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Information technology – Home electronic system (HES) application model – Part 3: Model of a demand-response energy management system for HES

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

Part 3: Model of a demand-response energy management system for HES

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

This International Standard replaces ISO/IEC TR 15067-3, first edition, published in 2000, and constitutes a technical revision.

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

– the demand response options have been expanded;
– distributed energy resources such as local generation and storage have been included;
– the terminology for demand response has been aligned with smart grid.

The list of all currently available parts of the ISO/IEC 15067 series, under the general title *Information technology – Home electronic system (HES) application model*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

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

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INTRODUCTION

ISO/IEC 15067 currently consists of three parts. All parts were previously published as Technical Reports. ISO/IEC 15067-3, energy management, is being upgraded to a standard at the request of the IEC Standards Management Board study group on energy efficiency (SG1 SMB-SG 1/0027/INF, July 2008, Recommendation 16). Energy management is becoming an essential part of the worldwide development of smart grids for electricity.

Part 2: Lighting model for HES

Part 3: Model of a demand-response energy management system for HES (this document)

Part 4: Model of a security system for HES

SC 25/WG 1, the Home Electronic System (HES) working group, has developed these models to foster interoperability among products from competing or complementary manufacturers. Product interoperability is essential when using home control standards, such as HES. This International Standard defines a standard framework for a generic energy management system and describes the communications services needed. A high-level model for an energy management system using HES is presented.

Homebuilders, suppliers of building materials and consumer product manufacturers all affect energy consumption in buildings. Products and services intended for energy management can be provided by

- programs developed for consumers by electricity suppliers, typically a public utility,
- products purchased by consumers independent of electricity supplier programs.

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Various methods for managing the electricity supply network, called the “electricity grid,” have been developed. The goal of these methods is to match the customer demand for power with the available supply. The need for such methods results from

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- electric supply limitations,
- public resistance to building large generating plants,
- public concern for environmental pollution, including greenhouse gases,
- public opposition to siting of new transmission lines,
- an anticipated demand for and availability of electricity for charging electric vehicles,
- public interest and support for renewable sources of energy,
- the introduction of distributed energy resources (DER) with local generators such as wind turbines and solar photo-voltaic (PV) panels,
- the variable and unpredictable nature of wind and solar distributed generation with output that may fluctuate with time and weather,
- the development of batteries and other advanced premises storage technologies plus power conditioning and management equipment,
- the introduction of alternative electricity pricing methods or tariffs that encourage efficiency.

The model presented in this standard focuses primarily on methods known as “demand response” (DR). Because demand response systems extend beyond the meter into customer premises, those impacted by demand response technology choices include utilities, third-party suppliers of demand response services, home network developers, appliance and DER manufacturers and consumers. An example of a third-party provider of demand response services is an aggregator serving a large building or neighbourhood.

Three types of DR are specified in this standard: direct control, local control and distributed control. The choice of DR method will vary by utility to achieve the load shape that aligns with supply limitations, transmission and distribution capabilities, regulatory constraints and

business considerations. However, distributed control offers consumers the most flexibility in adapting appliance operation to constraints imposed by the utility. The various standards developed by JTC 1/SC 25 for the *Home Electronic System* are important for effective distributed control, as specified.

DR is one element in the concept of the “smart grid”. The smart grid for electricity integrates subsystems for generation, transmission, distribution and customer services to improve the reliability and efficiency of electricity systems. The smart grid also extends these subsystems to accommodate distributed energy resources and demand response. A goal of the smart grid is to enable all these subsystems to interoperate using information technology. Therefore, this standard is an important contribution to the smart grid.

As the market develops for energy management products, consumer electronics companies, appliance manufacturers and other residential suppliers may offer products that combine load management using demand response with energy conservation. Energy conservation may offer methods for consumers to reduce energy consumption overall, in addition to reducing consumption at times of peak demand. These methods include products and systems for electricity generation, storage and management. Such products and systems are located on premises and can communicate with other on-premises products and systems in order to interoperate as a larger system. Examples are included in Annex A. Standards for these products are anticipated to expand this energy management model in future updates.

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

Part 3: Model of a demand-response energy management system for HES

1 Scope

This part of ISO/IEC 15067 focuses on products and services that can manage energy consumption and generation of devices dynamically in response to electricity supply and prices that may vary over time. The model specified here for energy management is intended to be generic and representative of a wide range of situations. This part of ISO/IEC 15067 applies to the customer services portion of the electricity smart grid.

This standard specifies an energy management model for programs that manage the consumer demand for electricity using a method known as “demand response”. Three types of demand response are specified in this standard: direct control (5.3.1), local control (5.3.2.2) and distributed control (5.3.2.3).

NOTE Customers and customer equipment may use these methods to control the energy consumption and generation of devices such as appliances and distributed energy resources (for example, photo-voltaic [PV], wind, fuel cell [FC], combined heat and power [CHP], electric vehicle [EV], and stationary battery [SB]).). The taxonomy and lexicon of an energy management model that supports these demand response methods are presented in 7.3 and 7.4.

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2 Normative references

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The following referenced documents are indispensable for the application 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 14543-2-1, *Information technology – Home electronic system (HES) architecture – Part 2-1: Introduction and device modularity*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

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

3.1.2
demand charge
charge for electricity based on the peak power consumed during a specified interval of time, subject to a time-smoothing algorithm

3.1.3
demand response
method for matching the demand for energy to the available supply of energy

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 control frequency signal) 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

3.1.7
DR supplier
utility or third-party supplier of demand response energy management services

3.1.8
electricity grid
electricity supply network

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3.1.9
energy
electric energy

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3.1.10
energy management agent
set of control functions that manage energy consumption as an agent for the customer

3.1.11
energy management gateway
residential gateway facilitating direct load control, distributed load control or demand response for electrical energy usage

Note 1 to entry: A residential gateway may provide gateway functions for energy management. If the residential gateway provides no other services, such as TV or Internet access, it is equivalent to an energy management gateway, which is a gateway limited to energy management. Some electric utilities use the term energy services interface for an energy management gateway.

3.1.12
energy reliability
enhanced availability of energy enabled for example by business and technical procedures

3.1.13
HAN device
device located in the home that can communicate via a home area network (HAN) wirelessly or via wires

Note 1 to entry: HAN is defined in ISO/IEC 15045-1. A wired HAN may use cabling specified in ISO/IEC 15018.

3.1.14
HES gateway
residential gateway that conforms to ISO/IEC 15045-1

Note 1 to entry: ISO/IEC 15045-1 is published. ISO/IEC 15045-2 is to be published.

3.1.15
local load control
demand response via publication of time-of-use electric rates

Note 1 to entry: With local load control the utility typically informs customers of the electric rates by a notice sent with the electric bill or via simple electrical signalling to a user interface such as various coloured lamps at the customer premises, and does not directly control appliances. The customer may use these rate data to select the times for an appliance to operate.

Note 2 to entry: In some implementations the utility sends a signal across the grid to a receiver at the premises that switches device operation between at least two different states according to the electricity tariff.

3.1.16
major appliance
household device using large amounts of energy compared to other appliances

Note 1 to entry: Examples include oven, microwave, refrigerator, cooking range, washing machine and dryer. Also called “white goods”. Most of the appliances listed use large amounts on power when operating in some modes. However, the appliances that are appropriate for energy management are those that consume large amounts of energy.

3.1.17
residential gateway
communications function that interconnects two or more networks using different communications protocols, with at least one network outside the premises and one or more networks inside the premises

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3.1.18
smart appliance
home appliance that exchanges command and control data with other units on a home area network

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Note 1 to entry: Depending on the application, smart appliances can communicate via the HAN with other appliances, with an application controller or with a utility for energy management. Smart appliance specifications are under development by appliance manufacturers and trade associations.

3.1.19
smart grid
electric energy distribution system using information and communications technology with automation for improving the stability and availability of electricity

Note 1 to entry: Some smart grids integrate into the electric grid excess power generated locally from sun and wind-driven devices.

Note 2 to entry: Technically, a grid is a network. However, in common usage the term “smart grid” refers to the entire energy system, which include generation, transmission, distribution, and customer systems.

3.1.20
supply indication
static or dynamic signal or message related to electricity supply

3.1.21
value-added services
optional services offered by a utility that may or may not be related to energy and may generate additional revenue

3.1.22
white goods
large sized household appliances using larger amounts of energy

Note 1 to entry: Examples include: oven, microwave, refrigerator, cooking range, washing machine, dryer. Also called “major appliances”.

3.2 Abbreviations

The following acronyms and abbreviations, commonly used in other industry publications, are used in this document.

CFL	Compact Fluorescent Lamp
CHP	Combined Heat and Power
DER	Distributed Energy Resources
DR	Demand Response
DRAM	Demand Response and Advanced Metering Coalition
DSM	Demand-Side Management
EMA	Energy Management Agent
EPRI	Electric Power Research Institute
EV	Electric Vehicle
FC	Fuel Cell
HAN	Home Area Network
HES	Home Electronic System
HVAC	Heating, Ventilation and Air-Conditioning
LED	Light Emitting Diode
PV	Photo-Voltaic
RTP	Real-Time Pricing
SB	Stationary Battery
TOU	Time-of-Use
UPS	Uninterruptible Power Supply
WAN	Wide Area Network

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4 Conformance

This standard specifies methods for demand response that may be implemented by an electric utility or by a third-party supplier of energy management services. For compliance with this standard one or more of the demand response methods in Clause 5 shall be implemented.

NOTE 1 Which method of demand response is chosen may be subject to local regulations and/or market conditions.

Utilities may offer value-added services in conjunction with demand response, as listed in 5.3.2.4, which are optional.

For those utilities choosing distributed load control for demand response, Clause 6 shall be implemented.

Any framework for the demand response options in Clause 5 shall use the taxonomy and lexicon of Clause 7. 7.3 and 7.4 define the taxonomy and lexicon corresponding to the options for demand response according to the HES demand-response energy management model. These include a combination of control signals, pricing data and event notices. An implementation claims conformance with this standard shall meet the requirements of at least one of the use cases specified in 7.3.2 to 7.3.8.

NOTE 2 Note that in some countries approvals from government regulators are required for the implementation of demand response.