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TECHNICAL REPORT

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Energy efficiency through automation systems

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ENERGY EFFICIENCY THROUGH AUTOMATION SYSTEMS

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IEC 62837, which is a technical report, has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
65/513/DTR	65/517/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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INTRODUCTION

Energy efficiency has received an ever growing attention worldwide since it is considered a major lever to help secure a sustainable society in view of climate change, growing population and security of supply [1][1]. Additionally the sustainability and conservation of resources need to be considered. Automation is the enabler of measures, solutions and systems for demand/response and energy efficiency. In the context of this TR we will only consider energy efficiency. IEC and ISO have both identified energy efficiency as one of their main areas of activity.

The current focus of the Standard Development Organisations (SDO) is harmonised terminology, calculation methods, indicators, energy management systems and standards for assessment and ratings (e.g. for buildings and industrial plants). For this purpose IEC SMB Decision 128/20 “New initiatives for IEC” work endorsed the SMB Strategic Group 1 on Energy Efficiency and Renewable Energy. This strategic group has since then developed 34 recommendations for future work in different domains. The three following recommendations cover the area of automation:

- Recommendation #7: IEC/TC 2, SC 22G and TC 65 together with ISO/TC 184 should develop guidelines for the design and operation of energy efficient systems in the field of industrial automation and industrial process control from a system point of view.
- Recommendation #27: In order to support the optimisation of automation and production processes already during the planning phase of production systems, SG1 recommends that all relevant product TC/SC include key data in their components/devices standards that are vital for a priori simulation of the component/device behaviour in an intended production system, as such simulation leads to optimised processes from an energy efficiency perspective.
- Recommendation #28: In order to support the optimisation of automation and production processes already during the planning phase of production systems, SG1 recommends that TC 65 and its SCs consider the development of simulation tools from a system point of view, to allow a priori optimisation of automation and production processes on the factory floor in terms of energy efficiency.

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In line with the recommendation #7, a workshop organized by the quoted committees and by SC 17B reached the consensus to create JWG 14, settled in TC 65, to cover the objectives and perform the tasks specified in the above mentioned recommendations. This document identifies a number of technology areas in the scope of various technical committees that need standardisation.

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1 Numbers in square brackets refer to the Bibliography.

ENERGY EFFICIENCY THROUGH AUTOMATION SYSTEMS

1 Scope

This Technical Report provides to the technical committees a framework for the development and adaptation of documents in order to improve energy efficiency in manufacturing, process control and industrial facility management.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62264 (all parts), *Enterprise-control system integration*

IEC 62264-1:2013, *Enterprise-control system integration – Part 1: Models and terminology*

ISO 20140-1:2013, *Automation systems and integration – Evaluating energy efficiency and other factors of manufacturing systems that influence the environment – Part 1: Overview and general principles*

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ISO 22400-2, *Automation systems and integration – Key performance indicators for manufacturing operations management – Part 2: Definitions and descriptions*[2]

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Energy

3.1.1
energy
capacity of a system to produce external activity or perform work

Note 1 to entry: Commonly, the term “energy” is used for electricity, fuel, steam, heat, compressed air and other like media. Energy can take a wide variety of forms, for example: chemical energy, mechanical energy, thermal energy, electric energy, gravitational energy, nuclear energy, hydraulic energy, etc.

Note 2 to entry: The SI unit for energy is joule (J), and for electric energy also watt-hour (W·h).

[SOURCE: CEN/CLC/TR 16103:2010, 4.1.1]

3.1.2
energy conversion
transformation of the physical or chemical form of energy

Note 1 to entry: The term “energy transformation” may be employed in this sense.

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2 To be published.

[SOURCE: CEN/CLC/TR 16103:2010, 4.1.7]

3.1.3
energy source
source material or natural resource from which energy in a useful form can be extracted or recovered either directly or by means of energy conversion

[SOURCE: CEN/CLC/TR 16103:2010, 4.1.2]

3.1.4
final energy
energy as received by an energy using system

Note 1 to entry: Final energy may be either primary or secondary energy, or both.

[SOURCE: CEN/CLC/TR 16103:2010, 4.1.12]

3.1.5
primary energy
energy that has not been subjected to any conversion process

Note 1 to entry: Primary energy includes non-renewable energy and renewable energy. The sum of primary energy from all energy sources may be called total primary energy.

[SOURCE: CEN/CLC/TR 16103:2010, 4.1.6]

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3.1.6
secondary energy
energy resulting from energy conversion of primary energy

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EXAMPLE Electricity, gasoline, process steam, compressed air.

[SOURCE: CEN/CLC/TR 16103:2010, 4.1.8]

3.2 Energy use and energy consumption

3.2.1
energy baseline
quantitative reference(s) providing a basis for comparison of energy performance

Note 1 to entry: An energy baseline reflects a specified period of time.

Note 2 to entry: An energy baseline can be normalized using variables affecting energy use and/or consumption such as production level, degree days (outdoor temperature), etc.

Note 3 to entry: Energy baseline is also used for calculation of energy savings, as a reference before and after implementation of energy performance improvement actions.

[SOURCE: ISO 50001:2011, 3.6]

3.2.2
energy consumption
amount of energy used

Note 1 to entry: Although technically incorrect, energy consumption is a widely used term.

Note 2 to entry: The manner or kind of application of energy is expressed as energy use.

[SOURCE: CEN/CLC/TR 16103:2010, 4.2.5]

3.2.3
energy demand
necessary supply capacity for the projected level of energy use

Note 1 to entry: When considering future trends, energy demand is often used in the sense of potential energy consumption.

Note 2 to entry: Energy demand is often used in the context of supply-demand interaction where demand is not given but dependent on external factors such as energy prices.

[SOURCE: CEN/CLC/TR 16103:2010, 4.2.3]

3.2.4
energy end user
entity consuming final energy

Note 1 to entry: The energy end user may differ from the customer who might purchase the energy but does not necessarily use it.

[SOURCE: CEN/CLC/TR 16103:2010, 4.2.2]

3.2.5
energy saving
reduction of energy consumption following implementation of energy efficiency improvement action(s)

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Note 1 to entry: The reduction is obtained by comparison against the baseline taking into account all adjustment factors.

Note 2 to entry: Energy savings can be potential following an assessment or actual after implementing an action(s).

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[SOURCE: CEN/CLC/TR 16103:2010, 4.2.8]

3.2.6
energy use
manner or kind of application of energy

Note 1 to entry: Examples are ventilation, lighting, heating, cooling, transportation, processes, production lines.

[SOURCE: ISO 50001:2011, 3.18]

3.2.7
energy using system
physically defined energy consuming item with boundaries, energy input and output

Note 1 to entry: An energy using system can be a plant, a process, part of a process, a building, a part of a building, a machine, equipment, a product, etc.

Note 2 to entry: Boundaries must be clearly delimited.

Note 3 to entry: Output can be energy, service, product.

[SOURCE: CEN/CLC/TR 16103:2010, 4.2.4]

3.3 Energy efficiency

3.3.1
energy efficiency
ratio between an output of performance, service, goods or energy, and an input of energy

Note 1 to entry: Both input and output have to be clearly specified in quantity and quality, and be measurable.

Note 2 to entry: Examples are conversion efficiency, energy required/energy used, output/input, theoretical energy used to operate/energy used to operate.

[SOURCE: CEN/CLC/TR 16103:2010, 4.3.1, modified – omitted notes 2 and 3 from original and added a new note 2]

3.3.2
energy efficiency improvement programme
set of activities focusing on energy end users with the intent of providing energy efficiency improvements that are verifiable, measurable or estimable.

Note 1 to entry: In the context of an energy management system, the definition would be, “action plan specifically aimed at achieving energy efficiency objectives and targets”.

[SOURCE: CEN/CLC/TR 16103:2010, 4.3.5]

3.3.3
energy efficiency indicator
value indicative of the energy efficiency

Note 1 to entry: Mainly used as a metric in policy evaluation and in macroeconomic studies.

[SOURCE: CEN/CLC/TR 16103:2010, 4.3.8]

3.3.4
energy intensity
energy consumption per financial unit of output

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EXAMPLE Gigajoule (GJ) per euro of GDP (gross domestic product). Gigajoule per unit of turn over.

[SOURCE: CEN/CLC/TR 16103:2010, 4.3.9]

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3.3.5
intrinsic energy efficiency
energy efficiency of a component which is achieved by design

3.3.6
load shedding
process of deliberately disconnecting preselected loads from a power system in response to an abnormal condition in order to maintain the integrity of the remainder of the system

[SOURCE: IEC 60050-603:1987, 603-04-32]

3.3.7
managed energy efficiency
energy efficiency achieved by systematic energy management

3.3.8
peak shaving
process in an electrical system intended not to exceed a maximum overall energy demand

Note 1 to entry: Peak shaving can be obtained by planning of the energy needs within the manufacturing system or load shedding or autonomous energy production.

3.3.9
rational use of energy
energy use by consumers in a manner best suited to the realization of economic objectives, taking into account technical, social, political, financial and environmental constraints

[SOURCE: CEN/CLC/TR 16103:2010, 4.3.12]

3.3.10
specific energy consumption
energy consumption per physical unit of output

EXAMPLE Gigajoule (GJ) per ton of steel, Btu/ton of product, annual kWh per m^2.

[SOURCE: CEN/CLC/TR 16103:2010, 4.3.10, modified – added in the example “Btu/ton of product”.]

3.4 Energy performance

3.4.1
energy performance
measurable results related to energy efficiency, energy use and energy consumption

Note 1 to entry: In the context of energy management systems, results can be measured against the organization’s energy policy, objectives, targets and other energy performance requirements.

Note 2 to entry: Energy performance is one component of the performance of the energy management system.

[SOURCE: ISO 50001:2011, 3.12]

3.4.2
energy performance indicator
EnPI
quantitative value or measure of energy performance, as defined by the organization

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Note 1 to entry: EnPIs could be expressed as a simple metric, ratio or a more complex model.

[SOURCE: ISO 50001:2011, 3.13]

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3.5 Energy management

3.5.1
energy management
coordinated activities directing and controlling the energy use of an entity

[SOURCE: CEN/CLC/TR 16103:2010, 4.5.1]

3.5.2
energy management profile
set of energy related application parameters and/or energy saving modes

3.5.3
energy managed unit
EMU
unit of asset for energy management, identified by an energy related functional partitioning

3.6 Automation process equipment

3.6.1
asset

physical or logical object owned by or under the custodial duties of an organization, having either a perceived or actual value to the organization

Note 1 to entry: In the case of industrial automation and control systems the physical assets that have the largest directly measurable value may be the equipment under control.

[SOURCE: IEC 62443-1-1:2009, 3.2.6]