Using Data Analytics to Accelerate Energy Savings in Commercial Buildings
IN THE PAST FEW YEARS...

Greater Availability of Interval Consumption Data

Emergence of Advanced Data Analytics Platforms
### WHAT DOES IT MEAN?

**POTENTIAL TO RADICALLY TRANSFORM EE PROGRAM PRACTICES & IMPROVE RESULTS**

<table>
<thead>
<tr>
<th></th>
<th>Dramatically Increase Scale</th>
<th>Better Customer Outcomes</th>
<th>Reduced Cost and Time-to-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Evaluate an entire portfolio very quickly at minimal cost</td>
<td>• Increase customer satisfaction</td>
<td>• Find more low-cost savings</td>
</tr>
<tr>
<td></td>
<td>• Deep, building-specific insight without onsite presence</td>
<td>• Improve measure persistence</td>
<td>• Conduct less on-site work</td>
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<tr>
<td></td>
<td><strong>MONTHS AND YEARS ARE NOW DAYS AND WEEKS</strong></td>
<td><strong>MORE PROGRAM PARTICIPATION LIFT PER DOLLAR SPENT</strong></td>
<td>• Minimize time-lags and get to faster savings</td>
</tr>
<tr>
<td></td>
<td><strong>6-8x EFFICIENCY TIME-TO-VALUE</strong></td>
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**FIRSTFUEL SOFTWARE - CONFIDENTIAL**
A RELEVANT ANALOGY

BUILDING MANAGER MRI

BUILDING MRI
FIRSTFUEL INVERSE MODELING

1. METER DATA + ADDRESS
2. FIRSTFUEL ANALYTICS
3. INSIGHT & EFFICIENCY

EVERY BUILDING’S DATA TELLS ITS OWN STORY

Remote Building Analytics platform

Example: End Use Breakdown

Ventilation
Heating
Cooling
Plug load
Lighting

No onsite visits or devices.
No building simulations or buildings “like” this one.
Unique analysis for every building
“FirstFuel’s Rapid Building Assessment has demonstrated itself as a viable solution to help automate the screening and auditing process.”

**FirstFuel’s rapid building assessment vs. traditional audits**

<table>
<thead>
<tr>
<th><strong>FirstFuel</strong> vs <strong>Onsite Audits</strong></th>
<th><strong>FirstFuel’s</strong> method of hourly accounting improves the quality of the estimates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Use Disaggregation</td>
<td>48 of 49 end-uses within margin of error</td>
</tr>
</tbody>
</table>
| Recommendations & Savings Estimates | Within 7% of onsite savings estimates  
|                                   | Found additional RCx measures                                                    |
| Speed & Scale                     | 3x+ faster than onsite audits  
|                                   | Study did not include elapsed time, scheduling or travel time                    |
|                                   | “...able to identify and quantify operational ECMs that on-site audits typically miss” |
|                                   | “...audits require the time intensive and intrusive step of contacting building staff...[FirstFuel’s] audit is completed without contacting the building staff.” |
How do advanced meter analytics drive scalable efficiency programs?
ANALYTICS-ENABLED EFFICIENCY PROGRAM DESIGN
USING ANALYTICS ACROSS THE LIFECYCLE OF EE

What are biggest opportunities *across* commercial portfolios?

What energy reduction options exist *within* low efficiency buildings?

How can we drive building operators to make changes?

How can savings impact be tracked over time?

**SCREEN PORTFOLIO** | **CONDUCT AUDITS** | **ENGAGE AND IMPLEMENT** | **MONITOR SAVINGS**
75% of energy efficiency opportunity found in 25% of buildings.
CONDUCT AUDITS

- **Building Name**: Medium Office Building 3
- **Building Address**: 95 River Road, Andover, Massachusetts, 01810, United States
- **Building Size (SqFt)**: 105,000 GSF
- **Primary Activity**: Office
- **Heating Type**: Gas
- **Cooling Type**: Electricity
- **Average Occupancy (%)**: 100
- **Year Constructed**: 1990
- **Last Renovated**: N/A
- **Electricity Cost**: $403,879 at average cost/kWh of 16 cents
- **Gas Cost**: $109,147 at average cost/Therm of $1.40

### Energy Consumption

<table>
<thead>
<tr>
<th>Energy</th>
<th>Total</th>
<th>Per SqFt</th>
<th>Per SqFt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>2,524,242 kWh</td>
<td>24.04 kWh</td>
<td>82.03 kBTU</td>
</tr>
<tr>
<td>Gas</td>
<td>77,962 Therm</td>
<td>0.74 Therm</td>
<td>74.25 kBTU</td>
</tr>
<tr>
<td>Total</td>
<td>16,406,912 kBTU</td>
<td>156.28 kBTU</td>
<td>156.28 kBTU</td>
</tr>
<tr>
<td>Peak Demand (Electric)</td>
<td>537 kW</td>
<td>5.12 W</td>
<td>17.47 BTU/hr</td>
</tr>
</tbody>
</table>

### Savings Potential

<table>
<thead>
<tr>
<th>Energy</th>
<th>Savings</th>
<th>Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$69,481</td>
<td>149 tonnes</td>
</tr>
<tr>
<td>Gas</td>
<td>$29,333</td>
<td>101 tonnes</td>
</tr>
<tr>
<td>Total</td>
<td>$98,814</td>
<td>250 tonnes</td>
</tr>
</tbody>
</table>
CONDUCT AUDITS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>SUMMARY</th>
<th>SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>Investigate potential HVAC operations and maintenance issues which are resulting in extremely high electrical and gas consumption.</td>
<td>$31,333</td>
</tr>
</tbody>
</table>

Several analyses point to very high electrical consumption for air conditioning and gas consumption for heating. When both heating and air conditioning consumption are high, there are several potential causes that should be investigated: 1) Simultaneous heating and cooling which is when the heating and cooling systems on at the same time and working against each other. 2) A malfunctioning economizer cycle that requires heating and cooling of excessive amounts of outdoor air rather than recirculating building air. 3) Heating and cooling equipment that is inherently inefficient. We recommend therefore that a study be initiated to determine the exact nature of the problem and correct it. Savings are based upon removing approximately one half of what we
LOW / NO-COST OPERATIONAL CHANGES COULD DOUBLE ENERGY EFFICIENCY IN COMMERCIAL BUILDINGS

RETROFIT VS. OPERATIONAL SAVINGS POTENTIAL SPLIT

HALF OF SAVINGS POTENTIAL LARGELY IGNORED

FIRSTFUEL SAMPLE BUILDING PORTFOLIO (60M SQFT)

Each bar represents a building

% OF RETROFIT SAVINGS
% OF OPERATIONAL SAVINGS

51 percent of all energy efficiency savings in commercial buildings are achievable through operational improvements—many at little or no cost to building owners. The portfolio above represents a $12M operational savings opportunity.
ENGAGE AND IMPLEMENT
MONITOR SAVINGS

Daily Summary: Compare actual consumption to baseline

Cumulative Savings: 4,329,354 kWh
$519,523 (@ 0.12 USD/kWh)
1,954 tonnes

Savings (selected period): $519,523

From: Nov 1, 2011 To: Nov 1, 2012

Zoom: 1m | 3m | 6m | YTD | 1y | All

Graph showing consumption data from November 2011 to November 2012.
GSA Objectives:
• Required by law to conduct audits in its largest buildings
• Set an aggressive 2% annual energy reduction target
• Need to extract more value from smart meter investment

FirstFuel Solution:
• Remote audits and remote monitoring for 300 largest bdgs
• Worked with GSA to determine program structure + key stakeholders to maximize impact

GSA Benefits:
• Scale -> Reach all buildings within tight timeframe
• Cost and Time -> Dramatically decreases technical analysis time and spend

2%/yr Savings Goal

GSA Covered Facilities

300 BUILDINGS

AUDIT 300 Bldgs

ENGAGE 300 Bldgs

MONITOR 300 Bldgs
CURRENT DEPLOYMENT RESULTS

YEAR 1 (Phase 1)
- 26 Bdgs
- 13M Sq.ft.
- $6.5M Savings
- 6 weeks vs. 6-8 months
- 50% operational savings

YEAR 2* (Phase 2)
- 90 Bdgs
- 47M Sq.ft.
- $14M Savings
- 8 weeks vs. 18-24 months
- 60% operational savings

YEARS 3-6 (Phase 2)
- 300 Bdgs

* Year 2/Phase 2 represents cumulative totals.

$14M Savings 85% cheaper
50% operational savings

50% operational savings
“Consumption spikes”... are actually rogue garage fans

FirstFuel “coaches” building manager to modify controls

Consumption decrease: 6.9 GWh
Energy savings: $825,000

* Energy reduction/savings reflect total across multiple measures
CASE EXAMPLE #2: LEADING MIDWEST UTILITY

Challenge / Opportunity:
– Difficulty finding deep savings after initial commercial EE programs
– Limited EE engagement in 100kW to 1MW segment

FirstFuel Solution:
– Portfolio screening, building auditing, performance monitoring (all remote)
– Partner provides Program Administration (PA) and enables Trade Ally network

Utility Benefits:
– Scale: Access hard-to-reach customers and operational savings
– Speed and Time: Channel retrofit leads to prescriptive/custom programs
– Customer Outcomes: Build stronger engagement levels with customers

SCREEN 9000 Bldgs
AUDIT 1000 Bldgs
ENGAGE 1000 Bldgs
IMPLEMENT ~250 Bldgs
MONITOR ~250 Bldgs
CASE EXAMPLE #2: LEADING MIDWEST UTILITY

**SCREEN**
- 29,000 Meter Population
- 14.5M Square Feet Analyzed
- 9,424 Analyzed Buildings
- 998 GWH Savings Potential
- 17% Portfolio Savings AVG %

**AUDIT**
- 200 Remote Audits Completed
- 72,000 Average Facility Size
- 54 GWH Savings Identified
- 650 Unique ECM’s Identified

**ENGAGE/IMPLEMENT**
- Three-tier engagement model with program partner
- Utilizing current Geotargeting strategies across different regions
- Projects set to begin in 1H 2014
ANALYTICS ENABLED EFFICIENCY

RANDOM.

STRUCTURED.

REACTION.

STRATEGIC.

RETOFITS

OPERATIONAL + RETROFITS = 2X

LOW SCALE.

HIGH SCALE.

HIGH COST.

LOW COST.