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Systems interface between customer energy management system and the power management system –
Part 4: Demand Side Resource Interface

Interface entre le système de gestion de l'énergie côté client et le système de gestion de puissance –
Partie 4: Interface de ressources côté demande

IEC 62746-4:2024-12(en-fr)

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SYSTEMS INTERFACE BETWEEN CUSTOMER ENERGY MANAGEMENT SYSTEM AND THE POWER MANAGEMENT SYSTEM –

Part 4: Demand-side resource interface

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IEC 62746-4 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is an International Standard.

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

Draft	Report on voting
57/2719/FDIS	57/2746/RVD

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 ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62746 series, published under the general title *Systems interface between customer energy management system and the power management system*, can be found on the IEC website.

NOTE The following print types are used:

- UML classes are formatted using bold and italics, for example ***RegisteredResource***.
- UML class attributes are formatted using italics, for example *mRID.*
- Message profile names are formatted using bold, for example **MarketDER**.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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

The IEC 62746 series defines interfaces between grid operator systems and systems located at residential, commercial, and industrial customer sites often referred to as Customer Energy Management Systems (CEMs). These interfaces are documented in detail in IEC 62746-3.

Customer owned resources can be a combination of load and generation which respond to signals provided by grid and/or market operators. These resources are identified and managed as individual resources with specific capabilities, or as virtual resources with an aggregated set of capabilities.

The IEC 62746 series describes the interface between Customer Energy Management Systems (CEMs) and the grid management systems including those within Distribution System Operators and Transmission System Operators. Each CEMS is designed to control resources associated with a residential, commercial, or industrial facility with the potential for a hierarchy of energy management systems.

Initial focus is on demand response and support for demand-side management; later developments are expected to include storage resources as well as grid support services from new demand-side resources. The interface applies to many types of communications, for example among multiple aggregators, or between an aggregator and multiple customers. Scenarios that publish import and/or export limits as part of a market-based systems or as part of an operational reliability framework, sometimes known as operating envelopes, are also supported.

This document describes CIM profiles corresponding to the Use Case described in Annex A.

Statements have been added to certain figures, tables, schemas, and enumerations throughout the document that indicate that they are reproduced with the permission of the UCA International User Group (UCAIug). These items are derived from the Common Information Model (CIM).

SYSTEMS INTERFACE BETWEEN CUSTOMER ENERGY MANAGEMENT SYSTEM AND THE POWER MANAGEMENT SYSTEM –

Part 4: Demand-side resource interface

1 Scope

This part of the IEC 62746 series describes CIM profiles for Demand-Side Resource Interface and is based on the use case shown in Annex A of this document.

Schemas associated with this document were generated using the CIM101 UML and leverages the Market package. This document defines profiles complimentary to other standards, namely those in IEC 61970, IEC 61968, and IEC 62325.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and acronyms

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
aggregation
collection of the capabilities of multiple resources into a single virtual resource

Note 1 to entry: A common use of aggregation is to collect many small resources and offer their capabilities in the form of a single larger resource to a market.

[SOURCE: IEC 62746-3:2015, 3.1.1]

3.1.2
aggregator
party who contracts with a number of other network users (e.g. energy consumers) in order to combine the effect of smaller loads or distributed energy resources for actions such as demand response or for ancillary services

[SOURCE: IEC 60050-617:2009, 617-02-18]

3.1.3
aggregator energy management system
collection of hardware and/or software components which together act as an intermediary between a Service Procurement System and multiple Customer Energy Management Systems

3.1.4
customer energy management system
collection of hardware and/or software components which together coordinate the electricity usage and production among various Distributed Energy Resources

3.1.5
demand response
action resulting from management of the electricity demand in response to supply conditions

[SOURCE: IEC 60050-617:2009, 617-04-16]

3.1.6
Distributed Energy Resource
Generators (with their auxiliaries, protection, and connection equipment), including loads having a generating mode (such as electrical energy storage systems), connected to a low-voltage or a medium-voltage network

Note 1 to entry: DER may include associated protection, control, and monitoring capabilities, and may consist of aggregated DER units.

Note 2 to entry: DER may also interact with the area EPS (typically a distribution network) by providing energy to the distribution network, by adapting their behaviour based on distribution network conditions, and/or by providing other transmission and distribution network-related services.

[SOURCE: IEC 60050-617:2009, 617-04-20, modified – notes taken from IEC 61850-7-420:2021, 3.1.13]

3.1.7
operator role
"upper" side of the DER communication chain, representing the entity which is responsible for procuring services and distributing operational controls and prices

3.1.8
resource role
"lower" side of the DER communication chain, representing the entity which is responsible for providing services and responding to operational controls and prices

3.1.9
service procurement system
collection of hardware and/or software component which together procure services to make the electrical grid more reliable and/or less costly

3.1.10
technical role
role that identifies responsibilities associated with participation within information exchanges with other actors

Note 1 to entry: Actors defined by use cases have assigned roles with associated responsibilities. Technical roles are physically realized through software and associated systems integration infrastructure.

[SOURCE: IEC 62746-3:2015, 3.1.14]

3.1.11
virtual resource
set of one or more physical resources that is represented as a single, aggregated resource

Note 1 to entry: This may be comprised of multiple entities that may be geographically distributed. Virtual resources can be an aggregated model of many types of loads, generation and storage, such as VPP, PV, factory, building, home, etc. Since the virtual resource can include both energy consumer and energy provider, the related "net load curve" can be positive (in this case the virtual resource acts as a consumer which consumes electrical power), or negative (in this case the virtual resource acts as generation assets to produce electrical power).

[SOURCE: IEC 62746-3:2015, 3.1.16]

3.2 Acronyms

Table 1 contains a list of acronyms used in this document.

Table 1 – List of acronyms

Acronym	Phrase
AEMS	Aggregator Energy Management System
CEMS	Customer Energy Management System
DAM	Day-Ahead Market
DER	Distributed Energy Resource
EPS	Electrical Power System
PV	Photovoltaic
RTM	Real-Time Market
SPS	Service Procurement System
UML	Unified Modeling Language
VPP	Virtual Power Plant
XML	Extensible Markup Language
XSD	XML Schema Definition

4 Reference and information models

4.1 General approach

Communications between electricity markets and grid operations are enabled by shared modelling among three series of standards: IEC 61968, IEC 61970, and IEC 62325. However, none of these standards extend into the domain of controllable resources deployed on the distribution grid, and specifically to those resources "behind" the customer electricity meter. IEC 62746 remedies this situation by providing a set of message profiles designed to convey grid instructions, grid conditions, pricing signals, and resources capabilities among multiple parties within the emerging Distributed Energy Resource (DER) space, as illustrated in Figure 1.

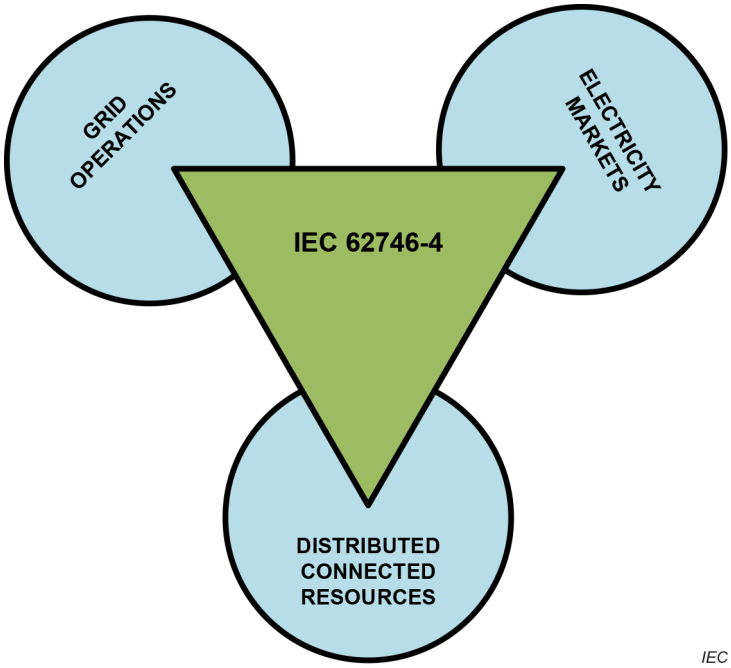

Figure 1 – IEC 62746-4 representation

The communication requirements are challenging given the wide range of communicating parties[1], including:

- Electricity market operators,
- Transmission system operators,
- Wholesale electricity service providers,
- Wholesale electricity service consumers,
- Distribution grid operators,
- Service aggregators, and
- Electricity consumers.

Additionally, there is a wide range of business processes which are established as well as many new models being devised. These processes include the communication of the time-varying changes in:

- Resource composition by grid location(s)
- Resource capability by market service
- Economic thresholds for service delivery/procurement
- Resource instructions/dispatches

The challenge of communicating with DERs (or their aggregators) can be visualized as a more complex permutation of communication with traditional bulk-power electricity generation stations. Therefore, IEC 62746-4 leverages the IEC 62325 series of standards which are currently in use to standardize bulk-power market exchanges.

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1 For an explanation of these actors, see IEC 60050-617:2009, *Organization/Market of electricity*.