Energy Efficiency in Critical Instrastructure Facilities—a Structured Approach

For cable operators, critical facility electricity use continues to grow at a much faster rate than other types of usage due to exponential growth in data throughput. Managing energy efficient facilities starts with measuring, monitoring and tracking energy usage over time. The challenge is to identify metrics that are both meaningful and useful to the business.

Defining Useful Energy Metrics

Coppervale can help MSOs develop effective metrics that that characterize their facilities with respect to energy efficiency, rank facilities according to efficiency performance, and properly select facilities for greater attention and/or corrective action should ROI dictate.

Attacking Facility Efficiency: Power Utilization Effectiveness (PUE)

PUE characterizes how efficiently the facility manages the environment. PUE has been an industry standard for Data Center energy efficiency for a number of years. The industry's consortium group that provides standards for metrics, the Green Grid, has defined PUE as:

$$\text{PUE} = \frac{\text{Total Facility Power}}{\text{IT Equipment Power (power needed for equipment serving customers)}}$$

Lower PUE implies a more energy efficient facility, as well as a more stable and consistent equipment room environment in the facility. Better energy efficiency lowers operational cost. A consistent and stable environment improves equipment life and reliability, as well as providing energy headroom for equipment growth in the facility if needed.

Having PUE information for each facility provides a good starting point for operators to evaluate the energy efficiency of their facility infrastructure. With such information, operators can identify outliers, and prioritize action toward facilities where efficiency is the worst. Solving issues with PUE is generally about solving issues with maintaining temperature in the facility, optimizing HVAC, creating hot-aisle/cold-aisle structures, and correcting any physical implementation items. Tracking and monitoring PUE across all facilities can help an Operator prioritize corrective actions.

Producing Desired Output with Energy: Data Center Energy Productivity (DCeP)

DCep focuses on the productivity of the energy being used by a facility. DCeP is a measure of whether the energy being used produces output for the business in an efficient way. One can have an absolutely efficient facility with PUE close to 1, but if the facility connects few customers and/or generates little revenue, it still might be considered wasted energy. DCeP tells operators which facilities are doing a better job of producing real output for the business, and those that aren't. Those that aren't are potential candidates for consolidation over time, regardless of how efficient they may run. The Green Grid has set this as a target metric for Data Centers, defining it as:

$$\text{DCeP} = \frac{\text{Work Units Produced by the Facility}}{\text{Total Energy used in Producing this work (in Watts)}}$$

Because work output is specific to industry, though, Green Grid has left it to industry and/or companies to decide for themselves what a "work unit" is for their industry. In the telecommunications industry, the real "output" the energy produces ultimately is revenue. As subscribers ultimately generate the revenue, subscriber count provides a good proxy for revenue.

From a definitional basis, operators should focus on measuring **Subcriber per kW IT (SPkWIT)** for each facility. Using this metric means operators only need to add the subscriber data for each facility, as the kW IT used in the denominator of this is the same kW IT used in the denominator of the PUE calculation. SPkWIT measured for each facility can tell operators which facilities are using IT energy most productively (i.e. to service customers). It should be noted that this metric is just as meaningful and useful if RGU's are used instead of Subscribers.

Moving Towards Sustainable Energy: Green Energy Co-efficient (GEC) and Carbon Utilization Effectiveness (CUE)

Green Energy Co-efficient (GEC) and Carbon Utilization Efficiency (CUE) focus on how the energy used by the facility is produced. GEC is a simple percentage of energy produced by renewable means as compared to total energy used. CUE is defined as the carbon content of Total Facility Energy divided by the IT Equipment Energy. The greater the amount of renewable sources, the better the GEC and CUE.

As the energy used in a critical facility is typically at or close to 100% electricity, calculating them is simplified significantly. For GEC, one needs to know the source of the power purchased, as well as the amount of any power generated locally via renewable sources. Dividing the power from renewable sources by the total facility power gives the simple percentage GEC. If the energy is 100% electricity, CUE simplifies to a simple multiplication of PUE times the Carbon Co-efficient for the geographic region where the facility is located. Co-efficients are supplied for specific geographic areas to industry by government. Calculating CUE for most data centers, then, just requires PUE for the facility and its address.

Improving GEC and CUE by themselves won't necessarily have immediate impact on bottom line in the short term. However, a significant portion of the world's supply of higher carbon non-renewable energy comes from parts of the world where governmental and political stability is an issue, which means stability of supply of these resources could be impacted. MSOs should develop the habit of tracking CUE now, so they can understand where they stand in the area of evolution to a more sustainable supply of energy in a controlled and economic manner.

Managing Energy Cost: Energy Cost per Subscriber

Since adding subscribers, services, service capacity and capability drives up costs, just looking at changes in the overall power bill will not be enough. Instead, operators should look at **Total Facility Power Cost per Subscriber** for each facility. This simple metric gives operators a comparison metric related to cost for facilities. Tracking it on an on-going basis will also allow operators to confirm in real monetary terms if projects to improve efficiency are really working or not. Calculating this requires the energy bill for the facility, along with the subscriber count already being used for SPkWIT metric. Tracking this data on a per facility basis will allow operators to see and understand variations in cost of power across geographies, deal with anomalies and outliers, as well as potentially look for reduction opportunities.

The Final Step: Using and Analyzing the Data

By analyzing the data from these metrics gathered for ALL critical infrastructure facilities, Operators can:

- Identify over time facilities that might be candidates for equipment right-sizing and/or consolidation
- Identify facilities performing poorly with respect to energy efficiency today
- Highlight and potentially rank facilities as to ability to payback and/or have acceptable ROI related to improving energy efficiency
- Track cost improvements in facilities related to completed projects to validate ROI assumptions
- Track business progress with respect to moving to lower carbon and hence greener, more renewable forms of energy.
- Understand better and track energy costs in facilities and the geographies where they are located.

With limited amount of effort and data, Operators can provide an initial characterization of the energy efficiency of their critical infrastructure facilities, and start the process of working towards improving it.

Coppervale

About Coppervale

Coppervale Enterprises Inc. is the broadband industry's leading energy management, engineering and sustainability consultancy. Our team consists of energy and carbon management specialists, environmental and sustainability professionals, and veteran cable engineering consultants. Let Coppervale show you how to improve operational efficiency, reduce your energy costs, and minimize your carbon impact.

Contact

3767 Alpha Way
Bellingham, WA 92886
www.coppervale.org

Lew Rakowsky
360-392-2598
lrakowsky@coppervale.org