



***Society of Cable
Telecommunications
Engineers***

**ENGINEERING COMMITTEE
Energy Management Subcommittee**

SCTE OPERATIONAL PRACTICE

SCTE 228 2016

**Inventory of Energy Efficiency Practices for
Broadband Provider Facilities**

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140 Philips Road
Exton, PA 19341

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1. Introduction

1.1. Executive Summary

SCTE 228 2016 is a resource intended to aid multiple system operator (MSO) stakeholders involved in decisions related to reduction of energy consumption at sites, with the intended outcome of increasing energy efficiency, reaching sustainability targets and reducing grid dependency.

This Operational Practice looks to consolidate best practices for reduction of energy consumption into an easy reference format. This format provides indications on what types of facilities each practice applies to as well information regarding value versus cost and goals achieved.

Key provisions of this Operational Practice include:

- A consolidated list of energy efficiency measures applicable to MSO facilities.
- Indicator of what types of facilities each energy efficiency measure applies to.
- Prioritization of energy efficiency measures based on applicability, cost, value, and impact on Energy 2020 goals.

1.2. Scope

This document is meant to apply to the cable industries facilities including critical facilities, office space, call centers and warehouses. The scope of this document does not include the outside plant.

1.3. Benefits

Some of the benefits of adopting this Operational Practice include:

- More informed and streamlined decision support for energy efficiency projects in facilities.
- Increase cost savings and return on investment for energy efficiency projects.
- Achieve the long term goal of increased operational efficiency.

Some of the benefits of this Operational Practice to SCTE Energy2020 Roadmap include:

- Useful guidelines pertaining to all critical and non-critical facility types in the cable industry.
- Positive impacts to industry's power consumption and energy cost reduction goals by increasing awareness of energy efficiency opportunities and improving project prioritization and decision-making.
- Positive impacts to industry's grid independence goal by providing information on renewable and alternative energies that will help diversify power supply.

1.4. Intended Audience

This Operational Practice is intended for anyone involved in decisions related to energy consumption reduction, energy efficiency, and sustainability at MSO facilities. Stakeholders include, but are not limited to, energy and sustainability teams, design and construction teams, network engineering, critical infrastructure engineering, other engineering units, business management, financial managers, budget coordinators, technical operations and corporate real-estate.

1.5. Areas for Further Investigation or to be Added in Future Versions

This Operational Practice helps to prioritize energy measures based on a qualitative feedback from cable industry subject matter experts (SMEs). It does not contain quantitative analysis of costs and measures. SCTE will further investigate the energy measures included in this Operation Practice, including review of user case studies and quantitative cost analysis. Specifically, future versions of this draft can consider incorporating:

1. Operational Practice Feedback – SCTE can update cost and value metrics used in Section 7 to prioritize measures after it receives feedback and case studies from users in the industry. Feedback and case studies will be compiled into the table seen in Appendix B.
2. Quantitative Analysis of Energy Measures – SCTE and/or a third party can conduct research on the energy measures recommended in Table 8.1 and the tables and figures from Section 7 to determine actual quantitative cost and value of each measure to the cable industry. SCTE EMS-028 will then be revised to reflect this analysis.
3. Methodologies in Integrated Energy Management – Future iterations of this Operational Practice will include more information on employing a staged and macro-level approach to energy management improvements, including energy efficiency, renewable energy, energy resilience, and energy demand reduction opportunities.
4. Technologies Progression – SCTE can update this Operational practice based on technological advances are made related to facility energy efficiency in the cable industry. As new applicable technologies arise, SCTE can add them to the list of energy measures and assigned a relative cost and value. Furthermore, since these new technologies may replace or make existing energy measures less attractive, SCTE can evaluate the applicability and cost/value of the existing measures and remove or modify them as appropriate.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document 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 might not be compatible with the referenced version.

2.1. SCTE References

- SCTE 226 2015 – Cable Facility Classification Definitions and Requirements
- SCTE 218 2015 Alternate Energy Taxes, Incentives & Policy Resources

2.2. Standards from Other Organizations

- No normative references are applicable.

2.3. Published Materials

- No normative references are applicable.

3. Informative References

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

3.1. SCTE References

- SCTE 226 2015, Cable Facility Classification Definitions and Criteria
- SCTE 218 2015, Alternate Energy Taxes, Incentives & Policy Resources
- SCTE Expo 2013, CCAP Case Study: Enabling Converged Video + Data thru Space & Power Savings
- SCTE 137-7 2010, Modular Headend Architecture Part 7: EQAM Architectural Overview Technical Report

3.2. Standards from Other Organizations

- No informative references are applicable.

3.3. Published Materials

- No informative references are applicable.

4. Compliance Notation

<i>shall</i>	This word or the adjective “ required ” means that the item is an absolute requirement of this document.
<i>shall not</i>	This phrase means that the item is an absolute prohibition of this document.
<i>forbidden</i>	This word means the value specified shall never be used.
<i>should</i>	This word or the adjective “ <i>recommended</i> ” 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.
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<i>deprecated</i>	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

Abbreviation	Term
AC	alternating current (electricity)
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
CCAP	converged cable access platform
CHP and CCHP	combined heat and power and combined cooling, heat and power

Abbreviation	Term
CMTS	cable modem termination system
DC	direct current (electricity)
EQAM	edge-QAM modulator
HVAC	heating, ventilation and air conditioning
ICT	information and communications technology
kVA	kilovolt-ampere
kW	kilowatt
kWh	kilowatt hour
LED	light emitting diode
MSO	multiple system operator
OTP	optical transition point
ROI	return on investment
SCTE	Society of Cable Telecommunications Engineers
SMEs	subject matter experts
SMATV	satellite master antenna television

5.2. Definitions

Term	Definition*
alternating current (electricity)	In alternating current, the flow of electric charge periodically reverses direction, whereas in direct current circuits, the flow of electric charge is only in one direction. The abbreviations AC and DC are often used to mean simply alternating and direct, as when they modify current or voltage. AC is the form in which electric power is delivered to businesses and residences. The usual waveform of an AC power circuit is a sine wave.
American Society of Heating, Refrigerating, and Air-Conditioning Engineers	Global society, founded in 1894, focused on advancing sustainable technology and energy efficiency in building systems.
converged cable access platform	Technology that integrates the functions of a CMTS and EQAM into a single platform. See Appendix B for more information.
combined heat and power and combined cooling, heat and power	CHP is the use of a heat engine or power station to generate electricity and useful heat at the same time. Trigeneration or CCHP refers to the simultaneous generation of electricity and useful heating and cooling from the combustion of a fuel or a solar heat collector. Cogeneration is a thermodynamically efficient use of fuel. In separate production of electricity, some energy must be discarded as waste heat, but in cogeneration this thermal energy is put to use. All thermal power plants emit heat during electricity generation, which can be released into the natural environment through cooling towers, flue gas, or by other means. In contrast, CHP captures some or all of the by-product for heating, either very close to the plant.
cable modem termination System	A headend component that provides the operator network side termination. A CMTS communicates with a number of cable modems to provide data services. See SCTE 137-7 for more details.
direct current (electricity)	Direct current is the unidirectional flow of electric charge. Direct

Term	Definition*
	current is produced by sources such as batteries, solar cells, thermocouples, and commutator-type electric machines of the dynamo type. Direct current <i>may</i> flow in a conductor such as a wire, but can also flow through semiconductors, insulators, or even through a vacuum as in electron or ion beams. The electric current flows in a constant direction, distinguishing it from alternating current.
edge quadrature amplitude modulation modulator (edge-QAM modulator)	A headend or hub device that receives packets of digital video or data from the operator network. See SCTE 137-7 for more details.
heating, ventilation and air conditioning	HVAC is important in the design of industrial and office buildings where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors. The three central functions of heating, ventilation, and air-conditioning are interrelated, especially with the need to provide thermal comfort and acceptable indoor air quality within reasonable installation, operation, and maintenance costs. HVAC systems can provide ventilation, reduce air infiltration, and maintain pressure relationships between spaces.
information and communications technology	Application of telecommunications equipment and technologies to manage information/data (hardware, software, electronics, etc.).
kilovolt-amperes	One thousand volt amperes – metric for measuring the apparent power in an electrical circuit.
kilowatt	One thousand watts – metric for measuring the electricity flow through a customer meter
kilowatt hour	The amount of kilowatts used in one hour. If a customer uses 100 kW an hour for two hours the total kilowatt hours for the two hour period would be 200 kWh.
light emitting diode	A two-lead semiconductor light source that can be used in lamps or light bulbs. LED lamps are more energy efficient and have a lifespan longer than most other lamp types.
multiple system operator	A corporate entity that owns and/or operates more than one cable system.
optical transition point	A critical facility for transport aggregation or extension to support the edge facility's service delivery and typically contains amplifiers for optical links or transmitters and receivers feeding optical nodes.
return on investment	Performance measurement used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. In economic terms, it is one way of considering profits in relation to capital invested or how quickly an investment will repay itself.
Society of Cable Telecommunications Engineers	SCTE is a membership organization, founded in 1969, that provides technical and applied science resources and programs for the cable telecommunications industry.
subject matter experts	A person or persons that have an in-depth understanding or knowledge on a specific subject.
satellite master antenna television	A legacy critical facility for receiving video signals for processing and distribution directly to the customer, where no connection to an Operator's Core Network exists.

**Some definitions taken from SCTE 218, SCTE 137-7 and SCTE EMS 025.*

6. Methodology

6.1. Approach

SCTE collected information on all possible energy measures applicable to MSO buildings from SMEs including energy engineers and cable industry leaders. All energy measures were consolidated into a master list of energy measures, organized into categories based on impact applicability within cable-specific facility classifications.

For each energy measure, SCTE identified or defined the following:

1. Category – major system or section of the facility the energy measure impacts (e.g. HVAC, Lighting);
2. Sub-Category – minor system or section of the facility the energy measure impacts (e.g. Cooling, Heating, Lighting Controls);
3. Energy Measure Name – short common reference name of the energy measure;
4. Description – more detailed description of the measure and its components;
5. Objective – description of what the energy measure is trying to achieve (e.g. how to achieve energy savings);
6. Applicable Facility Types – indication on what type(s) of facilities the practice applies to; and
7. Value/Cost – value and cost metric (scale of 1-5 for each) for the energy measure based on its potential for energy savings and capital cost (described in more detail below in 6.3).

6.2. Energy Measure Categories

Table 1 – List of Energy Measure Categories for SCTE EMS-028

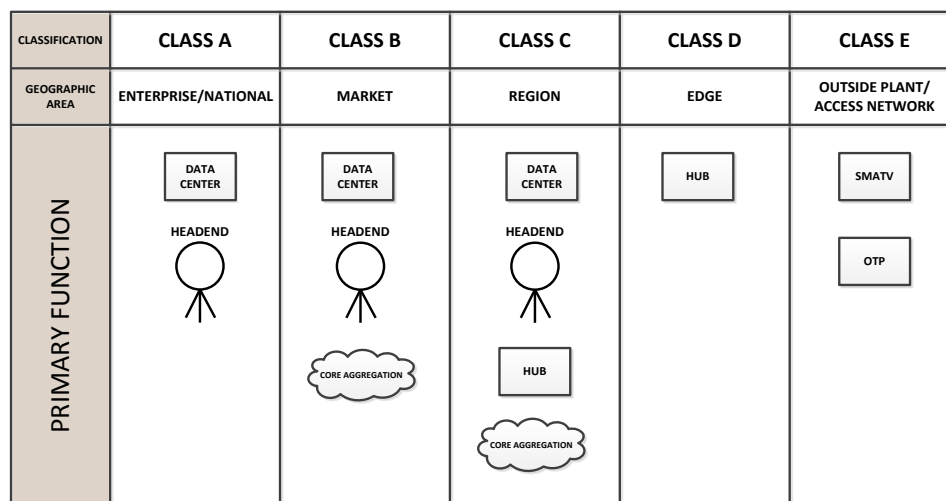
Category	Definition
Power Generation and Distribution	Measures that help reduce energy consumption by limiting conversion losses and increasing the efficiency of equipment in the power generation and distribution chain.
Heating, Ventilation and Air Conditioning (HVAC)	Measures that help reduce energy consumed by systems and equipment that support facility heating, cooling and ventilation.
Lighting	Measures that help reduce energy consumed by facility interior and exterior lighting systems and equipment.
Building Envelope	Measures that help decrease energy consumption by reducing heating and cooling losses due to leaks and solar absorption.
Miscellaneous	Any energy reduction measure that does not apply to the other four categories.

6.3. Facility Types

This operational practice provides energy conservation opportunities applicable to both critical and non-critical MSO facility types. The scope of this document does not include the outside plant. The following tables list and define the critical and non-critical facility classifications applicable to this document (adopted from SCTE 226 – see Figure 1).

Table 2 – Critical Facility Classification Levels

Critical Facility Classification	Definition
Class A	Critical facility such as data center servicing thousands or more customers requiring multiple megawatts redundant power availability
Class B	Technical facility such as headend or core aggregation servicing multiple neighborhoods with a megawatt of redundant power availability
Class C	Edge facility such as hub site servicing specific neighborhoods with smaller number of customer dependency and less than a megawatt of power availability required
Class D	Cabinet, Optical transport network supporting device servicing a focused customer base requiring power in the kilowatt range
Class E	Access Network level facility or enclosure utilized to support aggregation of a subset of an Edge Data Center's total access network

**Figure 1 – Critical Facility Classification Quick Reference (refer to SCTE 226)****Table 3 – Non-Critical Facility Classification Levels**

Non-Critical Facility Classification	
Admin	Administrative offices, multi-story buildings, high occupancy
Call Center	Call center, multi-story buildings, high occupancy
Lab	Research and Development laboratory space
Warehouse	Warehouse, work center or service depot
Retail	Public facing retail establishment