



***Society of Cable  
Telecommunications  
Engineers***

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**ENGINEERING COMMITTEE  
Energy Management Subcommittee**

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**AMERICAN NATIONAL STANDARD**

**ANSI/SCTE 213 2015**

**Edge and Core Facilities Energy Metrics**

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# 1. Scope

This document provides a metric to help operators measure how effective changes in the service impact energy consumption from both a high level and functional work perspective.

The metric *should* help:

- Drive the energy strategy and direction of the organization
- Provide a focus of energy for an operator
- Help make decisions regarding energy
- Drive performance operationally, financially and environmentally
- Measure energy change and within the organization
- Produce good internal and external public relations regarding energy impact

The scope of the energy metric standard includes edge and core network facilities servicing the customers. Excluded from this standard are labs and testing facilities, people space, parking lots, parking garages, warehouses, and Customer Premise Equipment (CPE). Please refer to SCTE 211 2015, Energy Metrics for Cable Operator Access Networks, for similar metrics for the access portion of the network.

# 2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of the standard. At the time of Subcommittee approval, the editions indicated were valid. All standards are subject to revision; and while parties to any agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents may not be compatible with the referenced version.

- No references are applicable

# 3. Informative References

The following documents may provide valuable information to the reader but are not required when complying with this standard.

## 3.1. SCTE References

[i1] SCTE 184 2015, SCTE Recommended Practices for Cable Facilities

[i2] SCTE 211 2015, Energy Metrics for Cable Operator Access Networks

[i3] SCTE 210 2015, Performance Metrics for Energy Efficiency & Functional Density of Cable Data Generation, Storage, Routing, and Transport Equipment

## 3.2. Standards from other Organizations

[i4] ETSI ES 205 200-2-1 ATTM Energy management; Global KPIs;, Operational infrastructures;, Part 2: Specific requirements;, Sub-part 1: Data centres

## 3.3. Published Materials

[i5] “*PUE<sup>TM</sup>*: A Comprehensive Examination of the Metric”, ASHRAE Datacom Series Book 11

[i6] “Harmonizing Global Metrics for Data Center Energy Efficiency”, Joint Statement of The Green Grid Taskforce, March 13, 2014

## 4. Compliance Notation

|                   |                                                                                                                                                                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>shall</b>      | This word or the adjective “ <b>required</b> ” means that the item is an absolute requirement of this specification.                                                                                                                                                              |
| <b>shall not</b>  | This phrase means that the item is an absolute prohibition of this specification.                                                                                                                                                                                                 |
| <b>should</b>     | This word or the adjective “ <b>recommended</b> ” means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.                    |
| <b>should not</b> | This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label. |
| <b>may</b>        | This word or the adjective “ <b>optional</b> ” means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.             |

## 5. Abbreviations and Definitions

### 5.1. Abbreviations

|               |                                                                          |
|---------------|--------------------------------------------------------------------------|
| <b>ASHRAE</b> | American Society of Heating, Refrigerating and Air-Conditioning Engineer |
| <b>ATS</b>    | automatic transfer switch                                                |
| <b>ATTM</b>   | access, terminals, transmission and multiplexing                         |
| <b>BDFB</b>   | battery distribution fuse bay                                            |
| <b>CATV</b>   | cable television                                                         |
| <b>CB</b>     | consumed bytes                                                           |
| <b>CMTS</b>   | cable modem termination system                                           |
| <b>CPE</b>    | customer premises equipment                                              |
| <b>CRAC</b>   | computer room air conditioner                                            |
| <b>CRAH</b>   | computer room air handler                                                |
| <b>DC</b>     | direct current                                                           |
| <b>DCeP</b>   | data center energy productivity                                          |
| <b>DX</b>     | direct expansion [air handler unit]                                      |
| <b>e.g.</b>   | for example ( <i>exempli gratia</i> )                                    |
| <b>EMS</b>    | [SCTE] Energy Management Subcommittee                                    |
| <b>ES</b>     | ETSI Standard                                                            |
| <b>ETSI</b>   | European Telecommunications Standards Institute                          |
| <b>FEC</b>    | forward error correction                                                 |
| <b>GB</b>     | gigabyte                                                                 |
| <b>Gbps</b>   | gigabits per second                                                      |
| <b>hr</b>     | hour                                                                     |
| <b>HVAC</b>   | heating, ventilation, and air conditioning                               |
| <b>i.e.</b>   | that is ( <i>id est</i> )                                                |

|             |                                                                                              |
|-------------|----------------------------------------------------------------------------------------------|
| <b>IT</b>   | information technology                                                                       |
| <b>KPI</b>  | key performance indicator                                                                    |
| <b>kV</b>   | kilovolt                                                                                     |
| <b>kVA</b>  | kilovolt ampere                                                                              |
| <b>KVM</b>  | keyboard-video-mouse                                                                         |
| <b>kWh</b>  | kilowatt hour                                                                                |
| <b>kW</b>   | kilowatt                                                                                     |
| <b>Mbps</b> | megabits per second                                                                          |
| <b>MHz</b>  | megahertz                                                                                    |
| <b>MPEG</b> | Moving Picture Experts Group                                                                 |
| <b>MSO</b>  | multiple system operator                                                                     |
| <b>MW</b>   | megawatt                                                                                     |
| <b>PC</b>   | personal computer                                                                            |
| <b>PDU</b>  | power distribution unit                                                                      |
| <b>PUE</b>  | power usage effectiveness                                                                    |
| <b>RDU</b>  | rack distribution unit                                                                       |
| <b>SCTE</b> | Society of Cable Telecommunications Engineers                                                |
| <b>STS</b>  | static transfer switch                                                                       |
| <b>TB</b>   | terabyte                                                                                     |
| <b>TGG</b>  | The Green Grid                                                                               |
| <b>TS</b>   | transport stream (?? see usage on page 12. My interpretation is that TS is transport stream) |
| <b>UPS</b>  | uninterruptible power supply                                                                 |
| <b>V</b>    | volt                                                                                         |

## 5.2. Definitions

|                           |                                                                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Core Facility</b>      | Structures responsible for backbone traffic and edge to edge connectivity of services to large pools of customers                                                |
| <b>Critical Facility</b>  | Any structure that if non-functional, impacts customer experience and would generate greater than 250 calls to call centers                                      |
| <b>Critical Load</b>      | Equipment, if turned off or not operable, greatly impacting customer experience                                                                                  |
| <b>Customer</b>           | Invoiced/complimentary consumer of network service(s)                                                                                                            |
| <b>DC Power Plant</b>     | Batteries, rectifiers, charge controllers, power bays, primary and secondary distribution equipment (BDFB/fuses), converters and inverters supporting load.      |
| <b>Downstream</b>         | Information flowing from the hub to the user                                                                                                                     |
| <b>Edge Facility</b>      | Structures servicing neighborhoods where an outage would be contained to a specific pool of customers and not impact greater customer base                       |
| <b>Meter</b>              | Equipment able to measure amount of energy in kWh or power in kW consumed over time                                                                              |
| <b>Metric</b>             | Mathematical calculation aiding in the intelligent decision making process                                                                                       |
| <b>Outside Plant</b>      | Section of the cable network responsible for connecting facilities to customers as well as facilities to facilities                                              |
| <b>People Space</b>       | Building whose primary function is to enable people to perform activities such as meetings, calls, computer work, and all other non-critical facility activities |
| <b>Power Distribution</b> | Moving of power in a controlled manner from utility service entry to load                                                                                        |

|                                           |                                                                                                        |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Uninterruptable Power Supply (UPS)</b> | Power protection device helping to prevent equipment power down during primary source of power failure |
| <b>Upstream</b>                           | Information flowing from the user to the hub                                                           |

## 6. Critical Facility Power

### 6.1. Definition of Total Facility Energy

Critical facilities are responsible for the housing of the equipment required to deliver the products to the cable subscribers. Equipment is typically staged in racks. Equipment requires proper power, airflow management, and backup power to support everyday operations. Total critical facility energy is defined as the energy dedicated solely to the facility (e.g., the energy measured at the utility meter of a dedicated facility or at the meter for a facility or equipment room in a mixed-use facility). Total facility energy includes all IT equipment energy, plus everything that supports the IT equipment-using energy, such as the following:

- Power-delivery components, including UPS systems, switchgear, generators, power-distribution units (PDUs), batteries, and distribution losses external to the IT equipment
- Cooling system components, such as chillers, cooling towers, pumps, computer room air-handling units (CRAHs), computer room air-conditioning units (CRACs), and direct expansion air-handler (DX) units
- Other miscellaneous component loads, such as data center lighting

The energy provided to the critical facility by all sources is consumed by all the elements of a critical facility. As such, total critical facility energy  $P_{TF}$  can be expressed as:

$$P_{TF} = P_{IT} + P_{HVAC} + P_L + P_{Dist} \quad \text{Equation 1}$$

#### Where

$P_{IT}$  = Power consumed by IT Equipment

$P_{HVAC}$  = Power consumed by HVAC and Cooling of facility

$P_L$  = Power consumed by Lighting and Convenience outlets in facility

$P_{Dist}$  = Power consumed for  $IR^2$  losses, rectifier/UPS inefficiencies, etc.

### 6.2. Determining $P_{TF}$ for a Critical Facility

- 1) For all critical facility locations, total critical facility power ( $P_{TF}$ ) **shall** be measured.
- 2)  $P_{TF}$  **shall** be measured from the utility service entrance that feeds all of the electrical and mechanical equipment used to power, cool, and condition the critical facility.
- 3) In the event a facility is fed by multiple sources,  $P_{TF}$  is the sum of the measurement from all the sources feeding the critical facility. Mathematically, this is represented by the following equation:

$$P_{TF} = \sum_1^n P_{TF(n)} \quad \text{Equation 2}$$

**Where**

$n$  = Total Number of Power Sources

$P_{TF(n)}$  = Power Measured at  $n^{th}$  source

**6.2.1. Although the majority of critical facilities are fed with 100% electricity, energy to power the facility does occasionally emanate from a source other than direct electricity (e.g., natural gas, purchase of chilled water for HVAC, etc.). When this happens, source energy weighting factors should be used to determine  $P_{TF(n)}$  for those sources. TGG and ASHRAE TC9.9 detail the use of source energy weighting in Section 4.9 of [i5] – please refer to it for how to treat energy sources other than electricity in determining  $P_{TF}$**

**6.2.2. A number of options exist for operators to use to measure and/or calculate  $P_{TF}$  for a critical facility. These include but are not limited to**

- a) Use of utility bill information from grid/source provider. Because this method relies entirely on third party data and reporting, and is not available in real time, but only at best in the month following the measurement, it is not preferred. But in many cases, as it *may* be the simplest and most practical way for an operator to attain  $P_{TF}$ , it is deemed an acceptable way for the purpose of the metrics defined in this standard. Output of this measurement would be in kWh, and time period  $\Delta t_p$  as extracted from the utility bill.
- b) *Should* they be accessible to operator personnel, periodic reading of utility meters placed at the critical facility by the grid/source supplier manually can also be used. As utility meters typically measure in kWh, meter readings must be taken over a period of time. Output of this measurement would be in kWh, and time period  $\Delta t_p$ .
- c) Automated power monitoring systems. These systems place power monitoring/measurement capability in the appropriate location in the critical facility, storing and/or transporting power data automatically as instructed by the operator. Systems such as these are preferred as they automate the data collection process, as well as allow for continuous measurement of data *should* that be required for a metric. Regardless of how the measurement detail is taken by the automated system, the measurement *should* be reported in kWh and time period  $\Delta t_p$ .

It is up to the operator to select and use a method and/or combination of methods to measure/calculate  $P_{TF}$  for all of its electricity sources feeding a critical facility.

**6.2.3. Frequency of Measurement**

- a) If utility bill information is used, the frequency of measurement *should* be monthly (i.e. totaled across a whole month), with  $P_{TF}$  being provided in kWh over the billing period. Utility bills are typically monthly, so this *should* be possible for large majority of sites.
- b) If manual readings from utility meters are used, measurement period *should* be at least once a month, preferably the first day of the month, providing a total kWh measurement for the previous month.