Description and Use of Metering Concepts used by Elia

The purpose of this document is to explain metering concepts used in messages containing metering data transmitted by Elia.

This manual should be read by metering operational staff who need to understand the contents of metering messages and provide clear understandable explanations of the data contained in metering messages.

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Chapter 1 Metering Concepts

1.1. Metered data

This section provides a general description of all the parameters used in the metering messages to describe measured data. In all the regulated messages, the measured data is electrical power. In the non-regulated messages, other quantities can be measured, both electric and non-electric. The way the parameters are incorporated into the metering messages is described in the other Metering Manuals available in: Metering (elia.be)

1.1.1. Active and reactive power

An AC power flow is made up of active and reactive components.

The active part (P) is the real component of the power which can be used to perform real work. Active power is expressed in Watts (W). Active power is absorbed by resistive loads (the current and voltage are in phase).

Reactive power (Q) is absorbed by inductive or capacitive loads which cause the current and voltage to become out of phase. Both types of loads absorb energy during one part of the cycle that is stored in the electric devices and magnetic fields, and which is returned to the source during another part of the cycle thus representing an inefficiency or loss. Reactive power is measured in Volt-Amperes Reactive (VAR).

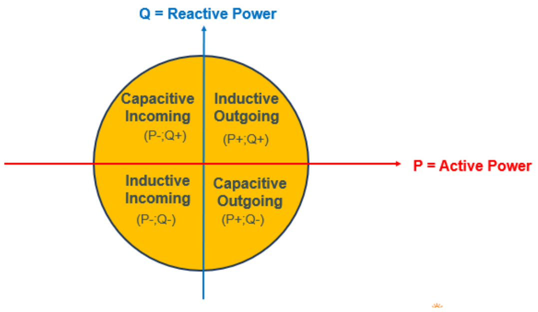

Figure 1 The characteristics of metering data : Power Type

Inductive loads, such as transformers or motors, cause the current to lag the voltage. Inductive power is in the same direction as the active power. Capacitive loads cause the current to lead the voltage. Capacitive power is in the opposite direction to Active power.

Each measured object has 6 channels:

- Active outgoing and incoming
- Reactive Outgoing capacitive and inductive
- Reactive Incoming capacitive and inductive

Knowing whether the power being used is active or reactive is interesting given the inefficiencies associated with reactive power. A specific attention is given to the P/Q ratio.

1.1.2. Apparent Power

Expressed in kVA, apparent power is the maximum power displayed on the meter. The apparent power is the (trigonometric) sum of the active and reactive power.

$$S = U\,I = \sqrt{P^2 + Q^2}$$

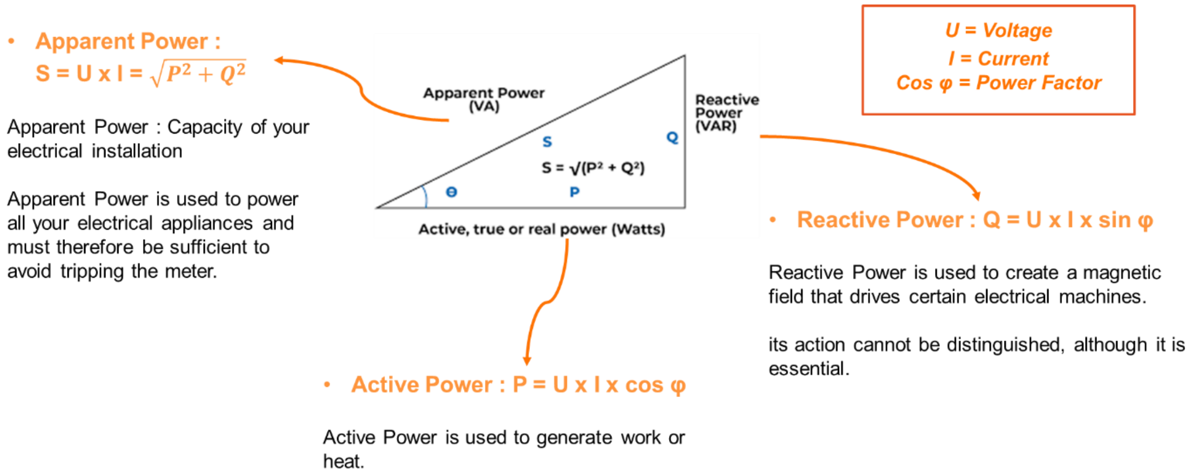

Figure 2 Summary of the Active, Reactive and Apparent Power

The apparent power is used to size the Contractual Power Put at Disposal for an Access Points (Grid User) or an Interconnection Point (DGO).

1.1.3. Direction

Power can flow into and out of the Elia grid:

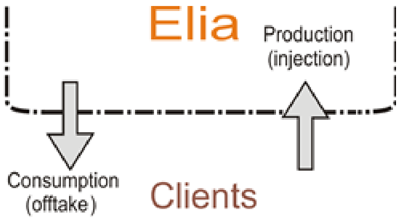

Figure 3 Direction of power flow with the Elia grid

Power flowing from Elia to the client is also referred to as “**offtake**” or “**outgoing**” and power flowing from the client into the Elia grid is also referred to as “**injection**” or “**incoming**”:

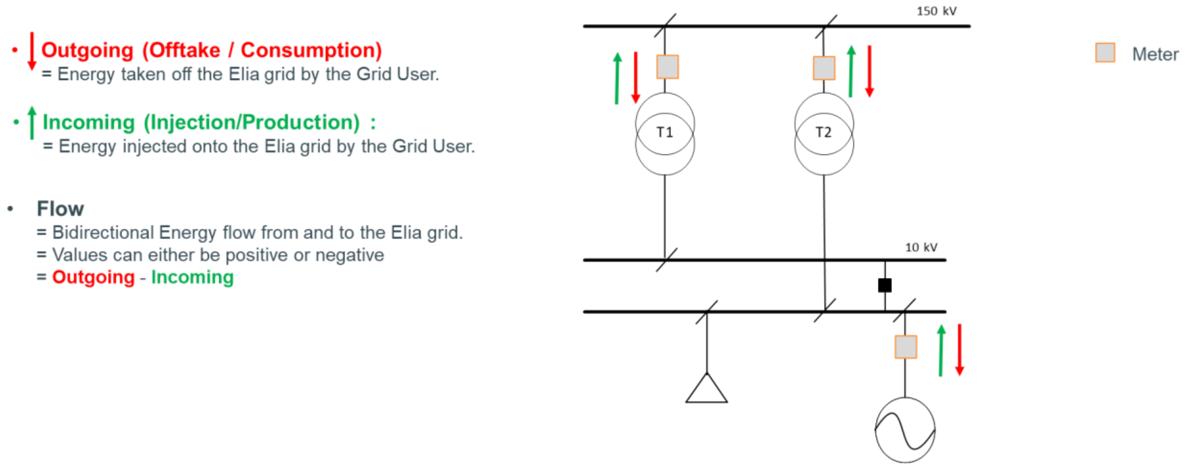

Figure 4 Direction of power flow with the Elia grid and Definitions

- In the CSV formatted messages, the direction of power flow is indicated by the labels CONS (consumption) and PROD (production).
- In the XML formatted messages, the power flow is indicated by the <partyFrom> and the <partyTo> elements. Power is transferred FROM <partyFrom> TO <partyTo>.
- In the XLSX formatted messages the direction of power flow is indicated by the labels Outgoing (consumption) and Incoming (production).

All power values provided in metering messages are positive values which have an associated direction. Metering messages therefore can contain (up to) 6 components: incoming Active, Capacitive, Inductive and outgoing Active, Capacitive, Inductive.

Concerning specific messages like the Imbalance messages: power can flow into and out of the BRP Balance perimeter.

1.1.4. Quantities

Metering data is provided as series of power values. These values represent the average power transferred during value periods of 15 minutes (also known as quarter-hour values).

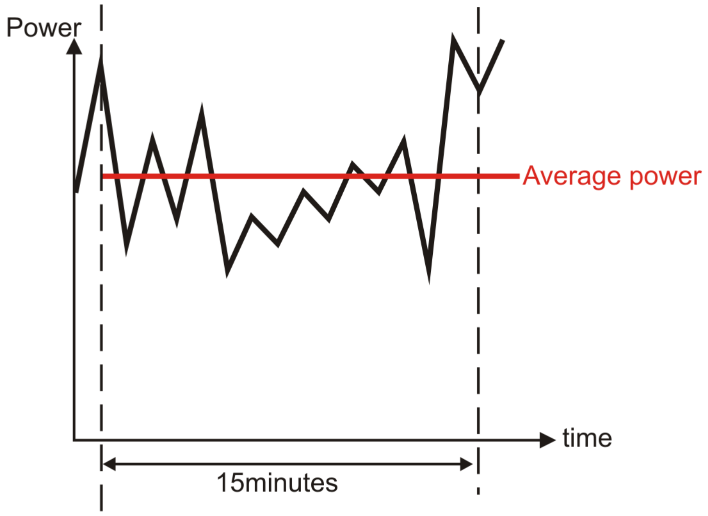

Figure 5 Averaged 15 minutes (quarter-hour) values

The series of value periods are delivered in a 'schedule' which has a specific duration. The duration is a single day. Each message contains all the daily schedules of a month. The duration is presented as a number of minutes. The number of value periods contained in a schedule is therefore the duration/15. The number of value periods in a "normal" day is therefore (24*60) / 15 = 96.

Due to daylight saving requirements, there is one day in the year which consists of 25 hours (and therefore 100 value periods), and one day which consists of 23 hours (and therefore 92 value periods). The switch between winter time and summer time for daylight saving reasons has implications for business applications that use metering data.

1.1.4.1. Compensation

Compensated power values account for changes in direction during the 15 minutes (quarter-hour) period. Consider the situation illustrated in the figure below, where during one part of the value period, power is produced and during the other part, power is consumed.

In the case of non-compensated, two values will be provided: the averaged non-compensated production and the averaged non-compensated consumption. Non-compensated values are labelled "NC" in a message.

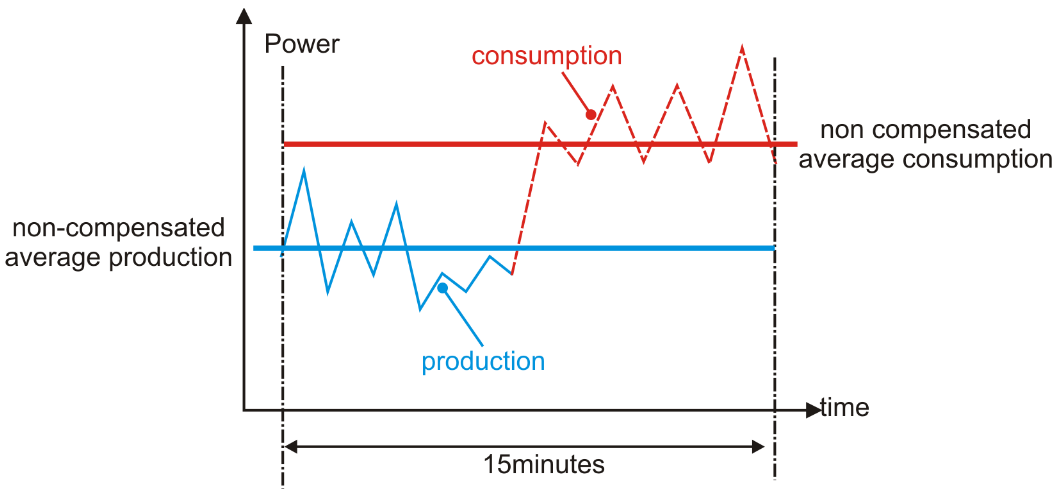

Figure 6 Non-compensated values

Compensated values are the difference between the power produced and consumed during the value period. One of them will be reduced to zero. Compensated values are labelled "C" in a message.

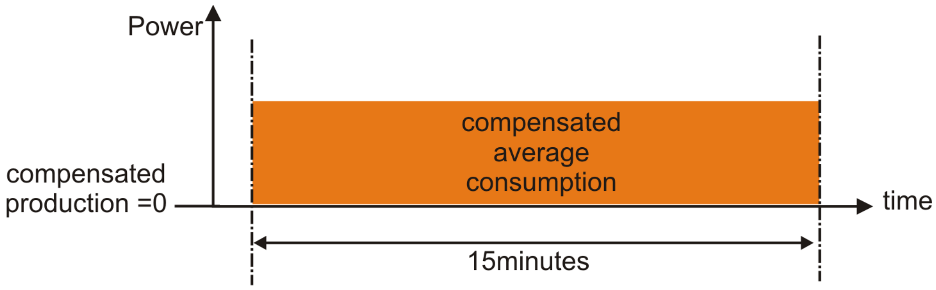

Figure 7 Compensated values

Compensated values are used for billing purposes.

Example:

If during the same ¼ hour, power is consumed and produced, the non-compensated values will give the measured values in both directions while the compensated value will be a calculated difference between the power produced and consumed during the 15' period.

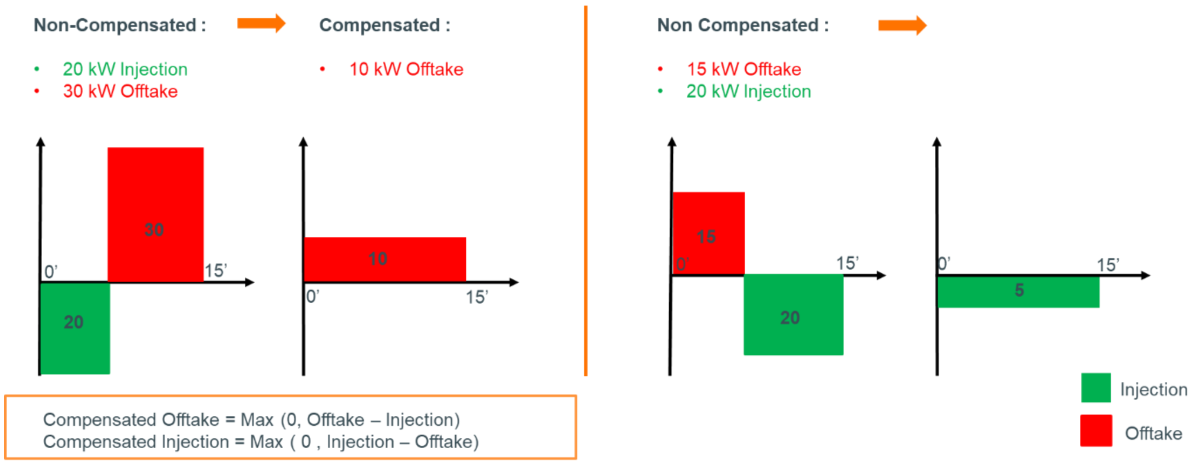

Figure 8 Non-Compensated Values VS. Compensated Values

1.1.4.2. Units

Regulated messages always contain power values. The unit in which the power values are presented depends on the type of power, i.e. active or reactive.

- Active power is expressed in Watts (W), Kilowatts (KW or KWT) and Megawatts (MW).
- Inductive and Capacitive reactive power is expressed in Volt-Amperes-reactive (VAR), Kilo Volt-Amperes-Reactive (KVAR or KVR) and Mega Volt-Amperes-Reactive (MVAR).

Non-regulated metering data can contain quantities other than power and will be labelled with the corresponding unit.

1.1.4.3. Quality

Power values can be measured, calculated, or estimated. Every power value in the message is assigned a quality label which can be one of the following:

- N (Normal)

This refers to normal measured values, usually determined by a single properly functioning meter.

- I (Inexact)

Power values may be labelled inexact for several reasons. It may be because there was a perceived problem with the meter, or that values were calculated from combined measurements from several meters, one of which was inexact.

- S (Substitute)

If no measurement is available, an estimated value is used.

Note that the quality of the measured data should not be confused with the *validity* of the message.

1.1.4.4. Metering type – Net and Gross

The metering type parameter specifies whether the power values are gross or net. Gross values are determined on the client side, where there is an interest in determining exactly how much power was produced and consumed within a certain period. Elia is concerned with net values.
The distinction between Gross and Net values is illustrated in the Figures below.

Gross Consumption = Net Offtake – Net Injection + Gross Production

- **Net Offtake** is the energy taken off the grid by the Grid User, usually measured at the Connection Points
- **Net Injection** is the part of the Grid user energy production that is not locally consumed, it is usually measured at the connection Points
- **Gross Consumption** is the total energy consumption of a grid user, including the energy that is consumed, but not taken off the Elia grid (locally produced)
- **Gross Production** is the sum of the Grid User Production Units.

NB: The concept of "Gross" Metering is only relevant for Access Points with Local Production.

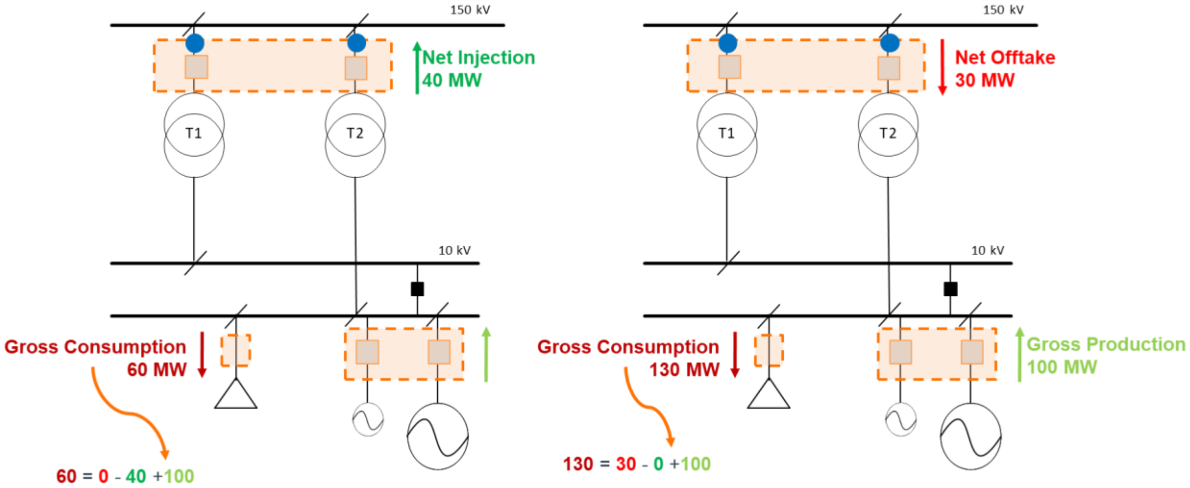

Figure 9 Example of the Gross Consumption Determination

Another example:

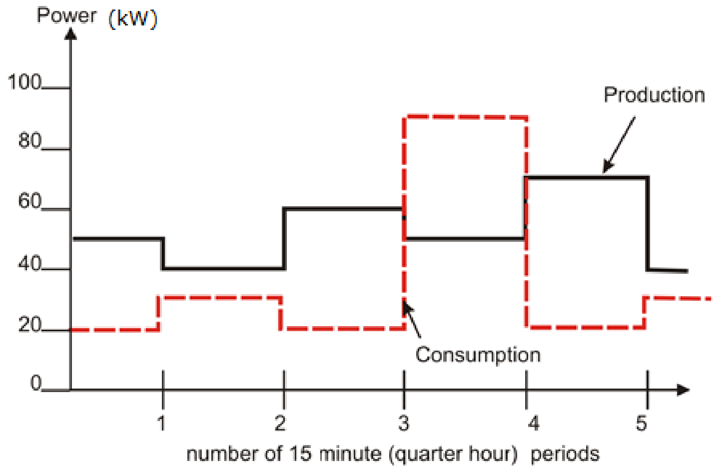

Figure 10 Gross production and consumption values

Periods/Type of consumption	1	2	3	4	5
Gross Consumption	20	30	20	90	20
Gross Production	50	40	60	50	70
Corresponding Net values	30 PROD	10 PROD	40 PROD	40 CONS	50 PROD

Gross power is labelled "G", Net power is labelled "N".

1.2. Published data

Metering Data related to Grid User Access Points is made available on eVMS and EPIC (Elia Portal Interface for Customers) to the relevant market parties.

- The Grid user receives the calculated metering data for all his Access Points (Net Compensated Offtake and Injection + Gross Consumption and Production). On top of this, the Grid user is entitled to the metering data from all the meters that are installed on its connection points, production units and any other meters that might be installed within his installations (submeters and additional commercial meters).
- The Access Contract Holder, Supplier and Balance Responsible Party only received the invoicing data relevant to them, the Access Point Net Compensated Offtake and/or Injection.
- Producers receive the Access Point Compensated Injection and the metering data related to their production units.

The metering data is made available via 2 channels:

- On **EMVS (B2B or B2C)**, the metering data of a given month is updated every day until the 10th calendar day of the following month. As of then, the data is deemed 'validated by Elia' and is no longer updated
- On **EPIC**, the data is made available following the same timing (non-validated until the 10th calendar day of M+1) but requires the user to come and fetch the data (it is not pushed).

1.3. Related documents

More info about metering services is available from the Elia website:
https://www.elia.be/en/customers/metering

For any other information please contact your Elia Key Account Manager or Metering services (email: Metering.Services@elia.be)

Appendix A. Glossary of terms

Client

A company that holds a contract with Elia, which entitles the latter to metering messages. The messages received depend on the market “roles” that the client has. One client may perform several roles. A client receives metering messages for each of its market roles.

Injection

Energy (produced by a producer) that is injected into the Elia grid

Non-regulated metering

A message containing specific metering data requested by a client and defined in a contract. This one can contain values for quantities other than power.

Offtake

Consumption of energy by a client connected to the Elia Grid

Schedule

The series of values contained in a metering message. A schedule contains values for each day of a month. The time is indicated by the value of the duration field which is given in minutes.

Source

The provider of the metering data

Volt-Amperes-Reactive

Unit of reactive power (VAR)

Watt

Unit of active power (W)

Appendix B. List of Figures