GUIDE FOR:
BUILDING DESIGNERS

Pacific Northwest NATIONAL LABORATORY

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METERED ENERGY DATA DISPLAY

Metered data energy displays can provide actionable information to building operators to help save energy and costs. To be used effectively, it is important to consider both code requirements for use of displays and the operator's intended use.

Energy Display Selection Considerations

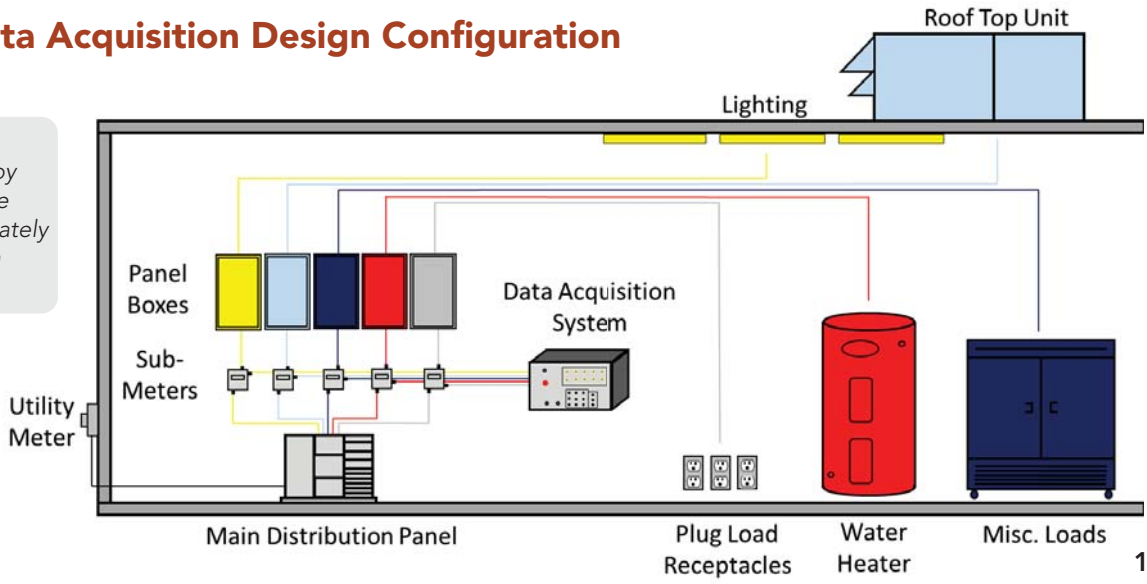
Energy displays systems may be integrated with the building control system (BCS) or installed as stand-alone meter data display systems. When selecting, installing and commissioning the sub-metering system and associated energy display, the following design options and operator needs should be considered.

	Options*	Considerations
Energy Display System Vendor Options	■ Standard software products are typically purchased with a one-time fee, are licensed according to number of installations, and include limited support with no additional services ■ Application Service Providers (ASP) offer solutions in which the ASP owns, operates, and maintains the software and servers for web-based applications that are usually priced according to monthly/annual fees ■ Turnkey solution providers offer fully-packaged solutions that include pre-installed software, hardware and accessories in a single 'bundle'	■ Pricing and licensing are usually per site and per user, can be subscription-based or one-time fee, and are often tied to the support services included ■ Bundled or optional services can include data and IT management and customizability for user interface and analytics ■ For buildings with a BCS, BCS providers may include an analytics package (turnkey solution), or include the option of a third party package on top of the BCS (ASP) ■ Servers can be hosted on-site or remotely by energy data display company (commonly known as software as a service, or SaaS)
Commissioning of Metering and Display System	■ Failure to commission sub-metering and energy display systems correctly is a common pitfall in their effective use. Suggestions for optimizing the commissioning process include: – Providing clear mapping of electrical design (what is being metered) to commissioning team – Ensuring sub-meters are communicating as intended to data acquisition system – Ensuring that all of the metering, data collection and display system work in a fully integrated way, and that one party takes responsibility for all integration and functioning	

*Granderson, J., Piette, M.A., Ghatikar, G., Price, P. (2009, June). Preliminary Findings from an Analysis of Building Energy Information System Technologies. Retrieved from https://cbs.lbl.gov/sites/all/files/2224e.pdf

Sub-metering & Data Acquisition Design Configuration

The number of sub-meters installed can be determined by the design team, provided the data acquisition system accurately totals all energy used by each end-use category.



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Metered Energy Data Display Uses and Visuals

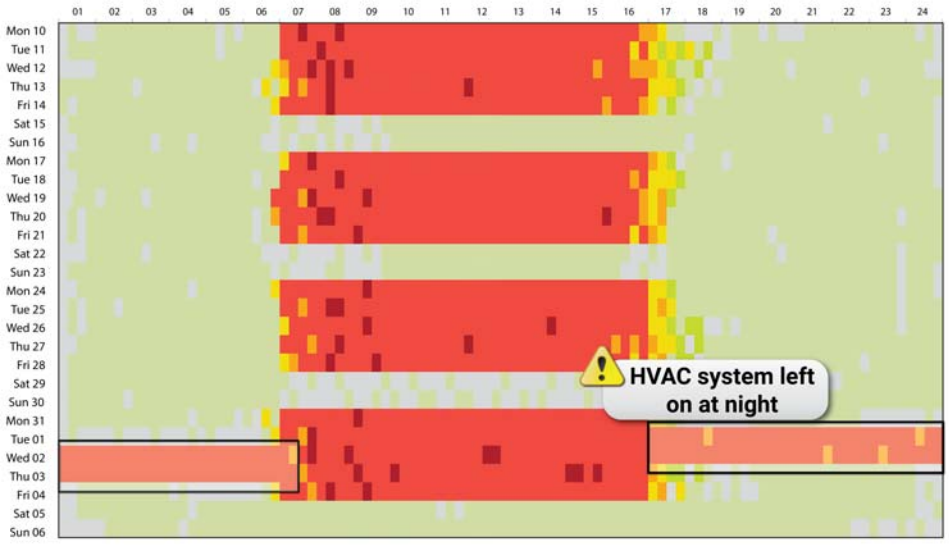
Energy data display systems should be used to help better manage building energy use. Potential applications include:

- Tracking energy use and identifying inefficiencies
- Benchmarking building performance and identifying areas for improvement
- Performing measurement and verification to track energy savings projects
- Automating utility bill analysis and estimating the cost of each energy end-use
- Incorporating data quality verification to self-diagnose any errors with the system

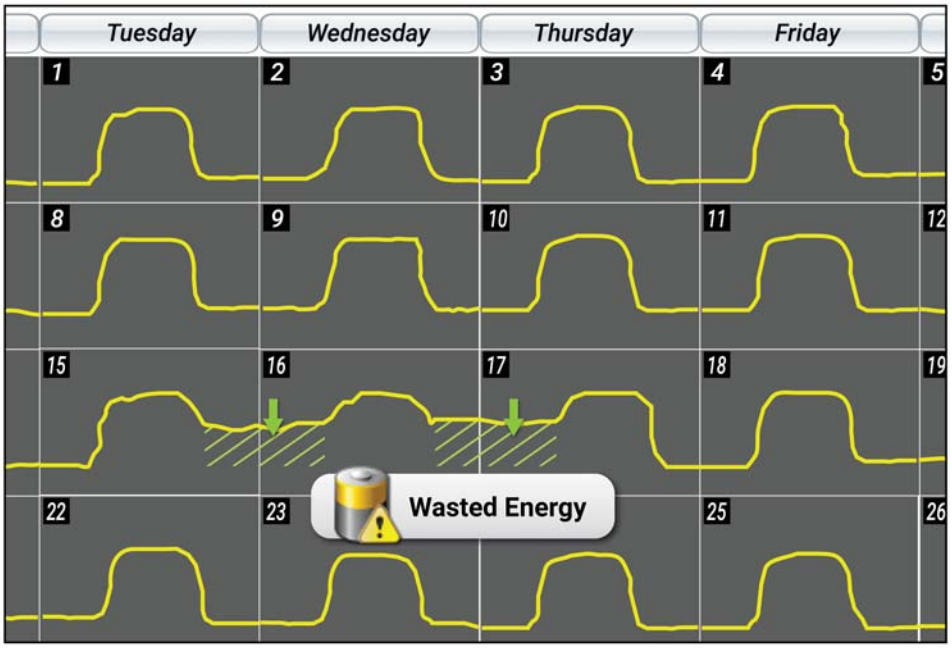
A description of each these functions, along with example visuals, is provided below.

TRACKING ENERGY USE

Heat Map identifying a building's HVAC system operating at full capacity overnight.



Calendar View of lighting sub-meter showing an abnormal profile on the 16th, likely indicating main office lighting was left on overnight.

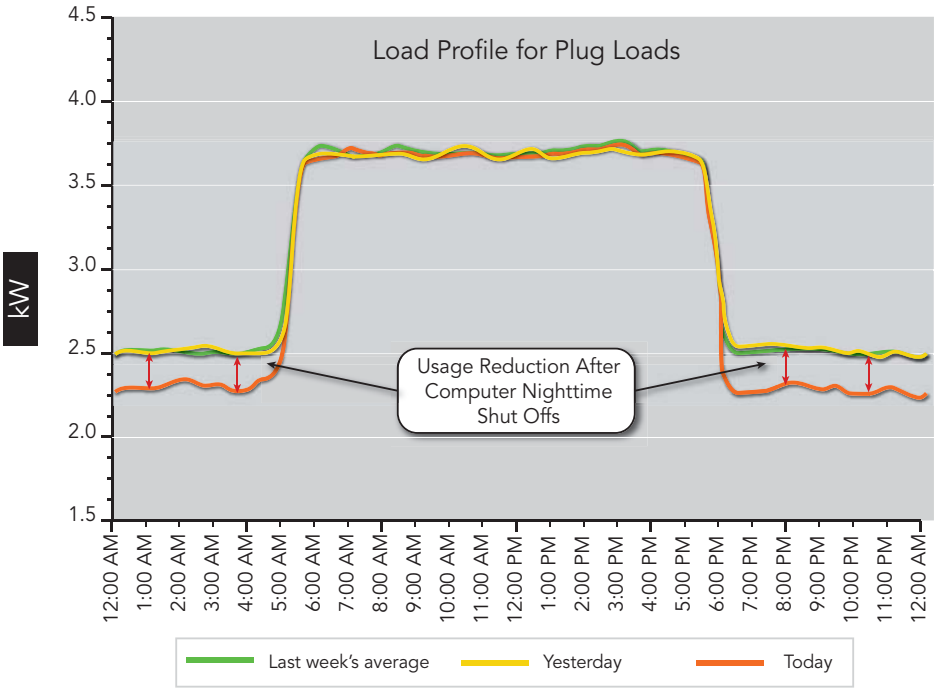


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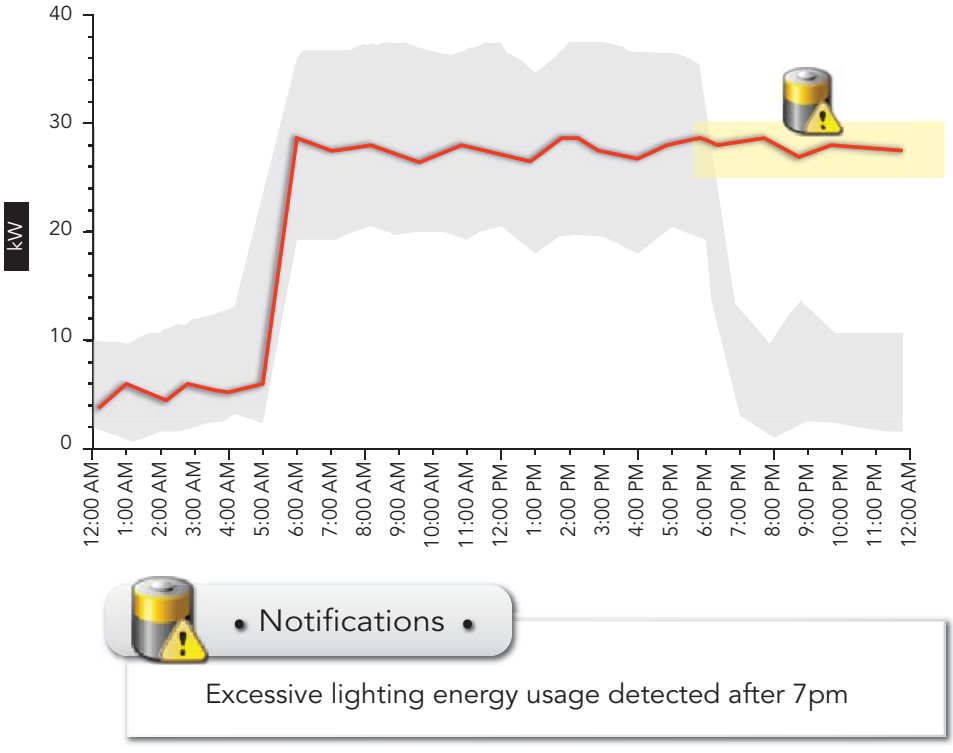
TRACKING ENERGY USE

Metered Energy Data Display Uses and Visuals *(Cont.)*

Overlay showing a reduction in today's plug load power draw overnight compared to yesterday and last week's average after a nighttime shut down of all personal computers was implemented.



Trend Analytics delivering a notification that the building's lighting system is operating outside the expected profile.

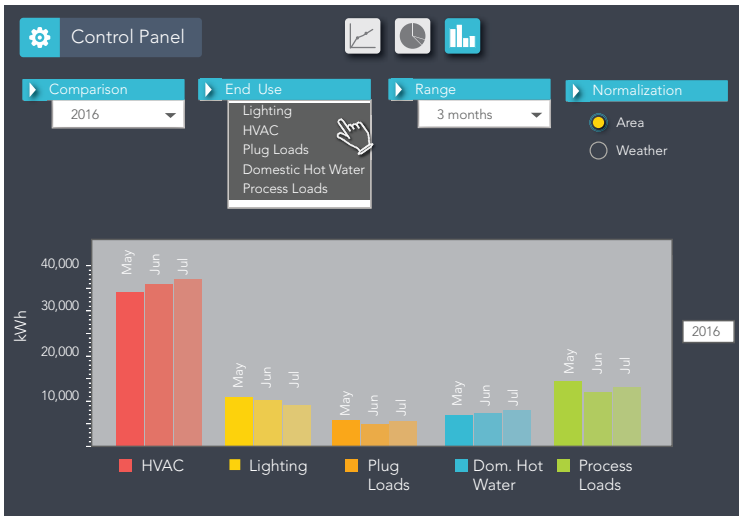


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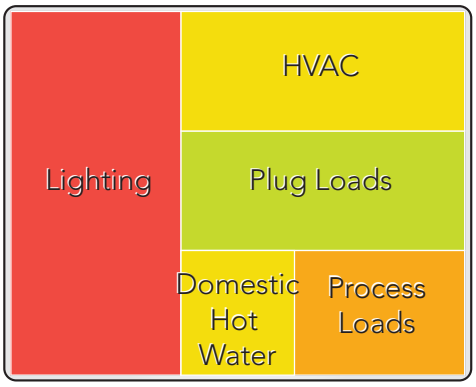
BENCHMARKING BUILDING ENERGY PERFORMAMCE

Metered Energy Data Display Uses and Visuals *(Cont.)*

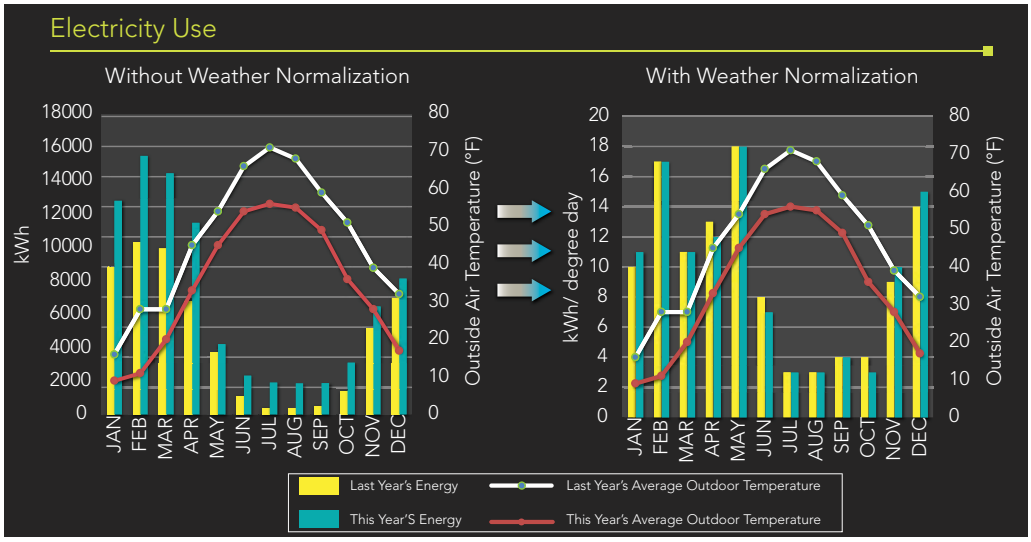
Benchmarking comparing energy use for each end use category over three months.



Sub-Meter Portfolio View showing lighting as the major energy contributor to the overall building load yesterday (relative size of rectangle) and showing an increase in lighting energy consumption between yesterday and last week (red color).



Normalization removing the impact of weather for benchmarking against last year's performance.



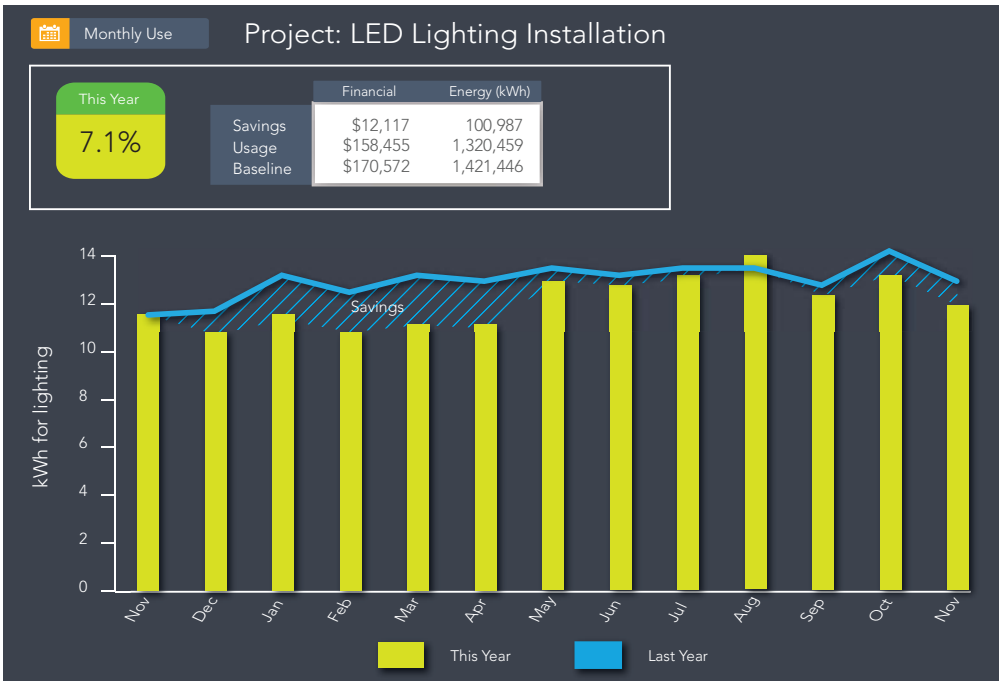
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MEASUREMENT & VERIFICATION

Project Tracking comparing lighting energy use before and after replacing all lights with light emitting diodes (LEDs).

Energy Savings Estimation allowing a user to input a desired profile for plug loads based on a conservation measure (e.g. nighttime computer shutdown).

Metered Energy Data Display Uses and Visuals *(Cont.)*

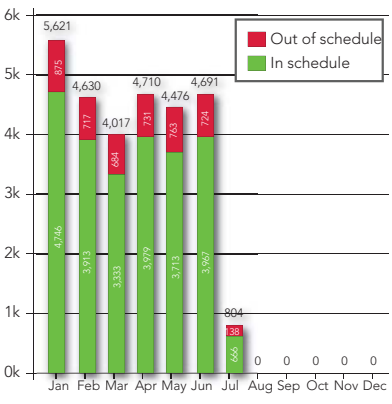


Project: Computer Nighttime Shut Down



Estimated Savings

Pre-project cost:	$ 28,950
Post-project cost:	$ 24,317
Wastage cost:	$ 4,633 (16%)

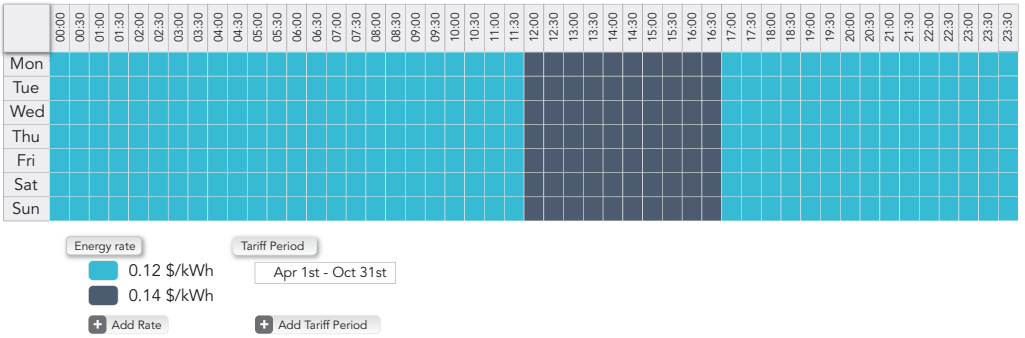


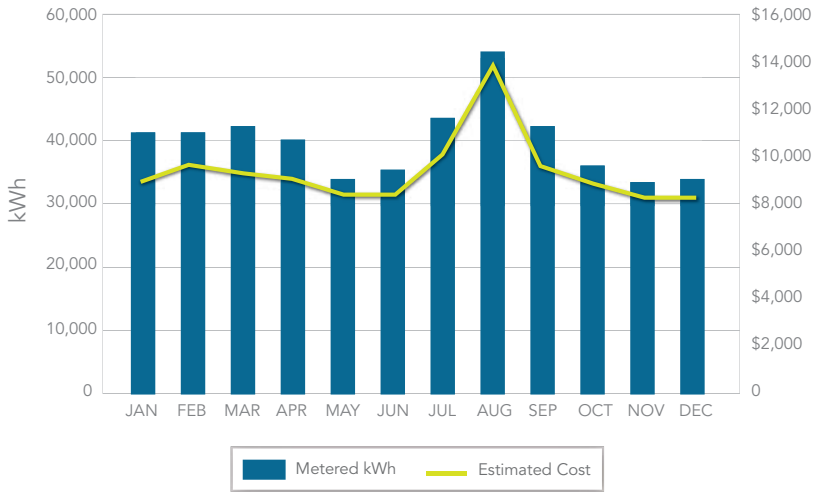
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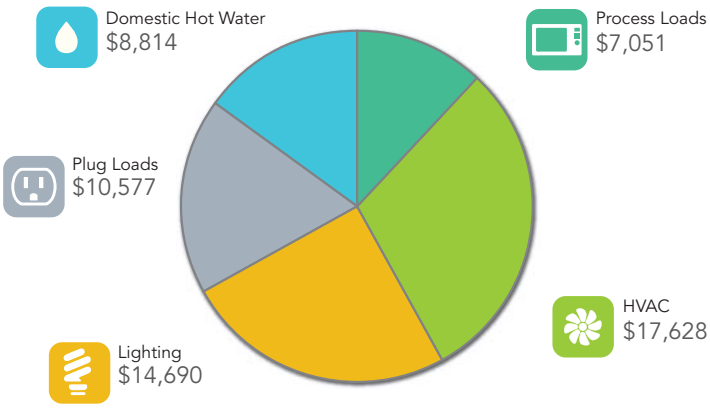
UTILITY BILL ANALYSIS

Cost Estimation allowing a user to input their utility rate structure and applying that rate structure to estimate the cost of the metered data use at both the whole building level and the end use category level.

Metered Energy Data Display Uses and Visuals *(Cont.)*





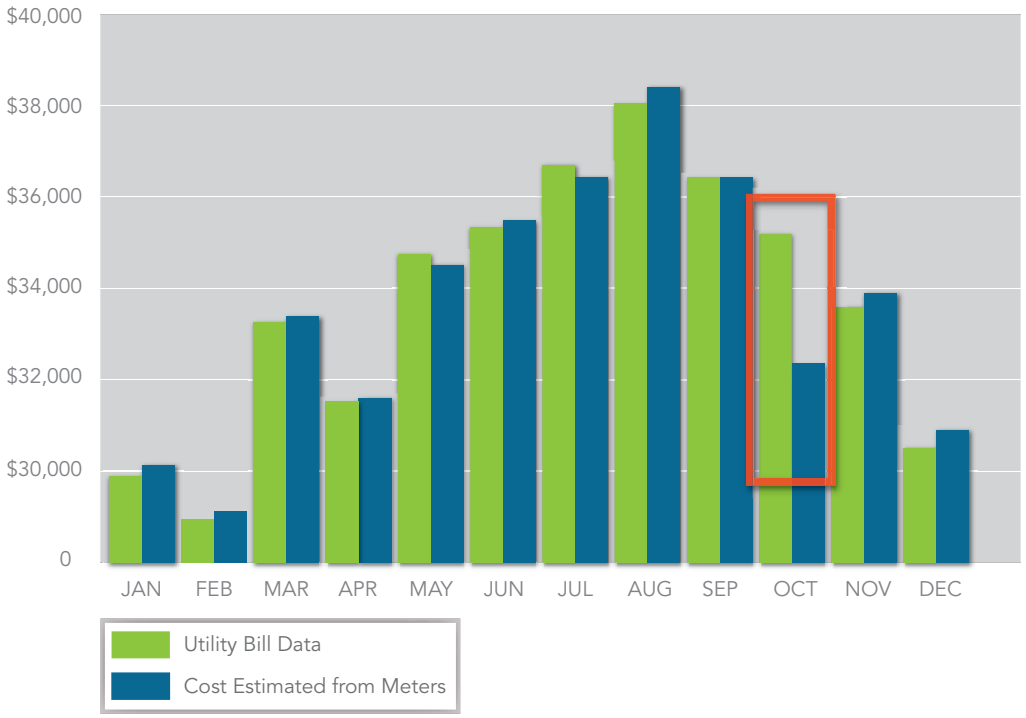


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UTILITY BILL ANALYSIS

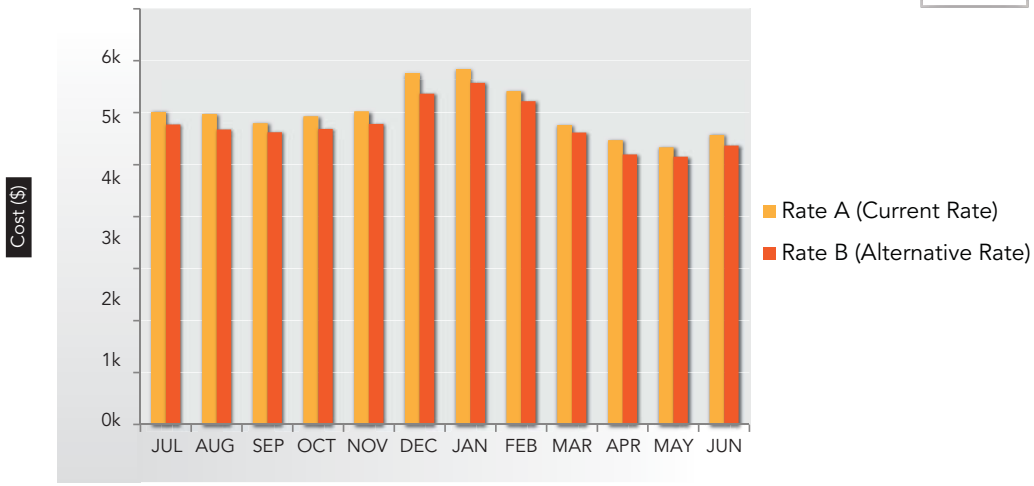
Metered Energy Data Display Uses and Visuals *(Cont.)*

Utility Bill Validation showing a comparison of the building energy costs estimated from the metered data and the actual utility bills.



"What if?" Utility Bill Analysis comparing the building's energy costs using the current rate structure to the costs if another rate structure was used.

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
RATE A	$	6,012	5,975	5,794	5,924	6,023	6,772	6,845	6,413	5,763	5,469	5,327	5,568	$ 71,885
RATE B	$	5,772	5,676	5,620	5,687	5,782	6,366	6,571	6,221	5,619	5,196	5,151	5,368	$ 69,028
														-3.9%



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DATA QUALITY VERIFICATION

Alarms and Notifications warning a user of uncharacteristic data spikes indicating likely metering errors.

Metered Energy Data Display Uses and Visuals *(Cont.)*

