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## SiteWatch Reporting

SiteWatch offers a fully supported energy monitoring solution, including reporting and alerting, scoping assistance, installation support, and hardware warranties.

Ongoing support can be used to gather findings from collected data, benchmarking, finding energy cost savings, or can even be incorporated into predictive maintenance efforts. This support can help with tracking energy use towards compliance goals, such as achieving savings reduction targets over a period. ABC Company may benefit directly from energy monitoring (EnMS) in support of ISO 50001 compliance and the Better Plant Initiative targets by identifying energy saving opportunities and verifying savings from implemented changes.

SiteWatch can support the ABC Company installation with the following:

- Annual or Bi-Annual site reviews with observations and recommendations per site, building, and/or usage group
- Generating deliverables to support compliance goals for ISO 50001, Better Plant Initiative, or other targets
- Ongoing assistance with measurement and verification of installed energy saving measures
- Establishing usage profiles for buildings, device groups, or any other category to inform any reporting or alerting

## ISO 50001 Support

ISO 50001 specifies the requirements for establishing, implementing, maintaining, and improving an energy management system to enable a systematic approach in achieving continuous improvement in energy use. The standard explicitly involves adopting a PLAN-DO-CHECK-ACT (PDCA) cycle for energy projects at a site, building, and device level as shown in the figure below. Sites are encouraged to monitor significant energy users and implement building-level metering. SiteWatch is uniquely suited to provide support for this effort, namely for PLAN and CHECK steps:

*Figure 1: Mapping ISO 50001 Elements (source - Georgia Institute of Technology)*



*Planning* involves reviewing energy use, developing a baseline, setting objectives, and identifying targets. With detailed energy use data on a device level, planning can be comprehensive and focus action where the most benefit can be gained.

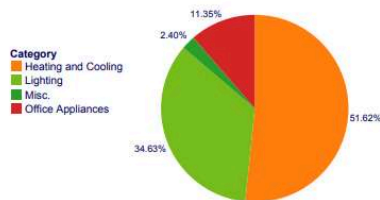
*Checking* involves verifying savings for implemented energy saving measures. If energy use is only tracked at the site level, critical information about specific improvements or changes will be missed. Reporting may not accurately reflect measure performance or attribute energy reductions appropriately.

SiteWatch can assist in achieving Site Energy Performance (SEP) goals through monitoring, reporting, and recommending energy saving measures at regular review intervals.

## Site Daily Energy Use

The site daily energy use report shows daily monitored energy use by usage group and compares energy use by day to previous periods. Energy consumed and associated costs are presented in an easy-to-understand graphic and table, allowing a quick comparison by load type. Any difference between the reported day and the previous day is indicated by a percent variance. A line chart shows the demand (kW) on a 5-minute interval with a comparison versus the previous day of the week (i.e. Monday shown versus previous Monday).

Daily Consumption by Load Type



Category	Cost	Energy	Same Day Last Week	Variance	% Variance
Heating and Cooling	\$17.71	116.6 kWh	112.1 kWh	4.5 kWh	4.0% ↑
Lighting	\$11.88	78.2 kWh	78.4 kWh	-0.1 kWh	-0.2% ↓
Misc.	\$0.83	5.4 kWh	5.4 kWh	0.0 kWh	-0.3% ↓
Office Appliances	\$3.90	25.6 kWh	25.8 kWh	-0.2 kWh	-0.7% ↓
<b>Site Totals*</b>	<b>\$55.35</b>	<b>384.1 kWh</b>	<b>380.2 kWh</b>	<b>3.9 kWh</b>	<b>1.0% ↑</b>

\* Site total may be higher than the sum of load types if not all loads are monitored

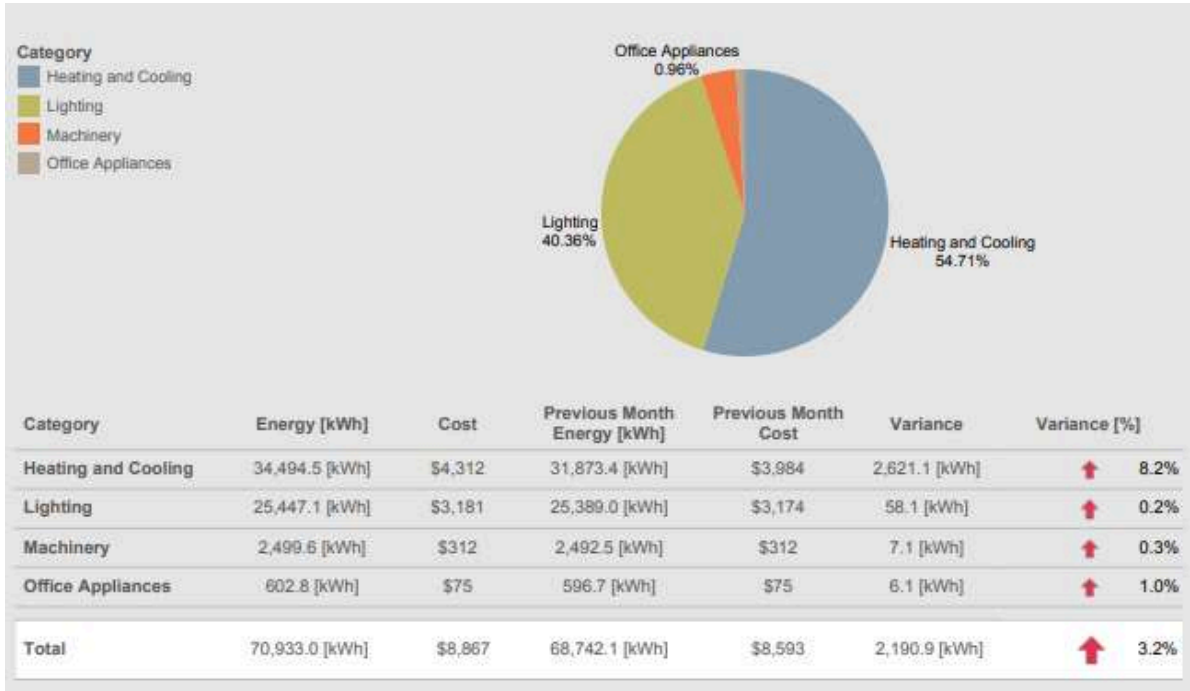
Power Usage on 2015-02-09 vs. the Same Day Last Week



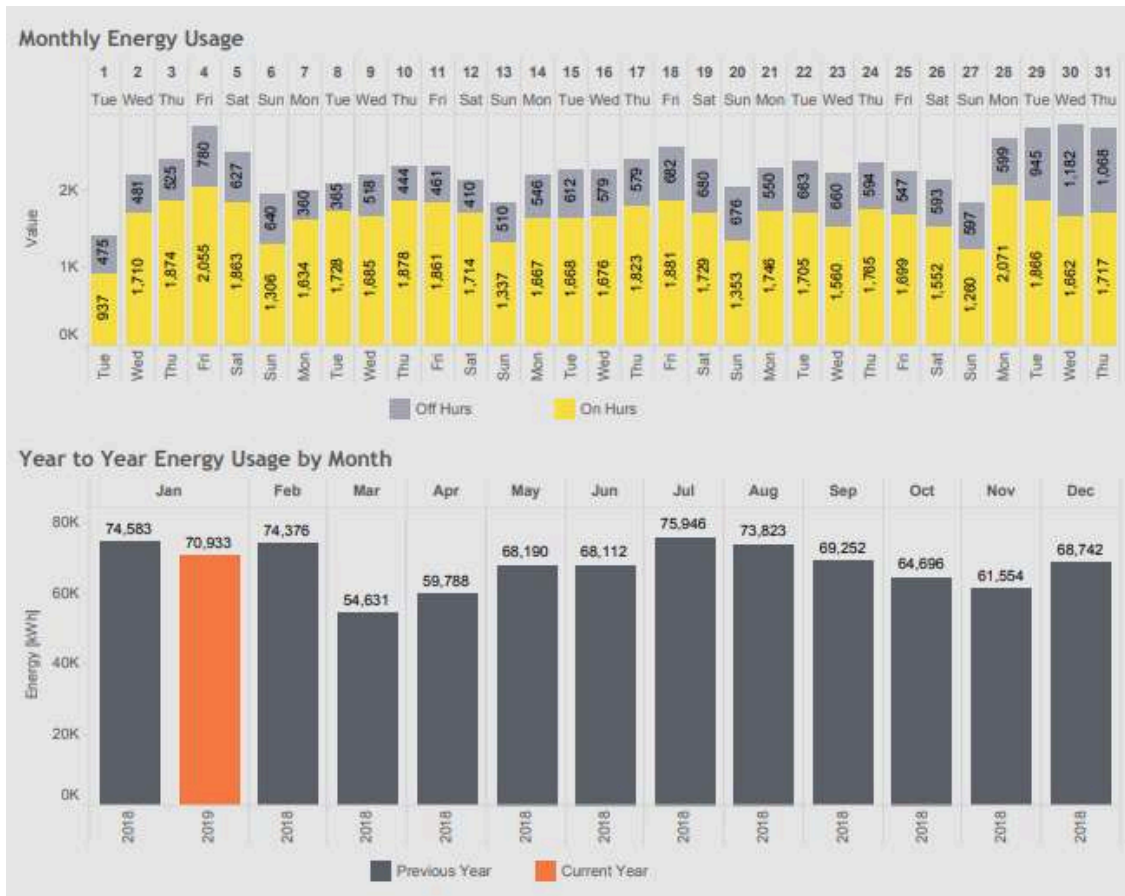
## Site Monthly Energy Use

The site monthly energy use report summarizes energy use by usage category, for ON and OFF hours for each day of the month, and a year over year comparison on a month to month basis. A site operator or building manager can use this information to understand what equipment types are consuming the most energy during the reporting month, how energy use changes between occupied/production periods and unoccupied/non-production periods, and how the current reporting period compares to other months and to the previous years' operation.

Monthly Energy Use by Category, and Variance from Previous Month



ON and OFF Hour Energy Cost, and Year-to-Year Monthly Comparison



## Automated Report Modules

Please see the document “SiteWatch Modular Reports List” for additional information on available modular reports.

Modular reports are available on a weekly basis and cover a range of parameters, reporting intervals, and how information is presented:

- Site energy or energy cost by weekday, and versus historical consumption/cost
- Site and device energy (namely HVAC) versus ambient weather conditions
- Weekly energy use by production line, physical area of plant, or business unit
- Phase imbalance on 3-phase monitored loads
- Weekly divergence in energy use of top devices
- Peak load hours and contributors

## Custom Reports

### ON Percentage and Load Factor

ON percent and load factor are used to indicate how often a device is considered ON, and at what load the device is typically operating. Devices may be required to operate continuously or may be able to shut down during non-production/unoccupied hours. Providing these details on monitored devices allows site personnel to quickly identify equipment that may not be required to run or run with too much or too little loading. Production equipment, supporting machinery, and HVAC systems may have different operating criteria, so understanding their actual usage is critical.

*ON % and Load Factor by Device (1-year monitoring period)*

Device	Device Type	ON %	Average Load Factor	Max Measured kW
RTU-1	AHU	39%	29%	26.51
RTU-2	AHU	39%	24%	33.41
RTU-3 Return Fan	AHU	36%	42%	3.52
RTU-3 Supply Fan	AHU	38%	53%	17.58

*Note: Panels are not included in this analysis as loads carried by the panel may serve different device groups.*

Runtime % - Runtime percentage is expressed as a percent of the hours when each machine has a load versus overall hours in the monitoring period:

$$\# \text{ Hours with Any Load} / \# \text{ Total Period Hours} = \text{Runtime \%}$$

Average Load Factor – This parameter demonstrates what level of loading the machine sees across the monitoring period when the equipment is operating. The average load factor is calculated as follows:

$$\text{Avg kW (or amps) When Running} / \text{Max kW (or amps) (measured or nameplate)} = \text{Avg Load Factor}$$



Load factor is based on the measured maximum kW (or amps) or the machine’s nameplate full load amps, if available.

An average load factor that is too high or low can indicate several issues with a machine or how it is operated. Likewise, runtime % can indicate to site personnel if equipment is being operated too often.

- A high average load factor (>90%) may indicate overloaded equipment. Equipment size should be reviewed when replacing. This also indicates equipment that may fail before the end of expected useful life.
- A low average load factor (<30%) may indicate improperly sized or improperly loaded equipment. Pumps and fans with a low average load factor are likely operating in an inefficient part of their performance curve or are cycling ON/OFF frequently. Compressors with a low load factor may be oversized or may be operating when there is no load on the system.
- High runtime percentage (>75%) may be acceptable but may also indicate equipment inadvertently left running at the end of production.
- Low runtime percentage (<10%) indicates equipment that is not being used as part of typical site operations and can indicate to personnel that switching operating/standby machines is required.

### Percent of Time by Load Factor Range

The load factor range table shows the amount of time a device is operated by load factor range. Zero percent indicates a device is off, while 90-100% indicates a device operating near fully loaded.

Each device may be considered individually, or within a group of machinery or equipment serving a common system or production line.

*% of Monitoring Period by Load Factor Range by Device (1-year monitoring period)*

Device	Load Factor Range					
	0%	1-25%	26-50%	51-75%	76-90%	91-100%
RTU-1	61%	16%	19%	3%	1%	0%
RTU-2	61%	28%	10%	0%	1%	0%
RTU-3 Return Fan	64%	8%	14%	11%	2%	1%
RTU-3 Supply Fan	63%	5%	1%	31%	1%	0%

The nameplate full load amps are required to provide accurate findings regarding load factor

- Ideal load factor is between 50-90%, and most device operating hours should fall in this range.

- Equipment with significant hours between 1-25% indicates a device may be oversized for its system.
- Equipment with significant hours >90% may indicate a device is overloaded or undersized, leading to ongoing maintenance issues or decreased service life.

## ON vs. OFF Hour Usage

Sites or buildings with operating schedules, including offices and non-24-hour production, should see a difference in energy use between ON and OFF hours (as defined by the site). Some monitored loads may see a 100% drop off between periods, while other may see limited or no reduction. SiteWatch provides simple, easy-to-understand findings on the differences between usage for these periods, the percent reduction, and advice on whether the reduction, or lack thereof, requires investigation:

*ON vs. OFF Hour Average kW*

Device or Panel	Device or Panel Type	Average ON kW	Average OFF kW	Percent Reduction
DP4-1 feed	DP4-1 feed	7.90	3.38	57%
DP4-1A feed	DP4-1A feed	15.03	6.88	54%
DP4-2 feed	DP4-2 feed	14.27	10.23	28%
DP4-2A feed	DP4-2A feed	15.87	8.72	45%
RTU-1	RTU-1	8.41	0.05	99%
RTU-2	RTU-2	8.76	0.05	99%
RTU-3 Return Fan	RTU-3 Return Fan	1.48	0.00	100%
RTU-3 Supply Fan	RTU-3 Supply Fan	9.62	0.04	100%
SP4-1A feed	SP4-1A feed	5.79	5.90	-2%

## Measurement and Verification

Measurement and verification (M&V) support from SiteWatch may be used to validate savings attributed to implementation of an energy saving measure. The measure may involve equipment replacement, adding controls to a device or system, or implementing a new control strategy. If the affected devices or systems are monitored by SiteWatch, our engineering team can assist with generating analytics to validate the measure is operating as intended and quantify the savings impact for submission to local regulators, especially in support of achieving rebates or incentives.

The M&V process involves several steps and can ensure that a project is successful while quantifying the annual savings for implementing a change.

**Identifying Wasted Energy** – Reviewing equipment operation through Power Radar, a site can estimate the energy cost for equipment and whether that equipment is following an expected usage profile.

Early Indication of Measure Non-Performance - By programming custom alerts pushed in real-time (e.g. fans running during off hours, fans exceeding new max power setpoints) a site can identify if a measure is performing as intended. Without an early indication of a measure not performing as intended, a project may lose access to utility incentives and not achieve energy savings that are key to a project's return-on-investment.

Troubleshooting and Commissioning – SiteWatch engineers engage with site personnel and contractors to determine corrective actions to correct non-performing measures. Non-performance can often be site can typically correct performance by addressing equipment settings or adjusting operating parameters to ensure proper sequencing,