EcoStruxure™ Power
Innovation At Every Level

How to Improve Building Energy Efficiency with IEC 60364-8-1 and EcoStruxure™ Power

Technical Guide

04/2020

se.com/ww/ecostruxure-power

Life Is On Schneider Electric

Purpose of the Document

Target Audience

This document is intended for EcoXperts, System Integrators, Application Engineers, and other qualified personnel who are responsible for the design of the Electrical Installations in different types of buildings.

Objective

This document takes the opportunity of the new 2019 IEC 60364-8-1 release to provide information and support about this standard and explain how EcoStruxure™ by Schneider Electric can help with compliance.

Section 1 introduces the standard and its scope, and describes the methodology to define a building's energy efficiency class by assessing the rating of all the possible energy efficiency measures.

Section 2 provides details about assessing measures, expert advice, and proposes solutions, based on EcoStruxure™ digital applications, to improve the rating for these measures and, as a result, the efficiency class of the building.

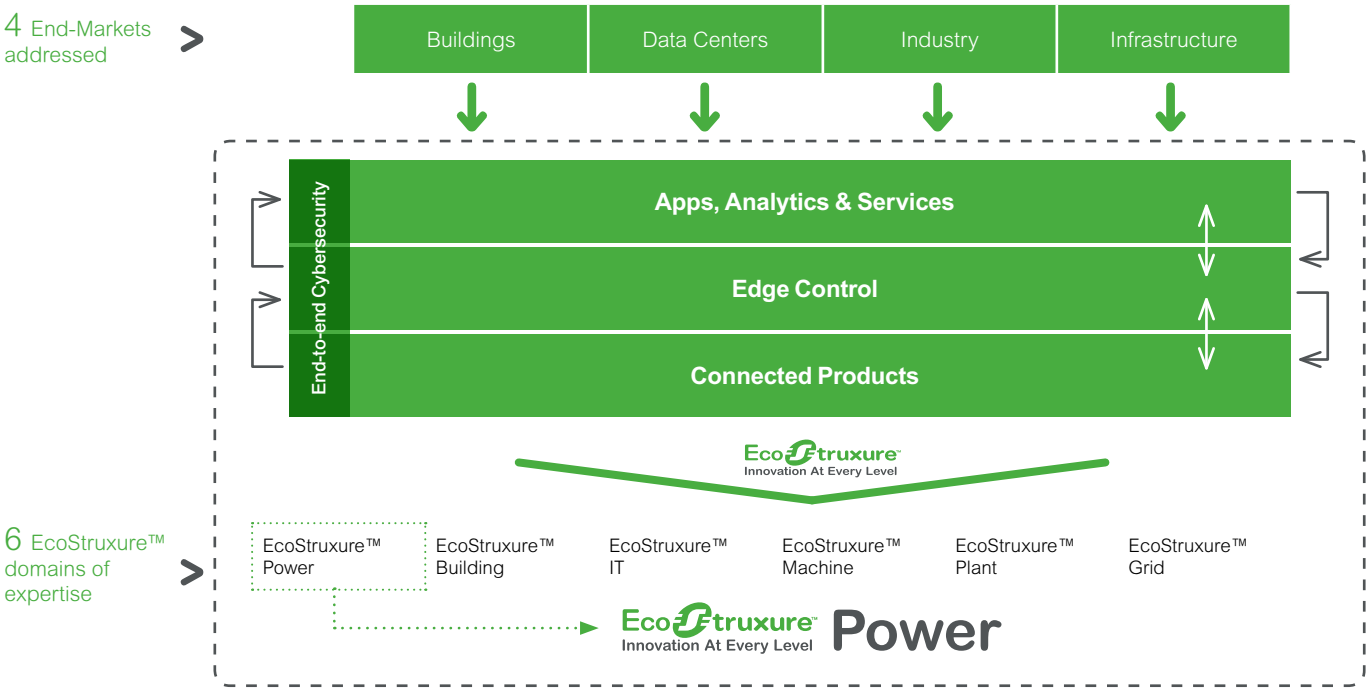
Table of Contents

Overview of EcoStruxure™ Power (1/2)

Introduction

As shown in the diagram below, and indicated by the green arrows, EcoStruxure™ Power is one of the six domains of EcoStruxure™, our IoT-enabled architecture and platform.

EcoStruxure™ Power plays a key role in all four End-Markets (Buildings, Data Centers, Industry and Infrastructure). This involves bringing the world of electrical distribution to those End-Markets.



EcoStruxure™'s integrated architecture serves four End-Markets with its six domains of expertise.

OUR VISION OF A NEW ELECTRIC WORLD

The world is becoming more electric and digital, and power is becoming more distributed, more complex to manage, and more integrated into our everyday lives. We envision a New Electric World where building staff and occupants are safer, with zero electrical safety incidents. Where power is 100% available, with zero unplanned downtime. Where energy and operations are more efficient, with zero energy waste. And where operational systems are resilient, with zero cyber intrusions.

We strive to make this vision a reality with our IoT-enabled EcoStruxure™ architecture and platform, which we deliver through our connected energy management ecosystem – a collective of partners and industry experts who are openly collaborating with us to push innovation, enhance productivity, reduce risk, and unlock new growth opportunities.

Overview of EcoStruxure™ Power (2/2)

EcoStruxure™ Power

- **EcoStruxure™ Power digitizes and simplifies low and medium voltage electrical distribution systems.** It provides essential data to aid the decisions that help protect people, safeguard assets, maximize operational efficiency and business continuity, and maintain regulatory compliance.

- **EcoStruxure™ Power is an open architecture and platform** designed with the intention of making it easy to add, upgrade, and swap components. The world is full of electrical distribution systems in various stages of maturity, produced by a variety of manufacturers. Interoperability with EcoStruxure™ Power is essential to making these power distribution systems future ready. The added benefit of a holistic Schneider Electric system is plug-and-play connectivity to achieve faster and lower risk integration and commissioning.

- **EcoStruxure™ Power architectures are cost-optimized** to deploy, using only the right technology to deliver the desired business outcomes for our customers – no more, no less. However, customer needs or demands change over time.

- **The EcoStruxure™ Power system is scalable** from light commercial and industrial buildings to critical facilities such as hospitals, data centers or infrastructure such as airports, rail and oil and gas. The scalability of EcoStruxure™ Power means it also grows and evolves with changing needs or demands through its modular architecture.

- **EcoStruxure™ Power architectures are fully flexible power distribution systems** with the ability to adapt to dynamic and ever-changing conditions, such as balancing supply and demand by the hour or minute or adding and then scaling on-site renewable generation capabilities over time. Connecting IT and OT systems into a single, easy-to-manage Ethernet IP network is at the heart of our digitization story. With EcoStruxure™ Power, facility managers can use the data they collect to make realtime decisions to maximize business continuity and optimize operations.

More about EcoStruxure™ Power

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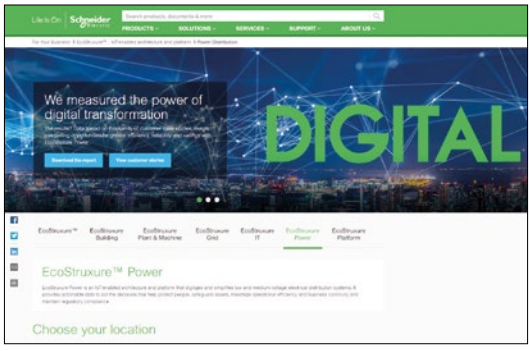

About IEC 60364-8-1 (1/3)

One Step Towards Reducing Energy Consumption in Buildings

A General Trend Towards Energy Efficiency Improvements

As a response to the United Nations climate conferences (COP), over the past 25 years, countries around the world have been adopting numerous regulations to set out minimum mandatory efficiency targets.

Some of these regulations target product performance (like the IEC 61800-9-1/2 series of standards to ecodesign electric motors), other regulations target systems like buildings.

Buildings: a Strategic Segment

According to International Energy Agency (IEA) estimations, building energy consumption represented around one-third of the global final energy demand in 2018.

The building sector has then been identified as a strategic opportunity for energy efficiency improvements. This strategy is further translated into different directives, regulations, standards, subsidies, etc., as each country will be inclined to reach a certain level of CO_2 reduction based on a previously set agreement.

Example in the European Community:

The 2012 Energy Efficiency Directive (2012/27/EU) establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020.

For buildings, it is completed with the Energy Performance of Buildings Directive (EPBD 2010/31/EU and EPBD 2018/844/EU).

Building Energy Consumption:

1/3

of Global Energy Demand

IEC 60364-8-1: The State-of-the-Art in Terms of Energy Efficiency in Buildings

The Standard for Energy Efficiency Improvements in Buildings

IEC 60364-8-1 is part of the IEC 60364 series of standards which regulates Low Voltage Electrical Installations.

Part 8-1, called "Energy Efficiency", enhances Parts 1 to 7 with the introduction of requirements and recommendations to design the electrical installation which provides the best compromise between the required level of service and safety, and the lowest electrical consumption.

It is applicable for both greenfield and brownfield projects and should be implemented throughout the life cycle of the facility. It does not apply to products within the electrical installation which have their own standards. The first edition of Part 8-1 of the IEC 60364 standard was released in October 2014. It has recently been updated, with a second edition released in February 2019.

Ref.: IEC60364-8-1 (ed 2.0) EE.pdf

An Opportunity to Lower Operating Expenditures

Even if the IEC 60364-8-1standard is not yet mandatory, working according to this standard offers electrical designers an opportunity to lower Operating Expenditures (OPEX) for their clients.

About IEC 60364-8-1 (2/3)

IEC 60364-8-1: The State-of-the-Art in Terms of Energy Efficiency in Buildings (cont.)

The Main Principles for Energy Efficiency Improvements

The standard is focusing on the 3 overarching principles that guided its development:

① MINIMIZE ENERGY LOSSES IN THE ELECTRICAL INSTALLATION

Decisions made when a building is initially designed or undergoing major renovations can have the biggest impact on its environmental and financial performance as the resulting energy savings accrue over the structure's entire lifespan.

This is why the new standard pays special attention to design parameters such as voltage drop, conductor sizing and optimization of the switchboard location in the installation.

② USE ENERGY AT THE RIGHT TIME, WHEN NEEDED AND AT THE LOWEST COST

The objective is first to reduce unnecessary consumption of energy (e.g. turn off the lights in a room when empty) and, when possible, to postpone consumption when energy is cost-effective (e.g. heat water during the night). Reducing the instantaneous/peak consumption also enables to subscribe to a lower energy contract and, for new projects, to optimize electrical installation design (e.g.circuit breaker rating, cable section).

For this reason, the standard evaluates monitoring measures embedded in the installation.

This goal is most easily implemented during a project's design phase, but also could be part of an efficiency upgrade at other times during a building's lifespan.

③ MAINTAIN THE BUILDING'S PERFORMANCE OVER TIME

Even the highest-efficiency buildings become less efficient over time, if owners aren't vigilant in monitoring ongoing operations. A formal, continuous-improvement style efficiency program can help ensure new buildings maintain their performance, and help bring existing facilities up to present-day standards over time. The essential requirement for such a plan is an understanding of current and ongoing electricity use through appropriate metering and monitoring equipment.

About IEC 60364-8-1 (3/3)

What's New in the 2019 Edition of the Standard?

Here are the main evolutions between edition 1 and edition 2 of IEC 60364-8-1:

Evolution of Annex B

Annex B, which was only informative in edition 1, has become normative in edition 2.

The Annex has also been improved, to enable electrical installation ranking:

- It has been enriched with energy efficiency classes

Figure 1: Electrical installation efficiency classes overview.

- The energy efficiency class of a building depends on the implementation of the energy efficiency measures. In this edition 2 of the standard, the measures have been completed and categorized as:
  - Initial installation
  - Energy management
  - Performance maintenance
  - Power monitoring
  - Bonus.

Improvement of Chapter 8

The clause 8.3, and mainly the part related to measurement, has been greatly improved: measurement applications are better described, and also a typical measurement scheme was provided. It includes the positioning of PMDs (Power Metering and Monitoring Devices compliant with IEC 61557-12) as described below:

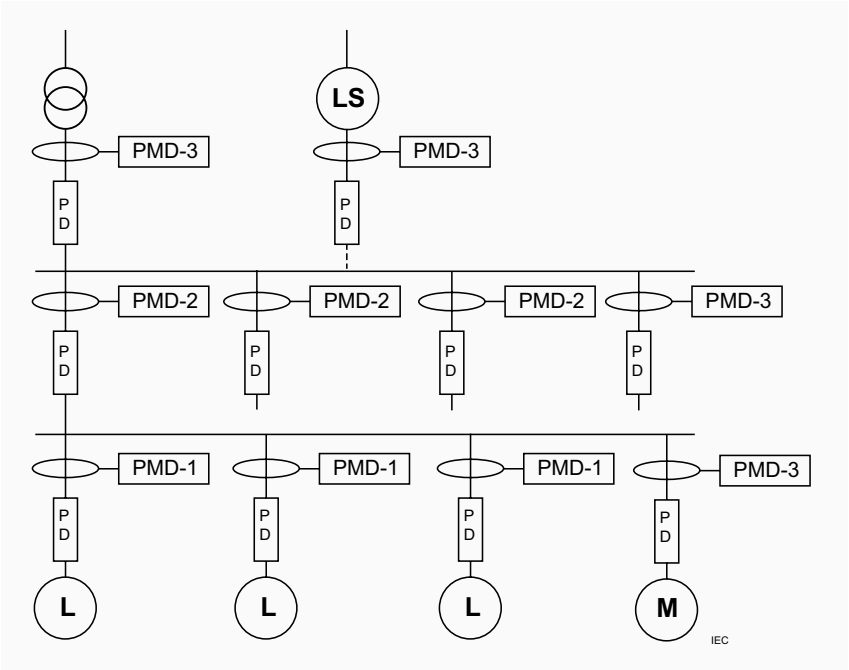

Figure 2: Example of measurement equipment selection in an installation (Paragraph 8.3.1.3 of the standard).

EcoStruxure™ Power and IEC 60364-8-1

The Relevant Combination for Energy Efficiency in Buildings

Energy efficiency of the buildings is key. This is the reason why Schneider Electric is focused on continuously creating and upgrading solutions to improve it.

These solutions are mainly based on implementing digital architectures which enable smart monitoring of the installation.

The digital applications are presented in the EcoStruxture™ Digital Application Design Guide which also describes their implementation.

In Section 2, for each energy efficiency measure proposed by the standard, solutions based on these digital applications are proposed to improve the rating of the measure and, in the end, improve the energy efficiency class of the building.

Digital Applications for Large Buildings and Critical Facilities
IEC EcoStruxure™ Power Design Guide
Ref: ESXP2G001EN
12/2019

SECTION 1

General Description of IEC 60364-8-1 Building Class Assessment Methodology

Introduction

Why Read this Section?

The objective of this section is to introduce standard IEC 60364-8-1 and to describe the methodology to define the energy efficiency class of a building.

Contents of this Section

First, we explain the purpose and the scope of the IEC 60364-8-1 standard.

Then, we present the methodology to assess the energy efficiency class of a building (according to the classification table). This methodology is based on the assessment of 23 parameters classified into 5 improvement categories.

Finally, we explain how to deal with buildings which do not reach the required efficiency class.

General Information about the Standard (1/2)

Purpose of the Standard

① DEFINE THE ENERGY EFFICIENCY CLASSES FOR A BUILDING'S ELECTRICAL INSTALLATION

Similar to the popular grading of consumer goods, the objective of the IEC 60364-8-1 standard is to define the efficiency classes for a building's electrical installation based on their level of efficiency.

The standard defines 6 classes, from EE0 to EE5. EE0 is given for buildings with the worst efficiency while EE5 is given for the best.

Example of energy efficiency grading for consumer goods (from G to A+++).

② PROPOSE A METHODOLOGY TO ASSESS THE ENERGY EFFICIENCY CLASS OF A BUILDING

Assessment of the energy efficiency class of a building's electrical installation is described specifically in Annex B. It proposes to evaluate a set of parameters which reflect the efficiency of the installation. This evaluation should be preferably based on measurements, but may also be based on calculations.

See Section 1 & Section 2 for assessment methodology.

③ PROVIDE AREAS FOR IMPROVEMENT OF THE ENERGY EFFICIENCY CLASS

Throughout the IEC 60364-8-1 document, best practices to improve the energy efficiency of electrical installations are presented.

Assessing the energy efficiency class using Annex B's content also helps understand which energy efficiency-related parameters should be improved first, and which measures should be adopted to improve the grade of these parameters.

See Section 2 for improvement proposals.

General Information about the Standard (2/2)

Scope of the Standard

Electrical Installations in New and Existing Buildings

Obviously, the standard targets electric installations in new buildings (Greenfield projects).

However, it also targets existing installations (Brownfield projects), as they, most of the time, do not apply even basic energy efficiency measures and can be a source of considerable improvement.

Sectors of Activities Covered by the Standard

In B.3.2 of Annex B, the standard defines an assessment of energy efficiency classes, with dedicated tables, for the following types of installations:

- Residential
- Commercial
- Industrial
- Infrastructure

Note: This guide only focuses on commercial and industrial installations, and infrastructure.

RECOMMENDED FREQUENCY FOR THE ENERGY EFFICIENCY CLASS ASSESSMENT	The standard (paragraph 4.2.1) recommends that the frequency of energy efficiency assessments shall not exceed: • 5 years for commercial installations • 3 years for industrial installations and infrastructure

Assessment of the Energy Efficiency Class (1/2)

Assessment of the Energy Efficiency-Related Parameters

Annex B of the standard states **23 parameters (21 + 2 bonus) to be evaluated, amongst 5 categories** of possible improvements of the energy efficiency.

Each assessed parameter receives points according to its own scoring grid.

Note: If a parameter is not assessed, it gets a default score of 0 point.

Category #1: Initial Installation (II)

II01: Determination of energy consumption
II02: Location of the main substation
II03: Voltage drop
II04: Efficiency of the transformer(s)
II05: Efficiency of fixed installed current-using equipment

Category #2: Energy Management (EM)

EM01: Zones
EM02: Usages
EM03: Demand response
EM04: Meshes
EM05: Measurement by usage
EM06: Detection of the occupancy by zone/room
EM07: Implementation of an energy management system
EM08: HVAC control
EM09: Lighting control

Category #3: Performance Maintenance (MA)

MA01: Implementation of life cycle methodology
MA02: Frequency of the performance verification procedure
MA03: Data management
MA04: Performance of the transformer(s) – If any
MA05: Presence of continuous monitoring for large energy-using systems

Category #4: Power Monitoring (PM)

PM01: Power factor
PM02: Total harmonic distortion

Category #5: Bonus (BS)

BS01: Renewable energy source
BS02: Electrical energy storage

Note: See page 18, to find out further details on each measure.

Assessment of the Energy Efficiency Class (2/2)

Calculation of the Total Energy Efficiency Points

Once the 23 parameters have been evaluated and graded, the points are added together.
The total number of points is used to determine the classification of the building.

Classification of Buildings

As explained on page 8, the buildings are sorted into 6 classes (EE0…EE5).
See table below for the definition of these classes.

The classification depends on the type of building: for a given total number of points, the energy efficiency class will be different whether the building is used for residential, industrial, commercial or infrastructure purposes.

Electrical Installation Efficiency Classes	Total Number of Points			
	For Residential	For Industrial	For Commercial	For Infrastructure
Class EE0	from 0 to 14	from 0 to 19	from 0 to 18	from 0 to 18
Class EE1	from 15 to 30	from 20 to 38	from 19 to 36	from 19 to 36
Class EE2	from 31 to 49	from 39 to 63	from 37 to 60	from 37 to 59
Class EE3	from 50 to 69	from 64 to 88	from 61 to 84	from 60 to 83
Class EE4	from 70 to 89	from 89 to 113	from 85 to 108	from 84 to 106
Class EE5	90 or more	114 or more	109 or more	107 or more

Table 1: Definition of electrical installation efficiency classes.

Buildings Which Do Not Reach the Required Efficiency Class (1/2)

The Need for a Well-Thought-Out Action Plan

Selection of the Measures

If the energy audit reveals that the required efficiency class is not reached, an action plan must be established, based on the good practices presented in the standard. Analyzing the detailed results of the assessment will help select the measures to start with, in order to have the best energy efficiency return on investment.

Comment: Note that improving the class of the building will improve its energy efficiency and consequently its Operational Expenditures (OPEX).

Passive/Active Energy Efficiency Measures

Measures can be sorted into passive and active:

- **Active measures** imply manual or automatic control of the electrical installation, to regulate consumption over time, depending on the user needs and on the environmental conditions, such as, for example, occupancy lighting control.
- **Passive measures** concern actions which are not related to controlling the installation, but to optimizing the design of the installation, or selecting more efficient devices, such as, for example, selection of higher efficiency equipment such as LED lighting.

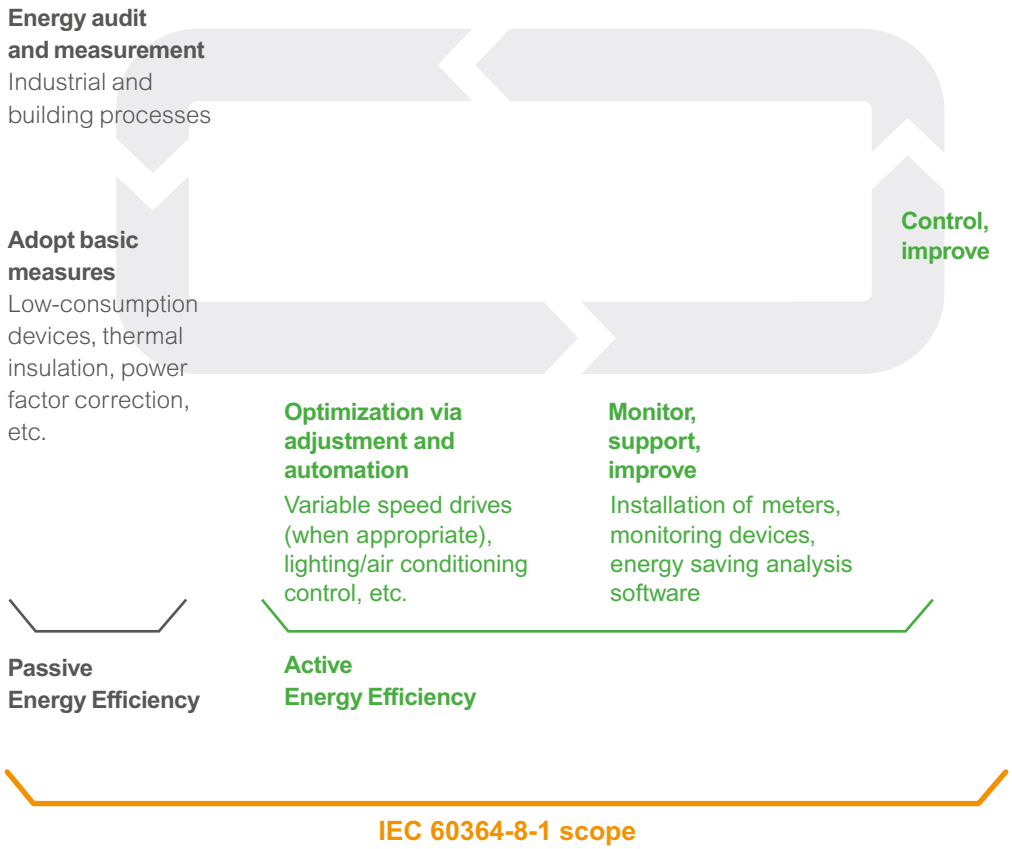

Figure 3: Energy efficiency improvement cycle.

Buildings Which Do Not Reach the Required Efficiency Class (2/2)

The Need for a Well-Thought-Out Action Plan (cont.)

Considerations for the Action Plan

The action plan shall not compromise **the safety of the installation**.

Also, as explained in IEC 60364-8-1 4.1.2, *"energy efficiency management **shall not reduce electrical availability and/or services or operation** below the level desired by the user".*

Therefore, *"The electrical installation **shall have provisions for overriding the energy efficiency management settings** according to the user's decision".*

Finally, the action plan **shall lead to an acceptable investment.**

SCHNEIDER ELECTRIC'S PROPOSAL	In Section 2 of this technical guide, parameter calculations and associated improvement measures provided by the standard are detailed. We also provide concrete Schneider Electric solutions to help improve the grade of the different parameters.

SECTION 2

Parameter Calculations and Our Recommendations for Improvement

Introduction

Why Read this Section?

The IEC 60364-8-1 standard has been introduced in Section 1 with its 23 parameters methodology to assess the energy efficiency class of a building.

In **Section 2**, the purpose is to detail the 23 parameters and associated energy efficiency measures to bring expert advice and explain how to implement these measures with Schneider Electric EcoStruxure™ Power solutions and applications.

Contents of this Section

For each energy efficiency improvement category, the related parameters are presented as follows:

- Criteria to evaluate
- Grading table (number of points for the parameter depending on the criteria evaluation)
- Some expert advice for the calculation of the criteria and/or how to improve
- Recommendations for improvement with Schneider Electric EcoStruxure™ Power solutions and applications.

Note: The calculation methodology is exactly the same whatever the type of installation: residential, commercial, etc. However, the points table is specific to each type of installation.
In this section, we only display the points table for Commercial buildings.
Refer to the IEC 60364-8-1 standard for other building types.

Evaluation and Recommendations for:

Category #1: Initial Installation (II) (1/5)

Parameter II01: Determination of Energy Consumption Coverage

CRITERIA TO ASSESS

$$K1 = \frac{a \,.\, 100}{b}$$

a = the annual energy consumption of the loads having the energy consumption measured at the origin of the mesh they belong to or downstream

b = yearly consumption of the installation

GRADING TABLE

K1	< 50%	≥ 50 and < 65%	≥ 65 and < 75%	≥ 75 and < 83%	≥ 83 and < 90%	> 90%
Points	0	1	2	4	5	6

Expert advice

To benefit from a **balanced and better monitored electrical network**, the best way is to **monitor at least the key usages** (big or more critical loads). Having more meters per mesh additionally brings more points in other categories.

How the standard defines a "mesh"

A "**mesh**" is defined as a circuit or a group of circuits identified with respective current-using equipment as useful for energy efficiency management. A mesh may belong to one or several zones.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **II01 GRADING**

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data to its relevant operational context, and by establishing energy intensity baselines for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #1: Initial Installation (II) (2/5)

Parameter II02: Consumption and Location of the Main Substation

For this measure, you can choose between two assessment methods.

CRITERIA TO ASSESS - METHOD #1

% = Percentage of consumption taken into account in the method versus total consumption of the installation.

GRADING TABLE

%	< 50%	≥ 50 and < 70%	≥ 70 and < 83%	≥ 83 and < 90%	> 90%
Points	0	1	2	3	4

OR

CRITERIA TO ASSESS - METHOD #2

$$R_B = \frac{a}{b}$$

a = the distance between the main substation and the optimum location calculated with the barycenter method

b = the distance between the most distant load and the optimum switchboard location calculated with the barycenter method

GRADING TABLE

R_B	> 0.3	≤ 0.3 and > 0.16	≤ 0.16 and > 0.07	≤ 0.07
Points	0	1	3	4

Expert advice

In order **to minimize losses**, transformers should be designed so that the **distances from the main loads are as short as possible.** Power losses in the cables or busways are directly linked to their length.

For example, **if we halve the average route length, we then halve the power losses.**

The optimum location of the main substation will be best determined using modeling and simulation software such as ID Spec.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #1: Initial Installation (II) (3/5)

Parameter II03: Voltage Drop

CRITERIA TO ASSESS

$$K_{VD} = \frac{\sum_{i=1}^{i=n} \Delta u_i \,.\, c_i \,.\, 100}{\sum_{i=1}^{i=n} c_i}$$

n = the number of circuits taken into account

Δ**u$_i$** = the voltage drop of the circuit considered

c$_i$ = the annual consumption of the circuit considered

GRADING TABLE

K_{VD}	> 5%	≤ 5 and > 3%	≤ 3 and > 2%	≤ 2 and > 1.5%	≤ 1.5 and > 1%	< 1%
Points	0	1	2	4	5	6

Expert advice

The **voltage drop needs to be calculated during the design phase** so that we are sure the right cables are chosen and the voltage loss is minimal. Also it needs to **be monitored during the operation of the building.**

This means that adequately placed meters to monitor all the loads with motors and all loads pulling cable losses can give a continuous understanding of whether some loads are causing inefficiency and there is a need to undertake maintenance.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **II03 GRADING**

Electrical Distribution Monitoring & Alarming

This application provides a realtime status of the electrical distribution system: actual status, power availability, detailed information about each connected device (circuit breakers, UPSs, transformers, generators, etc.). It identifies anomalies and provides alarming and notifications to the right personnel in case of any abnormal short-term or long-term conditions or events. To avoid alarm flooding and help with alarm interpretation, incidents are intelligently aggregated based on event type and time.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #1: Initial Installation (II) (4/5)

Parameter II04: Efficiency of the Transformer(s)

CRITERIA TO ASSESS

$$\eta_{TFO} = \frac{\sum_{i=1}^{i=n} \eta_i \cdot S_i}{\sum_{i=1}^{i=n} S_i}$$

η_{TFO} = the overall efficiency of the transformers

n = the number of transformers

η_i = the peak efficiency index (PEI) of the transformer considered

S_i = the nominal apparent power of the transformer considered

GRADING TABLE

η_{TFO}	< 98%	≥ 98 and < 99%	≥ 99 and < 99.5%	≥ 99.5%
Points	0	1	2	3

Standard Requirements for Power Transformers

For Power Transformers ≤ 3150 kVA

European standards require the use of a TIER1 that gives limits on fixed losses and yields according to the load.

For Power Transformers > 3150 kVA

European standards don't specify any losses, but a loss ratio that is fixed according to the load called PEI is used. In this case, it is necessary to take into account the load factor and the cost per kWh as well as the depreciation period in order to obtain the economic optimum by adding CAPEX and OPEX, and so, for large transformers, it is necessary to opt for TIER2 production cycles.

Expert advice

Make sure to choose a transformer with a better efficiency class.

This will reduce power losses and thus save on costs. In case **this information is not as easily accessible** as the other parameters, **it can be calculated by dividing the output power by the input power.**

During the operation phase, transformer losses can be accurately determined using metering on the input and output sides of the transformer. Also, metering can capture harmonics levels, which can affect the efficiency of a transformer by causing excessive heating. Metering and analysis software provides a dynamic picture of transformer efficiency during various levels of loading throughout the day or different production cycles.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **II04 GRADING**

Electrical Distribution Monitoring & Alarming

This application provides a realtime status of the electrical distribution system: actual status, power availability, detailed information about each connected device (breakers, UPSs, transformers, generators, etc.).
It identifies anomalies and provides alarming and notifications to the right personnel in case of any abnormal short term or long term conditions or events. To avoid alarm flooding and help with alarm interpretation, incidents are intelligently aggregated based on event type and time.

Power Quality Monitoring

This application monitors persistent steady state and event-based disturbances (harmonics, current unbalance, flicker and over/under voltage conditions, transients, interruptions, etc.). It enables better understanding of power quality disturbances, and a deep-dive analysis of power quality issues thanks to advanced dashboards and reports, and analytics-based advisory services to improve performance across the system.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #1: Initial Installation (II) (5/5)

Parameter II05: Efficiency of Fixed Installed Current-Using Equipment

CRITERIA TO ASSESS

$$R_{EC} = \frac{\text{Nominal consumption of installed current-using equipment consuming more than 5\% of the total annual consumption}}{\text{Nominal consumption of a replacement of the current-using equipment having the same function}}$$

GRADING TABLE

R_{EC}	< 1.2	≥ 1.05 < 1.2	< 1.05
Points	0	2	4

Expert advice

The **purpose of this measure is to highlight the importance of continuously revising high consuming loads** so that these loads can be easily identified and changed.
The method proposed is to **compare the efficiency of the current equipment vs the latest similar product on the market.** In this category, a good example is the replacement of incandescent lamps with LED ones.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **II05 GRADING**

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track improved performance, and verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (1/9)

Parameter EM01: Zones

CRITERIA TO ASSESS

$$K_Z = \frac{a \,.\, 100}{b}$$

a = the surface of the installation in m² where the zones are defined

b = the surface of the whole installation in m²

GRADING TABLE

K_Z	< 80%	≥ 80%
Points	0	1

Expert advice

Defining the right area to be a zone is as important as having zones covering a bigger area.
Having a granular zone brings more clarity on which type of loads are consuming energy in the facility and on the efficiency of the automation system (if any).

How the standard defines a "zone"

A "**zone**" is defined as a surface area or a location where electricity is used. For example this could be a floor in the building, space near the windows or a kitchen in the facility.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM01 GRADING**

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (2/9)

Parameter EM02: Usages

CRITERIA TO ASSESS

$$K_U = \frac{\sum_{i=1}^{i=n} a_i \cdot 100}{b}$$

n = the number of usages measured

$\mathbf{a_i}$ = the annual energy consumption for the considered individual usage

b = the total annual consumption of the installation

GRADING TABLE

K_U	< 80%	≥ 80%	≥ 80% and determined for each zone
Points	0	1	2

Expert advice

For this measure it is clear that the more different usages we monitor the better. But additionally, **an extra point can be gained by performing this monitoring per zone.** In this case it can be easily identified if the lighting management near the windows is performing as efficiently as expected.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM02 GRADING**

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (3/9)

Parameter EM03: Demand Response

For this measure, two assessments have to be done and their respective points have to be added:

CRITERIA TO ASSESS #1

$$R_D = \frac{a \,.\, 100}{b}$$

a = the sum of the rated power of the current-using equipment with implemented shedding

b = the rated power of the installation

GRADING TABLE

R_D	< 5%	≥ 5% and < 10%	≥ 10% and < 20%	≥ 20% and < 40%	≥ 40%
Points	0	1	2	4	5

AND

CRITERIA TO ASSESS #2

The maximum duration of the shedding of loads representing at least half of the power liable to be shed.

GRADING TABLE

Duration of the load shedding	< 10 min	≥ 10 min
Points	0	1

Expert advice

The more loads are included in the demand response program, the better the grade for this measure.

The combined power of the loads that can be shed should be as close to the total rated power of the installation as possible.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM03 GRADING**

Microgrid

An advanced Microgrid solution can help you gain resilience (it helps protect against extreme weather, cyberattacks, and grid instability), control financial and operational risks (with flexible EaaS), optimize energy costs (thanks to actionable insights on when to consume, store, and sell energy for the greatest financial advantage), and increase the sustainability of your installation.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (4/9)

Parameter EM04: Meshes

CRITERIA TO ASSESS

M_S = the number of criteria taken into consideration to determine the meshes.

GRADING TABLE

M_S	0	1	2	3	4	> 4
Points	0	1	2	4	5	6

Expert advice

More points can be gained in this parameter if more criteria have been considered during their definition: Technical criteria based on external parameters (like weather and proximity to a window) **+** Technical criteria based on control **+** Technical criteria based on critical points for measurement **+** Economic criteria based on ratio **+** Economic criteria based on the variable cost of electricity **+** Technical criteria based on energy inertia (for example some loads like fridges can be part of the load shedding plan for a short time without impact).

How the standard defines a "mesh"

A "**mesh**" is defined as a circuit or a group of circuits identified with respective current-using equipment as useful for energy efficiency management. A mesh may belong to one or several zones.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (5/9)

Parameter EM05: Measurement by Usages

CRITERIA TO ASSESS

$$R_{MU} = \frac{a \,.\, 100}{b}$$

a = the annual energy consumption of the loads measured by usage

b = the annual consumption of the whole installation

GRADING TABLE

R_{MU}	< 50%	≥ 50 and < 70%	≥ 70 and < 83%	≥ 83 and < 90%	≥ 90%
Points	0	2	4	5	6

Expert advice

In EM02 (Usages) we saw how to address the usages topic but now we can take even more advantage of it by monitoring these usages.

The more granular the monitoring solution the more points gained in this measure.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM05 GRADING**

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (6/9)

Parameter EM06: Detection of the Occupancy by Zone/Room

For this measure, two assessments have to be done and their respective points have to be added:

CRITERIA TO ASSESS #1

$$R_O = \frac{\text{Annual energy consumption of the current-using equipment within the zones or the rooms where the occupancy is permanently detected}}{\text{Annual energy consumption of the installation}}$$

GRADING TABLE

R_O	< 50%	≥ 50 and < 70%	≥ 70 and < 83%	≥ 83 and < 90%	≥ 90%
Points	0	3	6	8	10

AND

CRITERIA TO ASSESS #2

Measurement of the number of people in the building.

GRADING TABLE

Implementation of a measurement	No	Yes
Points	0	2

Expert advice

The most optimal solution to gain the 10+2 points in this measure is to **fully monitor the building, by having it equipped with a Building Management System (BMS),** to detect the occupancy by zone/room in reference to the number of people in the facility, **reinforced with an energy monitoring system covering all the loads.**

By correlating energy consumption with respect to building occupancy using Energy Modeling (Energy Performance Analysis application), **and using advanced energy visualization tools** (trends, reports & dashboards), **energy consumption can be optimized with respect to building occupancy.**

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM06 GRADING**

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations: by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track the improved performance, verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (7/9)

Parameter EM07: Implementation of an Energy Management System

CRITERIA TO ASSESS

$$R_i = \frac{\text{Annual consumption of the loads managed by or interfaced to an energy management system}}{\text{Annual load consumption of the installation}}$$

GRADING TABLE

R_i	< 50%	≥ 50 and < 70%	≥ 70 and < 83%	≥ 83 and < 90%	≥ 90%
Points	0	3	6	10	12

Expert advice

To reach the ultimate efficiency of the installation it is best to **interface as many loads as possible for monitoring and control purposes.**

Of course this should add value so these loads should be either part of zones, meshes or segmented in to some specific usages.

A combination of a Building Management System (BMS) and Energy Management System (EMS) provides monitoring and control functionality through the BMS bus or meters and contactors for the electrical equipment.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM07 GRADING**

Energy Benchmarking

This application enables benchmarking across multiple buildings or plants or process lines, from a centralized location, and comparison of energy usage by normalizing consumption with respect to area, production volume or other drivers. The good performers could be used as a model to improve the poor performers. Also it improves understanding (e.g. what makes an energy efficient facility use less energy than an inefficient facility).

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

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Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations: by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track the improved performance, verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (8/9)

Parameter EM08: HVAC Control

CRITERIA TO ASSESS

$$R_O = \frac{\text{Annual energy consumption of the current-using equipment within the zones or the rooms where the occupancy is permanently detected}}{\text{Annual energy consumption of the installation}}$$

GRADING TABLE

R_O	No consideration	Temperature control	Temperature control at room level	Time and temperature control at room level
Points	0	1	4	6

Expert advice

In order to gain points in this measure it is **clearly necessary to at least have some sort of temperature control system.**

For better efficiency performance and more points in this measure, it is **better to have a more centralized and granular system like a BMS controlling the HVAC.**

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM08 GRADING**

See EcoStruxure™ Building solutions designed by Schneider Electric.

From design, through integration to commissioning, EcoStruxure™ Building brings best-in-class engineering efficiency to your building. Combined with our asset and energy performance services, we enable lifetime efficiency of your building ensuring productivity and comfort for occupants.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #2: Energy Management (EM) (9/9)

Parameter EM09: Lighting Control

CRITERIA TO ASSESS

% = Percentage of the consumption of lighting automatically controlled.

GRADING TABLE

%	< 10%	≥ 10 and < 50%	> 50%
Points	0	2	6

Expert advice

Besides a BMS, **some lighting control can be performed through the direct control of the power supply to the circuit.** Contactors and timers are simple and cost-effective ways to provide lighting control via the lighting equipment electrical supply.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **EM09 GRADING**

See EcoStruxure™ Building solutions designed by Schneider Electric.

From design, through integration to commissioning, EcoStruxure™ Building brings best-in-class engineering efficiency to your building. Combined with our asset and energy performance services, we enable lifetime efficiency of your building ensuring productivity and comfort for occupants.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #3: Performance Maintenance (MA) (1/5)

Parameter MA01: Implementation of Life Cycle Methodology

CRITERIA TO ASSESS

P_{mp} = Existence of performance maintenance process.

GRADING TABLE

P_{mp}	No	Yes
Points	0	8

Expert advice

This **methodology shall include the following elements:** initial and periodic audit of the installation; appropriate accuracy of measuring equipment; implementation of an Energy Efficiency action plan to improve the efficiency of the installation.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **MA01 GRADING**

Energy Benchmarking

This applications enables benchmarking across multiple buildings or plants or process lines, from a centralized location, and comparison of energy usage by normalizing consumption with respect to area, production volume or other drivers. The good performers could be used as a model to improve the poor performers. Also it improves understanding (e.g. what makes an energy efficient facility use less energy than an inefficient facility).

Cost Allocation

This application will allow you to encourage energy efficiency behavior by allocating energy cost by department, business unit, area, floor or building. Also, it will allow you to find the biggest energy savings opportunities. Before initiating an energy savings action plan, it is necessary to understand which load type, business unit, area, floor or building provides the biggest savings opportunities.

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Energy Performance

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Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations: by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track the improved performance, verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #3: Performance Maintenance (MA) (2/5)

Parameter MA02: Frequency of the Performance Verification Process

CRITERIA TO ASSESS

f = Frequency of the performance verification process.

GRADING TABLE

f	Less than once a year	Yearly	Quarterly	Monthly	Weekly	Daily
Points	0	1	4	6	7	8

If the ongoing verification and the optimization is performed automatically i.e. by software, the frequency to consider for the table is daily.

Expert advice

The most efficient way to conduct energy performance verification is by comparing the actual consumption against a theoretical empirical modeled consumption. Any significant deviation from the model can be used as a trigger to investigate any potential equipment drift from its optimal settings or configuration.

For a more efficient verification process, the ongoing **verification and the optimization should be performed automatically by software.**

In this case the **frequency to consider for the table is daily.** Additionally, this **action can be delegated to cloud services** that will provide monitoring and verification and thereby enable large savings on the OPEX for this kind of functionality.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **MA02 GRADING**

Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations: by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track the improved performance, verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #3: Performance Maintenance (MA) (3/5)

Parameter MA03: Data Management

CRITERIA TO ASSESS

Δ T = Duration of the storage of data and classification.

GRADING TABLE

Δ T	Less than one year of history	More than 1 year and less than 5 years	More than 5 years
Points	0	4	8

Expert advice

Data helps understand energy performance.

By creating a model correlating energy consumption with associated energy drivers (such as outside temperature, productivity or building occupancy) it is possible to gain an understanding of the effects of building retrofits and energy efficiency improvements. **The more data is available, the better the insight into energy performance.**

Depending on the activities and criticality of the facility, **the solutions best fitting this measure can range from intermediate to more advanced.**

Some simpler and cheaper solutions with less functionality can store the data for few years (<5), but there are also **more advanced EMS that can process and store this data for much longer than 5 years.**

Additionally this **action can be delegated to cloud services** that will provide monitoring and verification and thus save a big part of the OPEX for this kind of functionality.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **MA03 GRADING**

Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations: by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track the improved performance, verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #3: Performance Maintenance (MA) (4/5)

Parameter MA04: Performance of the Transformer(s)

CRITERIA TO ASSESS

In case of transformers in the installation:

$$R_{ET} = \frac{\text{Number of transformers having a ratio } R_{WP}^{*} \text{ above 1.2 or below 0.8}}{\text{Number in transformers of the electrical installation}}$$

* R_{WP} = The average power delivered by the transformer during operation of the installation for the period of time considered / the power corresponding to the WP_{TFO}.

GRADING TABLE

R_{ET}	> 0.2	< 0.2
Points	0	1

Expert advice

We need **to help ensure that transformers operate within their rated power limits** for optimal efficiency.

This means we **need to have a constant measure of the load attached to longer transformer.**

Note: The working point of the transformer (WP_{TFO}) can be found on the transformer's nameplate.

Note: Where no transformer is part of the electrical installation, the points obtained are the maximum points.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **MA04 GRADING**

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

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For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #3: Performance Maintenance (MA) (5/5)

Parameter MA05: Presence of Continuous Monitoring for Large Energy-Using Systems

CRITERIA TO ASSESS

CM = Presence of continuous monitoring for large energy-using systems.

GRADING TABLE

CM	No	Yes
Points	0	5

Expert advice

Large energy-using systems are systems which consume over 10% of the installation's energy, i.e. cooling systems, heating systems and heat recovery systems.

The presence of **continuous monitoring with automatic alarming in case of variances in the electrical energy consumption of large energy-using systems is required** to maximize energy efficiency and to be able to identify if any maintenance actions need to be taken.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **MA05 GRADING**

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports. You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

Energy Modeling & Verification

This application helps define modeled energy consumption data related to energy drivers. It provides a feedback loop between energy managers and operations: by analyzing the energy performance of the facility or building against a modeled baseline which takes into account all relevant energy drivers such as outside temperature, occupancy rate or productivity. Also, the application uses modeled data to detect abnormal consumption values. Thanks to this application you could track the improved performance, verify and report savings by determining the difference between pre-retrofit and post-retrofit energy consumption.

For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

Evaluation and Recommendations for:

Category #4: Power Monitoring (PM) (1/2)

Parameter PM01: Power Factor

CRITERIA TO ASSESS

PF = Value of the power factor.

GRADING TABLE

PF	< 0.85 or no measurement	≥ 0.85 and < 0.90	≥ 0.90 and < 0.93	≥ 0.93 and < 0.95	≥ 0.95
Points	0	1	2	3	4

Expert advice

Smart power factor monitoring can be a big help in avoiding penalties and improving the efficiency of the facility.

The value of the power factor considered in this measure is a **parameter based on the value of the power factor measured at the origin of the installation**. However, having more granular monitoring on loads with induction motors or rectifiers can pinpoint local power factor correction needs.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **PM01 GRADING**

Electrical Distribution Monitoring & Alarming

This application provides a realtime status of the electrical distribution system: actual status, power availability, detailed information about each connected device (breakers, UPSs, transformers, generators, etc.).
It identifies anomalies and provides alarming and notifications to the right personnel in case of any abnormal short term or long term conditions or events. To avoid alarm flooding and help with alarm interpretation, incidents are intelligently aggregated based on event type and time.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports.
You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #4: Power Monitoring (PM) (2/2)

Parameter PM02: Total Harmonic Distortion

For this measure, you can choose between two assessment methods.

CRITERIA TO ASSESS - METHOD #1

THD_U = Value of the total harmonic distortion.

GRADING TABLE

THD_U	≥ 7% or no measurement	≥ 4% and < 7%	≥ 3% and < 4%	< 3%
Points	0	1	2	3

OR

CRITERIA TO ASSESS - METHOD #2

THD_I = Value of the total harmonic distortion.

GRADING TABLE

THD_I	≥ 20% or no measurement	≥ 10% and < 20%	≥ 5% and < 10%	< 5%
Points	0	1	2	3

Expert advice

Either of these 2 tables can be used depending on the availability of the voltage or current Total Harmonic Distortion (THD) measurement.

The value of the THD is measured at the origin of the installation. The purpose of this measure is to encourage monitoring of the THD in motors and transformers to be able to avoid excessive energy losses.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **PM02 GRADING**

Electrical Distribution Monitoring & Alarming

This application provides a realtime status of the electrical distribution system: actual status, power availability, detailed information about each connected device (breakers, UPSs, transformers, generators, etc.).
It identifies anomalies and provides alarming and notifications to the right personnel in case of any abnormal short term or long term conditions or events. To avoid alarm flooding and help with alarm interpretation, incidents are intelligently aggregated based on event type and time.

Power Quality Monitoring

This application monitors persistent steady state and event-based disturbances (harmonics, current unbalance, flicker and over/under voltage conditions, transients, interruptions, etc.). It enables better understanding of power quality disturbances, and a deep-dive analysis of power quality issues thanks to advanced dashboards and reports, and analytics-based advisory services to improve performance across the system.

Power Quality Correction

This application provides the proper compensation for power quality issues such as harmonics caused by non-linear loads (e.g. variable speed drives and other electronic equipment with switching power supplies). This is especially important for critical facilities such as hospitals, data centers, industrial plants or other infrastructure to avoid damage to sensitive equipment and unexpected disruptions.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #5: Bonus (BS) (1/2)

Bonus Parameter BS01: Renewable Energy Source

CRITERIA TO ASSESS

$$R_{PRE} = \frac{\text{Annual electrical energy production of the renewable sources}}{\text{Total annual electrical energy consumption of the installation}}$$

GRADING TABLE

R_{PRE}	< 5%	≥ 5% and < 15%	≥ 15% and < 30%	≥ 30% and < 50%	≥ 50% and < 80%	≥ 80%
Points	0	1	2	3	4	5

Expert advice

In this measure, besides the obvious "the more energy produced by renewables - the better maxim", **we can investigate the control and optimization solutions that operate these systems.**

They **play an important role in optimizing the way energy is being produced, consumed and stored.** A first layer of control, called the **Energy Management System (EMS)**, is key. Usually cloud-based, **these systems are able to forecast and optimize energy usage,** leveraging on-site distributed energy resources to reduce energy bills and better integrate renewables.

In addition to an EMS, **a Power Management System can be used** to operate the system on-site.

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **BS01 GRADING**

Electrical Distribution Monitoring & Alarming

This application provides a realtime status of the electrical distribution system: actual status, power availability, detailed information about each connected device (breakers, UPSs, transformers, generators, etc.).
It identifies anomalies and provides alarming and notifications to the right personnel in case of any abnormal short term or long term conditions or events. To avoid alarm flooding and help with alarm interpretation, incidents are intelligently aggregated based on event type and time.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports.
You can then identify "quick-win" opportunities for energy savings, by comparing and visualizing hourly, daily, weekly, monthly and yearly energy usage, and associated costs for different utilities. You can also identify and prioritize which load types, equipment, processes, areas or buildings lend themselves to a better return on investment for energy conservation initiatives.

Energy Performance

This application helps you normalize energy data to give it context, by relating energy efficiency data with relevant operational context, and by establishing baselines of energy intensity for buildings, processes, areas, shifts or products. It also helps establish normalized baselines for comparison against best performing processes/operations/buildings or shifts to find areas to optimize.

Microgrid

An advanced Microgrid solution can help you gain resilience (it helps protect against extreme weather, cyberattacks, and grid instability), control financial and operational risks (with flexible EaaS), optimize energy costs (thanks to actionable insights on when to consume, store, and sell energy for the greatest financial advantage), and increase the sustainability of your installation.

For in-depth advice and suggestions on how to address this measure, refer to the EcoStruxure™ Power Digital Applications Design Guide

Evaluation and Recommendations for:

Category #5: Bonus (BS) (2/2)

Bonus Parameter BS02: Electrical Energy Storage

CRITERIA TO ASSESS

$$R_{PES} = \frac{\text{Maximum power storage sources in kW}}{\text{Total annual electrical energy consumption of the installation divided by 360 days}}$$

GRADING TABLE

R_{PES}	< 1%	≥ 1% and < 5%	≥ 5% and < 10%	≥ 10%
Points	0	1	2	3

Expert advice

Electrical energy storage systems enable storage of renewable energy from peak production periods and use of that energy when demand exceeds production.

In addition, electrical storage systems **enable multiple features and services** including the optimization of energy billing, voltage and frequency support to the grid, and even the operation of the building's electrical system, or part of it, in the case of power outages.

In conclusion and in alignment with the grading of this measure, **the more of the energy produced we can store the better.**

RECOMMENDED SCHNEIDER ELECTRIC APPLICATIONS TO IMPROVE **BS02 GRADING**

Electrical Distribution Monitoring & Alarming

This application provides a realtime status of the electrical distribution system: actual status, power availability, detailed information about each connected device (breakers, UPSs, transformers, generators, etc.).
It identifies anomalies and provides alarming and notifications to the right personnel in case of any abnormal short term or long term conditions or events. To avoid alarm flooding and help with alarm interpretation, incidents are intelligently aggregated based on event type and time.

Energy Monitoring

Thanks to this application you will become aware of energy usage, by turning data into information and representing energy usage and consumption within easy to interpret graphical dashboards and reports.
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For in-depth advice and suggestions on how to address this measure, refer to the **EcoStruxure™ Power Digital Applications Design Guide**

BIBLIOGRAPHY

Reference Documents

The following documentation has been consulted to create this technical guide:

- **IEC Standard**
  https://www.iec.ch
  - IEC 60364-8-1 : Low-voltage electrical installations - Part 8-1: Functional aspects - Energy efficiency

- **Schneider Electric EcoStruxure™ Design Guide**
  https://www.se.com/ww/en/work/products/product-launch/digital-applications-design-guide/
  - Digital Applications for Large Buildings & Critical Facilities - IEC Design Guide
    (ref. ESXP2G001EN)

Useful Documentation (1/2)

Design Guide

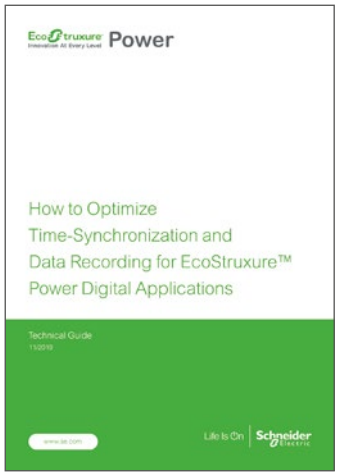
Digital Applications for Large Buildings and Critical Facilities

The Digital Applications Design Guide provides comprehensive details on the building blocks of EcoStruxure™ Power: the IoT applications are driven by a software layer to control the traditional electrical distribution infrastructure. Developed to help engineering consultants and designers, this guide is an invaluable resource for specifying, designing and prescribing EcoStruxure™ Power architectures capable of performing one or more of the business-driven applications described within.

IEC EcoStruxure™ Power Design Guide
Ref: ESXP2G001EN
12/2019

https://go.schneider-electric.com/WW_201903_Digital-Applications-for-Large-Buildings-and-Critical-Facilities-A09116_EA-LP-EN.html?source=Advertising-Online&sDetail=Digital-Applications-for-Large-Buildings-and-Critical-Facilities-A09116_WW

Technical Guides



How to Optimize Time-Synchronization and Data Recording for EcoStruxure™ Power Digital Applications

This technical guide details how to define the digital architecture to implement proper timestamping of the collected data depending on the selected digital applications. It provides a special focus on the various methods used to time-synchronize the internal clocks of advanced devices such as power meters, trip units, protective relays, PLCs, UPS controllers, harmonic filters, etc.

Technical Guide
Ref: ESXP2TG001EN
11/2019

https://www.se.com/ww/en/download/document/ESXP2TG001EN/

Discover How to Mitigate Risk of Fire for New and Existing Commercial Buildings

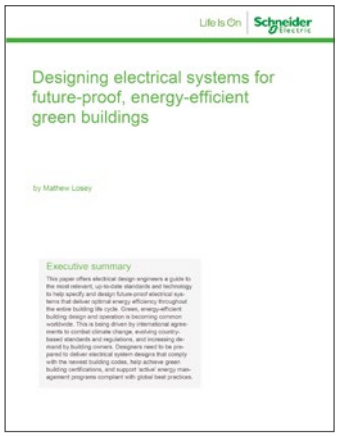
Learn how to go above and beyond electrical installation standards. Our Electrical Fire Prevention Guide considers the risk of fire caused by electrical currents that fall below overcurrent protection thresholds. It focuses on the latest solutions to help mitigate such hazards in both new and existing installations in commercial buildings.

Electrical Fire Prevention Guide
Ref: 998-20636077_GMA
06/2019

https://go.schneider-electric.com/WW_201907_Electrical-Fire-Prevention-Guide-Content_EA-LP-EN.html?source=Content&sDetail=Electrical-Fire-Prevention-Guide_WW&

Useful Documentation (2/2)

White Paper



Designing Electrical Systems for Future-Proof, Energy-Efficient Green Buildings

As the number of buildings and their associated emissions grow worldwide, governments and industry groups continue to introduce standards and guidelines that are driving the design and operation of green buildings. This represents a massive opportunity for design firms that are prepared to respond to their clients' requests for energy-efficient electrical systems in new and retrofit applications. This paper helps guide electrical design engineers on the most relevant, up-to-date standards and technology to help specify and design future-ready electrical systems that deliver optimal energy efficiency throughout the entire building life cycle.

White Paper
Ref: 998-20712088_GMA
2019

https://go.schneider-electric.com/WW_201910_Electrical-Design-for-Green-Buildings-WP_EA-LP-EN.html?source=Content&sDetail=Electrical-Design-for-Green-Buildings-WP_WW%C2%AD&

Tool

EcoStruxure™ Power Design (previously known as Ecodial) Design Tool

EcoStruxure™ Power Design is an easy-to-use software design tool for electrical installations. Thanks to its calculation capabilities, it can propose recommended protection equipment, cable cross-sections, as well as reactive power compensation. It can also generate clear calculation reports that fit into any electrical design specification. EcoStruxure™ Power Design reduces design time and minimizes the risk of manual errors. It is part of our Customer Life Cycle Software suite and is connected to the EcoStruxure™ Power platform.

Green Premium™

An industry leading portfolio of offers delivering sustainable value

Green Premium™

More than 75% of our product sales offer superior transparency on the material content, regulatory information and environmental impact of our products:

- RoHS compliance
- REACh substance information
- Industry leading # of PEP's*
- Circularity instructions

Discover what we mean by green

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The Green Premium program stands for our commitment to deliver customer valued sustainable performance. It has been upgraded with recognized environmental claims and extended to cover all offers including Products, Services and Solutions.

CO_2 and P&L impact through… Resource Performance

Green Premium brings improved resource efficiency throughout an asset's life cycle. This includes efficient use of energy and natural resources, along with the minimization of CO_2 emissions.

Cost of ownership optimization through… Circular Performance

We're helping our customers optimize the total cost of ownership of their assets. To do this, we provide IoT-enabled solutions, as well as upgrade, repair, retrofit, and remanufacture services.

Peace of mind through… Well-Being Performance

Green Premium products are RoHS and REACh compliant. We're going beyond regulatory compliance with step-by-step substitution of certain materials and substances from our products.

Improved sales through… Differentiation

Green Premium delivers strong value propositions through third-party labels and services. By collaborating with third-party organizations we can support our customers in meeting their sustainability goals such as green building certifications.

*PEP: Product Environmental Profile (i.e. Environmental Product Declaration)

Legal Information

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

Notes

Notes

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