NAVIGANT

ENERGY

Behind the Curtain – The Relationship Between Behavior and Operational Savings

2015 BECC Conference

Greg Wikler, Navigant Consulting

Floyd Keneipp, Tierra Resource Consultants

October 19, 2015

Outline

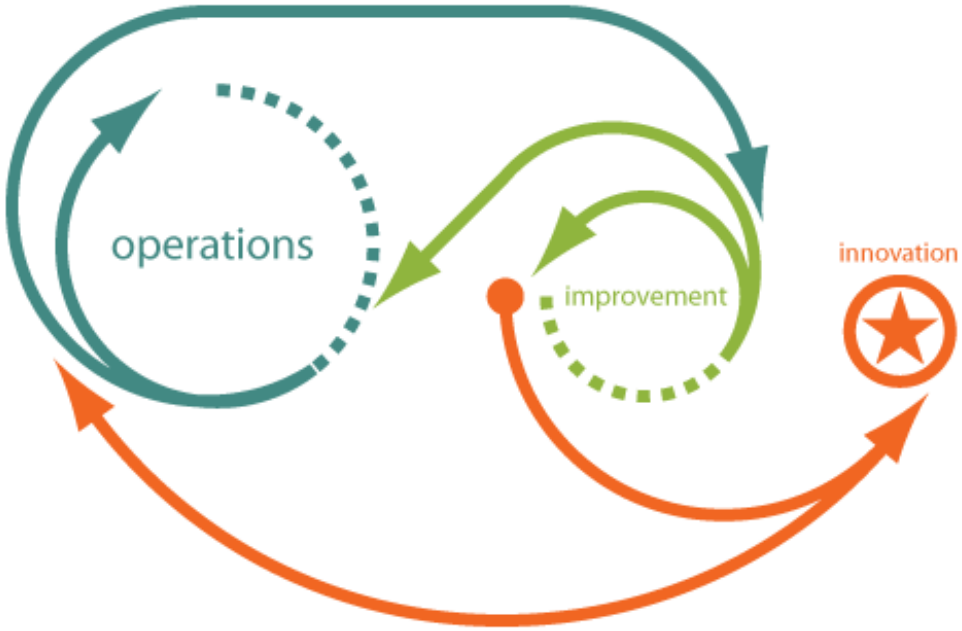
- **Defining Operational Efficiency**
  - Within the context of “behavioral” initiatives
- **Survey of the OE Program Environment**
  - Types and characteristics of OE programs
  - Trends and patterns, including the rise of data analytics
  - Measurement challenges
- **Case Studies of OE Efforts**
  - Small commercial buildings – Opower perspective
  - Large commercial buildings – FirstFuel perspective
  - Industrial process optimization – NYSERDA program example
- **Gaps and Opportunities**

Outline

- **Defining Operational Efficiency**
  - Within the context of “behavioral” initiatives
- **Survey of the OE Program Environment**
  - Types and characteristics of OE programs
  - Trends and patterns, including the rise of data analytics
  - Measurement challenges
- **Case Studies of OE Efforts**
  - Small commercial buildings – Opower perspective
  - Large commercial buildings – FirstFuel perspective
  - Industrial process optimization – NYSERDA program example
- **Gaps and Opportunities**

Defining Operational Efficiency

- Operational efficiency (OE) is a **system or building approach** to energy savings, not necessarily at an individual measure level
- OE represents efforts to increase the efficiency of how a building utilizes its existing equipment and systems
- By providing opportunities to educate and inform energy managers about the energy usage in their facilities, operational changes lead to improvements and ultimate innovation
- OE is becoming more important as it potentially represents a large portion of savings in C&I facilities



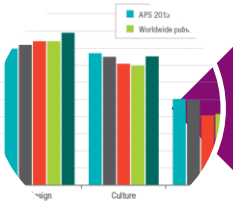
NAVIGANT ENERGY

AB 802 – New Energy Efficiency Legislation in California

» Requires the two energy regulatory agencies (California Energy Commission and California Public Utilities Commission) to develop new rules for the measurement and reporting of EE savings in existing buildings

Allows EE programs to broaden the scope of energy savings, including to-code, operational efficiency and behavioral initiatives drawing on meter-based performance data to set goals and determine cost-effectiveness

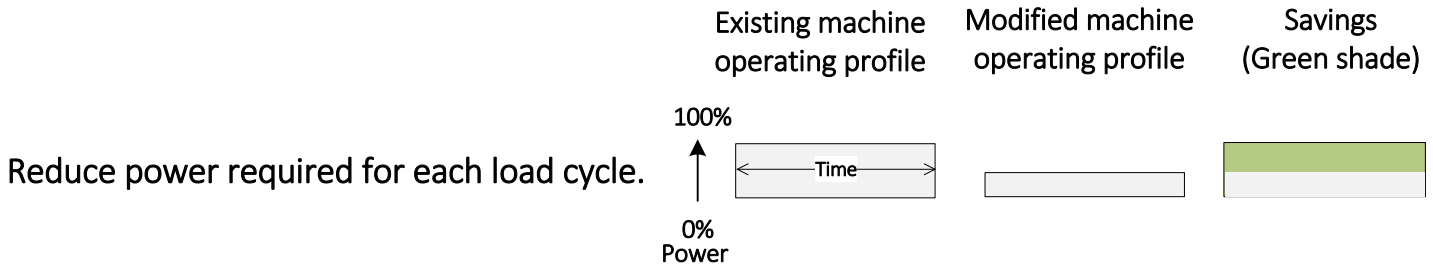
Provides for better access to energy usage and benchmark data for commercial and multi-family buildings



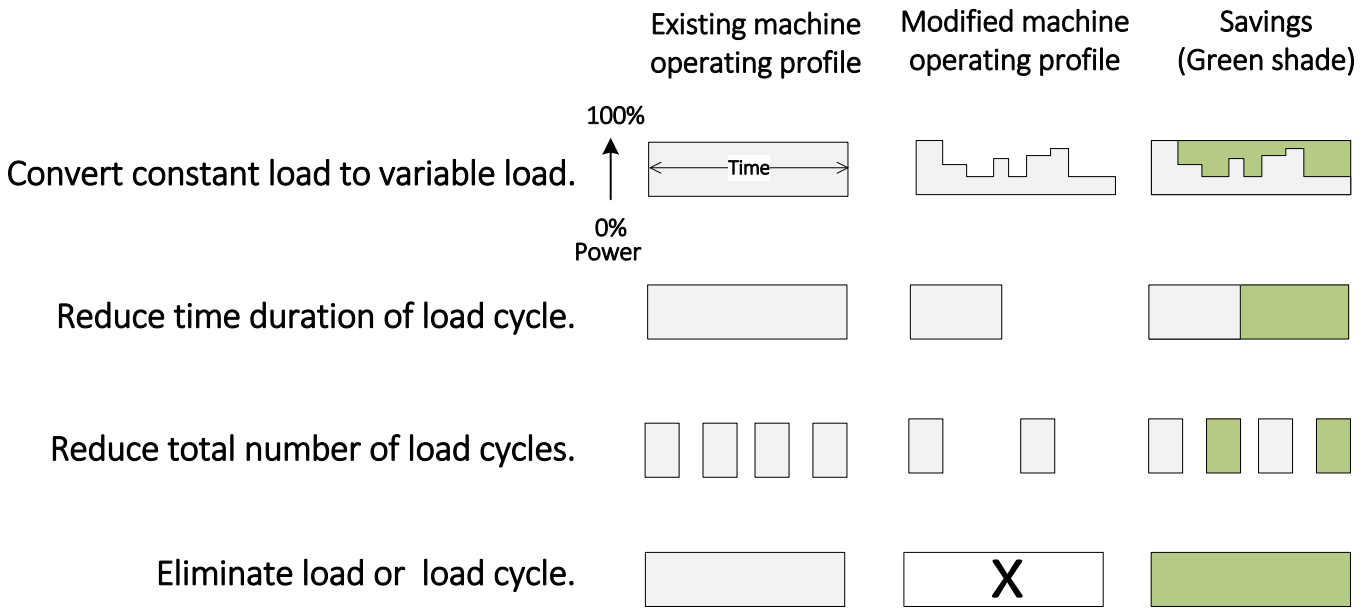
Creates a benchmarking program that allows large building owners to compare their buildings' energy use to similar buildings

Defining OE - Comparing EE and OE Load Shape Impacts

» Characteristics of load shape change from EE efforts

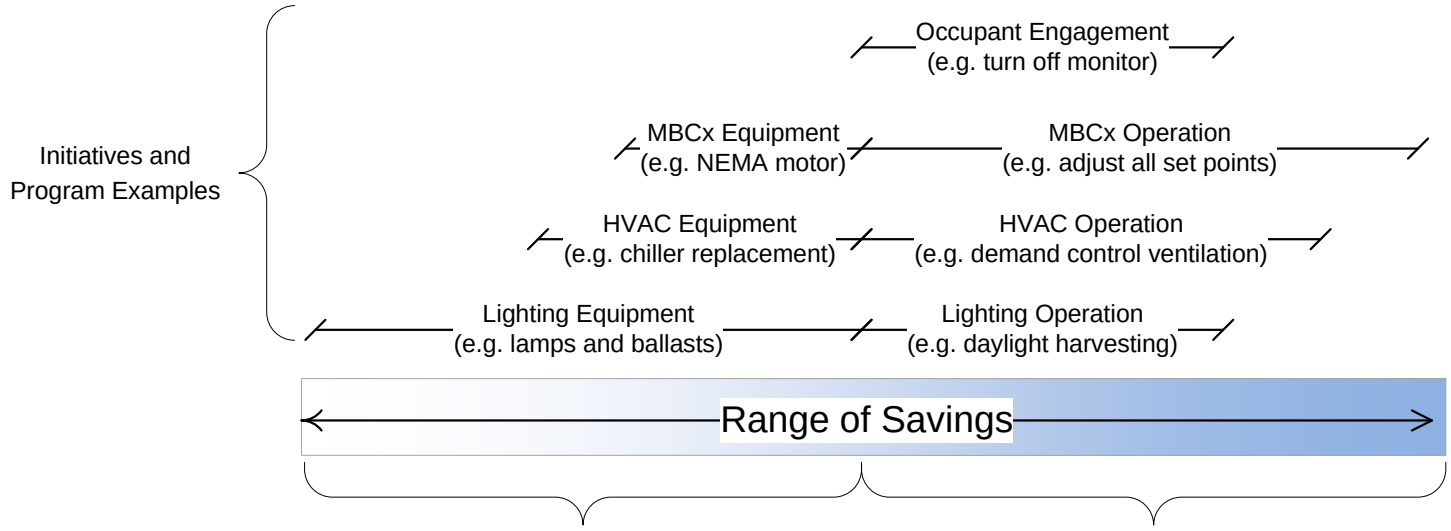


» Characteristics of load shape change from OE efforts



NAVIGANT ENERGY

The OE Program Environment – A Continuum of Opportunities



Comparative	Equipment Selection	Equipment Operation
Relationship to Work	Doing the same work for less energy	Doing less work
Definition	Associated with 'efficiency'	Associated with 'conservation'
Fuel savings	Same operating duration at lower power	Different operating duration and / or variable power levels
Demand savings	Savings a certain	Savings are uncertain
Load shape impacts	Keeps load shape, but shifts it 'down'	Changes load shape
Organizational decisions	Purchasing decisions	Operating decision
Code intent	Specify equipment efficiency	Specify equipment control or maintenance
Forecasting EE potential	Potential is estimated by modelling equipment stock turnover	Potential is calculated by estimating the average change in load profile for a subset of the equipment stock.
Nature of measure costs	Many projects require capital budgets	Most projects are expense

NAVIGANT ENERGY

Outline

- Defining Operational Efficiency
  - Within the context of "behavioral" initiatives
- **Survey of the OE Program Environment**
  - Types and characteristics of OE programs
  - Trends and patterns, including the rise of data analytics
  - Measurement challenges
- Case Studies of OE Efforts
  - Small commercial buildings – Opower perspective
  - Large commercial buildings – FirstFuel perspective
  - Industrial process optimization – NYSERDA program example
- Gaps and Opportunities

Introducing the 5 Identified OE Program Types

1. *Efficient Design/Construction (EDC)*

   New Building Commissioning

   Efficient Design Assistance

2. *Operations and Maintenance Improvement (O&M)*

   Retro-Commissioning

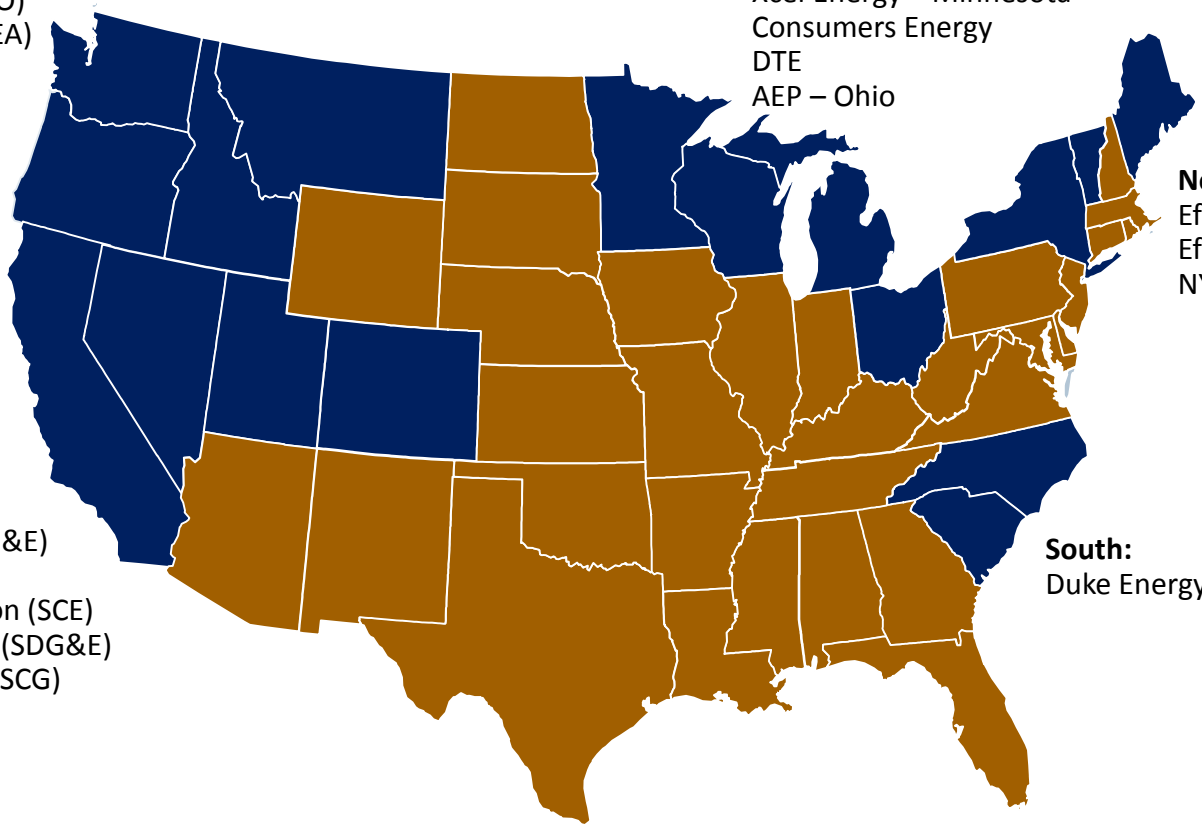
   Monitoring-Based Commissioning

3. *Strategic Energy Management (SEM)*
4. *Education and Training (E&T)*
5. *C& I Energy Dashboards (EDash)*

OE Utility Program Examples

Northwest:
Bonneville Power Administration (BPA)
Energy Trust of Oregon (ETO)
Northwest EE Alliance (NEEA)
Snohomish PUD (SnoPUD)
Puget Sound Energy (PSE)

Midwest:
Wisconsin Focus on Energy
Xcel Energy – Minnesota
Consumers Energy
DTE
AEP – Ohio



Northeast:
Efficiency Maine Trust
Efficiency Vermont
NYSERDA

Southwest:
NV Energy
Pacific Gas & Electric (PG&E)
Rocky Mountain Power
Southern California Edison (SCE)
San Diego Gas & Electric (SDG&E)
Southern California Gas (SCG)
Xcel Energy – Colorado

South:
Duke Energy

NAVIGANT
ENERGY

Sample OE Evaluation Approaches

- Results from OE Programs

1. *NYSERDA New Construction Program*	EDC	1. Bottom-up engineering analysis and calibrated simulation
2. *Efficiency Maine Trust RCx*	RCx	2. Bottom-up engineering analysis
3. *Energy Trust of Oregon Kaizen Blitz*	MBCx	3. Facility-Wide Regression Model
4. *BPA High Performance Energy Management* 5. *NEEA Industrial Initiative* 6. *Xcel Colorado Process Efficiency*	SEM	4. MT&R Facility-Wide Regression Model (engineering analysis on capital measures) 5. Bottom –up engineering analysis & Top-down statistical analysis 6. Surveys/Interviews
7. *Focus on Energy E&T Initiative*	E&T	7. File/Documentation Review and Surveys/Interviews
8. *SnoPUD Behavior-Based Energy Efficiency Pilot*	EDash	8. Quasi-experimental panel regression analysis

OE Program Best Practices


Prioritize savings opportunities


Commit to improvement


Enable information flow


Educate & engage personnel


Establish tracking & feedback mechanism


Provide long-term technical support


Follow up & reward persistence

NAVIGANT
ENERGY

Outline

- Defining Operational Efficiency
  - Within the context of “behavioral” initiatives
- Survey of the OE Program Environment
  - Types and characteristics of OE programs
  - Trends and patterns, including the rise of data analytics
  - Measurement challenges
- **Case Studies of OE Efforts**
  - Small commercial buildings – Opower perspective
  - Large commercial buildings – FirstFuel perspective
  - Industrial process optimization – NYSERDA program example
- Gaps and Opportunities

SMB Reports: Driving savings through engagement

Proactive reporting

Tailored insights & tips by business type

Data acquisition & validation

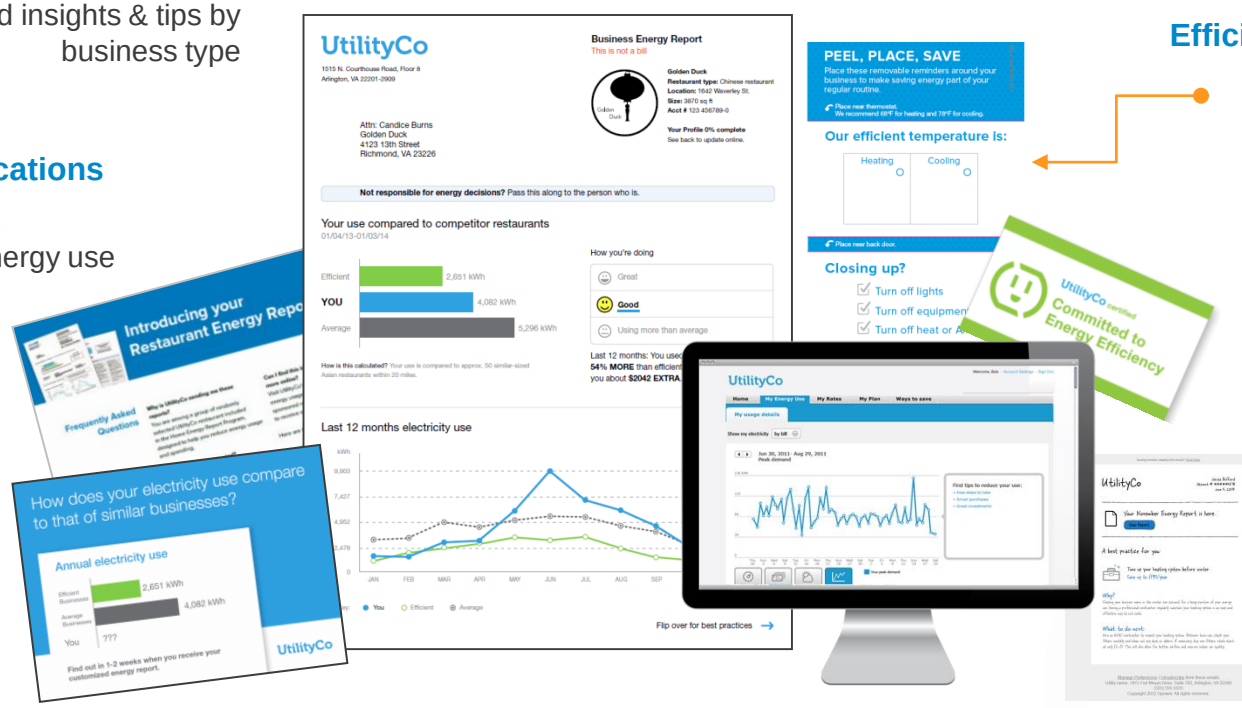
Get personal to grab attention

Efficiency Collateral

Enlist employees and customers

Intro communications

Reach the person responsible for energy use



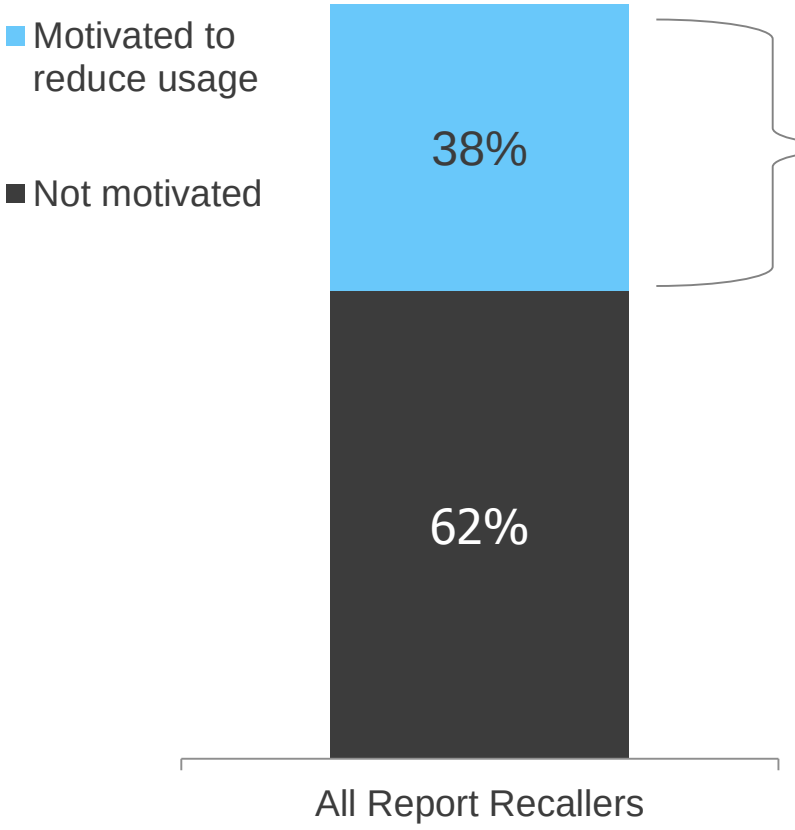
Web & Email

Encourage deeper engagement

Third of customers report being motivated to action

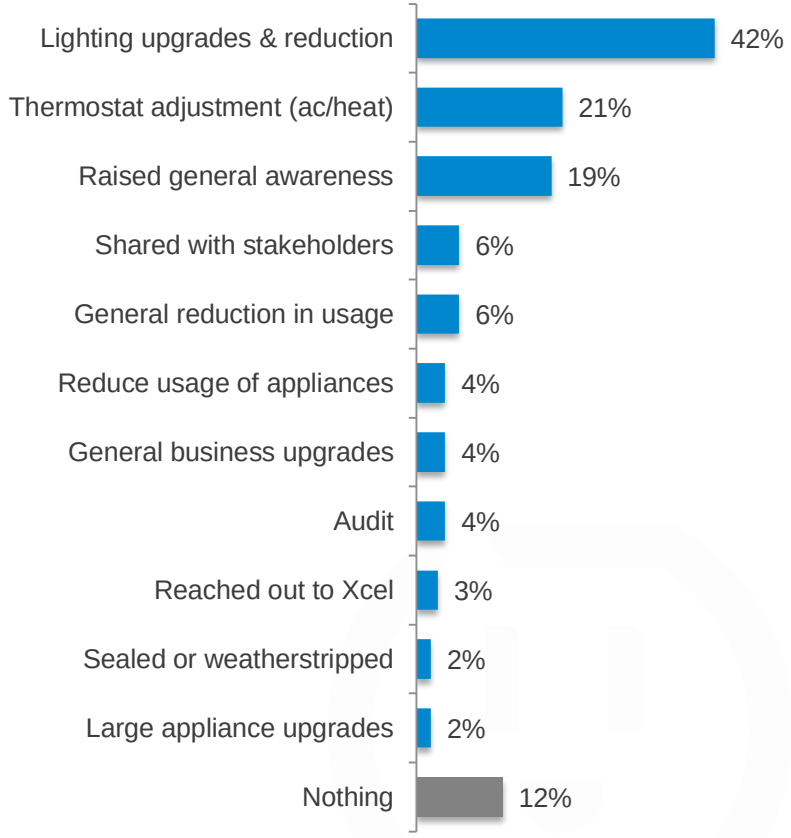
Did the Business Energy Report motivate you to reduce your business' energy usage?

1,083 interviews with recalling SMB report recipients
Average across 3 deployments



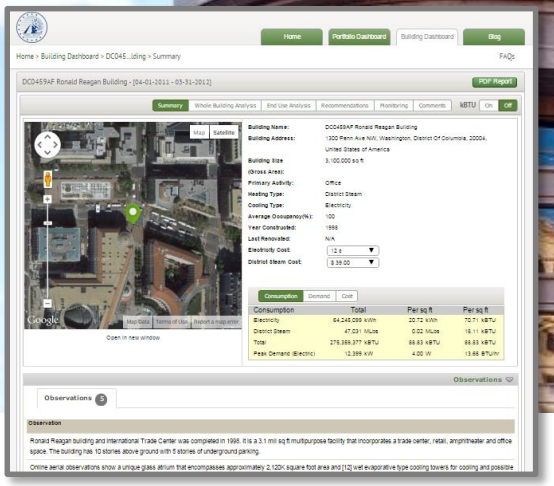
What have you done? (Open Ended)

Multiple codings allowed



GENERAL SERVICES ADMINISTRATION

Comprehensive Portfolio Efficiency Management Using Analytics



"GSA has been very impressed by the energy usage information that FirstFuel provides for us. FirstFuel assists the GSA in meeting our energy efficiency and savings goals in our buildings."

Dorothy Robyn
Former Commissioner Public Buildings Service (former)

GSA won the 2014 Federal Energy & Water Management for this initiative

Meet congressional mandate EISA 432

100% compliant energy audits

Support 3% annual energy reduction goal

170GWh of identified energy savings opportunity

Gain building operator buy-in & commitment

All operators utilizing FirstFuel platform

Extract more value from smart meter investments

$10M+ in total monitored energy savings

FIRSTFUEL
ANALYTICS | BUILDING SCIENCE | SOFTWARE

KEY DEPLOYMENT STATS

EE Roadmap Spans GSA's Entire Covered Services Portfolio

	YEAR 1	YEAR 2	YEAR 3
	26 Bdgs 13M Sq.ft.	90 Bdgs 47M Sq.ft.	178 Bdgs 89M Sq.ft.
$	$6.5M ID Savings 85% cheaper	$14M ID Savings 85% cheaper	$21M ID Savings 85% cheaper
	6 weeks vs. 6-8 months	12 weeks vs. 18-24 months	24 weeks vs. 3 years
	50% operational savings	60% operational savings	55% operational savings

FIRSTFUEL
ANALYTICS | BUILDING SCIENCE | SOFTWARE

- NYSERDA's Industrial and Process Efficiency program focus is on projects that improve manufacturing process productivity
- Incentives support projects that increase productivity including;
  - Throughput increases.
  - Scrap reduction
  - Quality improvements
  - Focus on reduced energy use per unit of production
- Integrates lean manufacturing principles into energy-saving approach by using advanced production management techniques.

Outline

- **Defining Operational Efficiency**
  - Within the context of “behavioral” initiatives
- **Survey of the OE Program Environment**
  - Types and characteristics of OE programs
  - Trends and patterns, including the rise of data analytics
  - Measurement challenges
- **Case Studies of OE Efforts**
  - Small commercial buildings – Opower perspective
  - Large commercial buildings – FirstFuel perspective
  - Industrial process optimization – NYSERDA program example
- **Gaps and Opportunities**

OE Challenges and Opportunities

1. Data on observed savings are incomplete and limited

Small sample sizes led to large uncertainties in estimated savings

Baseline energy use is difficult to measure

2. Terminology is not consistent for reported savings across data sets

Presented vs. Implemented Savings

Estimated vs. Actual Saving

3. There are no standard naming conventions for OE-based measures

It would be beneficial to develop a TRM for OE-based measures

4. A rigorous M&V process is lacking for OE measures

Regulators need to have confidence that savings are real and sustainable

OE Challenges and Opportunities (continued)

5. What is the relationship of OE programs to improved economic output?

The NYSERDA Industrial & Process Efficiency Program provides incentives for improvements such as capacity additions that improve the energy use per unit processed, quality improvement, scrap reduction, or increased throughput.

Other jurisdictions do not consider productivity metrics, such as increased throughput, in defining benefits

6. Methodologies for estimating economic useful life are not developed

Persistence of behavior is uncertain. E.g. impact of turnover of staff or residents

7. Advancement in data access will allow for disaggregation of impacts and improved persistence.

Smart thermostats collect data, wireless sensor are dropping in price

8. Methodologies for estimating OE potential are not refined

For EE, stock turnover models are studied, developed, and refined.

For OE, methods to disaggregate populations of users and define the impacted end uses are only now nascent.

NAVIGANT

ENERGY

Thank You!

Greg Wikler
Navigant Consulting, Inc.
One Market Street, Spear Street Tower
Suite 1200
San Francisco, CA 94105, USA
Tel: +1.415.399.2109
Email: Greg.Wikler@navigant.com

Floyd Keneipp
Tierra Resource Consultants, LLC
1200 Mt. Diablo Blvd., Suite 208
Walnut Creek, CA 94596, USA
Tel: +1.925.954.7363
Email: Floyd.Keneipp@tierrarc.com

Matt O'Keefe
OPower
San Francisco, CA 94105, USA
Tel: +1.415.848.4798
Email: Matt.okeefe@opower.com

Jordana Cammarata
First Fuel
San Francisco, CA 94105, USA
Tel: +1.415.992.6317
Email: jcammarata@firstfuel.com