EcoEnergy

METER DATA ANALYTICS:

DERIVING MAXIMUM VALUE FROM METER DATA

ANALYZE. ACHIEVE. ACCELERATE

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Introduction

Energy metering & sub-metering is being proposed as a crucial element of energy efficiency at almost every organization. With a maxim of "measure to save", over 5% of energy cost saving is often pegged to granular metering.

Presently, the energy consumption is tracked at least once a month at facility level, if not more. This explains the consumption at overall facility level, helps one compare the energy consumption of a facility during the same months over the years, and tracks any anomalies. Depending on the objective and availability of funds, sub-metering may be considered to provide load-wise energy consumption details. Through advanced meters that are being deployed nowadays, it is additionally possible to get time series data at pre-determined intervals. Over a period of time, these can generate a huge set of valuable data. A successful metering strategy requires more than installing the meters. This article explains how to derive maximum value out of metered data, especially from interval-metering and sub-metering of energy consumption in an organization.

Benchmarking

In multi-facility organizations, it becomes imperative for management teams to know how each of the different facilities are performing in terms of energy consumption, and how they fare in terms of efficiency. While metered data gives a direct view of energy consumption at each of the facilities, it also acts as the fundamental piece of information in computing appropriate efficiency metrics. Metrics used could be ones like Energy Usage Intensity (EUI) which is kWh per sq m / sq ft or Power Usage Effectiveness (PUE) which is Total Facility Energy divided by IT Energy. These kinds of metrics not only enable determining which facility is efficient irrespective of the magnitude of energy consumption, but also help in comparing with other peers and industry benchmarks. This enables organizations to set efficiency goals and charter a plan for achieving them.

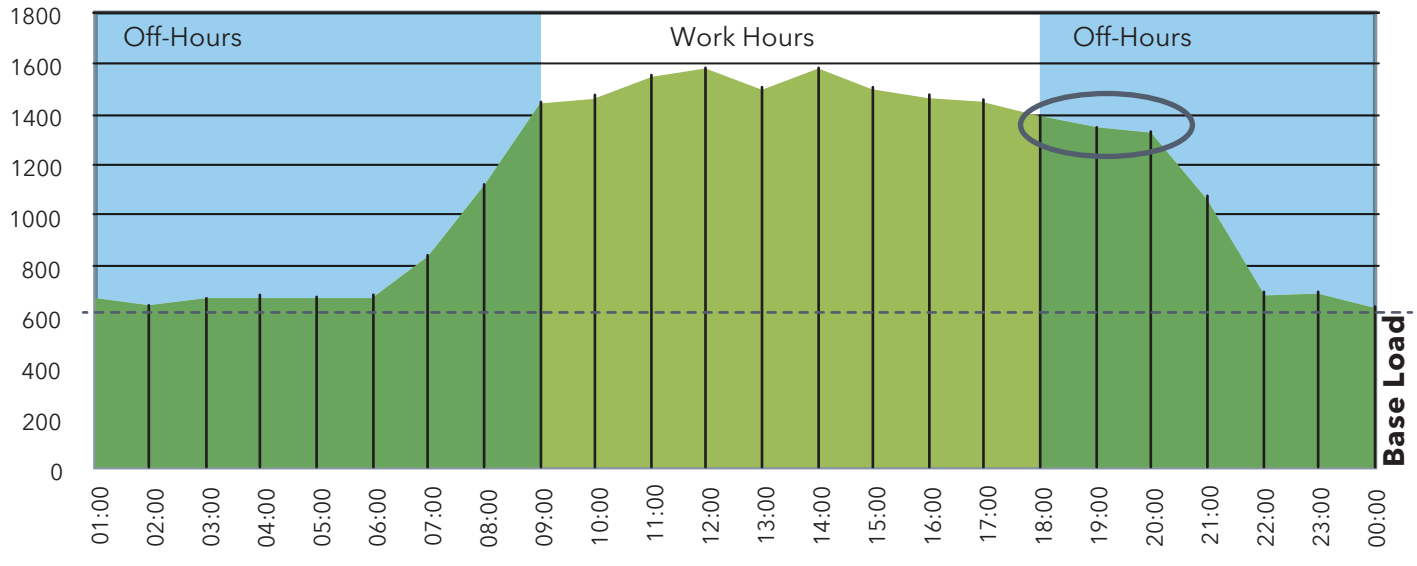
FACILITY	TYPE	AREA (sq ft)	ANNUAL ENERGY (kWh)	EUI (kWh/sq ft/yr)
Site A	Office	20,000	360,000	18
Site B	Office	17,000	357,000	21
Site C	Office	15,000	285,000	19
Site D	Office	13,500	27,000	20
Site E	Office	8000	184,000	23

As can be seen, the highest consuming facility is not necessarily the most inefficient.

Schedule Mismatch

Most organizations have schedules of operation that impact energy consumption. They could be based on work hours of employees, varying equipment / business loads in different shifts, off-hours / holiday / weekend schedules, etc. Analyzing metered data helps identify compliance with these schedules. Any deviation observed is a potential area for energy savings, e.g., consider the working hours of a facility to be from 9 am to 6 pm. However, energy consumption data could indicate that 70% to 80% of work hour energy consumption continues on till 8 pm, which may be unjustifiable. The situation can then be investigated, and appropriate corrective action taken.

Fig. 1: Schedule Mismatch



Base Load

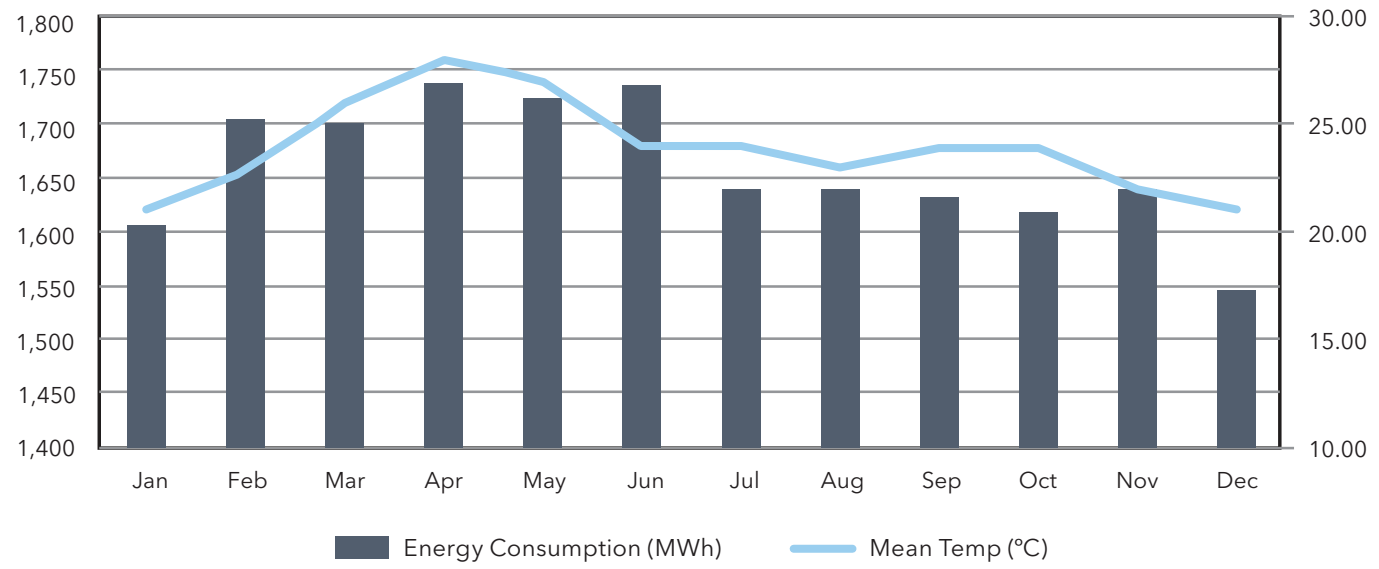
Data collected during off-hour periods indicates the base load of the facility. It is the energy requirement of the facility irrespective of any active operations. Hence, this is the minimum energy that is used by the facility (hence at least this much cost is incurred). However, the observed base load may not be justified. By understanding the loads that are expected to be operational, the actual energy consumption data could be verified and it may turn out to be more than expected. Any reduction that is subsequently achieved in the base load will bring about the most savings for single-shift facilities, and gradually to a lesser extent for extended hours or multi-shift facilities.

Seasonality and Weather Impact

Energy consumption of facilities could follow a seasonal pattern based either on weather, business cycles or holidays / festival periods. Analyzing data over longer time horizons of at least a year helps in identifying these patterns. And checking if these are in line with known events or cycles could identify energy saving opportunities.

Comparison could also be done of cycles across multiple years which could bring out differences in consumption pattern. Investigation into the root cause of differences would help control energy consumption better. Typical optimizations here relate to thermal insulation of facilities, equipment energy efficiency and controls.

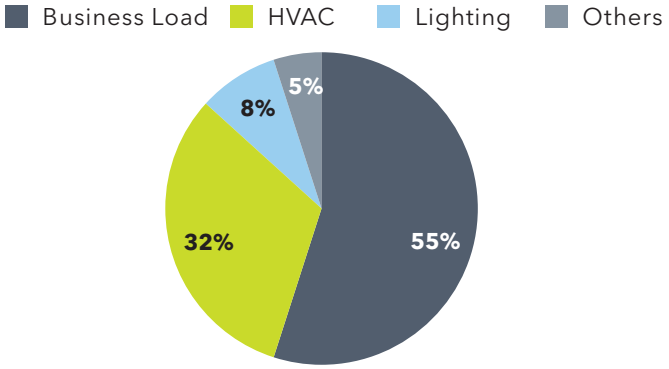
Fig. 2: Seasonal Consumption Pattern



Load Breakup

One of the primary reasons & benefits of sub-metering is to gain an insight into load breakup and identify loads that are sub-optimal in energy efficiency. This could either be based on absolute consumption details or in relation to other load values, e.g., the HVAC load with respect to IT load in a Data Center. The load relationship could also be studied for different time periods to understand the way it is changing, e.g., how is it varying between day & night, work & off day, summer & winter, etc. These insights would help justify or improve the energy consumption.

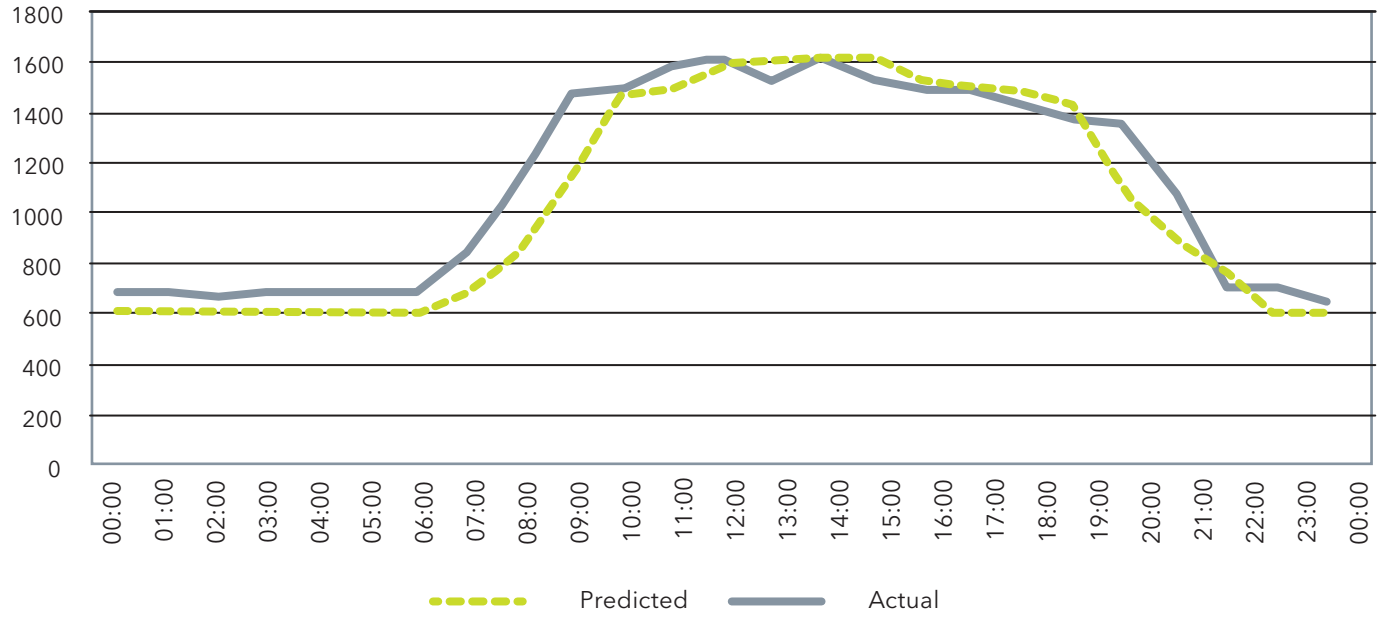
Fig. 3: Load Distribution



Analytics & Forecasting

One of the significant values of having metered data over long periods of time is in enabling prediction of energy consumption. Energy models of building take into account various infrastructure details, geo-specific weather data and other key impacting parameters to forecast energy consumption. The accuracy of prediction improves when historical data is considered, as enabled through metering and monitoring of different key parameters. In day-to-day operations, the forecasted consumption can be used as a reference to control energy consumption proactively rather than reactively. Dynamic operating environments can provide energy saving opportunities on a continuous basis. Analytics of metered data on an ongoing basis would enable organizations to leverage maximum potential at the earliest opportunity. For example, they could highlight spikes, anomalies in usage pattern, growth or drop in energy consumption, changes in key impacting parameters, etc.

Fig. 4: Actual vs. Predicted Consumption



Equipment Efficiency

With appropriate level of sub-metering, it is possible to determine the actual performing efficiency of equipment. This not only tells whether the units are performing at expected levels, but also brings to attention any maintenance needs when the levels drop unexpectedly. This prevents avoidable losses in terms of energy as well as cost, e.g., it would be possible to determine the efficiencies of equipment like UPS and CRAC units using sub-metered data. Metrics like EER used for CRAC units would require other associated parameters to be monitored as well.

Peak Shaving / Shifting

Metered data can be used to identify usage patterns, sources of energy consumption, and classification of peak loads into critical and non-critical. This insight can then be used to determine if any of the peak loads can be shifted to non-peak hours, or if non-critical loads can be reduced. This helps in decreasing the peak load charges.

With increasing demand for energy, and supply lagging behind, utility companies face challenges in providing peak demand requirements. While augmenting their peak supply capacities, some utility companies offer demand response programs that incentivize end-users to reduce their demand. Metered data analysis and peak shaving / shifting would also enable one to participate in such demand response programs and claim incentives.

Fig. 5a: Pre Peak Load Shaving

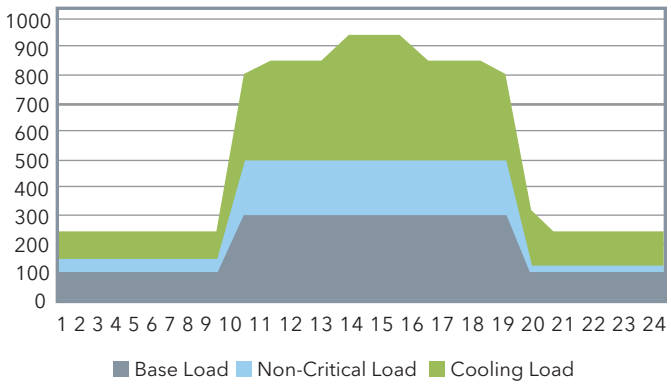
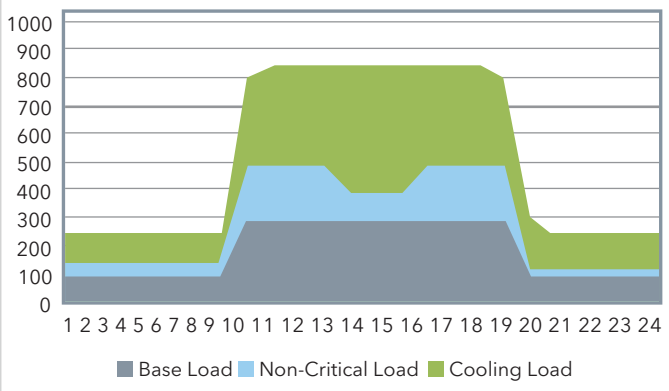


Fig. 5b: Post Peak Load Shaving



Contract Demand

It is typical of organizations to forecast their business growth and associated energy requirements while applying for a contract demand from utilities. And the requested demand would be much more than what is required presently. This unutilized capacity comes at additional recurring cost which is justified by many to be worth the hassle / risk of getting additional capacity at short notice. However, it would be a worthwhile exercise to periodically review the predicted business growth and energy requirement. It can so happen that due to business decisions or turbulent market conditions, actual energy requirement will be much below the predicted requirement. Even considering the lead time of procuring additional capacity, such instances can enable releasing of excess capacity and make the exercise cash positive. Metered data provides a strong basis for analyzing the peak demand requirement and the demand growth that has actually been seen over a period of time to make this call.

Loss Reduction

Quality of power has a bearing on performance reliability, efficiency and life of equipment. Many meters allow data points to be monitored that enable determination of power quality like Power Factor and Harmonics. Enabling them could highlight problem areas which could then be addressed appropriately to the extent possible.

Utility Meter Faults & Billing Errors

The availability of sub-metering on main lines enables one to detect any fault in the main utility meters. Though rare, utility meter fault could go undetected, especially if it has been present over a period of time. Installation of sub-meters enables one to detect existing problems as well any new ones that may arise. With granular view into consumption, metered data can be used to compute utility charges independently. This can then be used to verify the correctness of received invoices and reconcile with utility companies.

Billing at Multi-tenanted Sites

In multi-tenanted facilities, contracts could be in place that charge based on occupied area and not necessarily on energy consumption. Metered data can be used by organizations to renegotiate contracts that charge more in line with their actual consumption or restructure them to be charged based on actuals.

Emissions Reporting

One of the big challenges in reporting emissions is collecting reliable data on energy consumption. Metered data monitored through a central system not only enables auditable data, but also dramatically reduces the time required in data collection and report preparation.

Metering and monitoring requires investment. And at times, it becomes difficult to justify it. However, it has also been seen that at places where investments have already been made, the use of data is restricted only to a limited subset. It is the author's hope that readers of this article would be able to tap the full value of benefits realizable from their metered data.

About the Author

Raviraj Kadiyala heads the Energy Management Services practice at EcoEnergy for Telecom, Transportation and Logistics customers.

His current work encompasses developing propositions that deliver energy efficiency, reduce energy costs and add value to core business needs of customers through M2M, IoT, analytics, central monitoring and managed services. His experience in the fields of Energy Management and Telecom Networks covers solution architecture, product development, pre-sales commercials, and delivery.

This article was published in **Energy Manager magazine, Volume 5, Issue 1, Jan-Mar 2012**
This paper was also included in the **Resource library of Retail Industry Leaders Association**

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