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Can Your Energy Management System Turn Big Data into Intelligence?

Use analytical techniques to reduce energy spend, efficiently manage budgets, and enhance Enterprise value.

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In the course of monitoring and controlling a medium-sized building (30,000 square feet), an efficient Energy Management System (EMS) will gather around 40,000 time-stamped data points each day. For an Enterprise of 1,000 retail locations, this yields over 10 billion data points per year.

With this incredible amount of data, it is easy to imagine a giant tidal wave of data looming over the Enterprise, threatening to engulf it in endless trivia. So how do retailers use this data once the initial EMS deployment is successful?

To help retailers turn EMS data into intelligence, this paper provides a framework of techniques to turn the 'big data' flood of tens of millions of telemetry points per day into a few dozen intelligent observations whose patterns can be analyzed and absorbed into true insight.

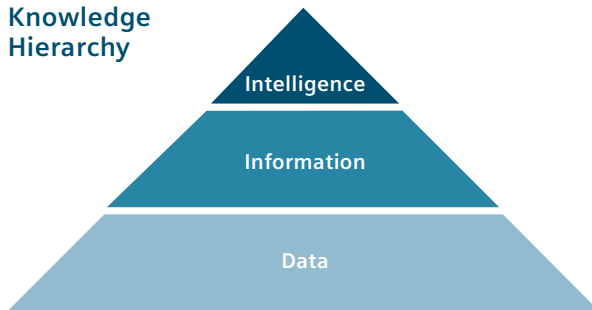
“The goal is to turn data into information, and information into insight.”

Carly Fiorina
Former CEO of
Hewlett Packard¹

The Knowledge Hierarchy

A tried and true concept, the Knowledge Hierarchy has been known in various forms with differing names. One of the most common forms makes use of the pyramid approach. At the bottom of the pyramid is the largest slice, data. This is the billions of raw, unprocessed data points; a flood beyond understanding by mere humans. It is the anticipation of this tsunami that causes retailers to ask how this data can be utilized.

Knowledge Hierarchy



Organizing, structuring, and presenting the data in context leads to the next slice of the Knowledge Hierarchy, information. Organized by location and time series, and with related data shown together often graphically, the raw data becomes much more useful as information that can be analyzed and absorbed. However, there is still an unrelenting amount in this slice. Every minute, every hour, and every day brings more information from the EMS and does not distinguish what is important and what can be ignored. Information still requires an army of intelligent personnel to sift and screen.

“You can have data without information, but you cannot have information without data.”

Daniel Keys Moran
Programmer and Science Fiction Author²

The last slice of the Knowledge Hierarchy is to process the EMS information into intelligence by determining missing data, bad data, misbehaving systems, trends, outliers, and anomalies. At this step, the EMS applies a number of different tools to shape this transformation: data scrubbing, a rules engine, aggregation, and ranking.



Information to Intelligence: Transformation Tools

1. Data Scrubbing

Data scrubbing takes note of data we know to be missing or false. Sensor failures, wiring and communications failures, and even human intervention can all corrupt data. As an example, when a zone temperature sensor reports -459 degrees Fahrenheit, it is certain that the data has been corrupted. This should be treated as a sensor failure and not a call to action about a retail space that is uncomfortably cold. Missing data is information in itself, not a call for further processing.

2. Rules Engine

The rules engine is driven by a set of controls derived from the extensive domain knowledge found within the EMS consisting of facilities engineering, lighting and HVAC systems, and electrical engineering. Its job is to automatically detect anomalous behavior in complex systems. For example, if an HVAC system has been trying to cool for twenty minutes but its supply temperature is almost the same as its zone temperature, then the system is not working properly. As well, if an outside light sensor never seems to detect the dark of night, there is a good chance that it has been mistakenly located near a light source. Or, if a freezer's temperature rises above 32 degrees for two hours, it is not a defrost cycle, but rather, a failure. These examples signify how the rules engine is designed to find problems and condense thousands of data points down to simple facts: “Site 99, Rear Sales HVAC stage one cooling out of tolerance.”

Examples of Turning Sensor Data into Intelligence in an EMS

Data	Information	Intelligence
81	Zone temperature above 80°F	HVAC Delta T insufficient after 75 minutes runtime; HVAC Health KPI for prior 7 days 44; dispatch HVAC technician
45	Freezer temperature above 32°F	Freezer temperature exceeds threshold for 85 minutes; dispatch
50	Outside light below 75 foot candles	Exterior lights ON excessively

Analytics is “the ability to look at the data and then turn that into a story; to be able to draw from all kinds of information and turn it into a story.”

Frank Wrenn

Former Manager of Market Research at Delta Air Lines³

3. Aggregation

Aggregation is the process of distilling many data points down to one. From hundreds of meter readings and a few facts about a site, the EMS can aggregate to a single datum: “the HVAC unit serving the front right of the sales floor on site 42 has a health score of 67”; or, “site 3291 used 1.5 kWh per square foot on January 9th”. Aggregation can even come in multiple steps: daily, then weekly or monthly, then yearly. The aggregated intelligence is much easier to compare across devices and sites than the raw data.

4. Ranking

Ranking helps to turn the intelligence created by the scrubbing, rules engine, and aggregation into an even higher-level intelligence. The ranking process takes the intelligence gleaned for each site in several categories (communications, energy use, HVAC systems, sensors, etc.) and ranks the site among its peers for each category. This is the highest-level of intelligence of all: “store 42 has the most HVAC problems of all sites”; or, “site 3291 uses more electricity per square foot than any other site”.

Conclusion

Using the outlined analytic techniques, including data scrubbing, the rules engine, aggregation, and ranking, the ‘big data’ flood of tens of millions of telemetry

points per day can be reduced to a few dozen intelligent observations whose patterns can be analyzed and absorbed by a small team to reveal true insight about the Enterprise. An efficient EMS will bubble the most prominent problems to the surface and, when someone elects to dive in and understand the situation, will present the story of the underlying information in highlight form, accentuating the points that make the most difference.

Retailers who understand this process of turning data into intelligence and patterns into insight can lead the way to success by reducing energy spend, applying maintenance budgets efficiently, and enhancing overall value to the Enterprise.

The EMS Intelligence Process

For retailers to ensure that their EMS is turning big data into intelligence, the following process should be implemented:

1. Select an efficient EMS that identifies the biggest problems within the Enterprise, thereby gaining valuable insight.
2. Work the outliers, the most egregious faults, the biggest energy wasters, first.
3. Gain insight into the Enterprise by observing the patterns in the highest-level intelligence.
4. Do not get distracted by complex and interesting phenomena that do not result in much impact on the Enterprise.

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- 3 Wrenn, F. (2015, March 19). *ZoomInfo*. Retrieved from <http://www.zoominfo.com/p/Frank-Wrenn/111572705>

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