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Framework for energy market communications

Part 451-4: Settlement and reconciliation
business process, contextual and assembly
models for European market

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power systems management and associated information exchange.

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**Framework for energy market communications - Part 451-4:
Settlement and reconciliation business process, contextual and
assembly models for European market
(IEC 62325-451-4:2014)**

Cadre pour les communications pour le marché de l'énergie
- Partie 451-4: Processus métier de règlement des écarts et
de réconciliation, modèles contextuels et modèles
d'assemblage pour le marché européen
(IEC 62325-451-4:2014)

Kommunikation im Energiemarkt - Teil 451-4: Abwicklungs-
und Abstimmungsgeschäftsprozesse, kontextbezogene
Modelle und Einbindungsmodelle für den europäischen
Markt
(IEC 62325-451-4:2014)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 57/1449/CDV, future edition 1 of IEC 62325-451-4, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62325-451-4:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-09-27
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-12-25

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Endorsement notice

The text of the International Standard IEC 62325-451-4:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61968-11	NOTE	Harmonized as EN 61968-11.
IEC 61970-301	NOTE	Harmonized as EN 61970-301.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62325-301	-	Framework for energy market communications -- Part 301: Common Information Model (CIM) extensions for markets	EN 62325-301	-
IEC 62325-351	-	Framework for energy market communications -- Part 351: CIM European market model exchange profile	EN 62325-351	-
IEC 62325-450	2013	Framework for energy market communications -- Part 450: Profile and context modelling rules	EN 62325-450	2013
IEC 62325-451-1	-	Framework for energy market communications -- Part 451-1: Acknowledgement business process and contextual model for CIM European market	EN 62325-451-1	-
IEC 62325-451-2	-	Framework for energy market communications -- Part 451-2: Scheduling business process and contextual models for European market	EN 62325-451-2	-
IEC 62361-100	-	Power systems management and associated information exchange - Interoperability in the long term -- Part 100: CIM profiles to XML schema mapping	EN 62361-100	-
IEC/TS 61970-2	-	Energy management system application program interface (EMS-API) -- Part 2: Glossary	CLC/TS 61970-2	-

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INTRODUCTION

This standard is one of the IEC 62325 series which define protocols for deregulated energy market communications.

The principal objective of the IEC 62325 series of standards is to produce standards which facilitate the integration of market application software developed independently by different vendors into a market management system, between market management systems and market participant systems. This is accomplished by defining message exchanges to enable these applications or systems access to public data and exchange information independent of how such information is represented internally.

The common information model (CIM) specifies the basis for the semantics for this message exchange.

The European style market profile is based on different parts of the CIM IEC standard. The CIM is defined through a series of standards, i.e. IEC 62325-301, IEC 61970-301 and IEC 61968-11 standards.

This document provides for the European style market profile the settlement and reconciliation business process that can be used throughout a European style market. This standard was originally based upon the work of the European Transmission System Operators (ETSO) Task Force EDI (Electronic Data Interchange) and then on the work of the European Network of Transmission System Operators (ENTSO-E) Working Group EDI.

This document describes the settlement and reconciliation process for wholesale markets; it is brought to the attention of the reader that it is envisaged to initiate work on a combined reconciliation process for retail and wholesale markets.

FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –

Part 451-4: Settlement and reconciliation business process, contextual and assembly models for European market

1 Scope

Based on the European style market profile (IEC 62325-351), this part of IEC 62325-451 specifies a package for the settlement and reconciliation business process and the associated document contextual model, assembly model and XML schema for use within European style markets.

The relevant aggregate core components (ACCs) defined in IEC 62325-351 have been contextualised into aggregated business information entities (ABIEs) to satisfy the requirements of this business process. The contextualised ABIEs have been assembled into the relevant document contextual models. Related assembly models and XML schema for the exchange of information between market participants are automatically generated from the assembled document contextual models.

This International Standard provides a uniform layout for the transmission of aggregated data in order to settle the electricity market. It is however not the purpose of this International Standard to define the formula to be taken into account to settle or reconcile a market. The purpose of this standard is only to enable the information exchange necessary to carry out the computation of settlement and reconciliation.

The settlement process or reconciliation process is the way to compute the final position of each market participant as well as its imbalance amounts.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

IEC 62325-301, *Framework for energy market communications – Part 301: Common information model (CIM) extensions for markets*

IEC 62325-351, *Framework for energy market communications – Part 351: CIM European market model exchange profile*

IEC 62325-450:2013, *Framework for energy market communications – Part 450: Profile and context modelling rules*

IEC 62325-451-1, *Framework for energy market communications – Part 451-1: Acknowledgement business process and contextual model for CIM European market*

IEC 62325-451-2, *Framework for energy market communications – Part 451-2: Scheduling business process and contextual model for CIM European market*

IEC 62361-100, *Power systems management and associated information exchange – Interoperability in the long term – Part 100: CIM profiles to XML schema mapping*¹

3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC TS 61970-2 apply, as well as the following.

NOTE Refer to IEC 60050, *International Electrotechnical Vocabulary*, for general glossary definitions.

3.1

aggregate business information entity

ABIE

aggregate business information entity is a re-use of an aggregate core component (ACC) in a specified business

[SOURCE: ISO/TS 15000-5:2005, Clause 9, modified (modification of the definition)]

3.2

aggregate core component

ACC

collection of related pieces of business information that together convey a distinct business meaning, independent of any specific business context

Note 1 to entry: Expressed in modelling terms, this is the representation of an object class, independent of any specific business context.

[SOURCE: ISO/TS 15000-5:2005, Clause 9, modified (modification of the definition)]

3.3

application program interface

API

set of public functions provided by an executable application component for use by other executable application components

3.4

assembly model

assembly model is a model that prepares information in a business context for assembly into electronic documents for data interchange

3.5

based on or IsBasedOn

use of an artefact that has been restricted according to the requirements of a specific business context

[SOURCE: IEC 62325-450:2013, 3.4]

3.6

business context

formal description of a specific business circumstance as identified by the values of a set of context categories, allowing different business circumstances to be uniquely distinguished

[SOURCE: UN/Cefact, Unified Context Methodology Technical Specification]

¹ To be published.

3.7**European style market profile
ESMP**

the European style market profile, the object of this International Standard

3.8**information model**

representation of concepts, relationships, constraints, rules, and operations to specify data semantics for a chosen domain of discourse

Note 1 to entry: It can provide shareable, stable, and organized structure of information requirements for the domain context.

3.9**market management system
MMS**

computer system comprised of a software platform providing basic support services and a set of applications providing the functionality needed for the effective management of the electricity market

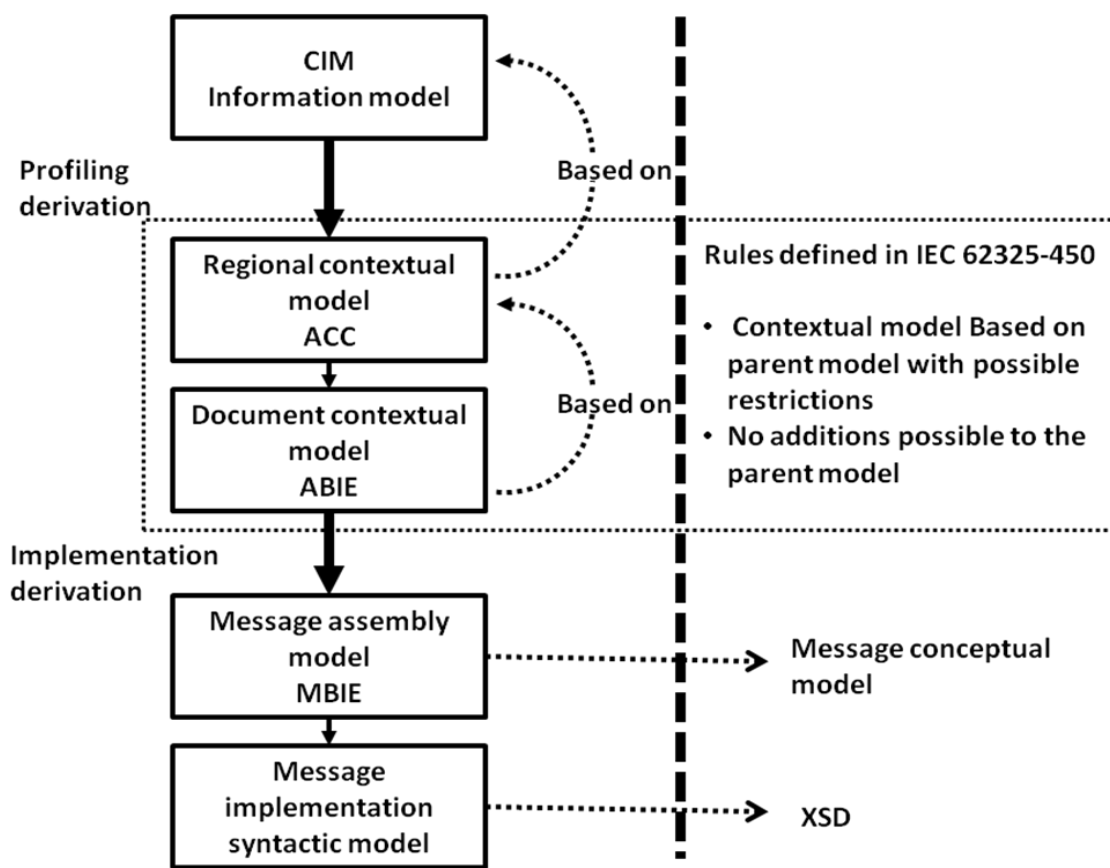
Note 1 to entry: These software systems in an electricity market may include support for capacity allocation, scheduling energy, ancillary or other services, real-time operations and settlements.

3.10**message business information entity
MBIE**

aggregation of a set of ABIEs that respects a define set of assembly rules

4 Document contextual model and message assembly model basic concepts**4.1 Overview**

IEC 62325-450 defines a set of CIM profiles that follows a layered modelling framework as outlined in Figure 1 going from the common information model (CIM, IEC 61968-11, IEC 61970-301 and IEC 62325-301), to different regional contextual models and their subsequent contextualized documents for information exchange; the final step being the message specifications for information interchange.



IEC

Figure 1 – IEC 62325-450 modelling framework

The regional contextual models are the basic core components that are necessary to build electronic documents for information interchange. This is defined in the European style market contextual model (IEC 62325-351). These core components are also termed aggregate core components (ACCs).

A document contextual model is based upon a specific business requirements specification and is constructed from the contextualisation of the ACCs that can be found in the European style market contextual model. The contextualised ACCs at this stage are termed aggregate business information entities (ABIEs). These ABIEs are the constructs that are assembled together into a specific electronic document to satisfy the information requirements outlined in the business requirements specification. The transformation from an ACC to an ABIE shall respect the rules defined in IEC 62325-450.

Once a document contextual model has been built that satisfactorily meets the business requirements, a message assembly model can be automatically generated from it.

XML schema then may be automatically generated from the message assembly model. If necessary specific mapping can take place at this stage to transform the CIM class and attribute names into more market legacy names.

4.2 European style market package structure

Figure 2 describes the main package structure of the European style market profile.

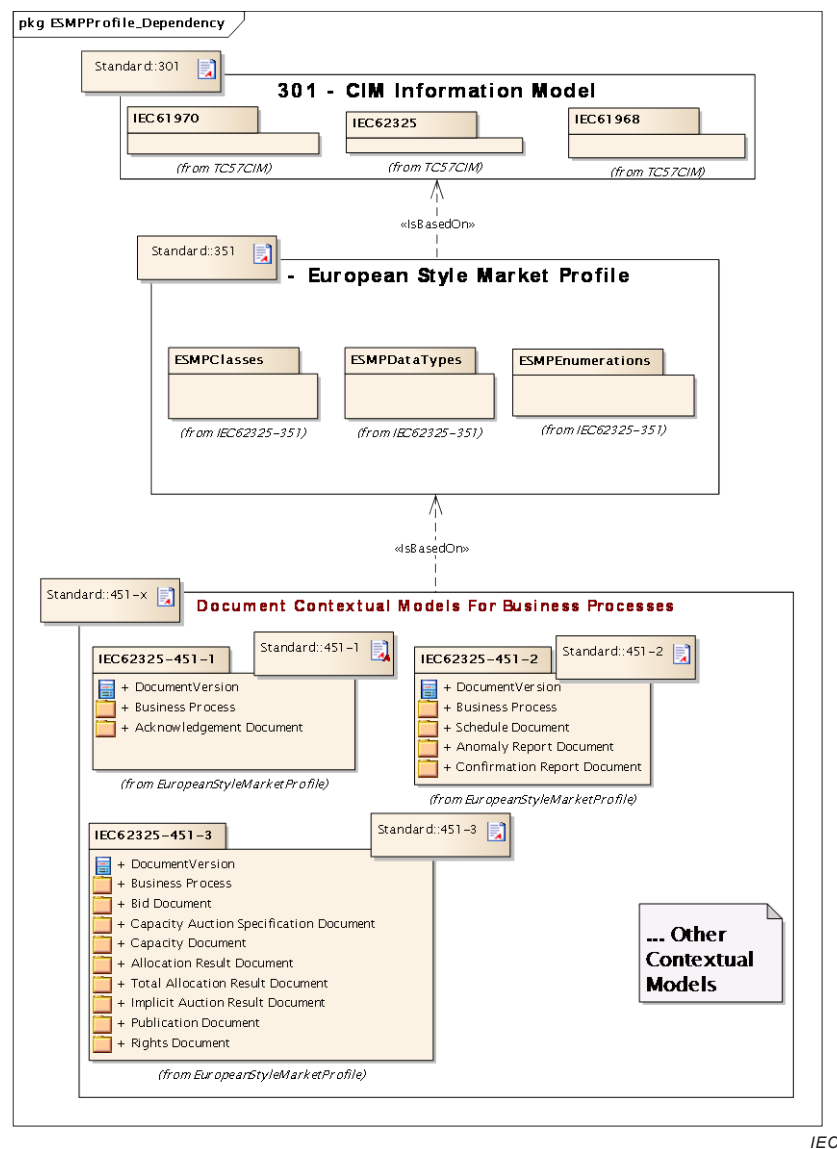


Figure 2 – Overview of European style market profile dependency

For each business process, a business process package is described in an IEC 62325-451-x (x from 1 to n) standard. A business process package contains:

- The document contextual model (ABIE) and the automatically generated message assembly model (MBIE) for each electronic document required to enable the completion of the business process. Each document is a sub contextual model derived by restriction from the European style market profile.
- The XML schema of the business document that is automatically generated from the message assembly model.

The European style market profile (ESMP), as defined in IEC 62325-351, provides the core components permitted for use in an IEC 62325-451-x standard as all ABIEs shall be “based on” the IEC 62325-351 core components:

- ESMPClasses: Defining all the semi-contextual classes of the European style market profile derived by restriction from the CIM model.
- ESMPDataTypes: Defining all the core datatypes used within the ESMP classes.

All the core components that are used in every electronic document structure have been harmonized and centralized in the European style market profile. These core components are consequently the basic building blocks from which all electronic document ABIEs are derived.

4.3 From the European style market profile to the document contextual model

The document contextual model for a given business process is constructed by an information analyst who identifies all the information requirements necessary to satisfy the business process.

Once the information requirements have been identified the information analyst identifies the related ACCs that are available in the European style market profile and contextualises them to meet the information requirements. This contextualisation step creates a set of aggregate business information entities (ABIEs).

In a final step the information analyst assembles together into a specific document contextual model package the ABIEs to form a document model satisfying the business requirements.

4.4 From the document contextual model to the message assembly model

Once the document contextual model has been finalised, the message assembly model may be automatically generated.

All document contextual models share the same core components and core datatypes. These are defined in the European style market profile (IEC 62325-351) and are contextualised and refined in all document contextual models (IEC 62325-451-x series) respecting the rules as described in IEC 62325-450.

4.5 From the assembly model to the XML schema

The final modelling step applies a standardized set of criteria in order to generate a uniform XML schema from the assembly model. This transformation process respects the rules defined in IEC 62361-100.

5 The settlement and reconciliation business process

5.1 Balance responsible party and settlement

As indicated in the IEC 62325-301 "MarketRoleKind enumeration", in the European style electricity market, a balance responsible party could be defined as:

- A party that has a contract proving financial security and identifying balance responsibility with the imbalance settlement responsible for the market balance area entitling the party to operate in the market. This is the only role allowing a party to nominate energy on a wholesale level.

NOTE The meaning of the word "balance" in this context signifies that the quantity contracted to provide or to consume shall be equal to the quantity really provided or consumed.

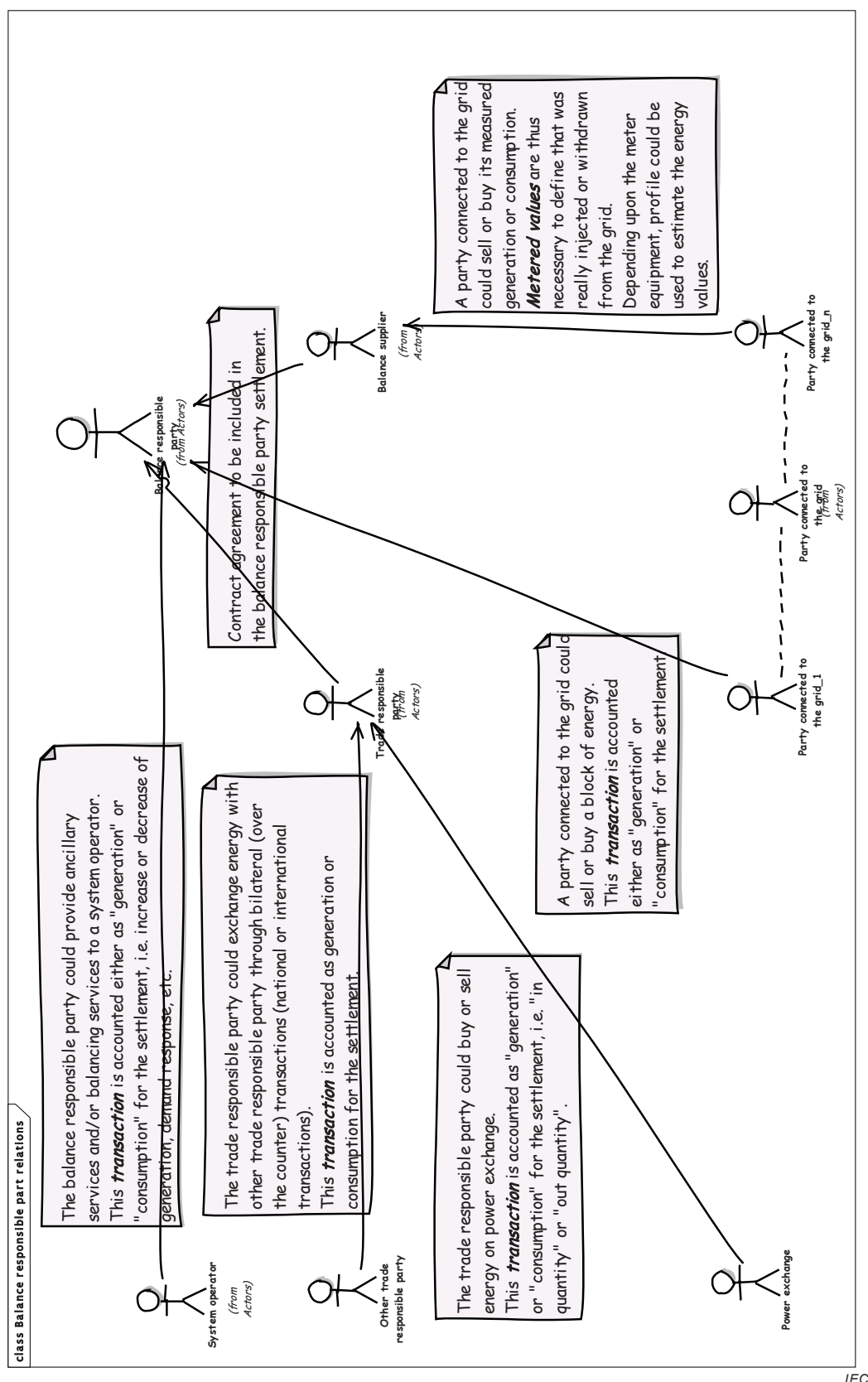
The role of balance responsible party is linked to the role of balance supplier, i.e.

- A party that markets the difference between actual metered energy consumption and the energy bought with firm energy contracts by the party connected to the grid. In addition the balance supplier markets any difference with the firm energy contract (of the party connected to the grid) and the metered production. There is one balance supplier for each accounting point.

A party connected to the grid could be defined as:

- A party that contracts for the right to consume or produce electricity at an accounting point.

Figure 3 describes the different transactions of a balance responsible party that could have to be considered when carrying out a settlement or a reconciliation process:



IEC

Figure 3 – Balance responsible party relations

The settlement process enables thus to reconcile all the "commercial transactions" with the actual measured values either from meters, estimated values or profiles.

The main purpose is thus to assess, after the fact, that the balance responsible party was balanced and if not to compute the deviations and to settle them.

5.2 Overall business context

Within an electricity market, actors are buying/selling energy between them as well as selling energy to end users or buying energy from generating units. These activities are carried out from the time of early planning and trading, until the intraday processes.

When the market business processes as well as the operational processes (real-time operation) are closed, then comes the time to settle or reconcile the market, i.e. to compute for each balance responsible party what he has injected in a market area and what he has withdrawn from this market area.

For proper operation of an European style electricity market, each balance responsible party shall be balanced, i.e. he should have the sufficient “generation” (physical inputs or buying transactions) to cover its “consumption” (physical outputs or selling transactions) at each time.

The settlement process is the basic process to compute an imbalance deviation based on commercial transactions and accounting energy values. It should be pointed out that the accounting energy values could be energy meter readings, estimated energy meter readings or profiles (derived from an index value and not based upon a load/generation curve).

Settlement and reconciliation processes are often carried out several times, i.e. typically there are one or more re runs of the processes based on more accurate accounting energy values. Typically, the reconciliation process is spread over the period until all metering values have been read.

Depending upon local regulation, additional information could be used to compute the kinds of imbalance, or deviation between the planned and the realized schedules.

It is not the purpose of this part of IEC 62325-451 to state how to collect the energy meter readings, the index values, etc. Only aggregated values per balance responsible party are used for the settlement process; the way to aggregate the data from the energy meter readings is not within the scope of this document.

5.3 Use cases

The settlement or reconciliation process takes place once the market and operation processes have been completed from the long term planning down to the intraday market and through the day ahead market as well as the real time operations of the bulk power system.

The settlement or reconciliation process is composed of three basic activities.

- The first activity is the computation and aggregation per balance responsible party of all agreed transactions including over the counter transactions, cross-border transactions, power exchange transactions, and balancing transactions.
- The second activity is the computation and aggregation per balance responsible party of all the accounting energy values, measured, estimated, or profiled for its physical injection or withdrawal.
- The third activity is the settlement or reconciliation of these values, i.e. computes the imbalances and establishes the imbalance settlement amounts.

Figure 4 describes the actors and main use cases of the settlement or reconciliation process.

The roles that take parts in the settlement or reconciliation process are, for example:

- Balance responsible party, who receives the settlement information.
- Nomination validator, who provides the cross-border transactions.
- Merit order list (MOL) responsible, who provides the balancing transactions.
- System operator, who provides the aggregated schedules, balancing and system frequency data.
- Metered data aggregator, who provides the aggregated metered information. The metered data aggregator may have local metered data aggregators that provide initial aggregated input for consolidation and validation before being sent to the imbalance settlement responsible.
- Imbalance settlement responsible, who establishes the imbalances (quantities and amounts).
- Billing agent, who invoices the balance responsible party.

The information necessary to run the settlement or reconciliation process for a given market area is the following:

- Aggregated executed schedules per balance responsible party that originate at the last stage of the scheduling process; these schedules could be day ahead, or intraday transactions and could originate from a nomination validator for cross border transactions.
- Aggregated metered data or estimated data per balance responsible party.
- Balancing and system frequency data that originate from the merit order list responsible and from ancillary services activation by the system operator.
- Settlement pricing information. This is outside the scope of this document and is dependent on local market rules.