



TECHNICAL REPORT



**Information technology – Home electronic system (HES) application model –
Part 3-7: GridWise transactive energy systems research, development and
deployment roadmap**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.200

ISBN 978-2-8322-8852-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms, definitions, and abbreviated terms	7
3.1 Terms and definitions	7
3.2 Abbreviated terms	8
4 Overview of the roadmap	8
4.1 General	8
4.2 Stages	9
4.3 Roadmap tracks	10
4.3.1 General	10
4.3.2 Regulatory and policy	10
4.3.3 Business models and value realization	10
4.3.4 System design and architecture	10
4.3.5 Physical and cyber technologies and infrastructure	10
4.4 Swim lane definitions	11
4.5 Organization of material	11
4.6 Core concepts	12
4.6.1 General	12
4.6.2 Questions to bear in mind	12
4.6.3 Benefits and enablers summary	13
5 Regulatory and policy	13
5.1 General	13
5.2 Vision – what we hope to see at each stage	14
5.3 Enablers – elements required if the vision is to be realized	15
5.4 Results – outcomes made possible by new patterns of use	16
5.5 Benefits – how these outcomes add value	17
6 Business models and value realization	17
6.1 General	17
6.2 Vision – what we hope to see at each stage	18
6.3 Enablers – elements required if the vision is to be realized	19
6.4 Results – outcomes made possible by new patterns of use	20
6.5 Benefits – how these outcomes add value	21
7 System design and architecture	22
7.1 General	22
7.2 Vision – what we hope to see at each stage	23
7.3 Enablers – elements required if the vision is to be realized	24
7.4 Results – outcomes made possible by new patterns of use	25
7.5 Benefits – how these outcomes add value	26
8 Physical and cyber technologies and infrastructure	27
8.1 General	27
8.2 Vision – what we hope to see at each stage	28
8.3 Enablers – elements required if the vision is to be realized	29
8.4 Results – outcomes made possible by new patterns of use	30

8.5	Benefits – how these outcomes add value	31
Annex A (informative)	Core concepts	33
A.1	General.....	33
A.2	Regulatory and policy	33
A.3	Business models and value realization.....	33
A.4	System design and architecture	33
A.5	Physical and cyber technologies and infrastructure.....	34
	Bibliography.....	35
Figure 1	– Distribution system evolution	9
Figure 2	– Example benefits and enablers for the "regulatory and policy" track.....	14
Figure 3	– Example benefits and enablers for the "business models and value realization" track	18
Figure 4	– Example benefits and enablers for the "system design and architecture" track.....	23
Figure 5	– Example benefits and enablers for the "physical and cyber technologies and infrastructure" track.....	28
Table 1	– Example vision table	11
Table 2	– Example enablers table	11
Table 3	– Example results table	12
Table 4	– Example benefits table	12
Table 5	– Regulatory and policy vision (RPV)	15
Table 6	– Regulatory and policy enablers (RPEs)	16
Table 7	– Regulatory and policy results (RPRs)	16
Table 8	– Regulatory and policy benefits (RPBs)	17
Table 9	– Business model and value realization vision (BMV)	19
Table 10	– Business model and value realization enablers (BMEs).....	20
Table 11	– Business model and value realization results (BMRs).....	21
Table 12	– Business model and value realization benefits (BMBs)	22
Table 13	– Design and architecture vision (DAV)	24
Table 14	– Design and architecture enablers (DAEs)	25
Table 15	– Design and architecture results (DARs).....	26
Table 16	– Design and architecture benefits (DABs)	27
Table 17	– Physical and cyber technologies and infrastructure vision (PCV).....	29
Table 18	– Physical and cyber technologies and infrastructure enablers (PCEs)	30
Table 19	– Physical and cyber technologies and infrastructure results (PCR).....	31
Table 20	– Physical and cyber technologies and infrastructure benefits (PCBs).....	32

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 3-7: GridWise transactive energy systems research,
development and deployment roadmap**

FOREWORD

- 1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.
- 2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO National bodies.
- 3) IEC and ISO documents have the form of recommendations for international use and are accepted by IEC and ISO National bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC and ISO documents is accurate, IEC and ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC and ISO National bodies undertake to apply IEC and ISO documents transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC and ISO document and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC and ISO do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC and ISO marks of conformity. IEC and ISO are not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this document.
- 7) No liability shall attach to IEC and ISO or their directors, employees, servants or agents including individual experts and members of its technical committees and IEC and ISO National bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this ISO/IEC document or any other IEC and ISO documents.
- 8) Attention is drawn to the Normative references cited in this document. Use of the referenced publications is indispensable for the correct application of this document.
- 9) Attention is drawn to the possibility that some of the elements of this ISO/IEC document may be the subject of patent rights. IEC and ISO shall not be held responsible for identifying any or all such patent rights.

The main task of IEC and ISO technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

ISO/IEC TR 15067-3-7, which is a Technical Report, has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
JTC1-SC25/2900/DTR	JTC1-SC25/2966/RVDTR

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

A list of all parts in 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.

In this document, the following print type is used:

- ***Bolded italics*** represent condensed encapsulations of the transactive energy (TE) principles described in ISO/IEC TR 15067-3-8:2020, 6.4.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

It has been said that if Thomas Edison could see the electricity industry today, he would recognize it as being much the same as 100 years ago, but that may not be the case for much longer. The century-old paradigm of large-scale generation and distribution is starting to change as renewable resources make more of an impact. New distributed devices, both consumer and utility-owned, affect the grid directly and also interact with each other. Preparations are already underway to integrate these new resources and technologies by considering operational and policy changes based on measured and effective choices. For example, the industry is undergoing a fundamental shift from a "load following" paradigm, where central generation adjusts to varying demand, to a "supply following" paradigm, where responsive demand absorbs variable generation such as solar and wind. During the transition to a more distributed system, the industry cannot afford to design purely for either extreme. A key to success is to use technologies that support flexible coordination of both centralized and distributed elements. One such approach is provided by transactive energy (TE) systems.

Transactive energy systems are systems of economic and control mechanisms that allow the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter. This definition is from ISO/IEC 15067-3-8:2020, 3.28 [1]¹.

This broad definition allows us to recognize the existing use of transactive techniques in bulk energy markets and to consider how to enable new techniques for possible use in distribution systems, at the interface between transmission and distribution, and perhaps even more broadly.

The need for transactive energy systems is being driven by economic, technological, and customer preference opportunities that were just beginning to exist five years ago. Better performance and declining costs for many renewable energy sources and storage technologies now being deployed suggest use of distributed energy resources will continue growing. Distribution systems were not designed for large-scale deployment of distributed energy resources with potential power flows in multiple directions. Ad hoc arrangements have worked so far, but as the combined effects of changes that are often outside of regulatory and utility observation and control become significant, a more robust response to maintaining and enhancing safety, reliability, and resilience of distribution energy systems and markets is required.

ISO/IEC TR 15067-3-7 is adapted from the GridWise®² Architecture Council document, *Transactive Energy Systems Research, Development and Deployment Roadmap* [2], which provides a broad perspective of how transactive energy systems and their use will evolve over time. It has been edited to align with the format of IEC documents.

¹ Numbers in square brackets refer to the Bibliography.

² GridWise is a registered trademark of Gridwise, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC or ISO.

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

Part 3-7: GridWise transactive energy systems research, development and deployment roadmap

1 Scope

This part of ISO/IEC 15067, which is a Technical Report, explains the organization and structure of the transactive energy systems research, development, and deployment roadmap.

2 Normative references

There are no normative references in this document.