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INTERNATIONAL STANDARD

colour inside

Information technology – Home Electronic System (HES) application model – Part 3: Model of an energy management system for HES



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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) APPLICATION MODEL –

Part 3: Model of an energy management system for HES

FOREWORD

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ISO/IEC 15067-3 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology. It is an International Standard.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) This edition revises ISO/IEC 15067-3:2012 by expanding beyond demand response to include a balance between multiple sources of power and appliance demands for this power.
b) This edition specifies a system framework that addresses the need for user-centric energy management by providing control options for consumers.

The text of this International Standard is based on the following documents:

Draft	Report on voting
JTC1-SC25/3201/CDV	JTC1-SC25/3254/RVC

Full information on the voting for its approval 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.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, and the ISO/IEC Directives, JTC 1 Supplement available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

A list of all parts of the ISO/IEC 15067 series, published under the general title *Information technology – Home Electronic System (HES) application model*, can be found on the IEC and ISO websites.

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INTRODUCTION

Throughout most of the twentieth century, public policy and regulations encouraged utilities to expand the supply of electric power. This expansion of electricity systems world-wide has been a major achievement. However, technology developments and plans to mitigate climate change are having profound effects on the utility industry. Standards are being developed to provide an orderly transition for adapting to these changes.

Electricity generation is gradually shifting to the edge of the grid with local power generated from wind and solar at homes, buildings, and community sites. This is similar to the morphing of the central-office telephone-switching network to edge computing in our PCs, laptops, and smart phones for accessing Internet services such as Voice over IP (VoIP: telephone calls using the Internet), text messages, and email. These shifts in the power grid are motivated by technology changes and public demands to ensure that the essential role of electricity continues but from a diversity of sources that are

– more reliable,

– resilient to climate change,

– less polluting, and

– more affordable than depending on a single utility.

Public policy encouraging the expansion of electric power systems produced a world-wide proliferation of electricity generation and power grids including transmission and distribution lines. It was not until the late 1980s that policy makers in some developed nations started to worry about whether the supply of electricity would be able to continue increasing indefinitely to meet the demand anticipated primarily from industrial growth. Some regulators mandated integrated resource planning, where utilities were ordered to consider both supply and demand when preparing budgets to justify tariffs. The utility industry responded by offering programmes to manage customer demand for power called "demand-side management."

The introduction of local power generation from wind and solar is adding impetus to demand-side management because the power generated by wind turbines and solar-voltaic cells can fluctuate quickly with changing weather and the availability of sunlight. Local power sources including solar, wind, and storage are collectively called "distributed energy resources" (DER). Traditional demand-side management has been a centralized command-and-control system usually operated by a utility.

Adoption of demand-side management programmes varies widely by nation and by utility. The term "demand response" has been applied to customer equipment that responds to control signals by changing power consumption, called the "demand" for electricity. Typically, these signals are sent by a public utility for direct control of water heaters or air conditioners.

ISO/IEC 15067-3:2012 redefined the concept of demand response (DR) to include indirect incentives such as price changes or event notices that motivate customers to control demand locally by altering appliance usage. This reflected the transformation of demand response from utility-focused to consumer-focused. This document revises ISO/IEC 15067-3:2012 by expanding beyond demand response to include a balance between multiple sources of power and appliance demands for this power. Hence, this document addresses consumer energy management more generally, rather than just demand response. For this reason, "demand-response" has been removed from the title to de-emphasize a focus on demand for power supplied mostly from a public utility. This is part of a family of Home Electronic System (HES) standards addressing energy management, listed in the Bibliography.

This document focuses on energy management controlled by consumers. Effective energy management is tailored to user wishes and equipment that is responsive to fluctuating supplies. It provides performance and cost benefits without mandates and penalties. The growth of local power sources requires effective energy management equipment that is responsive to and managed by consumers, as specified in this and related documents.

This document specifies a system framework that addresses the need for user-centric energy management. This framework accommodates optimization of energy management across connected loads to balance consumer goals and constraints. It accommodates a diversity of internal and external power sources and was developed as options are proliferating for local DER equipment. This framework consists of a system model for equipment in homes and buildings that enables consumers to manage their usage of electricity in accordance with

– their activities requiring power for appliances, lights, electric vehicles, etc.;
– their budget; and
– other preferences related to power such as
  - using green sources, and
  - minimizing their environmental impact affecting climate change.

As the energy industry evolves, energy management will be enabled by on-premises control of power usage in response to fluctuations in power availability and cost from all sources, especially local sources on premises or in the neighbourhood. Energy management equipment (hardware and software) will be part of consumer electronics products from competitive suppliers rather than exclusively furnished for a utility programme. The goal of this document and related standards is to facilitate a marketplace where consumers have product choices for energy management.

The model in this document includes consumer equipment for energy management that is primarily located in homes and buildings. It consists of a system that

– interacts with occupants to determine user preferences for appliance operation, costs, and other factors influencing the consumer's use of energy, such as possible contributions to climate change;
– monitors power source availability and costs that are:
  - local (DER within the premises),
  - external (from a neighbourhood microgrid, transactive energy, an aggregator, or a public utility);
– maintains a database of power needs for appliances (including electric vehicle chargers) as a function of operating modes;
– measures power flows from local sources, storage, and appliance consumption for system performance and stability; and
– determines optimal power sourcing and allocation.

The energy management model specified in this document includes a controller that acts as an agent for the consumer to combine user preferences with power availability and power needs to meet the consumer's goals. Among these goals are convenience, comfort, health, and safety within budget constraints. Since this system controller is acting as an agent for the consumer, it is called the energy management agent (EMA). This model accommodates an EMA with features of artificial intelligence to facilitate energy management.

The EMA determines power allocation in part based on distributed energy measurement devices on premises. The system equipment can be stand alone, embedded in other consumer electronics, or hosted as an application in a gateway. This gateway can be a generic communications interface between a home network and an external network, an energy management gateway designed for handling energy-related data, or the HES gateway specified in the ISO/IEC 15045 series.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) APPLICATION MODEL –

Part 3: Model of an energy management system for HES

1 Scope

This part of ISO/IEC 15067 focuses on a model of a system in homes and buildings that can manage energy consumption and generation of electricity by devices on premises dynamically in response to electricity availability from:

– sources within the home or building such as solar panels, wind turbines, or storage (stationary or mobile),

– neighbourhood microgrids,

– transactive energy,

– energy aggregators, and

– public utilities.

This document specifies a model including a framework and methods for energy management consisting of interconnected elements that can be configured to support various methods for a Home Electronic System (HES) energy management system. The methods specified are intended to be generic and representative of a wide range of situations. This document applies to the customer grid-edge portion of the electricity grid (within a home or building) and applies even if the consumer has sufficient local power generation to operate without connecting to a public utility.

This document includes an energy management model that balances power supplied from internal and external sources with demand from appliances and electric vehicle chargers. The model offers flexibility for locating the energy management equipment in a stand-alone product, embedded in consumer electronics, or hosted in a gateway. This gateway can be a generic communications interface between a home network and an external network, an energy management gateway designed for handling energy-related data, or the HES gateway specified in the ISO/IEC 15045 series.

This model specifies a local controller that achieves the allocation of power in accordance with available supplies, consumer preferences for appliance operation, and power requirements of these appliances within constraints set by the consumer. Such constraints are typically financial (a budget for electricity) but can also include goals such as using green sources and minimizing their impact on climate change. This controller is called the energy management agent (EMA) since it acts as an agent for the consumer. This model accommodates an EMA with technology of artificial intelligence to facilitate energy management.

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.

ISO/IEC 10192-3:2017, *Information technology – Home Electronic System (HES) interfaces – Part 3: Modular communications interface for energy management*

ISO/IEC 14543-2-1, *Information technology – Home Electronic System (HES) architecture – Part 2-1: Introduction and device modularity*

ISO/IEC 15045 (all parts), *Information technology – Home Electronic System (HES) gateway*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
application cluster
logically related group of components that provides the functions of an application in a home or building

3.1.2
demand charge
total amount billed for demand in accordance with the relevant conditions of the tariff or supply agreement

Note 1 to entry: A demand charge for electricity is typically based on the peak power consumed during a specified interval of time, subject to a time-smoothing algorithm.

[SOURCE IEC 60050-691:1973, 691-03-05, modified – Note 1 to entry has been added.]

3.1.3
demand response
action resulting from management of the electricity demand in response to supply conditions

Note 1 to entry: "Demand response" includes a variety of methods for matching the demand for electricity to the available supply.

[SOURCE IEC 60050-617:2011, 617-04-16, modified – Note 1 to entry has been added.]

3.1.4
direct load control
demand response via remote control of one or more appliances by a utility or third-party service provider

Note 1 to entry: With direct control the utility uses a communications network or other signalling method (e.g. a signal embedded in the power service line) to control appliance operation remotely.

3.1.5
disaggregated bill
utility bill that shows energy consumption by major appliances

3.1.6
distributed load control
demand response based on dynamic price for electricity, event notices, or other information sent from the utility to smart appliances or to an energy management agent