

DECEMBER 9, 2021

Save on Energy Workshop: How To Get The Most Value From Your Building Energy Data

Presented by the IESO





Today's Presenters

Rob Edwards: Business Advisor, IESO

Stephen Dixon: President, KnowEnergy

Jess Burgess: Consultant, Canadian Institute for Energy Training-Econoler

Agenda

- Introduction
- Types of Energy Data
- Accessing Your Energy Interval Data
- Energy Benchmarking with ENERGY STAR® Portfolio Manager
- Energy Data Analysis Tools and Approaches
- Participant Q&A
- What's Next?

About the IESO



Reliably operate Ontario's Province-wide system 24/7



Purposefully engage to enable informed decisions



Plan for Ontario's future energy needs



Support innovation



Enable competition and create efficient electricity markets



Cybersecurity leadership



Enable province-wide energy efficiency



Smart Metering Entity

2021-2024 CDM Framework

- \$692M, four-year CDM Framework launched in January 2021
- Centrally delivered by the IESO under the Save on Energy brand
- Programs target commercial, institutional and industrial customers with opportunities for residential electricity consumers
- Renewed programming for income-eligible electricity consumers and on-reserve First Nation communities



Save on Energy Programs

- Ontario businesses, large and small, have access to incentives for retrofits and other energy-efficiency projects to lower energy costs
 - Retrofit Program
 - Small Business Program
 - Energy Manager Program
 - Training and Support
 - Energy Performance Program
 - Existing Building Commissioning Program (targeting spring 2022)



Energy Performance Program

- Holistic approach to energy savings: operational + behaviour + capital
- Savings determined by comparing annual metered consumption to the baseline energy model
- Incentive of \$0.04/kWh paid each year for three years + \$50/kW adder for summer peak demand savings (June to August, weekdays)
- Facilities need to save at least 5 percent energy savings within first 2 years



Existing Building Commissioning Program Update

In 2022, the IESO will launch a program to help building owners hire a commissioning agent to tune up their buildings

- A building tune-up can find savings and improve occupant comfort by reprogramming and repairing energy-using systems
- All buildings "drift" away from how they should work, and some were not set up properly in the first place, so a building tune-up can help
- Minor replacement of some equipment would be allowed, but incentives for most capital projects would be accessed through other Save on Energy programs ineligible in this program

Energy Water Reporting and Benchmarking

- The Province of Ontario's **Energy & Water Reporting and Benchmarking** (EWRB) regulation is designed to help building owners and managers improve the energy and water efficiency of their buildings
- Large building owners need to report their building's energy and water use once a year to the Ministry of Energy starting:
 - July 1, 2019 for buildings 100,000 square feet and larger
 - July 1, 2023 for buildings 50,000 square feet and larger
- Building information and usage data are reported online through ENERGY STAR Portfolio Manager

Energy Water Reporting and Benchmarking (cont'd)

- The EWRB initiative can help you:
 - save money on utility bills by tracking usage
 - compare your energy and water usage to similar buildings
 - identify energy and water efficiency opportunities
- It will give owners, managers and customers access to market data that can help them make smarter investments
- In the future, building performance data will be published on [Ontario's Data Catalogue](#) so you can compare your building's energy and water usage to other similar buildings

Green Button

- Green Button is a data standard that provides residential and business energy customers with more choice in how they access their electricity or natural gas usage data
- Green Button applications can analyze this data to provide customers with personalized ways to increase energy efficiency. This will help customers:
 - save money on their monthly bills
 - reduce demand on the energy system
- To be implemented by all LDCs in Ontario by November 2023

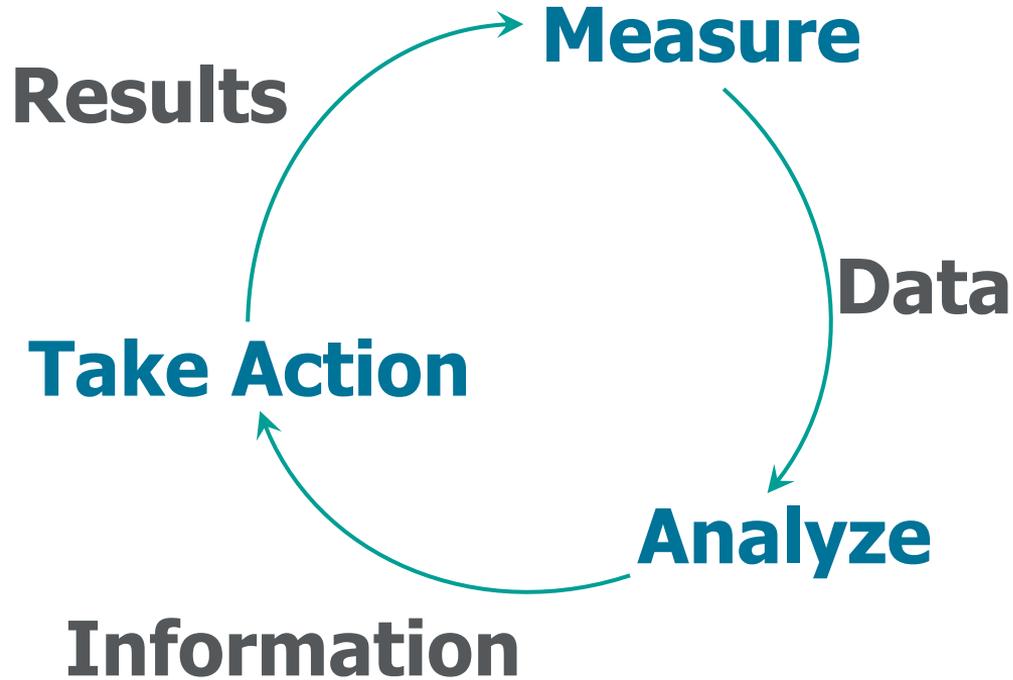
Green Button: How Does It Work?

- Green Button is designed to integrate with existing usage data
 - Format: XML
 - Type of data: electricity consumption data (also applicable to gas and water)
 - Source: smart meters, interval meters and other meter databases
 - Timeliness: data available via 24-hour time lag
- Green Button doesn't replace any existing tools; it is a "pipe" that allows data to flow from utilities to customers and solution providers
- Solution providers and reporting databases can build a Green Button "connector" to make their platforms compatible



Source: MaRS

The Energy Action Cycle



Who Has A Role?

Internal

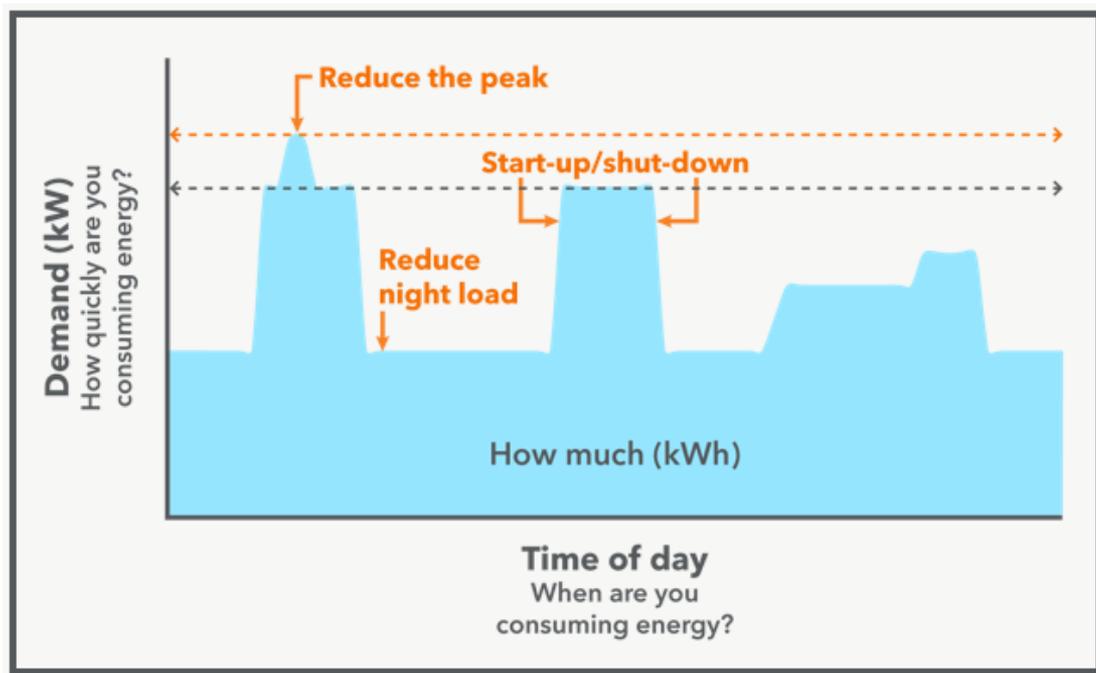
- Operations/maintenance technician
- Operations/maintenance manager
- ESG/sustainability/energy manager
- Superintendent
- Director of operations

External

- Energy services provider
- Controls provider
- Energy consultant

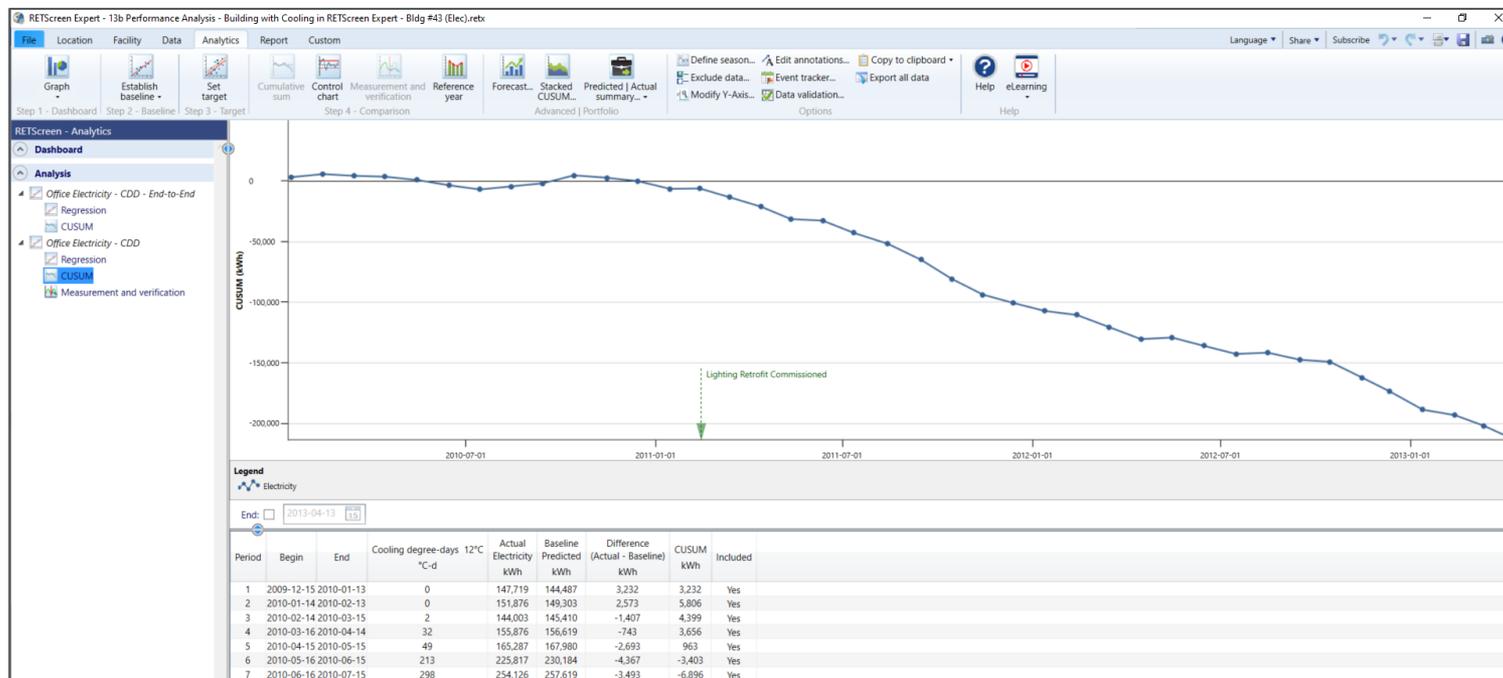


Energy Analysis Basics: What Is A Demand Profile?



Energy Analysis Basics: What Is A CUSUM*?

*CUSUM= cumulative sum control chart





Types of Energy Data

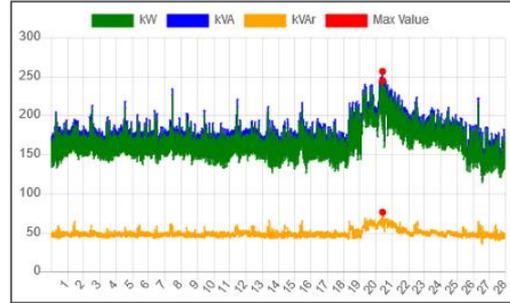
Energy Data Types and Formats

Monthly Bill

Electricity Retail Contract Monthly Bill Statement	
Account Number: 000 000 000 000 000 0	
Meter Number: 000000	
Your Electricity Charges	
Electricity	
YOU ARE BUYING YOUR ELECTRICITY FROM [ENERGY RETAILER NAME] *	
Global Adjustment	0.00
700 kWh @ Your Contract Price	0.00
Delivery	0.00
Regulatory Charges	0.00
Your Total Electricity Charges	0.00
H.S.T.	0.00
Ontario Electricity Rebate	(0.00)
Total Amount	\$0.00

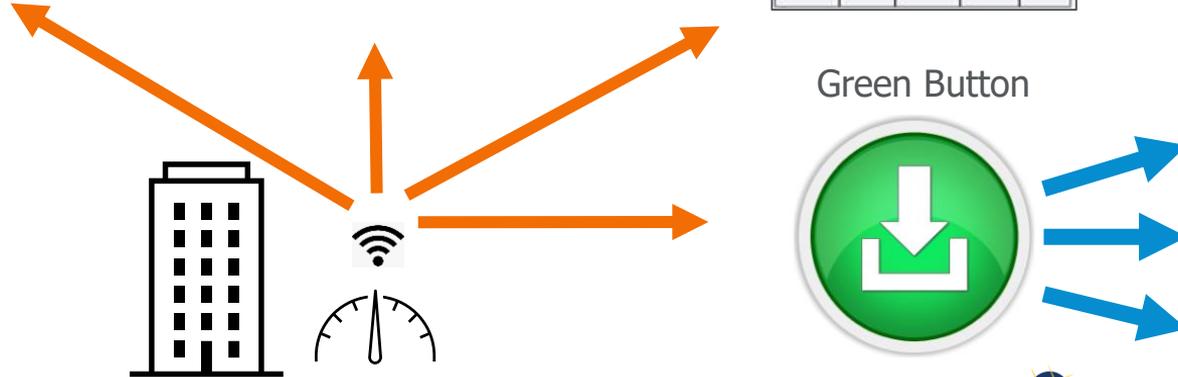
* Energy retailer phone #: 1-888-900-0000. Energy retailer website: www.****.com

LDC Data Analytics Platform

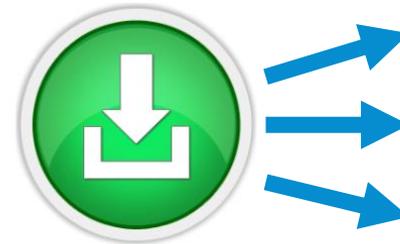


Database

Time	kW	kVAr	kVA	PF
00:05	40.30	34.60	53.10	0.759
00:10	40.30	37.40	55.00	0.733
00:15	46.10	43.20	63.20	0.730
00:20	51.80	46.10	69.40	0.747
00:25	40.30	34.60	53.10	0.759
00:30	54.70	51.80	75.40	0.726
00:35	51.80	43.20	67.50	0.768
00:40	37.40	37.40	52.90	0.707
00:45	54.70	49.00	73.40	0.745
00:50	57.60	49.00	75.60	0.782



Green Button

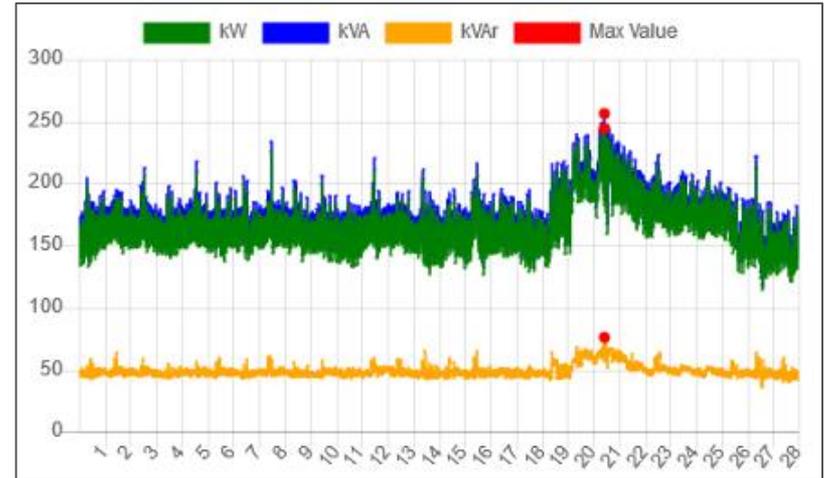




Accessing Your Energy Interval Data

Hands-on Demo: Accessing Your Energy Data

1. LDC data visualization platform
2. RETScreen



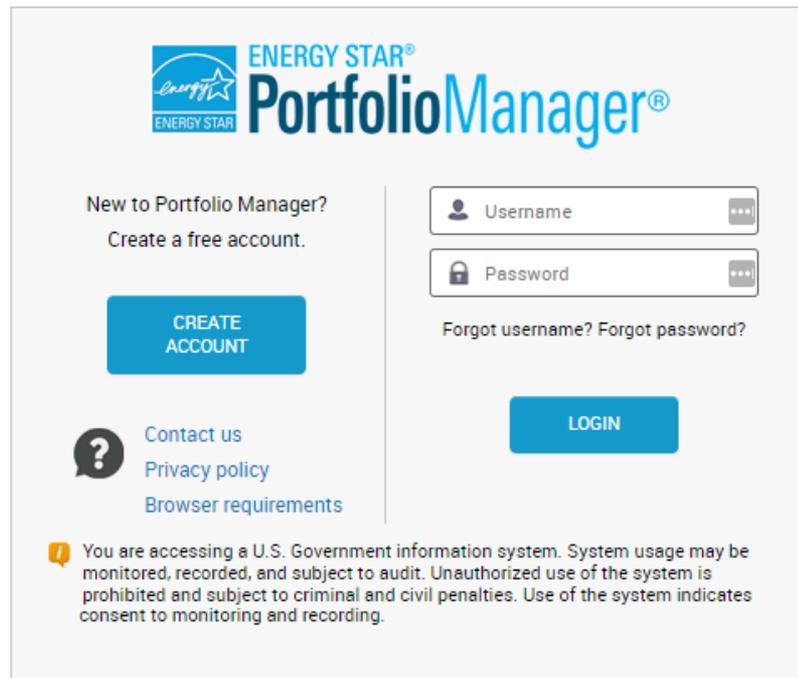
Thank you to Christina Guido and the Town of Caledon for access to their energy data for this demonstration!



Benchmarking in ENERGY STAR Portfolio Manager

Benchmarking in ENERGY STAR Portfolio Manager

- Free benchmarking tool from ENERGY STAR and Natural Resources Canada
- Anonymously compare performance to similar buildings
- Receive a 1-100 performance score
- Recognition opportunities
- Primary tool for EWRB reporting



The screenshot shows the ENERGY STAR Portfolio Manager interface. At the top left is the ENERGY STAR logo. To its right is the text "ENERGY STAR® PortfolioManager®". Below the logo, there are two main sections: "New to Portfolio Manager?" and "Login".

The "New to Portfolio Manager?" section includes the text "Create a free account." and a blue button labeled "CREATE ACCOUNT". Below this button are three links: "Contact us", "Privacy policy", and "Browser requirements", each preceded by a question mark icon.

The "Login" section includes two input fields: "Username" and "Password", each with a user icon and a password icon respectively. Below these fields is the text "Forgot username? Forgot password?". A blue button labeled "LOGIN" is positioned below the "Forgot" text.

At the bottom of the page, there is a disclaimer: "You are accessing a U.S. Government information system. System usage may be monitored, recorded, and subject to audit. Unauthorized use of the system is prohibited and subject to criminal and civil penalties. Use of the system indicates consent to monitoring and recording."

Hands-on Demonstration: Benchmarking

The screenshot displays the ENERGY STAR Portfolio Manager interface. At the top, the user is logged in as 'TdS.' and the dashboard metrics are current as of 11/04/2020 03:09 PM EST. The main content area is divided into two sections. On the left, there is a 'Properties (3)' section with an 'Add a Property' button and a 'Source EUI Trend (GJ/m²)' chart. The chart shows a downward trend in Source EUI from 2014 to 2019. On the right, there is a 'Dashboard' section with a search bar and a table of properties. The table lists three properties: Knowenergy Centre, M&S Building, and TdS Place, with columns for Name, Energy Current Date, ENERGY STAR Score, Site EUI, and Source EUI. A 'Refresh Metrics' button is located above the table, and a 'Download Data Table' button is at the bottom right of the table area.

Name	Energy Current Date	ENERGY STAR Score	Site EUI (GJ/m ²)	Source EUI (GJ/m ²)
Knowenergy Centre 9485688	12/31/2019	81	0.75	1.06
M&S Building 9768734	10/31/2019	66	0.76	1.05
TdS Place 12978946	11/30/2018	69	1.24	1.77

Case Study: Finding Savings With Benchmarking

Overall intensity: 47.5 kWh/ft²

BOMA Best average: 27.4 kWh/ft²

REALpac average: 29.5 kWh/ft²

Demand intensity

Typical peak demand intensity: 4-10 watts/ft²

This building demands 380 kw/57,000 ft² = 6.7 watts/ft²

Electrical energy intensity

Typical energy intensity for an office building: 14-26 kWh/ft²

This building used 1,743,120 kWh = 30.6 kWh/ft²

Natural gas intensity

Typical intensity: 41k-82k BTU/ft²

This building's intensity: 57,665 BTU/ft²



Overall energy intensity above comparable benchmarks. Can we find the reason?

Demand intensity is in range

Electrical intensity **not in range**

Natural gas intensity is in range

Solution: Small HVAC system to serve the 24/7 operations center outside of 8 a.m. to 5 p.m.

Savings: \$84,000 per year



Hands on Demonstration: Energy Data Analysis

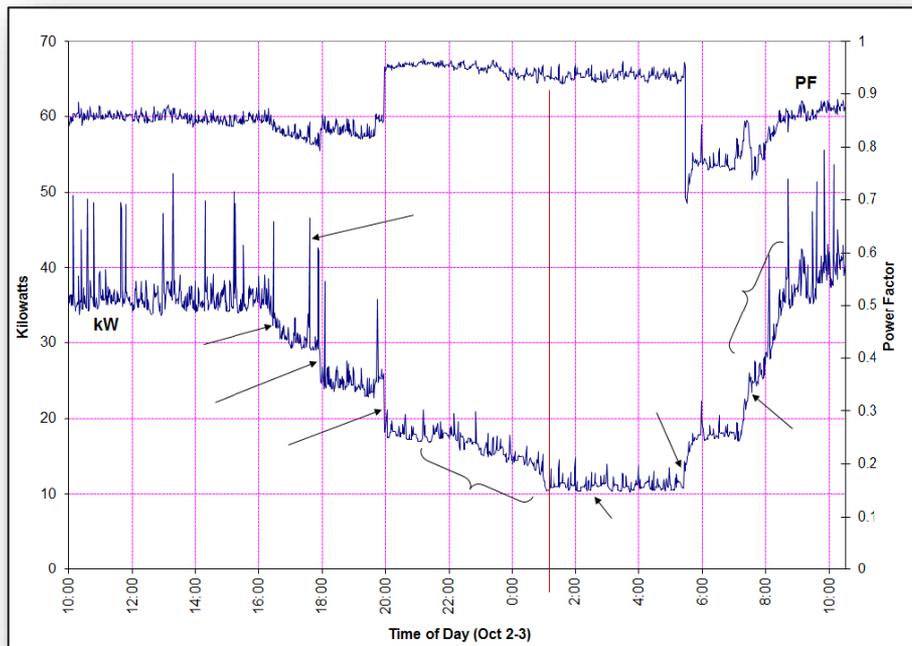
Interval Data Time Series Analysis in RETScreen Expert

The image displays two overlapping screenshots of the RETScreen Expert software interface. The background screenshot shows a heatmap visualization of interval data time series analysis, with a color scale ranging from blue (low values) to red (high values). The x-axis represents time (Monday to Wednesday, 12:00) and the y-axis represents weeks (from 2018-12-17 to 2018-11-25). The foreground screenshot shows the main dashboard of RETScreen Expert, version 8.1.2.13. The dashboard includes a navigation menu on the left, a central workflow diagram, and various tool options. The workflow diagram is a circular process with four quadrants: Performance Tracker (top-left), Virtual Energy Analyzer (top-right), Smart Project Identifier (bottom-right), and Financial Risk Assessor (bottom-left). The central text reads 'RETScreen Expert Clean Energy Management Software - Version 8.1'. The dashboard also lists facility types (e.g., Power plants, Industrial/Agricultural) and integrated features (e.g., User manual, eLearning, Databases).

Detailed Profile Analysis Using 5-Minute Demand (kW) and Power Factor (PF) Data

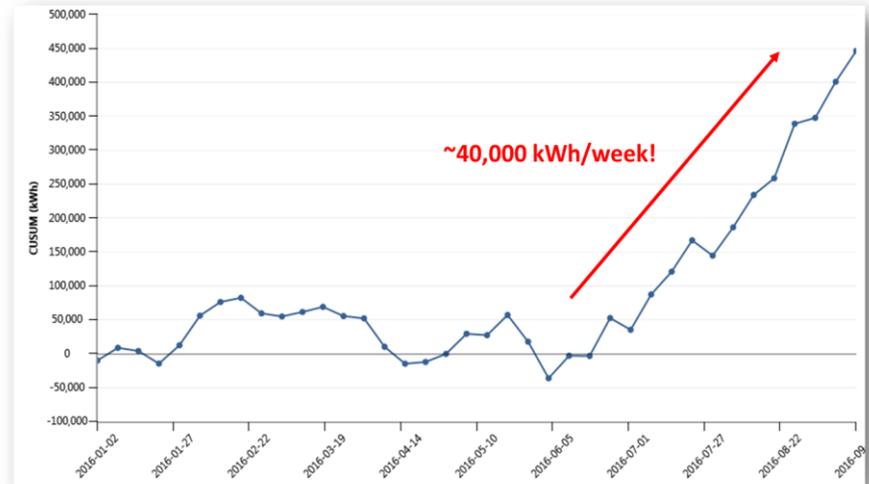
Using kW & PF Information

- ▶ + kW - PF
 - Motor load on
- ▶ + kW + PF
 - Lighting load on
- ▶ - kW - PF
 - Lighting load off
- ▶ - kW + PF
 - Motor load off

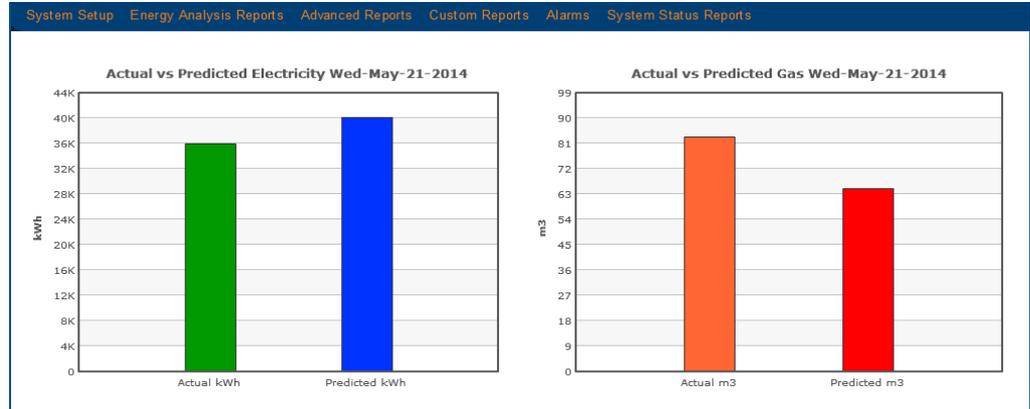
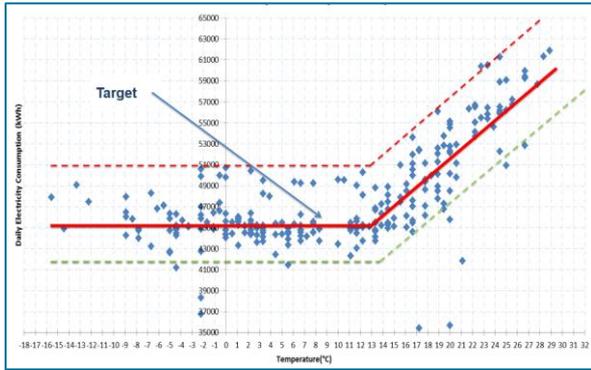


Case Study: Valuable Data for Industry

- LDC customer concerned with bill increase
- 2+ years of electricity data analyzed
- Weather and production as drivers
- Beginning of “increase” traced back with CUSUM to a specific week
- Operational change identified as cause
 - Not due to weather
 - Increase in waste due to idle equipment
 - Avoidable with new operational procedure
 - ~ 40,000 kWh per week (>\$4,000/week)



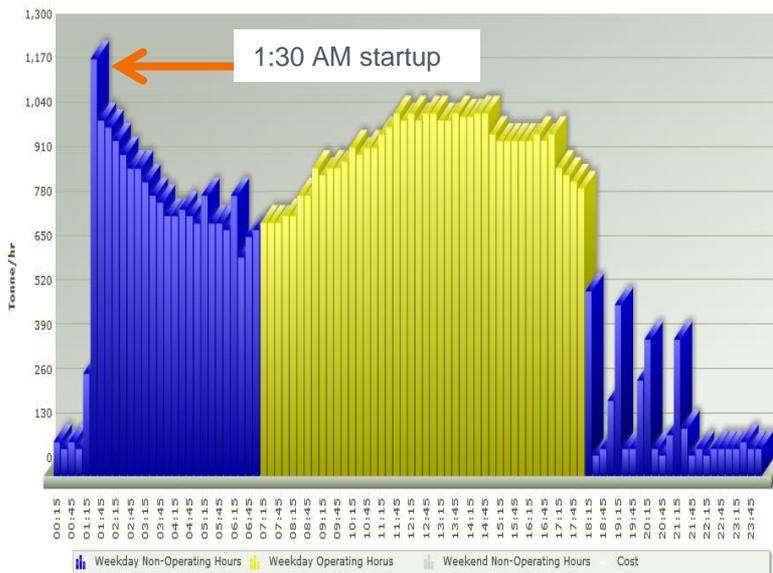
Case Study: Simple is Actionable!



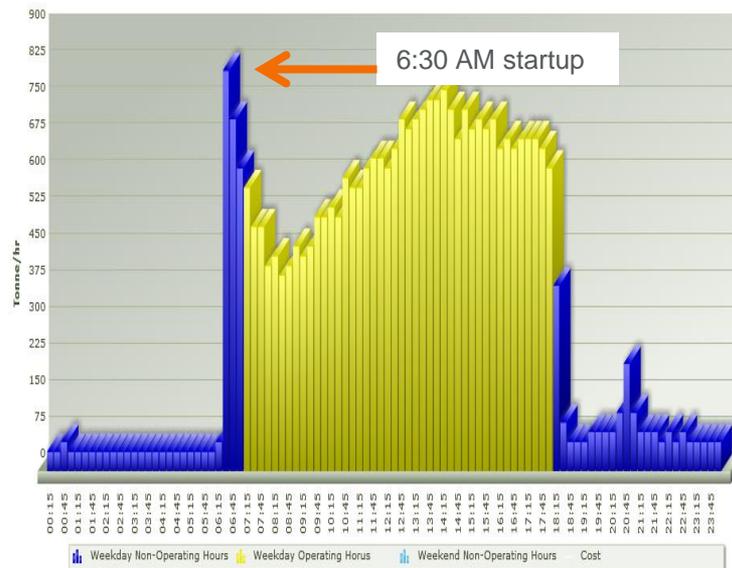
Targets (Predicted kWh)

Case Study: Office Schedule Optimization

Cooling Demand Before



Cooling Demand After

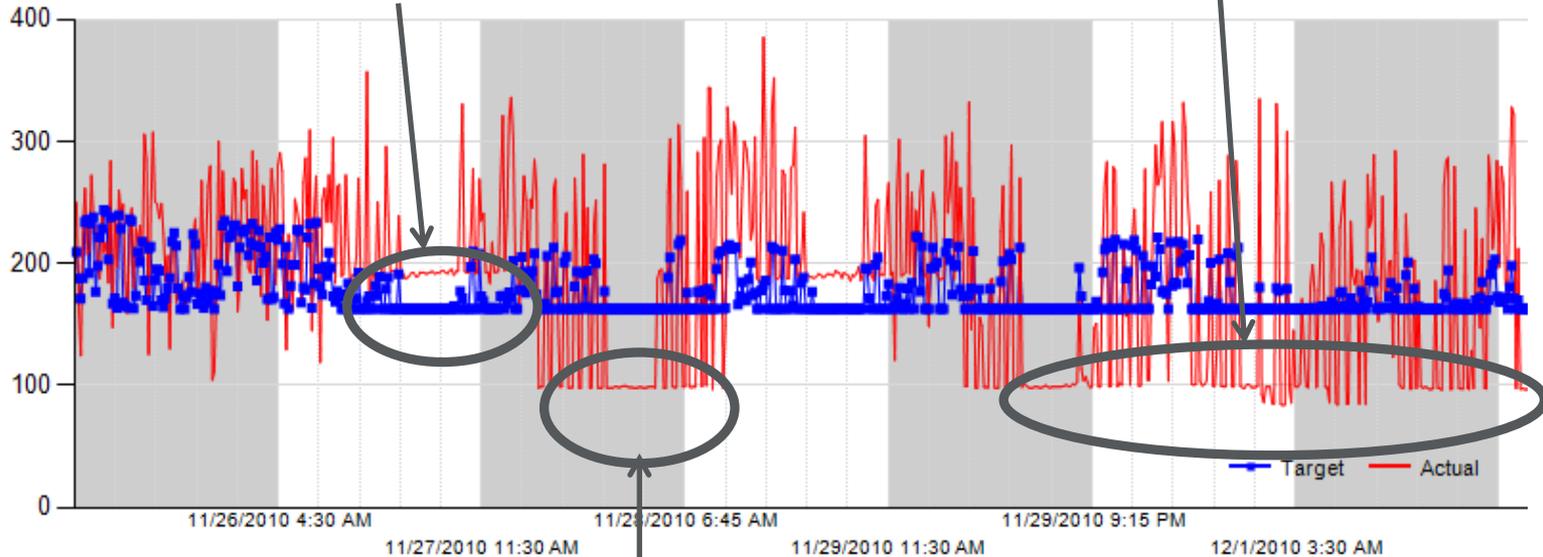


Cost impact: \$24k if undetected over the summer

Case Study: Data Inform Operating Procedures

Actual (190 kW) > Predicted (170 kW) when production is stopped

Standard operating procedure to ensure fan is shut down properly



Actual (100 kW) < Predicted (170 kW) another time production is stopped

Energy Information Comprehensive Reference

ENERGY INFORMATION HANDBOOK

Applications for Energy-Efficient Building Operations






















Introduction

The Advanced Methods rely on sophisticated underlying analyses, but interpreting their output does not tend to require deep expertise, because much of the analysis is automated. In contrast, the Fundamental Methods may require more user expertise, to be able to translate graphs and data trends into an understanding of performance.

Interpretation of Method Output

Analysis Methods	Requires Minimal Expertise	Requires Advanced Expertise
Simple Tracking	██████████	██████████
Utility Cost Accounting	██████████	██████████
Internal Rate of Return	██████████	██████████
Carbon Accounting	██████████	██████████
Longitudinal Benchmarking	██████████	██████████
Cross-Sectional Benchmarking	██████████	██████████
Loading Profiling	██████████	██████████
Peak Load Analysis	██████████	██████████
PV Monitoring	██████████	██████████
Loading Histograms	██████████	██████████
Simple Baselines	██████████	██████████
Model Baselines	██████████	██████████
Lighting Efficiency	██████████	██████████
Heating and Cooling Efficiency	██████████	██████████
Energy Signature	██████████	██████████
Energy Savings	██████████	██████████
Cumulative Sum	██████████	██████████
Anomaly Detection	██████████	██████████

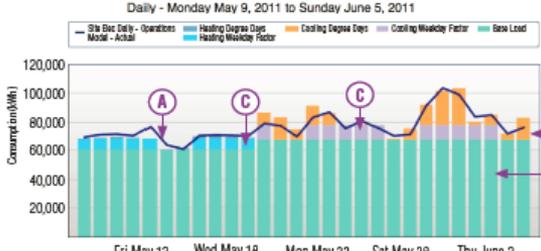
Fundamental Methods
Model Baselines

Example 2: Whole-Building Electric Baseline

- A Actual daily electric use (dark blue) is overlaid with stack bars showing baseline use.
- B Baseline components are: base load and weather (heating and cooling degree days).
- C The baseline also accounts for occupancy in heating and cooling "weekday factors."

For the period shown, actual use is at or below baseline reflecting efficient operations.

Daily - Monday May 9, 2011 to Sunday June 5, 2011



Consumption (kWh)

Legend: Site Elec Daily - Operations, Model - Actual, Heating Degree Days, Cooling Degree Days, Heating Weekday Factor, Cooling Weekday Factor, Base Load

Timeline: Fri May 13, Wed May 18, Mon May 23, Sat May 28, Thu June 2




Load Profiling

Peak Load Analysis

Monitoring

PV

Loading Histograms

Simple Baselines

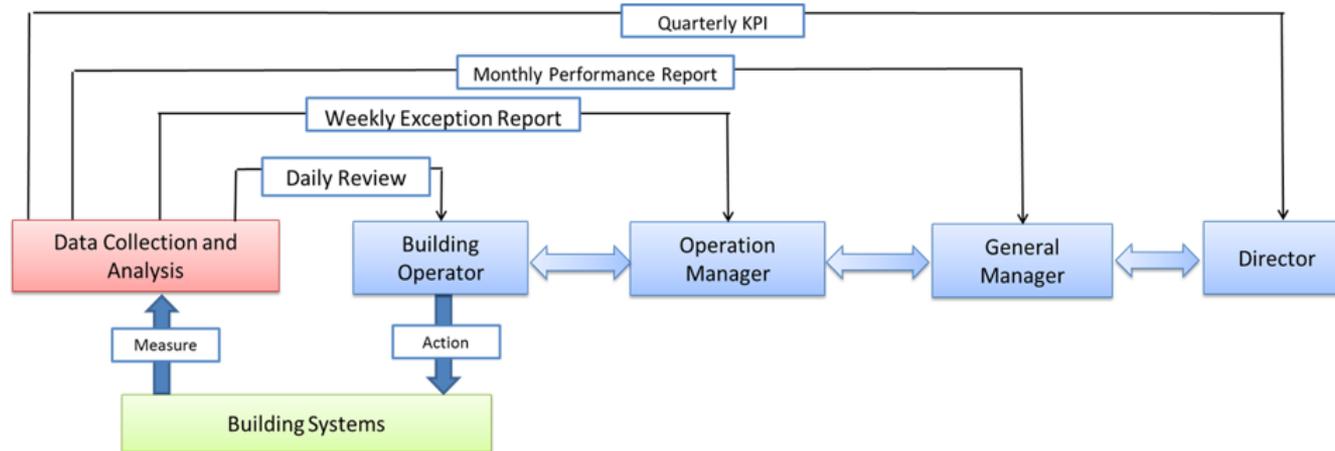
Model Baselines

Lighting Efficiency

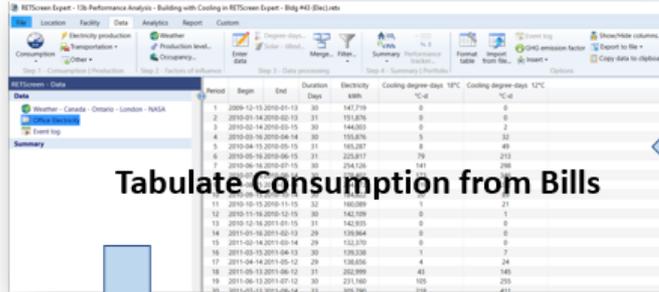
Source: <https://betterbuildingsolutioncenter.energy.gov/sites/default/files/attachments/energy-information-handbook.pdf>

In the Loop

- Energy performance data are visible to all staff in a form they can **understand** and **act upon**



Performance Analysis with CUSUM

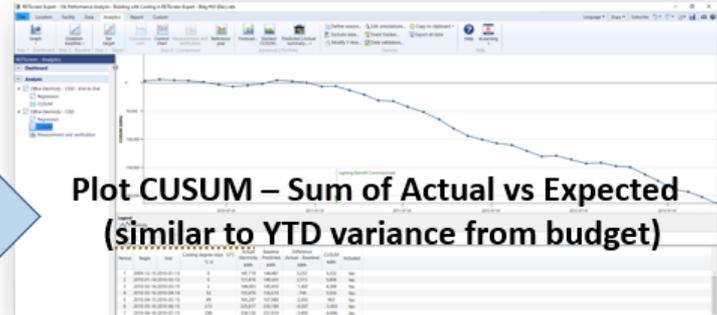


Tabulate Consumption from Bills

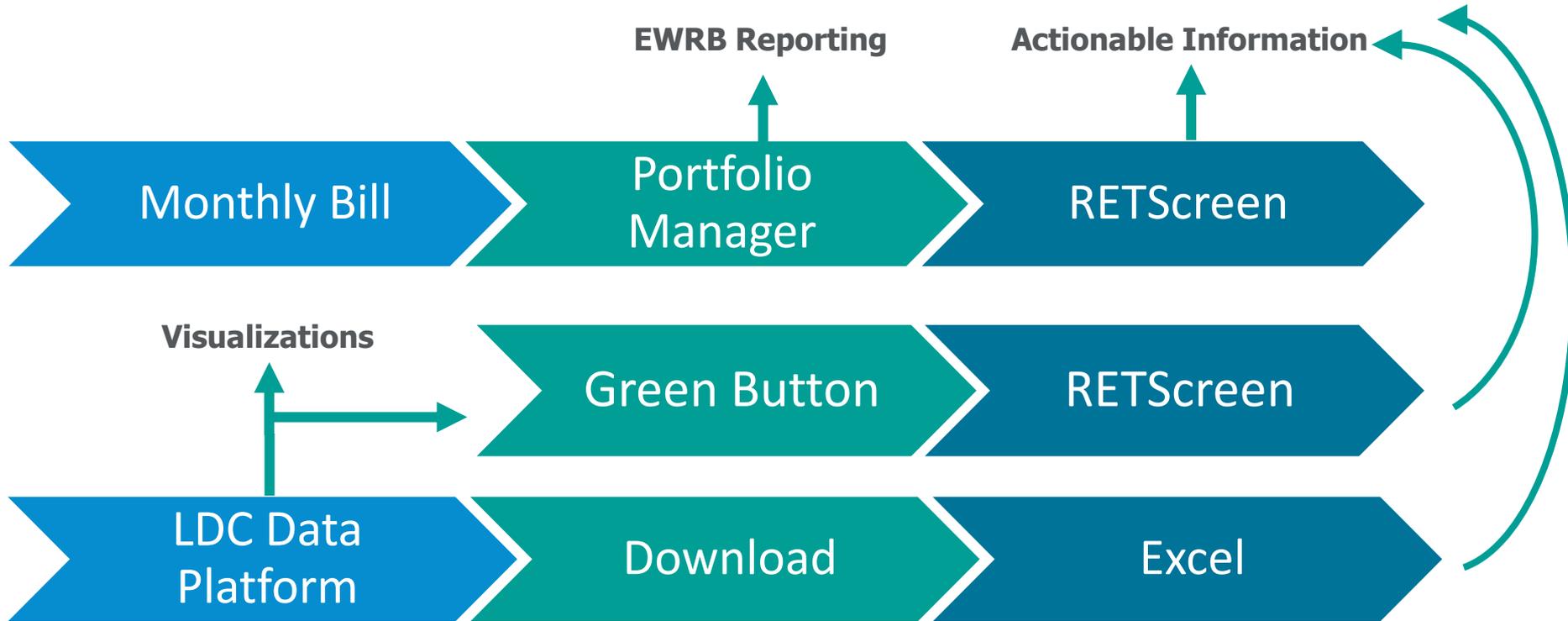
Period	Begin	End	Duration	Electricity	Cooling degree days 10°C	Cooling degree days 12°C
1	2009-12-15	2010-01-13	30	147,719	0	0
2	2010-01-14	2010-02-13	31	151,876	0	0
3	2010-02-14	2010-03-15	30	146,903	0	2
4	2010-03-16	2010-04-14	30	153,876	5	32
5	2010-04-15	2010-05-15	31	163,267	8	49
6	2010-05-16	2010-06-15	31	225,817	79	213
7	2010-06-16	2010-07-15	30	234,526	141	290
8	2010-07-16	2010-08-14	30	149,626	160	211
9	2010-08-15	2010-09-14	31	146,089	1	21
10	2010-09-15	2010-10-14	30	142,109	0	1
11	2010-10-15	2010-11-15	31	142,903	0	0
12	2010-11-16	2010-12-15	30	142,109	0	0
13	2010-12-16	2011-01-15	31	142,903	0	0
14	2011-01-16	2011-02-13	29	139,944	0	0
15	2011-02-14	2011-03-14	29	132,370	0	0
16	2011-03-15	2011-04-13	30	139,339	1	7
17	2011-04-14	2011-05-12	29	138,006	4	24
18	2011-05-13	2011-06-12	31	202,999	43	145
19	2011-06-13	2011-07-12	30	231,160	105	255
20	2011-07-13	2011-08-12	31	153,790	158	413



- Get a tracking tool:
 - MT&R Spreadsheet (free)
 - RETScreen Expert
- Start with your monthly bills



Energy Data Reporting and Analysis Pathways





Participant Q&A

Please submit your questions using the Chat

What's Next?

Customized coaching workshops:

- Develop your building energy baseline
- Identify anomalies and potential savings opportunities
- Performance monitoring and energy management
- Prepare data collection analysis protocols to support...
 - EWRB reporting
 - Energy Performance Program participation

Details and application information to follow in early 2022

Thank you

SaveOnEnergy.ca

saveonenergy@ieso.ca



[@SaveOnEnergyOnt](https://twitter.com/SaveOnEnergyOnt)



facebook.com/SaveOnEnergyOntario



[linkedin.com/showcase/
SaveOnEnergy-Ontario](https://linkedin.com/showcase/SaveOnEnergy-Ontario)