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INTERNATIONAL STANDARD

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colour inside

Industrial facility energy management system (FEMS) – Functions and information flows

Système de gestion d'énergie des installations industrielles (FEMS) – Fonctions et flux d'informations



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IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL FACILITY ENERGY MANAGEMENT SYSTEM (FEMS) – FUNCTIONS AND INFORMATION FLOWS

FOREWORD

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Draft	Report on voting
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Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

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INTRODUCTION

The world's energy use has been increasing along with economic growth. Energy use by Organization for Economic Co-operation and Development (OECD) countries is no longer increasing. According to World Energy Outlook 2020 [3], energy demand in OECD countries has been on a declining trend since 2007 with continued increase of their gross domestic product. On the other hand, energy use in developing countries has been increasing in both growth rate and value. Energy use by the industry sector is more than 50 % of the total consumption and it is forecast to increase by about 10% between 2018 and 2030. Although the rate of increasing energy demand is lower than the rate in the report published in 2012, this increase causes serious concerns for environmental impact and presents opportunities for energy management. To control global warming, the energy from renewable resources will be increasing globally. It is expected that the share of renewable energy to total demand will increase from about 30 % in 2019 to about 40 % in 2030. Outputs of renewable energy resources such as solar photovoltaics and wind etc. require power regulation to manage integration with the overall grid. Industrial facilities are major energy consumers and, also major energy generators. Therefore, the industrial sector is expected to play a significant role to satisfy the power regulations for the smart grid using renewable energy for decarbonization. Consequently, it is quite urgent for the industrial sector to deploy energy management systems to improve the energy efficiency to support the decarbonization of society.

Energy management in the manufacturing industries is linked to production and depending on the industry it can have a very wide range of requirements. To date, energy management systems have been custom developed for/by each company and then enhanced based on practical experiences thus further customizing them. Therefore, there are many different EMS for each organization. As coordination between related organizations becomes necessary for the optimal operation of each facility, the functions of an industrial Facility Energy Management System (FEMS) are required to be standardized to realize the benefits of making better use of the available energy within and across enterprises and organizations.

Production systems have a hierarchical layered structure such as Enterprise Resource Planning (ERP), Manufacturing Operations Management (MOM) / Manufacturing Execution Systems (MES) and Control. FEMS may have been installed parallel to each layer of the production system to communicate with them. As the production system is integrated for overall optimization, expanding the boundary of FEMS for the horizontal and/or vertical integration of FEMS is also required to have an input to that integrated production system structure.

For overall optimization, the production system executes under the multiple constraints such as safety, cost, quality of products, production schedule, market requirement, energy, and others particular to the industry and application. These multiple constraints are prioritized according to the business situation and used as the objective functions for optimization. Due to the complexity and continuous variability of practical operation conditions, the objective functions for optimization, in most cases, are set to the production system manually by an experienced engineer or operator who has deep knowledge of the operation. FEMS have been supporting those people by providing necessary information for their decision-making processes during the operation.

As a FEMS needs to collect energy related information from many kinds of production systems, MOM/MES and ERP, the volume of information has been increasing extensively. It is necessary to clarify the necessary information and functions for energy management. It is also necessary to automate the execution processes of functions of FEMS including the decision-making processes for optimization as possible.

Automation technologies including modelling, simulation, Artificial Intelligence (AI), and others enable automating the process for optimization thus reducing manual operation / intervention. FEMS provide necessary functions and information for the above-mentioned optimization.

FEMS functions need to be defined as an international standard to improve interconnectivity between the FEMS and other related systems. This document proposes to define the functions, information flows and classification of FEMS based on the level of achievement of FEMS capabilities. The level of automation of FEMS functions will be one factor to define the classification. The level will provide management with a motivation and path for a stepwise progression through the classification. The resulting FEMS standard increases the sophistication of control in industrial complexes and processes so that improved optimization of facility operations can be obtained. Furthermore, the information exchange among FEMS and other systems such as MOM/MES and ERP will be defined for the integration.

International standardization will benefit both end users and suppliers of FEMS.

INDUSTRIAL FACILITY ENERGY MANAGEMENT SYSTEM (FEMS) – FUNCTIONS AND INFORMATION FLOWS

1 Scope

This International Standard specifies the functions and the information flows of industrial Facility Energy Management System (FEMS). Generic functions are defined for the FEMS, to enable upgrading traditional Energy Management System (EMS) from visualization of the status of energy consumption to automation of energy management defining a closer relation with other management and control systems. A generic method to classify the FEMS functions will be explained. The information exchange between the FEMS and other systems such as Manufacturing Operations Management (MOM), Manufacturing Execution System (MES) and Enterprise Resource Planning (ERP) will be outlined.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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/TS 62872-1:2019, *Industrial-process measurement, control and automation – Part 1: System interface between industrial facilities and the smart grid*

IEC/TR 62837:2013, *Energy efficiency through automation systems*

ISO 22400-1:2014, *Automation systems and integration – Key performance indicators (KPIs) for manufacturing operations management – Part 1: Overview, concepts and terminology*

ISO 22400-2:2014/AMD1:2017, *Automation systems and integration – Key performance indicators (KPIs) for manufacturing operations management – Part 2: Definitions and descriptions – Amendment 1: Key performance indicators for energy management*

3 Terms, definitions, and abbreviated terms

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
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