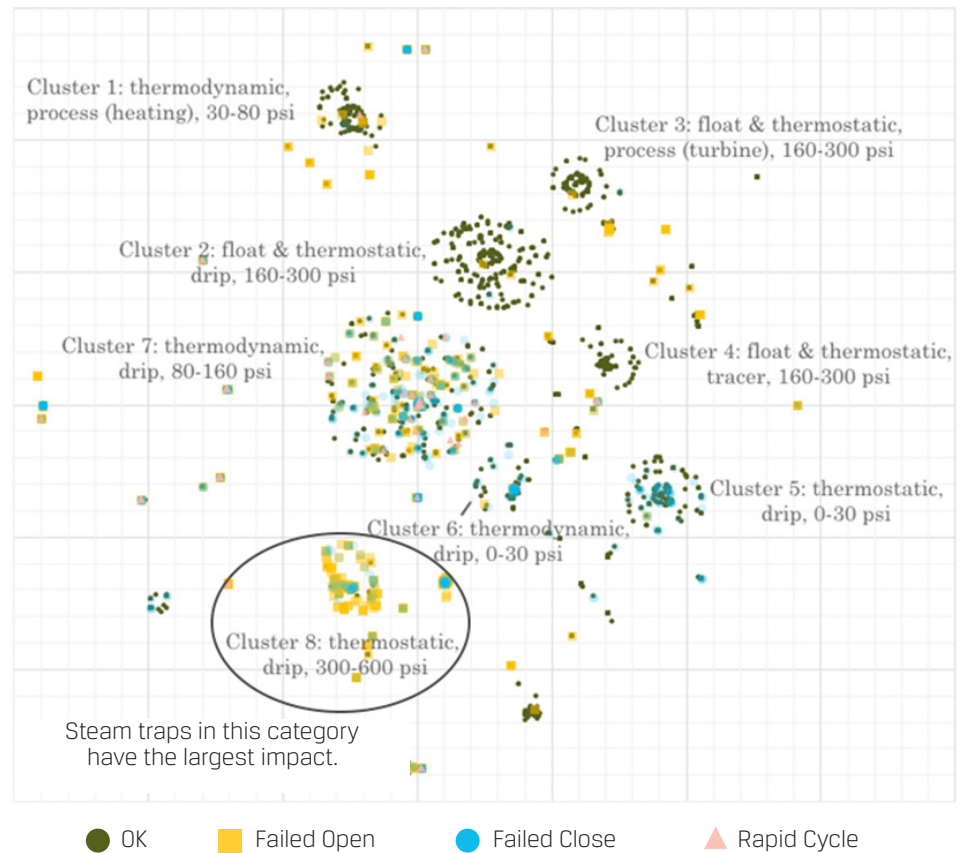


Source: Mining Energy Efficiency Program Data, ACEEE Summer Study on Energy Efficiency in Buildings, August 21–26, 2016, Pacific Grove, California

Optimized Incentive Structure

It is possible to mine extremely valuable insights to improve program cost effectiveness from survey data that were collected primarily for tracking savings in an industrial steam trap replacement program for a major West Coast utility. Rather than paying a uniform incentive for replacing a steam trap, we identified a particular category of steam traps (down to the application, pressure, type, and size) that always fail in an open position, leading to huge energy losses (Exhibit 3). Those types of traps could be prioritized in the program either by building customer awareness about the dramatic consequences of their failure or by focusing incentives on these types of traps, leading to improved program cost effectiveness.

EXHIBIT 3: IDENTIFYING SAVINGS POTENTIAL FOR SPECIFIC EQUIPMENT CATEGORIES ALLOWS OPTIMIZATION OF THE INCENTIVE STRUCTURE.

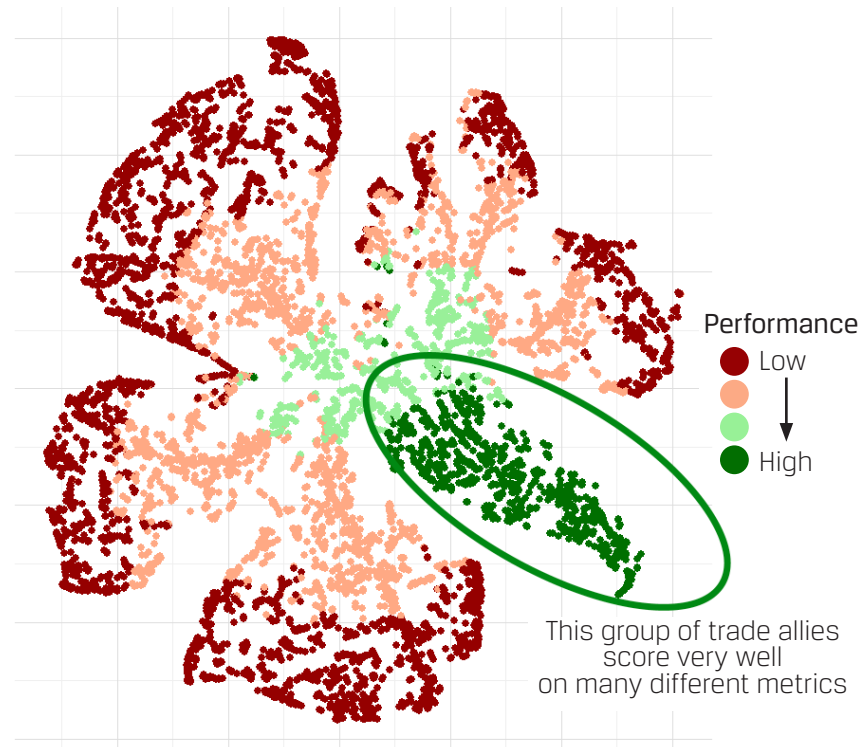


Source: Analysis of steam trap survey data, Technical Report, ICF, 2015

Improved Operational Efficiency

Using advanced data visualization techniques to analyze the trade allies network for an ICF client's DSM portfolio allowed the data analysts and trade ally managers to quickly identify a "super group" of trade ally who scored well on a number of metrics. Using this analysis allowed trade allies managers to get a concrete idea of how to allocate their time when interacting with trade allies in order to ensure that the key players have high satisfaction with the program. Collecting and reporting metrics related to application processing times, application flaws, and their causes could help evaluate a program's performance either against its own historical performance or against other similar programs. ICF also analyzed the application process using these metrics, easily identifying and addressing bottlenecks to optimize the DSM portfolio.

EXHIBIT 4: ADVANCED DATA VISUALIZATION TECHNIQUES ALLOW THE IDENTIFICATION OF TRADE ALLIES WHO PERFORM WELL ON SEVERAL METRICS SIMULTANEOUSLY.



Source: Successful Trade Ally Outreach and Management Programs, Technical Presentation, ICF, 2016

Key Takeaways

Data collected by DSM programs contain a wealth of information about participants, contractors, building and equipment characteristics, measure types, and expected savings. Using data that are already being collected by DSM programs, we have demonstrated that advanced analytics techniques can enhance the marketing power of energy efficiency programs, improve program cost effectiveness by optimizing incentive structure, and improve customer satisfaction by streamlining program delivery.

Depending on the type of target application of data mining, a leading DSM program can integrate publicly available data sources, utility billing history, smart meter, and smart thermostat data to derive further insights from energy efficiency program datasets with the ultimate goal of optimizing program designs and increasing savings.

As a part of ongoing work, ICF is integrating these analyses into our enterprise platform in order to have access to these insights in real time. This process allows ongoing improvement of program delivery in real time rather than relying on ex-post program evaluations, helping you to get the biggest bang for your marketing, incentive, and implementation dollars.

About ICF

ICF (NASDAQ:ICFI) is a global consulting and technology services provider with more than 5,000 professionals focused on making big things possible for our clients. We are business analysts, policy specialists, technologists, researchers, digital strategists, social scientists, and creatives. Since 1969, government and commercial clients have worked with ICF to overcome their toughest challenges on issues that matter profoundly to their success. Come engage with us at icf.com.

- [facebook.com/ThisIsICF/](https://www.facebook.com/ThisIsICF/)
- twitter.com/ICF
- [youtube.com/icfinternational](https://www.youtube.com/icfinternational)
- plus.google.com/+icfinternational
- [linkedin.com/company/icf-international](https://www.linkedin.com/company/icf-international)
- [instagram.com/thisisicf/](https://www.instagram.com/thisisicf/)

Any views or opinions expressed in this white paper are solely those of the author(s) and do not necessarily represent those of ICF. This white paper is provided for informational purposes only and the contents are subject to change without notice. No contractual obligations are formed directly or indirectly by this document. ICF MAKES NO WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, AS TO THE INFORMATION IN THIS DOCUMENT.

No part of this document may be reproduced or transmitted in any form, or by any means (electronic, mechanical, or otherwise), for any purpose without prior written permission.

ICF and ICF INTERNATIONAL are registered trademarks of ICF and/or its affiliates. Other names may be trademarks of their respective owners.

About the Authors

Hassan Shaban has 7 years of experience in energy engineering and advanced analytics with applications in demand side energy efficiency, power plant operations and renewable energy production. As a member of the Energy Efficiency Analytics and Policy Team at ICF, he has mined and analyzed numerous datasets collected by demand-side management programs, smart meters and smart

thermostats and has worked on developing and improving different modules in ICF's modeling platforms.

Mr. Shaban holds a B.S. in Mechanical Engineering from the University of Alexandria, Egypt and a Ph.D. in Mechanical Engineering from the University of Ottawa.



Haider Khan has 13 years of experience in econometric and energy modeling, simulation, and optimization for utility analytics, including demand side management, energy efficiency, and renewable energy. Mr. Khan leads work in energy efficiency analytics and policy, conducting residential, commercial, and industrial energy modeling; data analytics; econometric modeling; software development for energy savings estimation; and DSM program implementation support.

Mr. Khan earned his B.S. degree in Mechanical Engineering from the University of Engineering and Technology and his M.S. degree in Mechanical Engineering from Oklahoma State University.



David Meisegeier is a Vice President and Senior Technical Director at ICF with more than 24 years of experience in energy efficiency, demand side management and pollution prevention for the residential sector. His professional skills include: design and implementation of strategic energy efficiency and demand reduction programs; market and technology assessments of energy efficient products and systems; and information technology development. Having previously served as ICF's Residential Sector Lead, Mr. Meisegeier now focuses on helping utilities develop solutions for their rapidly changing landscape including distributed energy resources, customer engagement and grid modernization. Mr. Meisegeier has innovated residential programs and solutions that leverage the Internet of Things and mobile technologies, including overseeing development of Power Rebate™ – the industry's first mobile rebate app. He holds an M.S. in Engineering Management from George Washington University and a B.S. in Architectural Engineering from Pennsylvania State University.

For more information, contact:

Steve Fine
steve.fine@icf.com +1.301.407.6762

David Meisegeier
david.meisegeier@icf.com +1.301.407.6854

Haider Khan
haider.khan@icf.com +1.703.934.3868

