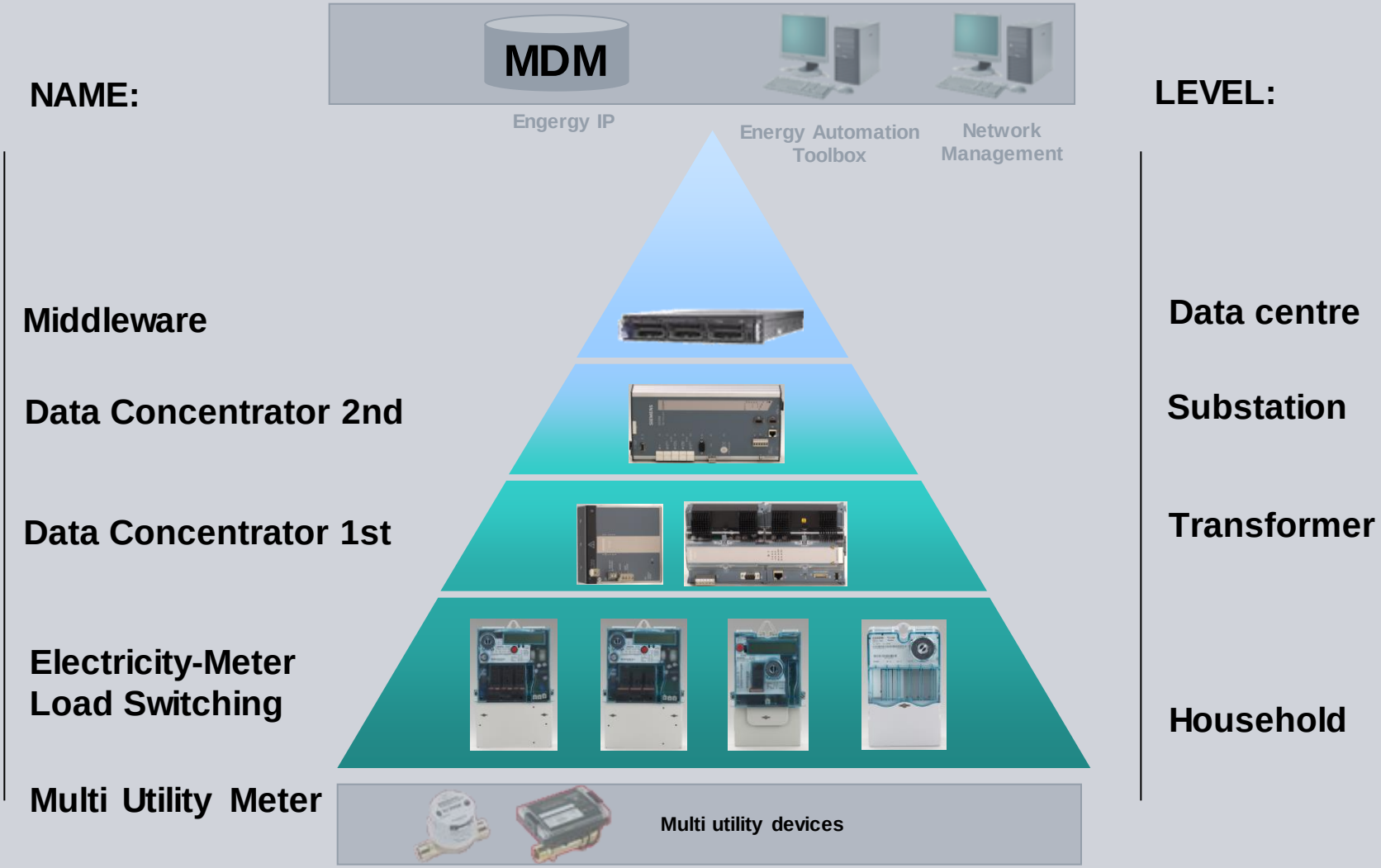
Smart metering system

Smart grid/metering

Infrastructure classification

SIEMENS



AMIS meters and Load Switching Device

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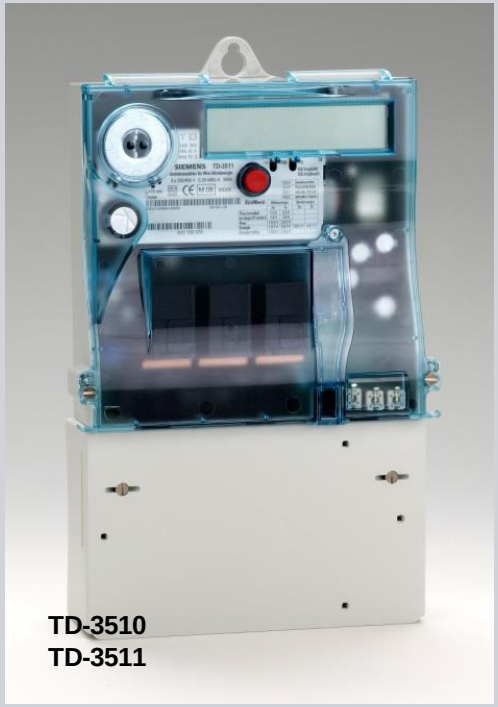

TD-3510
TD-3511

TD-3512

TD-3520

Integration of multi utility

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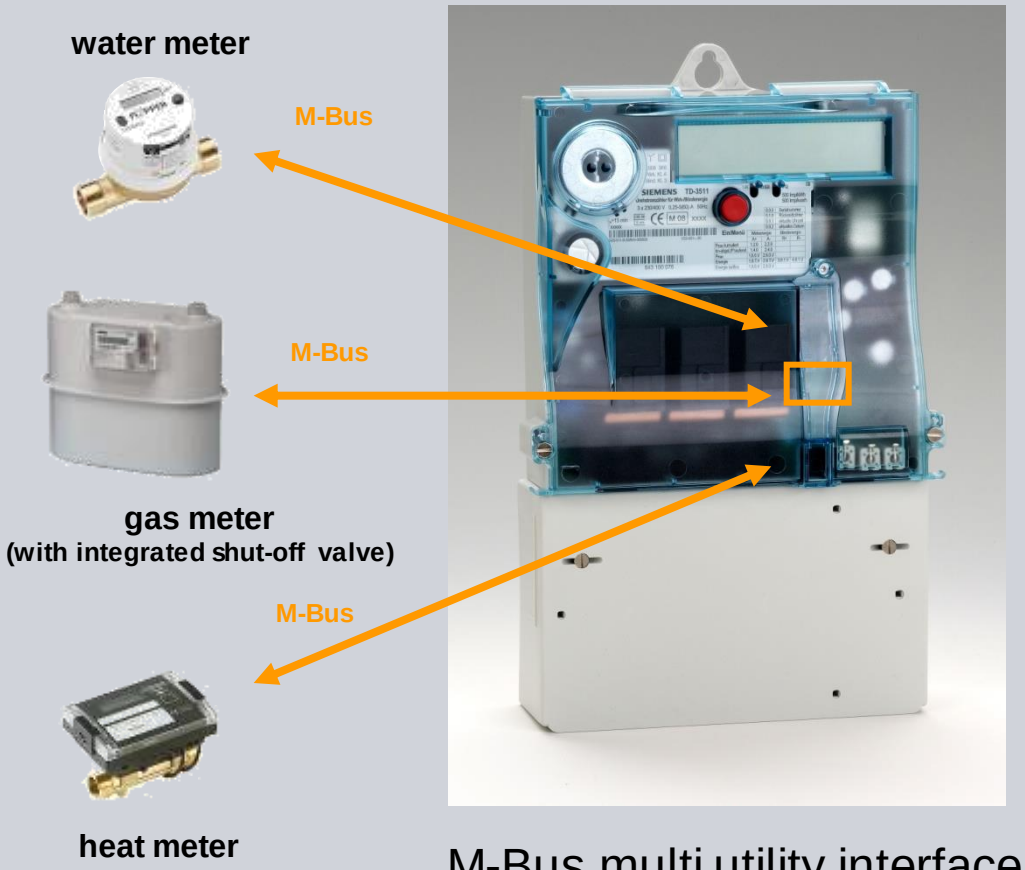

M-Bus multi utility interface

(wired/wireless)

AMIS data concentrator (CP-341x)

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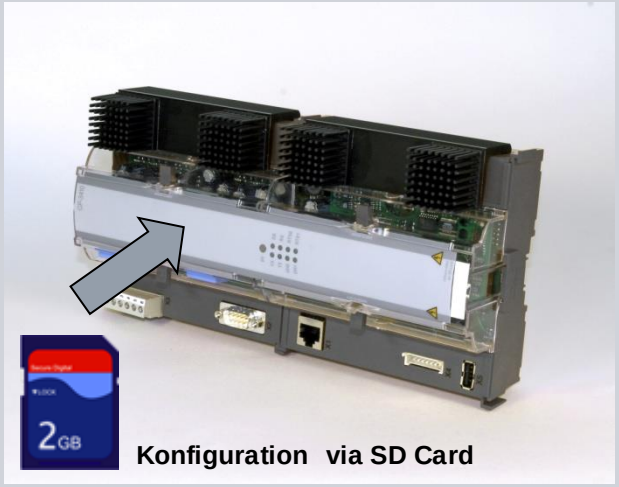
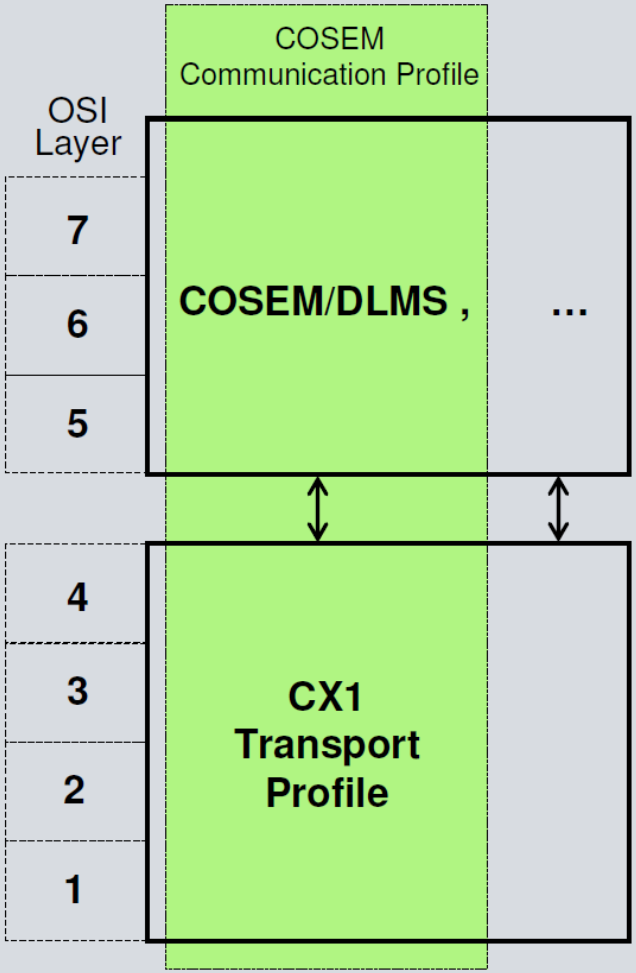


Konfiguration via SD Card


IO-Interfaces

- Data concentrator and RTU functionality
- Master for up to 2000 terminal devices (meters and load switching devices)
- DLC-Modem included (DSP architecture)
- Parameterization via pre-parameterized flash-card or web-browser
- Extendable with periphery-modules from the automation technology
- Concept for alternative ways of communication for important stations
- Parameterization of connected modems via AMIS DC to integrate them to AMIS management system
- 2 HW-version interfaces (LAN or serial)



- CX1 transport profile – flexible lower layer protocol stack for distribution line carrier communication
- CX1 offers an adaptive and robust transmission technique, could be easily extended with new (faster) modulation/coding methods
- CX1 compatibility with narrow-band modulation techniques (e.g. S-FSK, PSK) is possible.
- Adaptive cellular CX1 network needs no frequency planning and no Tx speed engineering for an effective grid coverage

AMIS Communications – AMIS DLC Modulation Method

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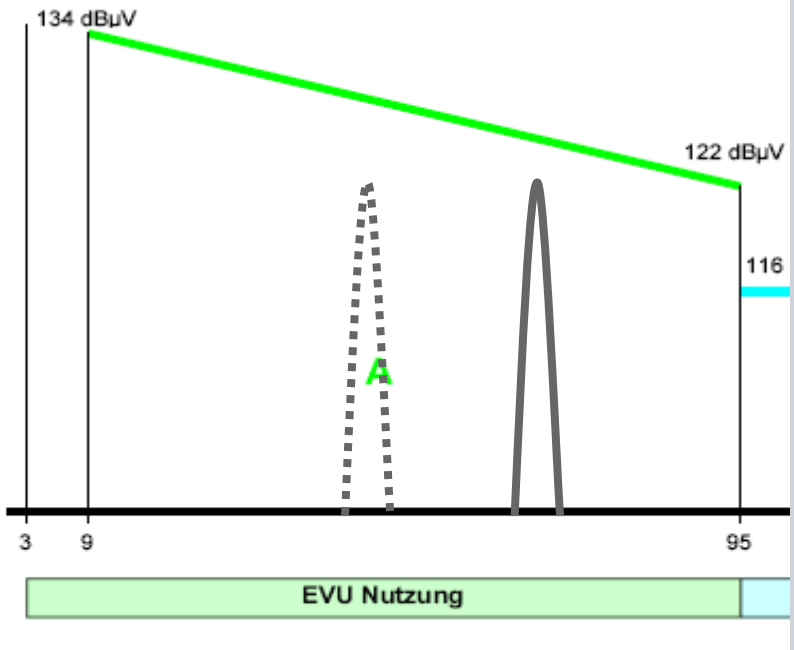
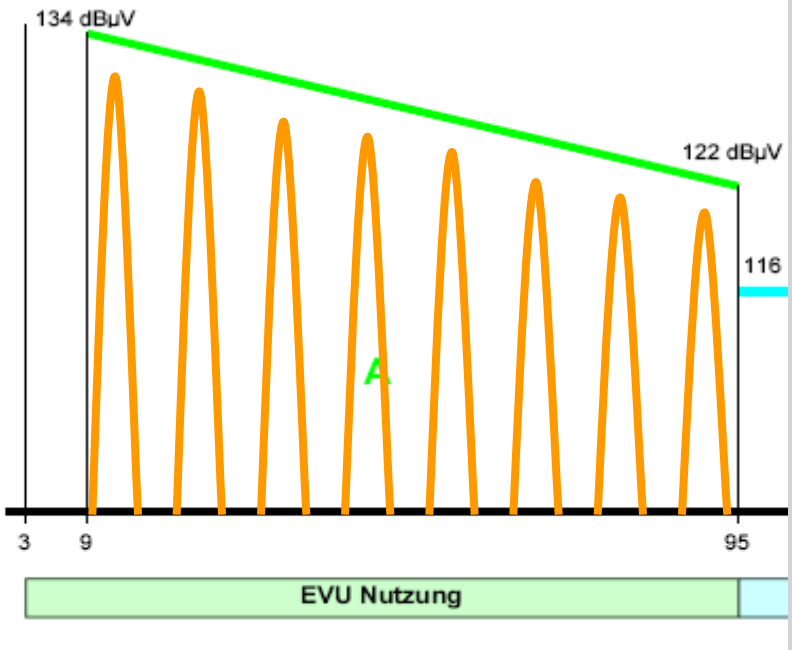
FSK **S-FSK**

AMIS Spread Spectrum





Smart Meters
AMIS Smart Grid Metering

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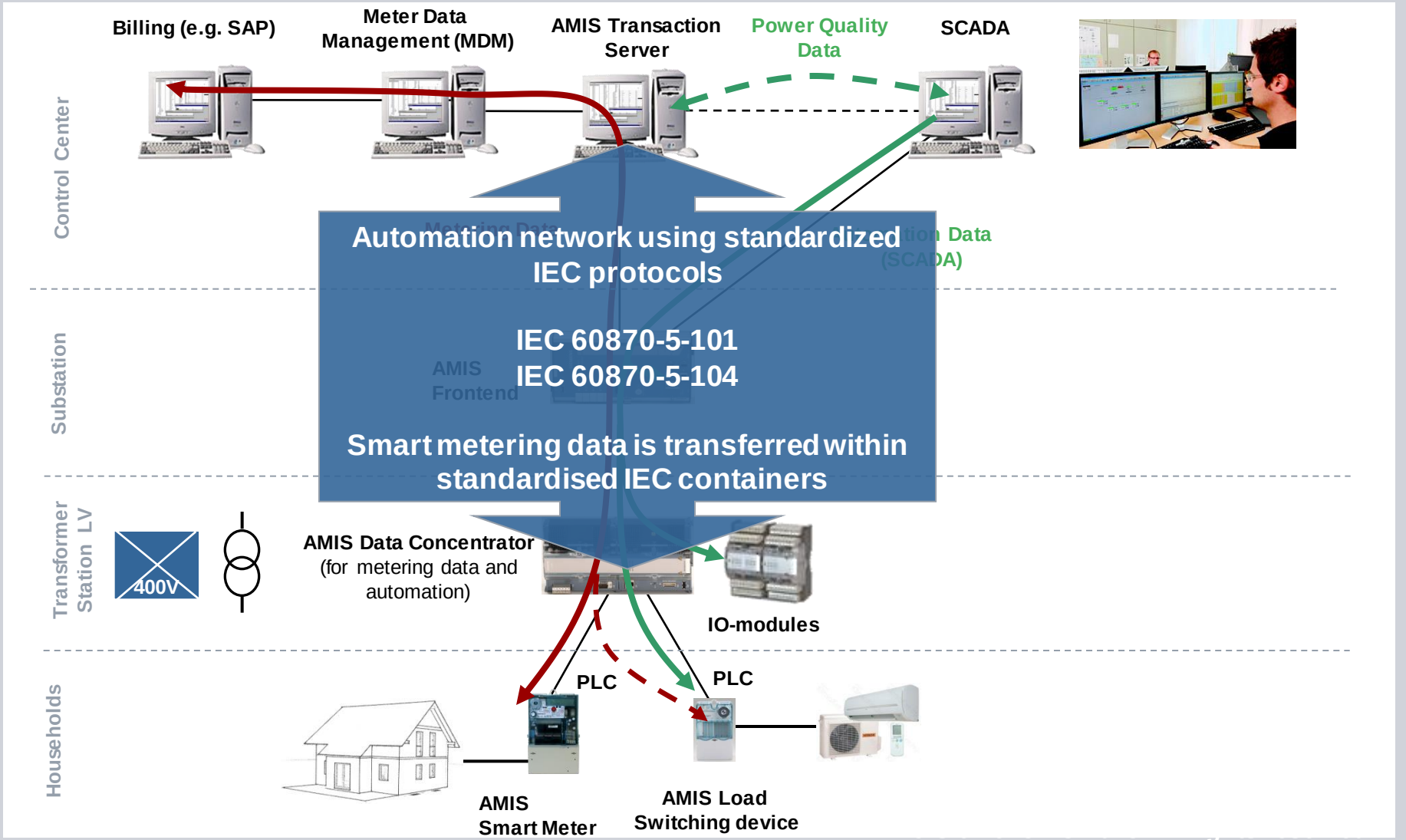

Violation of voltage band

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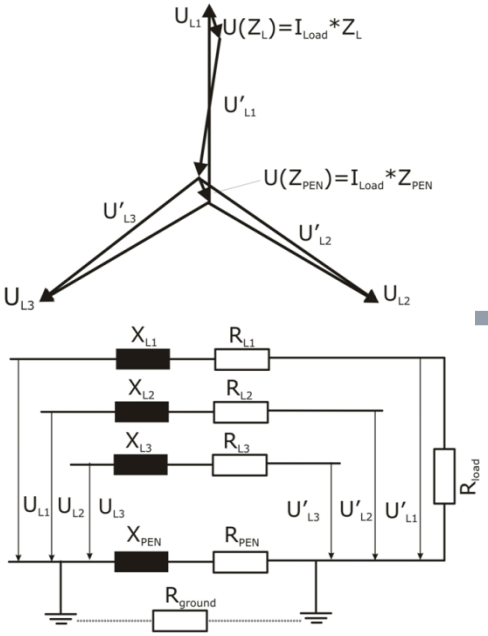
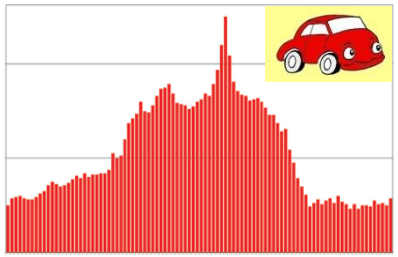
Voltage band (tolerance: 230V +/- 10%)

Asymmetric network load



+

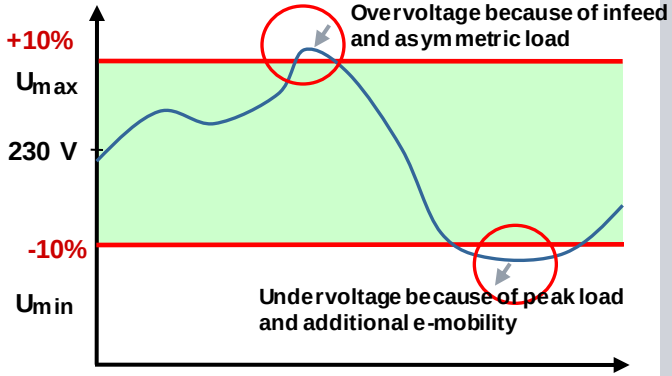
Real peak loads



Decentralized infeed

=

→ Potential violation of voltage band



Asymmetric loads and decentralized generation can cause overvoltages

Power flow in a transformer substation

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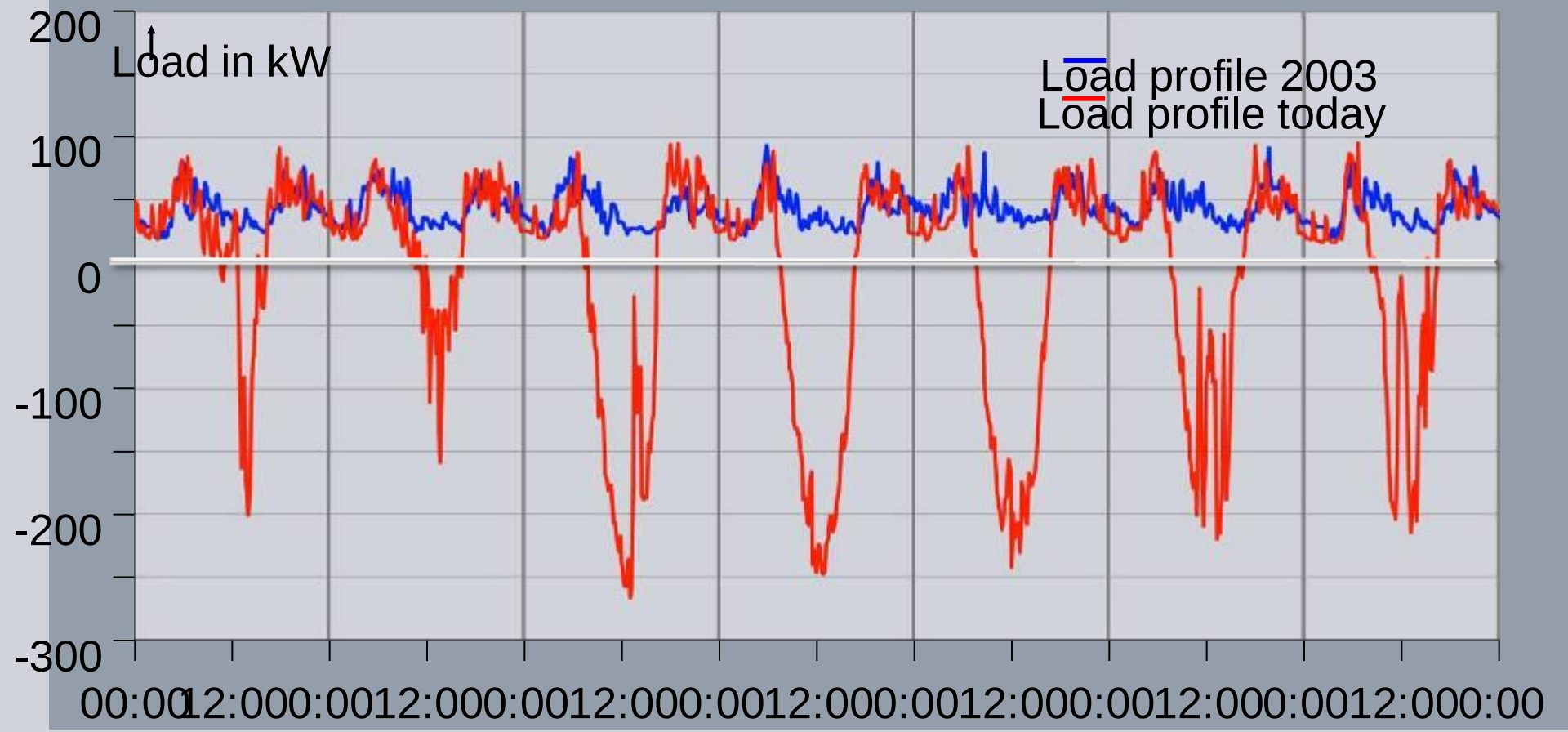
Weekly load of a transformer station in the rural area of LEW-Verteilnetz GmbH – 2003 and today

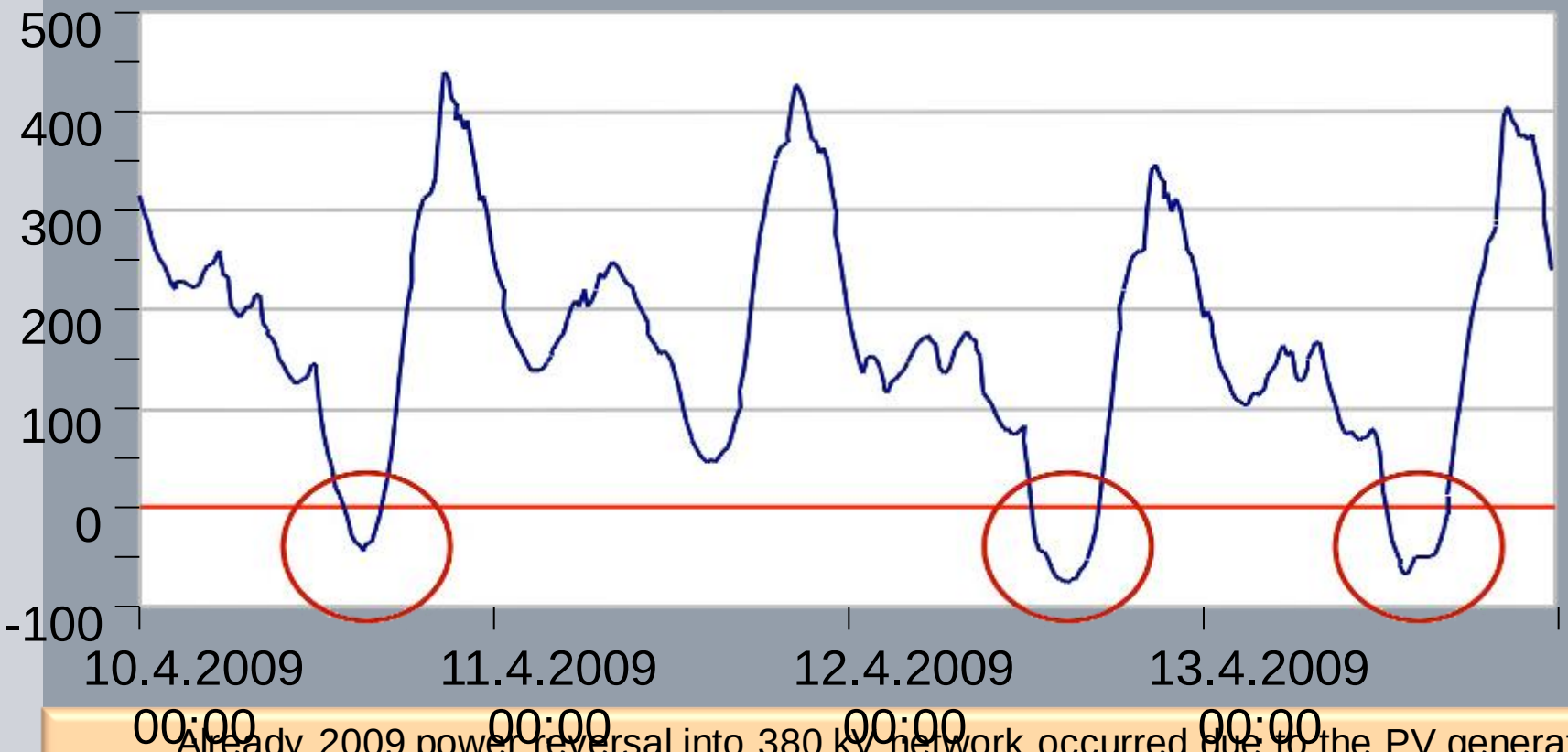


Source: LEW

Power flow in a transformer substation

SIEMENS

Feeding into transmission network – Good Friday until Easter Monday 2009 (in MW)



Already 2009 power reversal into 380 kV network occurred due to the PV generation.
This now appears weekly in 2011.

Source: LEW

Integration of e-mobility

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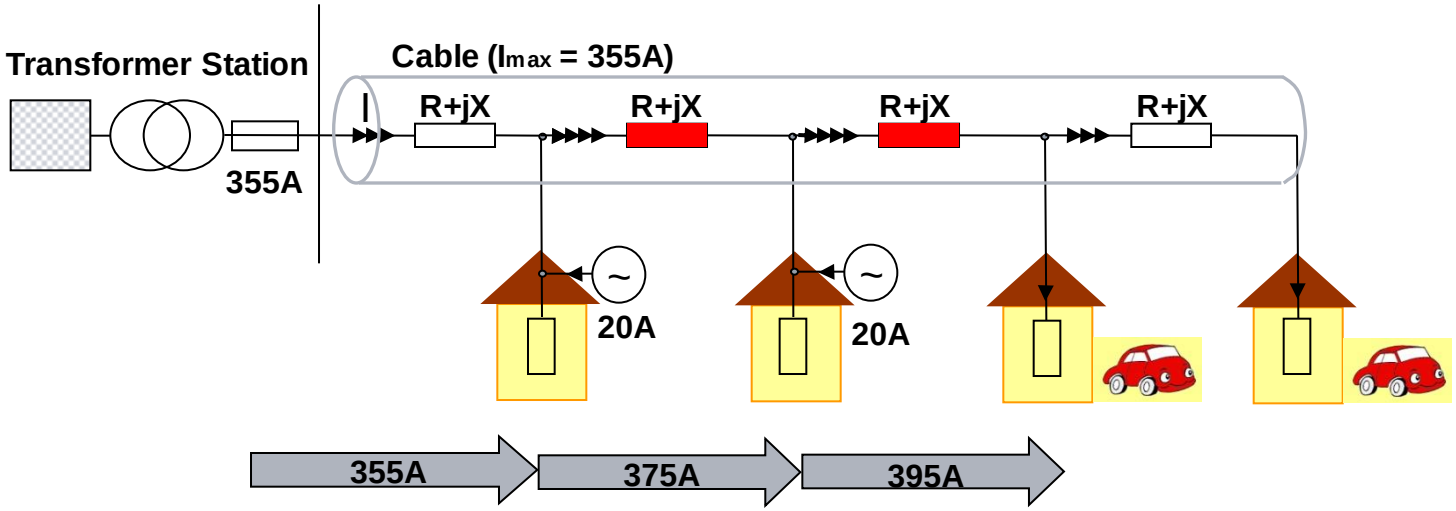
Load- and protection problem

Example: low voltage feeder with decentralized energy production



➔ Additional protection measures required for primary equipment (cable, transformers, etc.)

➔ Loads and production must be balanced in a way that no protection element trips

Eyes in the network

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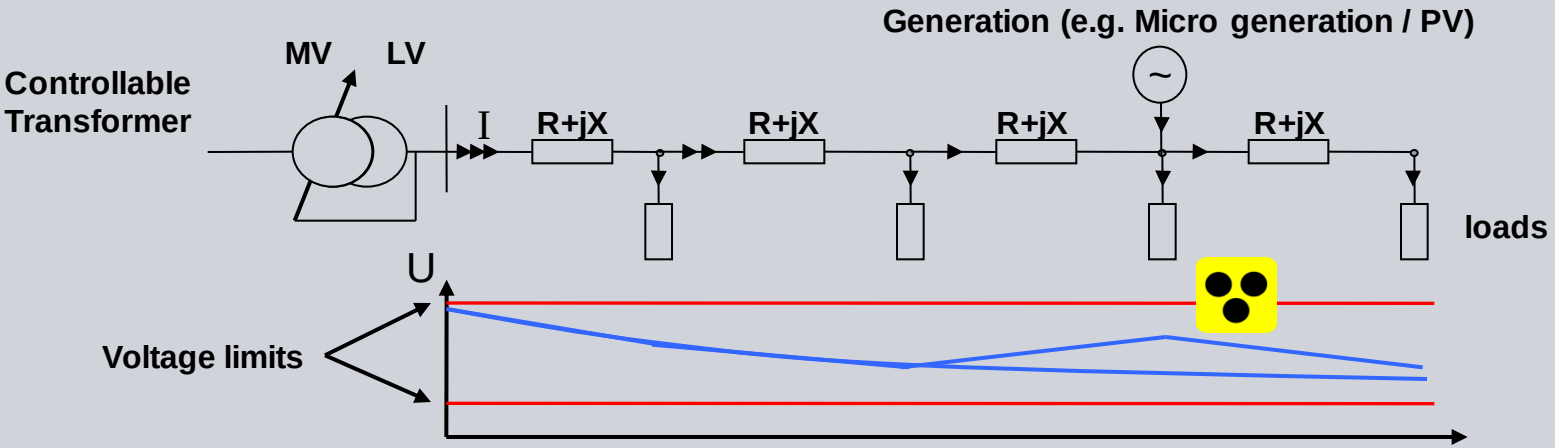
Voltage characteristic depends on infed power and grid impedance

Meters of a grid segment measure **Voltages - Phase Angles - Currents** and other PQ parameters at the same time which makes the grid transparent.



MV and LV - Sensors and Controllers

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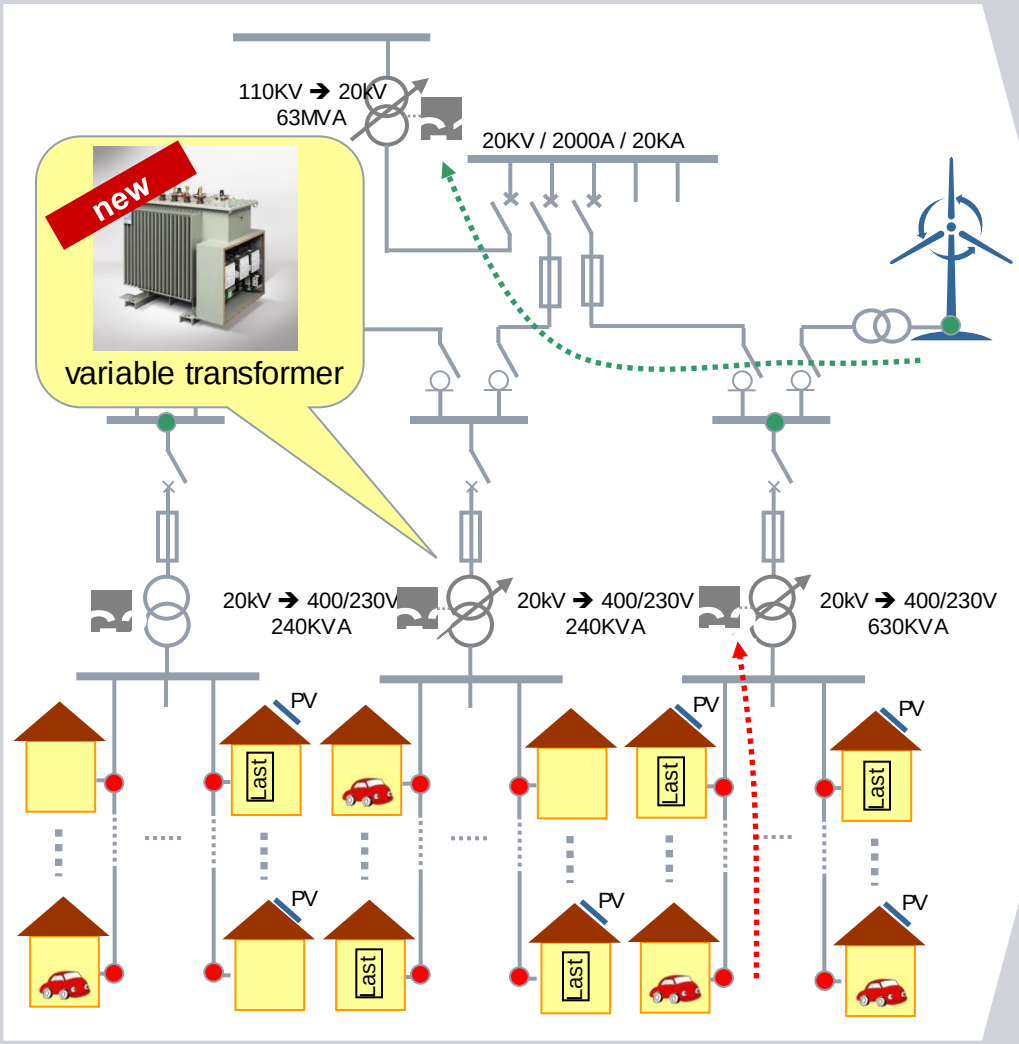


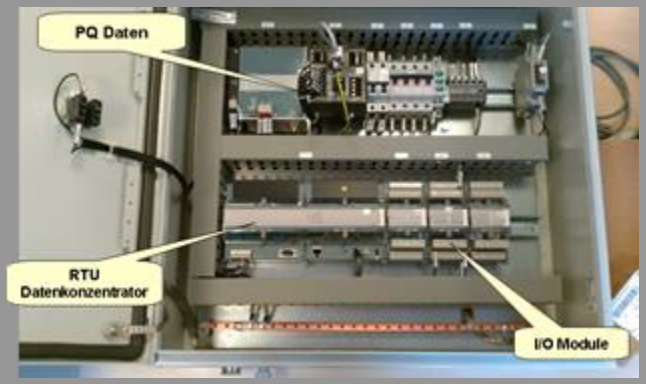
Sensors / Controllers

- Sensor Middlevoltage
- Sensor / Meter Lowvoltage

G1 Grid Controller Middlevoltage

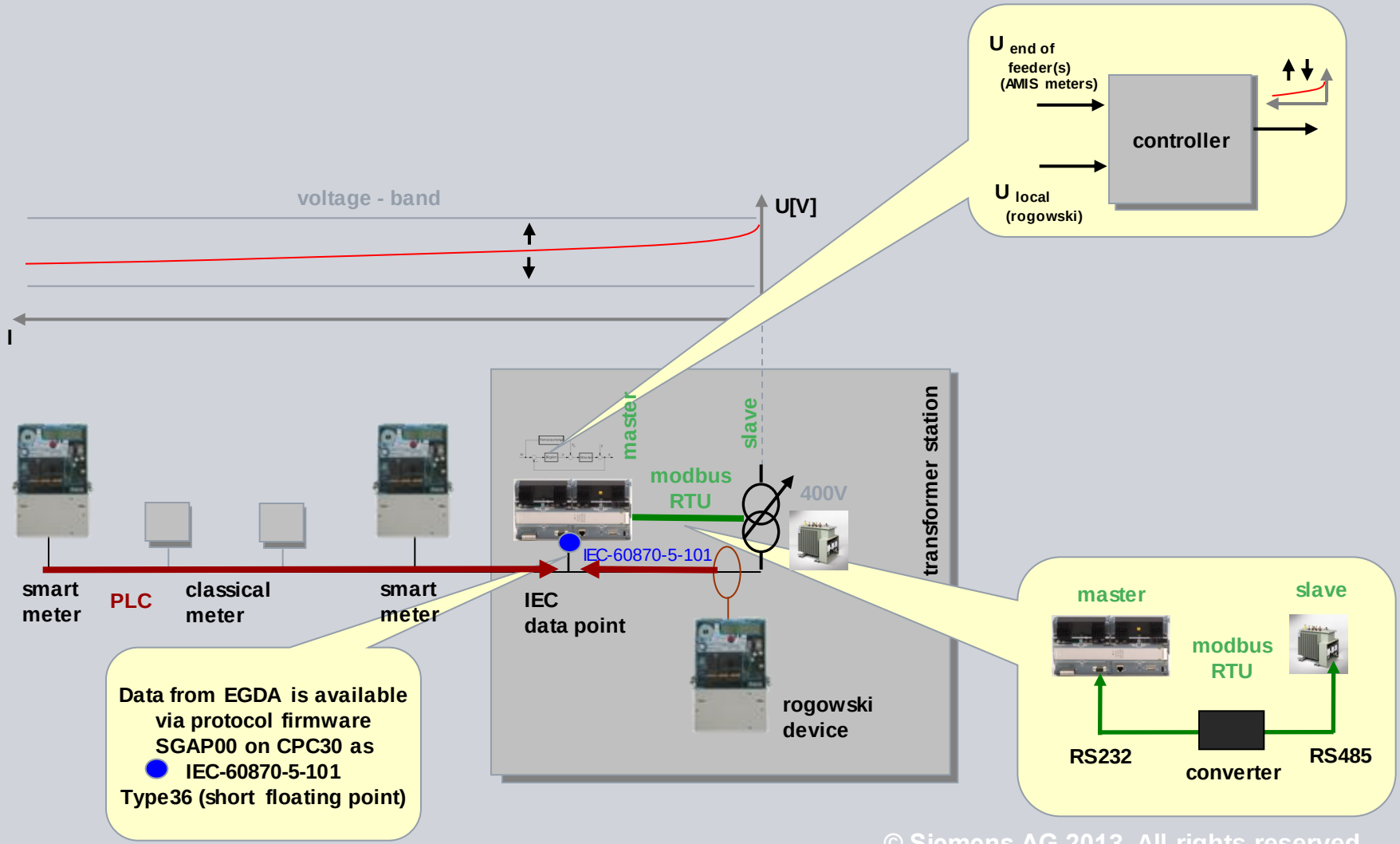
G2 Grid Controller Lowvoltage

Meters are geographically in an optimal position, in order to deliver data from the low voltage network



Simeas P55 in the transformer statation

Overview: How to connect Sensors and FITformer



Fast measurement and transmission

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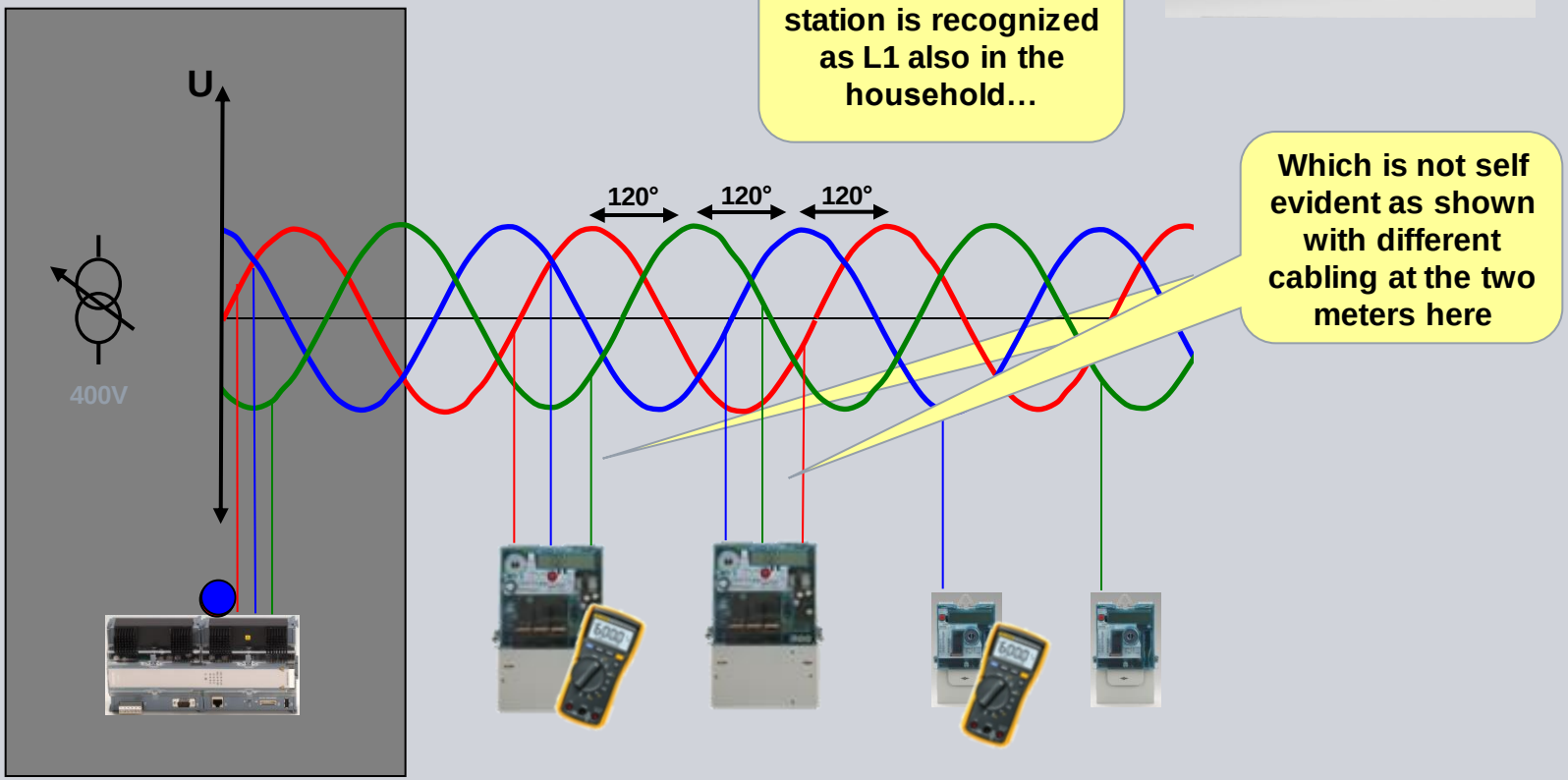
- Data transmission e.g. every 10-30s to the transformer station
- Phase correction of measurement data
- Check for availability of measurement devices



Device Configuration in a Feeder Example

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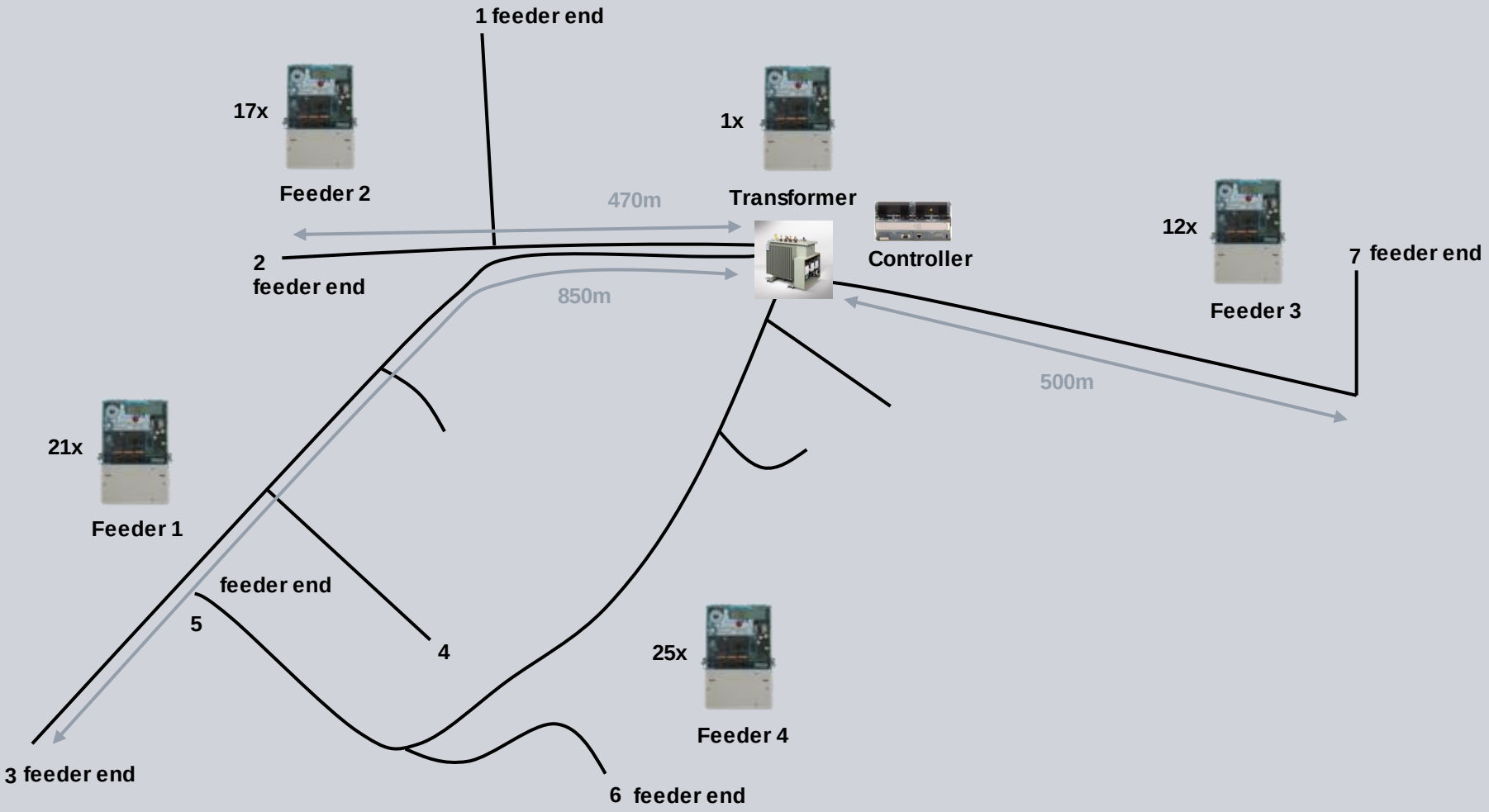

Documentation of eye-catching grid values

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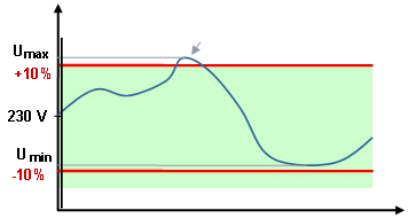


Datenkonzentrator

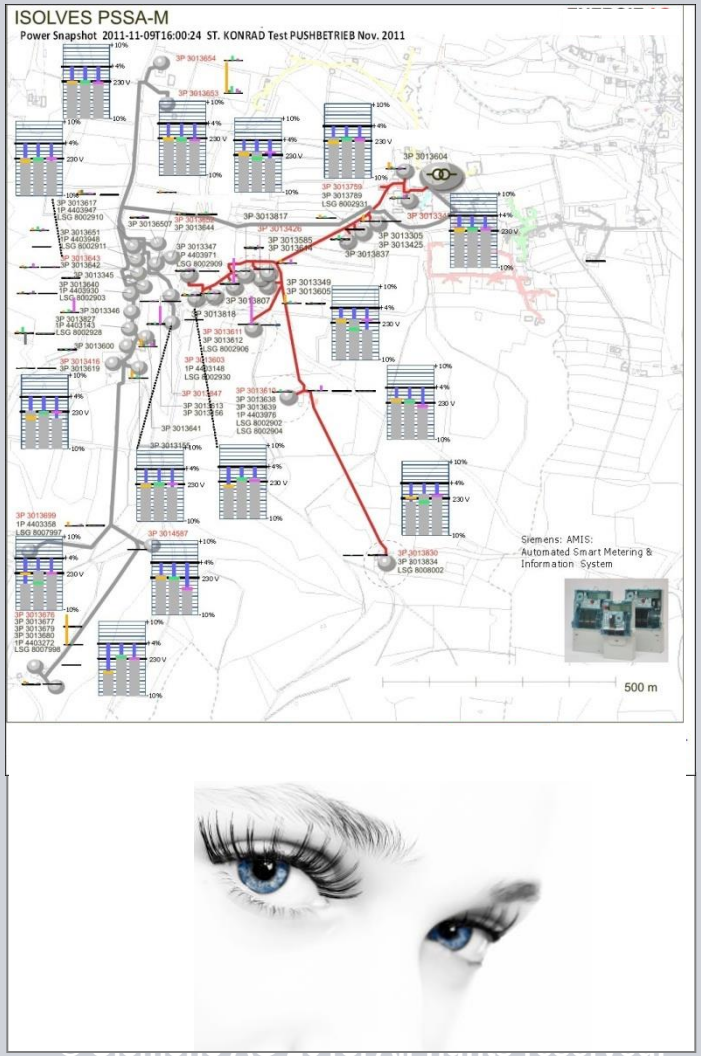
Intelligent meter

Intelligent meter + trigger function

10.000 values every 15min per meter

Measured values – Eyes in the network

I_eff effective value of current incl. harmonics
I_gw effective value of current of first harmonic
U_eff effective value of vlotage incl. harmonics
U_gw effective value of current of first harmonic
U_ll* effective value of line-to-line voltage
ku* voltage imbalance in %
ki* asymmetric load in %
P_eff effective value of effective power incl. harmonics
Q_eff effective value of reactive power incl. harmonics
P_gw* effective value of effective power of first harmonic
Q_gw* effective value of reactive power of first harmonic
U_10eff 10 minutes average value of effective voltage
U_15eff 15 minutes average value of effective voltage
PHI_uu phase angle between voltages



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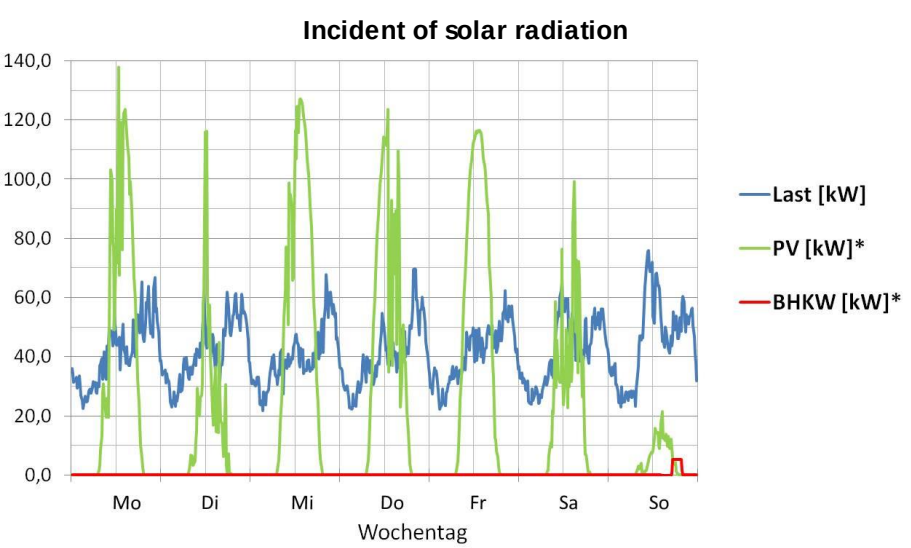
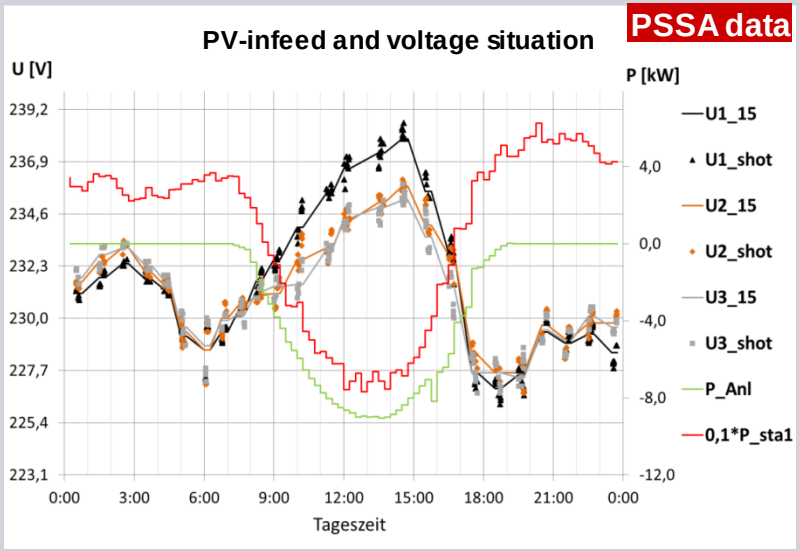
Data collected by “Power Snap Shot Analysis”





- **Voltage** heavily depends on **Photovoltaic infeed**
- In terms of change to alterntive energy sources it will be necessary for distribution network operators to take specific measures for voltage stabilizsation
  - therefore measurement in the LV gird is essential
  - analysis in order to be able to describe factors of influence precisely
- **Smart Meters** and/or **sensors in the LV** are **point of origin towards smart girds**

FITformer, PSSA and EGDA in use…

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Ďakujem za pozornosť