Big Data in the Utilities Industry

Current status and future outlook

Timotej Gavrilovic, Colin Kerrigan
Demand Side Analytics, Customer Energy Solutions
May 2015

T1G5@PGE.COM
C1K4@PGE.COM

Agenda

Overview of Demand Side Analytics at PG&E

Analytics Development is an Ongoing Process

Examples of DSA work

Pacific Gas and Electric Company

Energy services to 15 MM people:

- 5.1 MM Electric accounts
- 4.3 MM Natural gas accounts

70,000 square miles with diverse topography and climate zones

20,000+ employees

A regulated, investor-owned utility

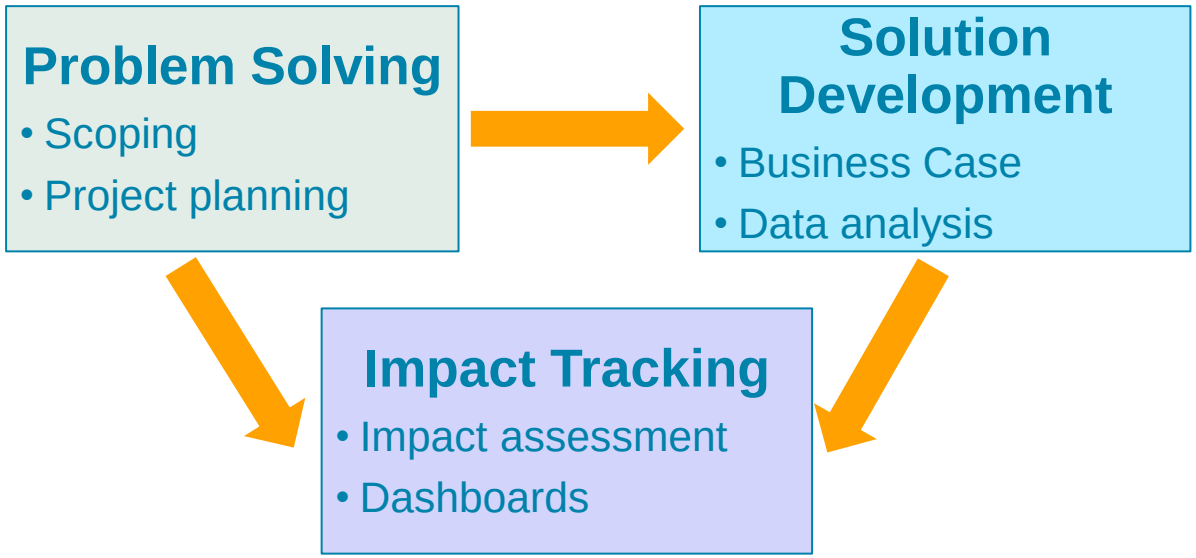
Demand Side Analytics Team Overview

Team Mission

- Provide strategic and analytical support for decision making within Customer Energy Solutions (CES) and other groups throughout PG&E
- To grow data-driven decision making as a discipline throughout PG&E

Energy Efficiency | Demand Response | Distributed Generation | Pricing Products | Electric Vehicles

Works with Electric Operations and Energy Procurement to tackle cross-cutting strategic issues such as the 'duck curve' or deferral of distribution equipment investments



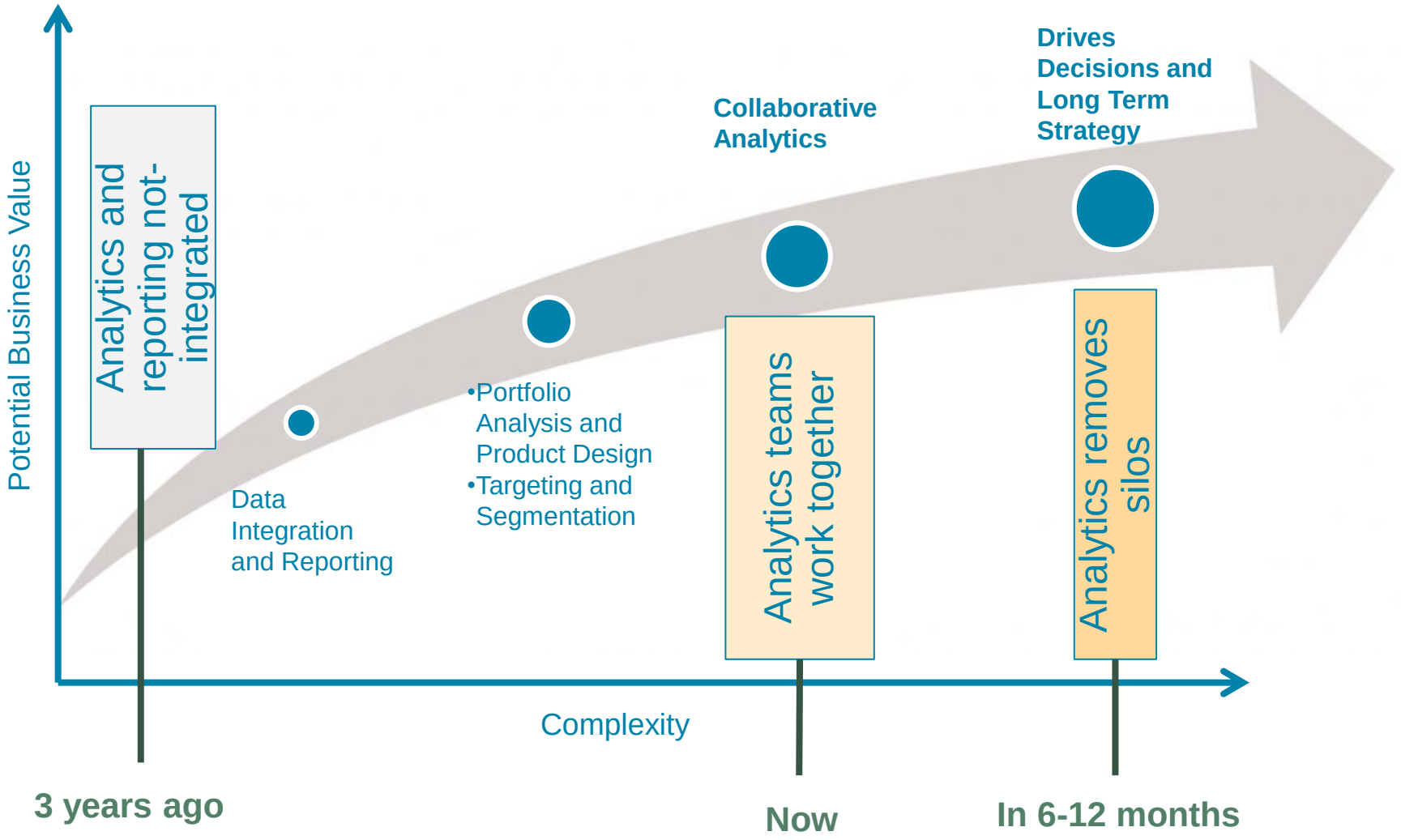
Agenda

Overview of Demand Side Analytics at PG&E

Analytics Development is an Ongoing Process

Examples of DSA work

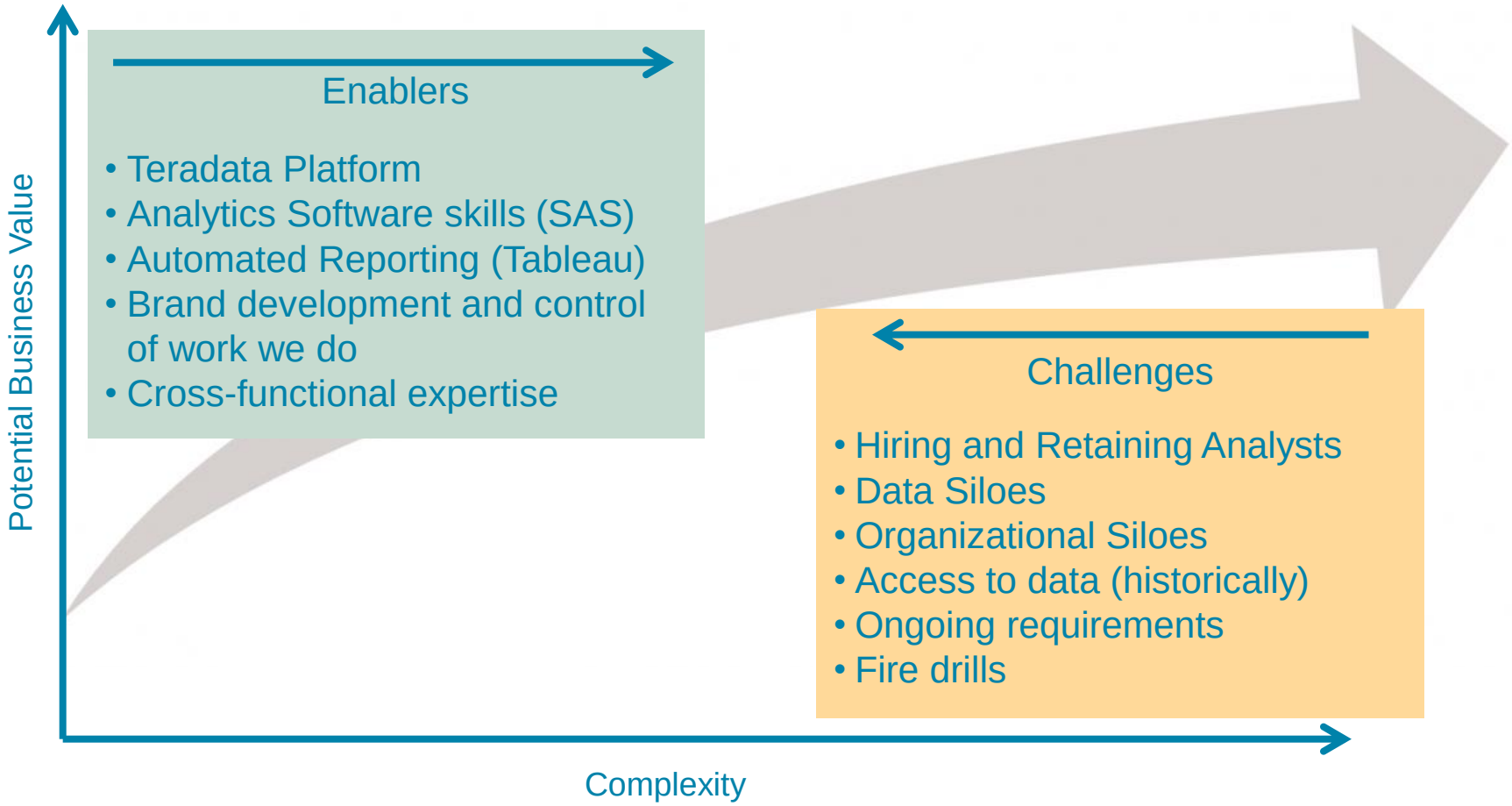
Analytics Development is an Ongoing Process



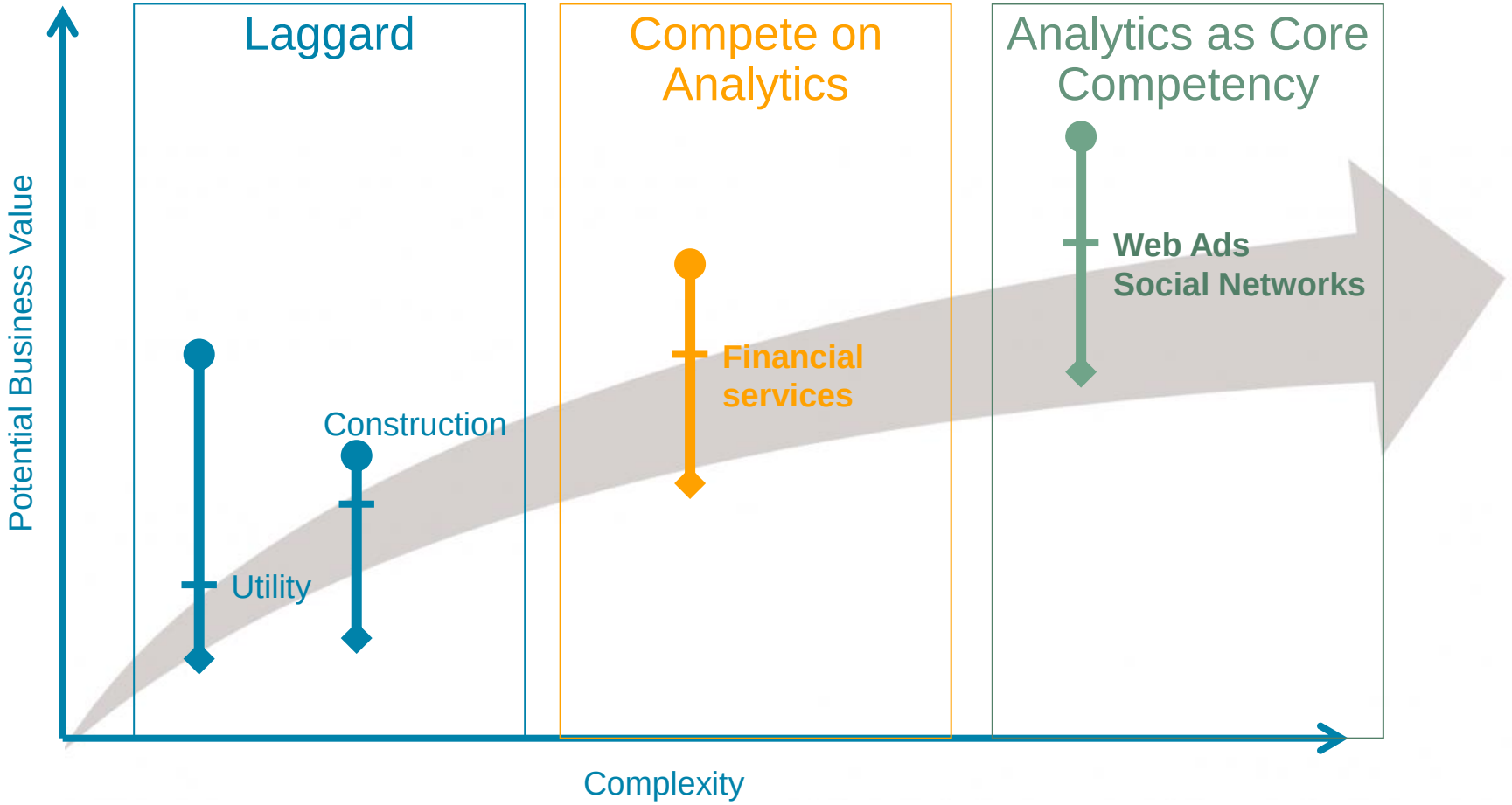
TEAM HISTORY

- Started *four years ago* as a brainchild of a Senior Director in Customer Energy Solutions

Demand Side Analytics Team Overview



Utility is a Laggard Industry with Strong Analytics Potential



Source: Potential Business Value taken from McKinsey Global Institute study on Big Data: The next frontier for innovation, competition and productivity

Agenda

Team Intro

Analytics Development is an Ongoing Process

Examples of DSA work

- Data Integration and Visualization
- Targeting
- Integration and Planning

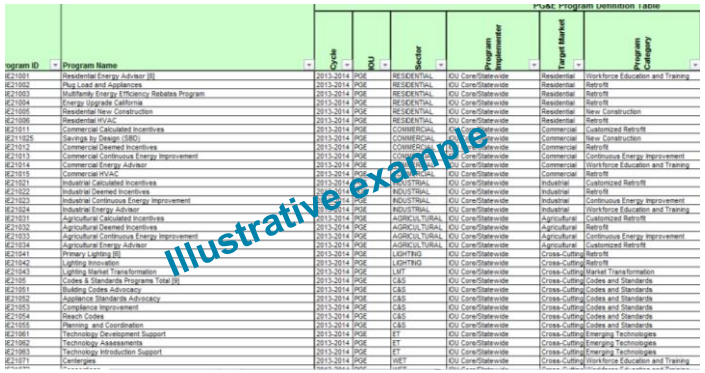
Data Integration and Visualization

Data Visualization Helps Transition from Reporting to an Analytics Driven Culture

Metrics and Data have always been used at PG&E to drive decision making. Furthermore, executive leadership holds each organization accountable by tracking performance on specific data and metrics.

Data-Driven Decisions

Historically, Excel and PowerPoint were used to track performance.



Insight-Driven Decisions

Now, each organization in CES has a custom built performance dashboard, which tracks key metrics, finances, safety stats, etc.

Analytics-Driven Culture

Digging into the Energy Efficiency Portfolio

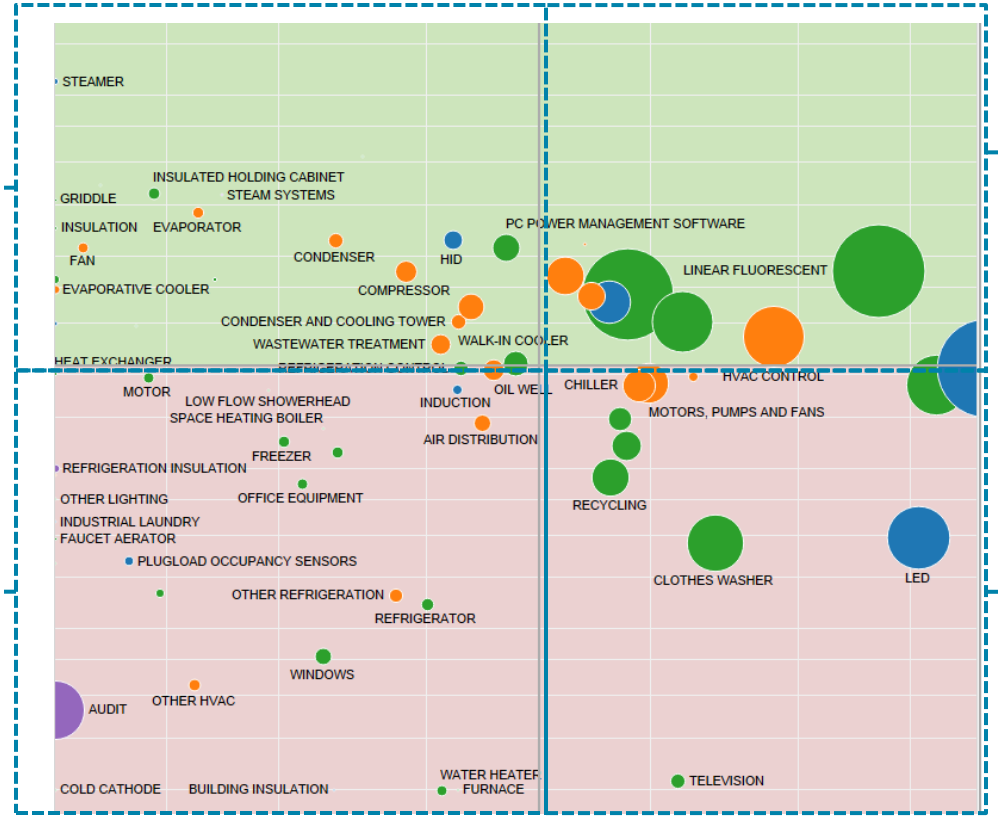
Analysis of historical portfolio performance, combined with market knowledge, provides for a systematic approach to EE portfolio management

Question 1

Question 2

Question 3

Question 4

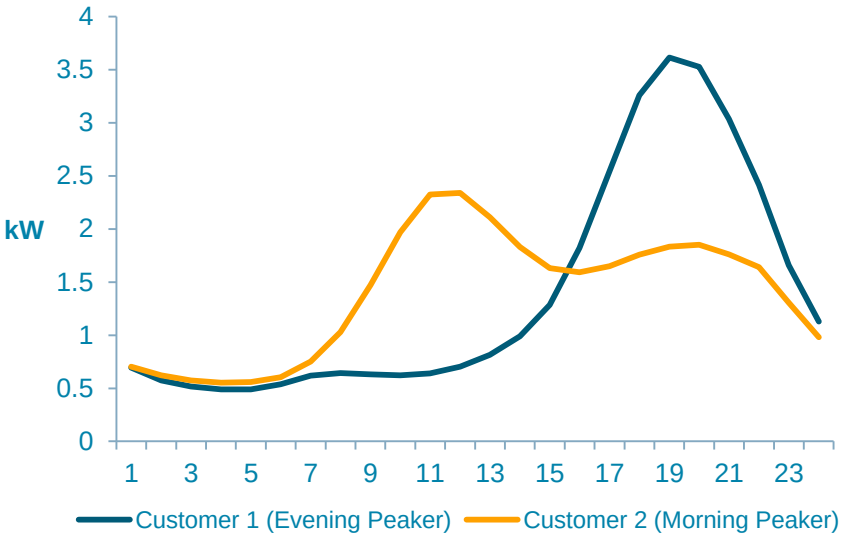


Targeting

Enhancing Program Targeting for Increased Performance and Reliability

Interval data allows demand response programs to be targeted such that participating customers will reliably respond to system operator needs

	Likelihood to Enroll	Daily Usage
Customer #1	High	33.4 kWh (Low Tier 3)
Customer #2	High	33.2 kWh (Low Tier 3)

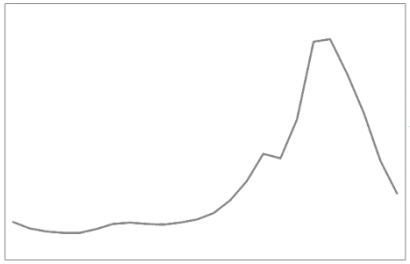


Two potential SmartAC participants have similar overall usage….

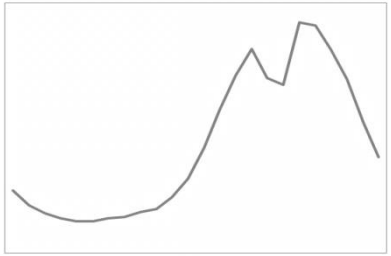
…but a load shape based segmentation reveals one is a far better candidate for SmartAC.

Load Segmentation Adds Significant Value

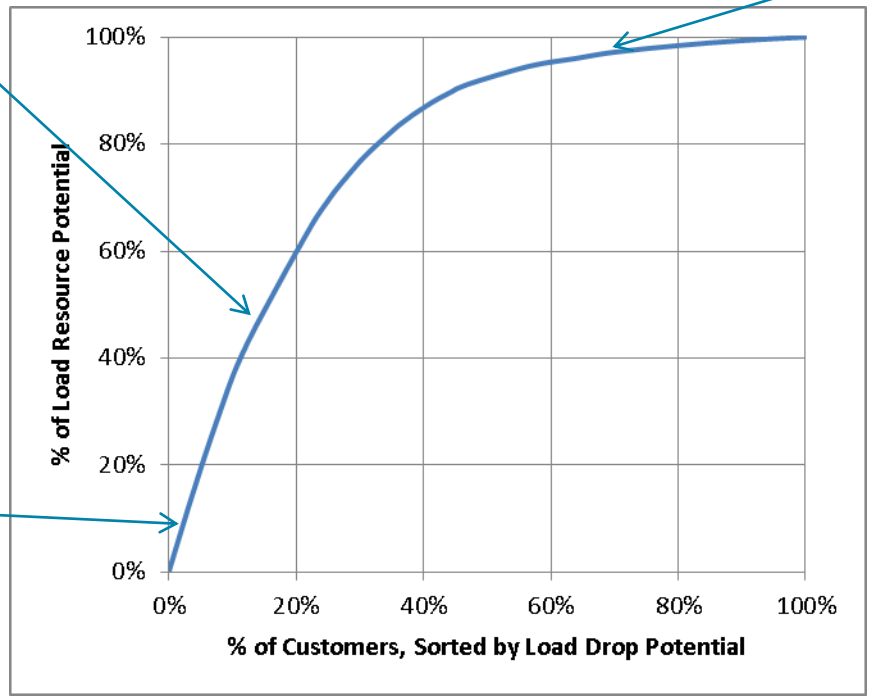
40% of residential customers account for over 80% of load resource potential for SmartAC

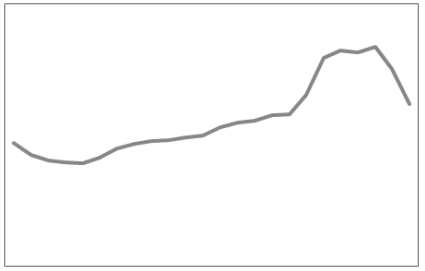


Med. Load Drop Segment



High Load Drop Segment



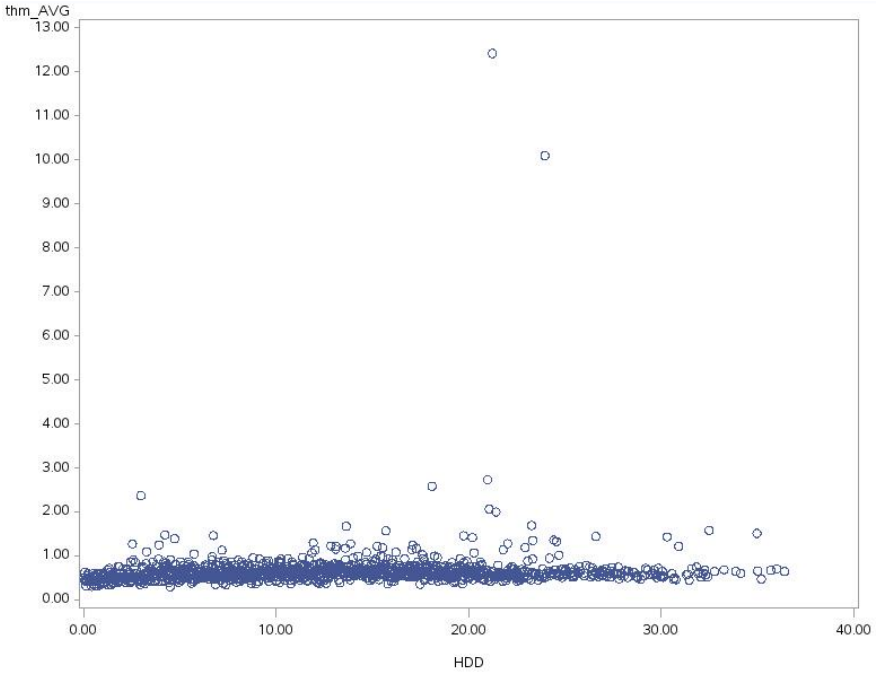


Negligible Load Drop Segment

Individual Heating Needs Sensitivity

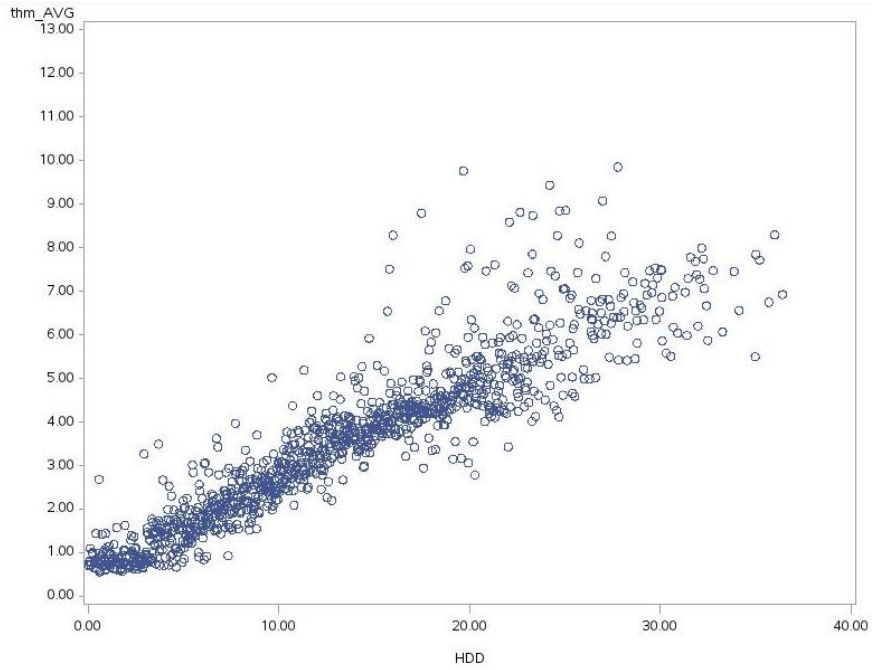
Heating needs drive most winter usage for about 70% of customers. Since high usage is almost always due to heating, high sensitivity customers are also high usage customers.

Low Sensitivity Customers
(Bottom 10%)



Other factors likely explain most gas use variance.

High Sensitivity Customers
(Top 10%)



Heating needs are a key driver of gas use variance.

PG&E Residential Electricity Theft Prediction

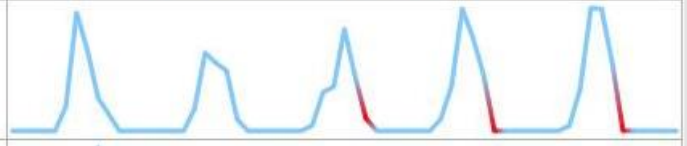
Pacific Gas and Electric Company®

Filters

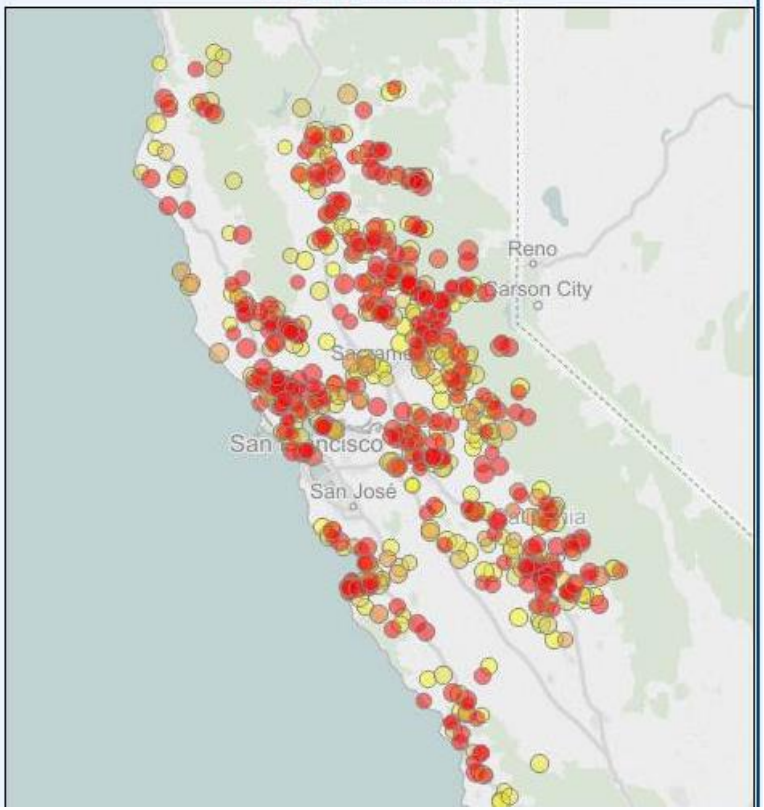
Top Suspected Cases	Avg Max Month Usg (kWh)	County	City	End Use	Meter Type
1,000	545 – 1,599	(Multiple values)	(Multiple values)	(All)	(All)

Top 1,000 Customers Identified By Theft Detection Algorithm

kWh Usage Per Month

Rank	Customer Name	
1	JACKSON POLLOCK	
2	RAY BRADBURY	
3	JACQUES-LOUIS DAVID	
4	JEAN DUJARDIN	
5	GEORGIA O'KEEFE	
6	ASTRID LINDGREN	

Energy Theft Heat Map



Integration and Planning

Targeted DSM for Electric Reliability

Goal: Target demand side programs to defer distribution upgrades, freeing up capital dollars for projects with higher reliability and safety impacts.

Solution: Identify which customers provide the largest opportunity for local peak load reduction by combining SmartMeter data, customer insights, and previous program participation information.

Per recommendations of Distribution Planning, the following substations were targeted:

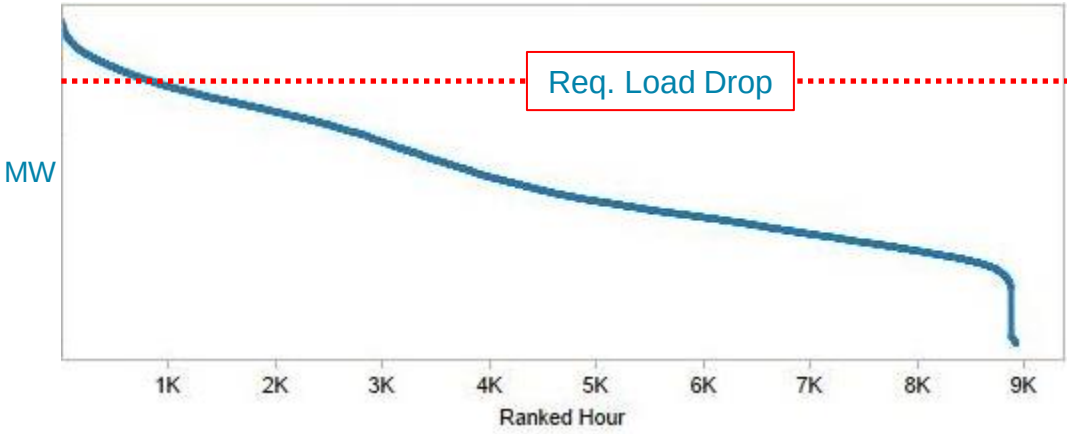
1) Atlantis
2) Camelot
3) Cibola
4) Valhalla

Feeder Load Duration Suggests DSM Opportunity

Aggregation of customer data enables new insights into T&D Infrastructure

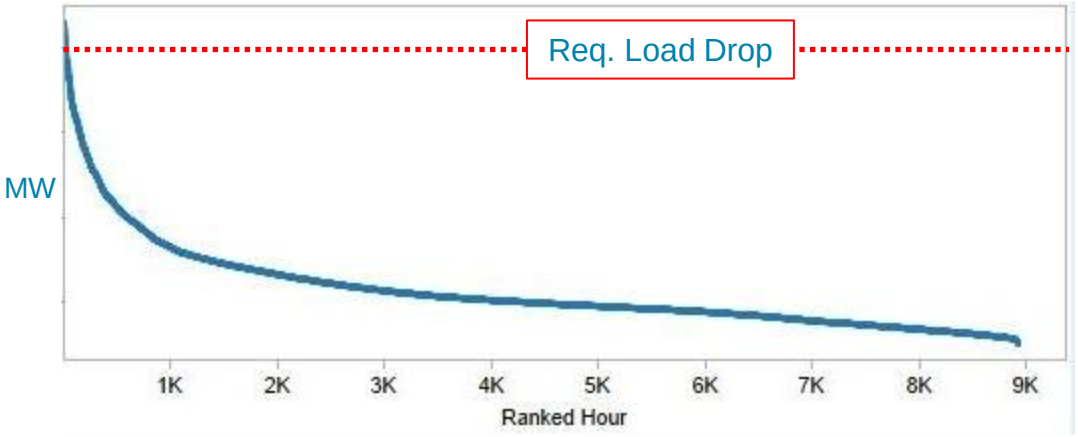
Camelot 9913

Relatively flat load duration curve puts many hours at risk of overload, indicating that EE needs to be a focus



Camelot 9914

Steep load duration curve indicates demand response may be a viable option due to limited hours at risk of overload



Targeted DSM for T&D

Updated Through 1/31/2015

Pacific Gas and Electric Company

All Segment(s) - Cibola 9917 Feeder(s)

Filters

Top SP IDs (For Export)
100,000

Customer Name

Feeder Filter

- Atlantis 9910
- Atlantis 9912
- Avalon 9910
- Avalon 9917
- Avalon 9919
- Camelot 9913
- Camelot 9914
- Cibola 9910
- Cibola 9917
- Elysian Fields 9910
- Elysian Fields 9917
- Metropolis 9919
- Mount Olympus 7917
- Mount Olympus 7919
- Shangri-La 9919
- Utopia 7919
- Valhalla 7915
- Valhalla 7916

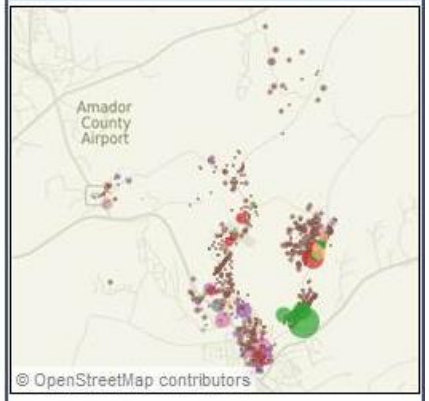
Segment Filter

- LCI
- SMB

Top 100,000 SP IDs By Coincident Demand - Click on chart to filter report

Customer Name	Naics 2 Segment	Assigned Rep	Demand Response	Feeder Peak Coincident Demand (kW)	kW Savings
BRUCE WILLIS'S NURSING..	Healthcare			177.6	2.6
THE OSBOURNES'S AMUS..	Hospitality			79.5	6.9
LEONARD NIMOY'S NURSI..	Healthcare		Y	62.8	0.5
TOM HANKS'S EDUCATIO..	Schools	Maryanne B..		58.1	
RYAN O'NEAL'S OTHER IN..	Offices	Maryanne B..		47.0	5.2
TOM HANKS'S EDUCATIO..	Schools	Maryanne B..		45.3	
CLIVE CUSSLER'S SOCIAL..	Healthcare			45.1	0.3
DENZEL WASHINGTON'S ..	Uncategor..		Y	33.5	
RYAN O'NEAL'S JUSTICE, ..	Governme..	Maryanne B..		32.0	1.1
EDMOND O'BRIEN'S FOOD..	Hospitality			25.4	0.3
ERSKINE CALDWELL'S RE..	Offices			22.9	
JAMES BROWN'S MOTOR ..	Retail	Stefan Stoc..		22.2	1.4
L. FRANK BAUM'S ACCOM..	Hospitality			21.6	10.4
DICK CLARK'S ADMINISTR..	Governme..			20.9	0.4
MATT BIONDI'S SMALL BU..	Uncategor..			20.6	

Demand During Peak Hours - Click on circles to filter report



- Government
- Healthcare
- High Tech
- Hospitality
- Manufacturing & T..
- Offices
- Residential
- Residential (RES)
- Retail
- Schools

EE kW Savings By SA ID - Click on chart to see specific programs

Customer Name	Naics 2 Segment	DR Particpation	2010	2011	2012	2013	2014	2015	Grand Total
BRUCE WILLIS'S NURSING AND RESIDENTIAL CARE FACILITIES	Healthcare		2.6						2.6
THE OSBOURNES'S AMUSEMENT, GAMBLING, AND RECREATION INDUSTRIES	Hospitality		6.9						6.9
LEONARD NIMOY'S NURSING AND RESIDENTIAL CARE FACILITIES	Healthcare	Y	0.5						0.5
CLIVE CUSSLER'S SOCIAL ASSISTANCE	Healthcare					0.3	0.0		0.3
RYAN O'NEAL'S OTHER INFORMATION SERVICES	Offices			5.2					5.2
RYAN O'NEAL'S JUSTICE, PUBLIC ORDER, AND SAFETY ACTIVITIES	Government				1.1				1.1

Pipeline kW Savings ... Click on chart to see specific ...