EXTENDED VOLTAGE CAPABILITY OF DECENTRALIZED GENERATION

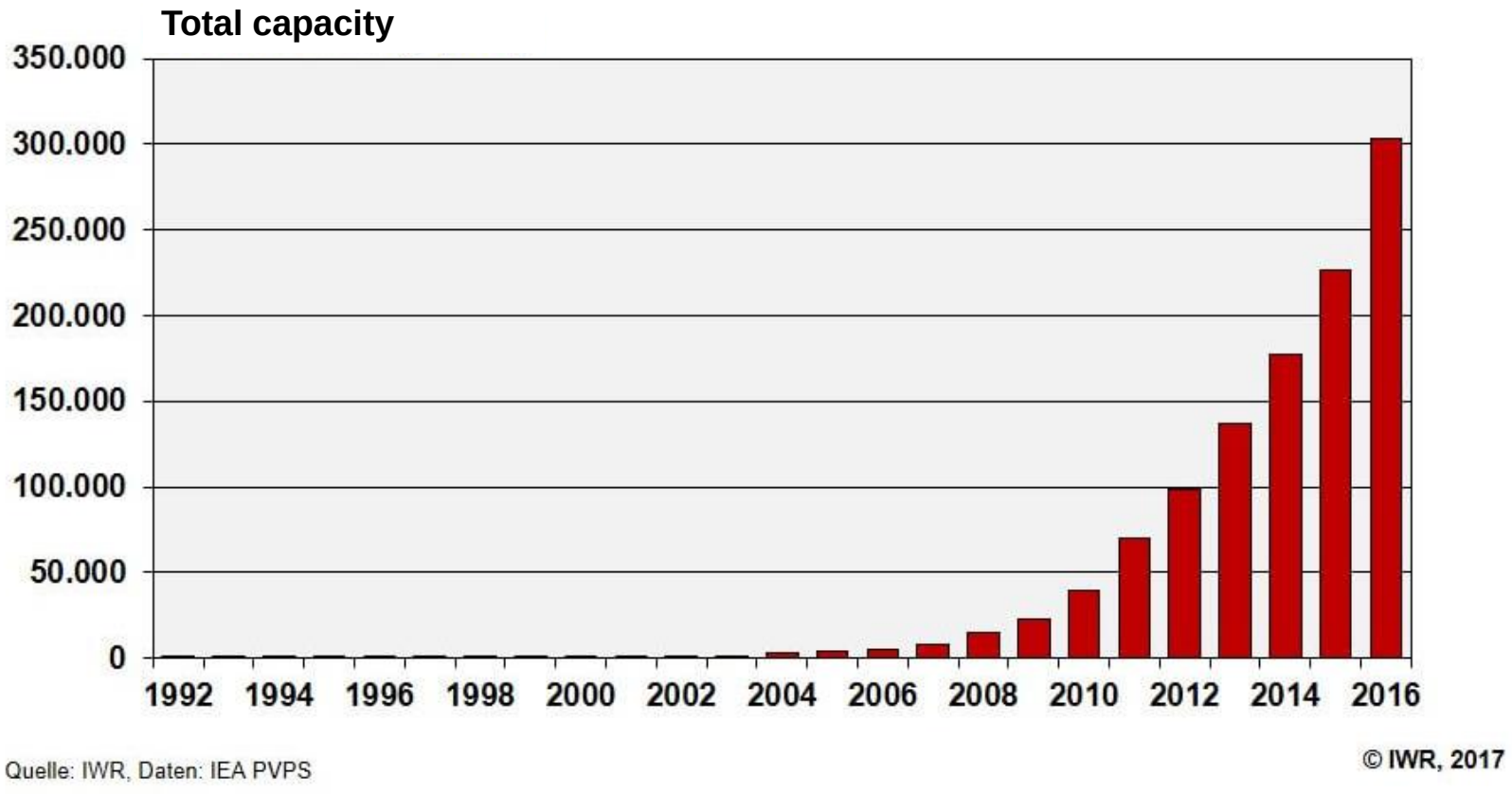
STEFAN HOPPERT

Agenda

- Growth of renewable energy and electric mobility
- Why do I need a string regulator?
- Active regulation
- LVRSys™ applications
- Customer example
- Summary and outlook

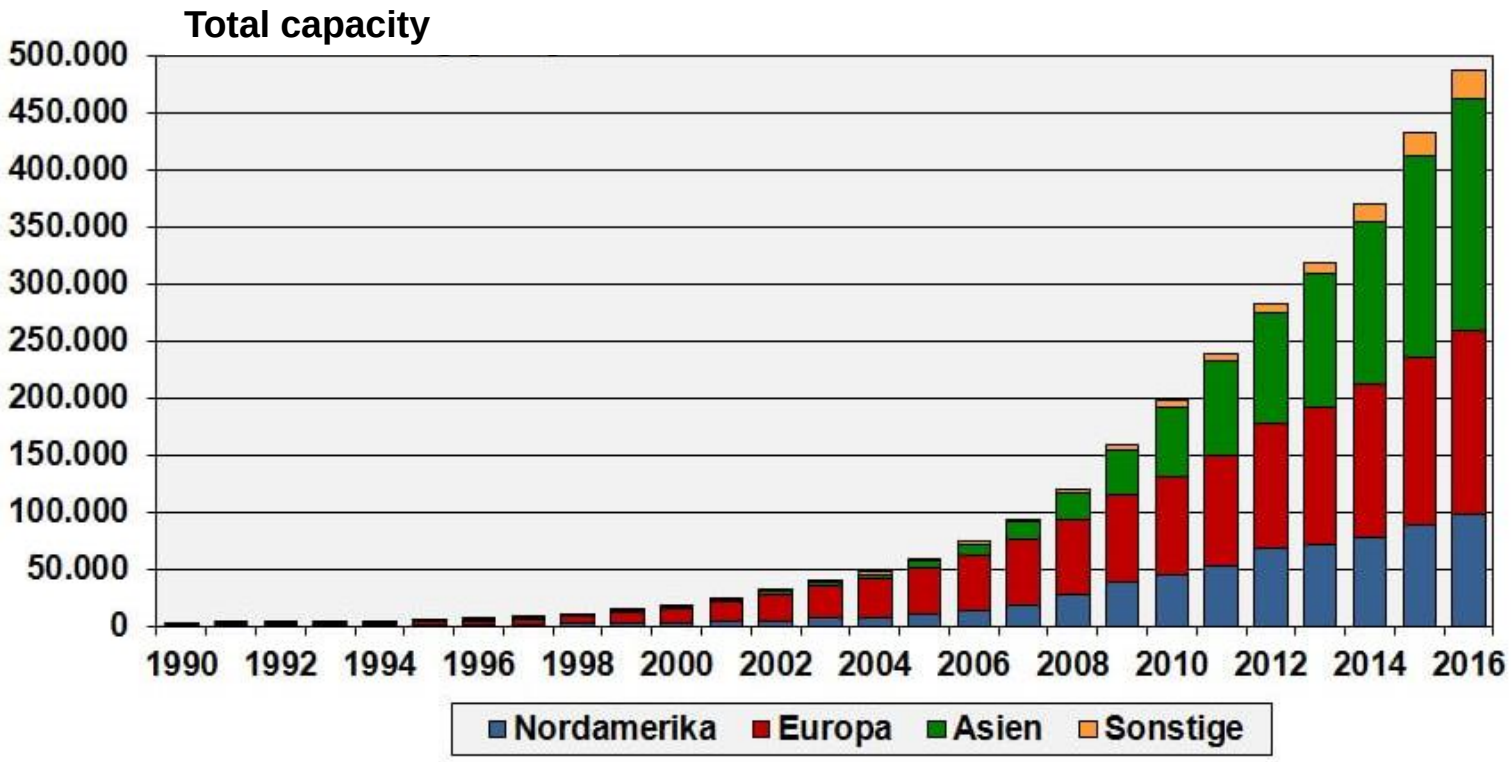
Growth of renewable energy and electric mobility

PV – Installations worldwide



Growth of renewable energy and electric mobility

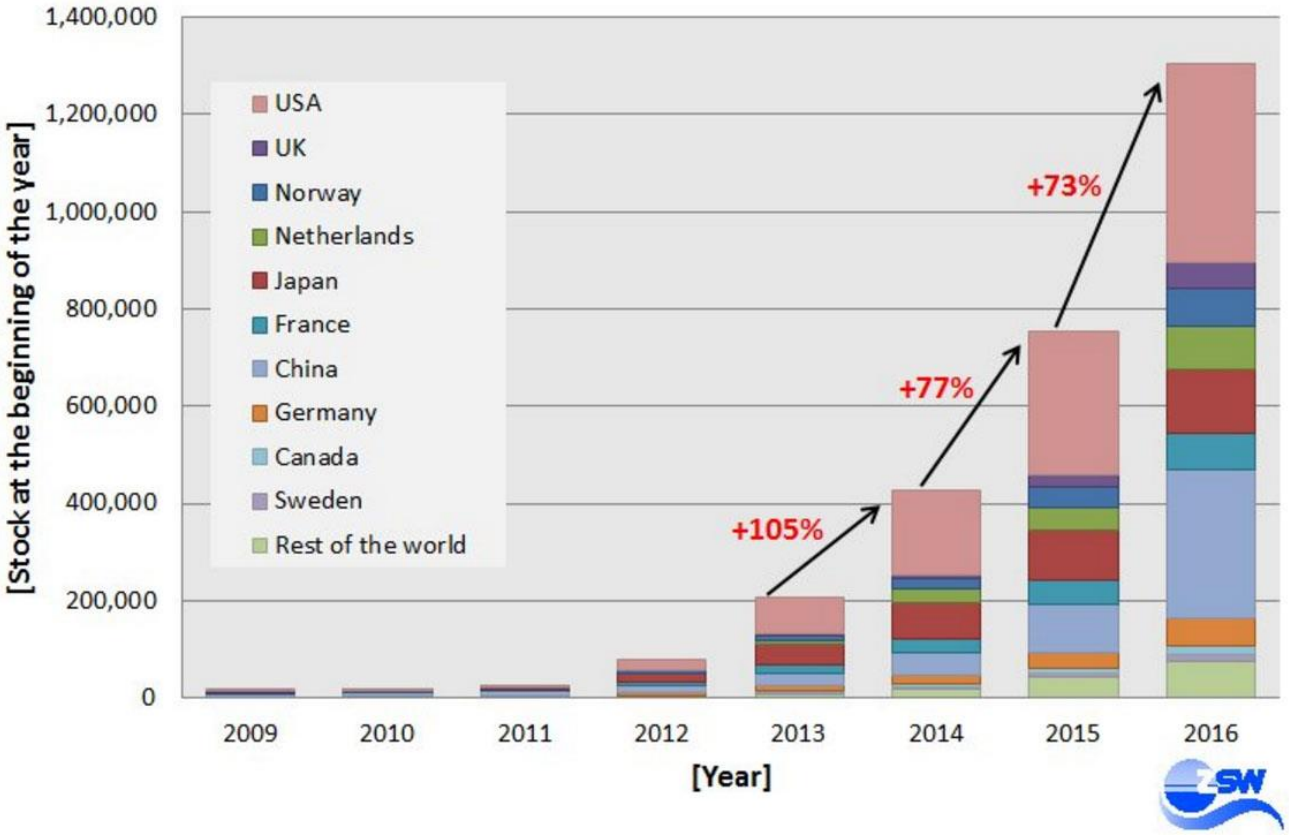
Wind – Installations worldwide



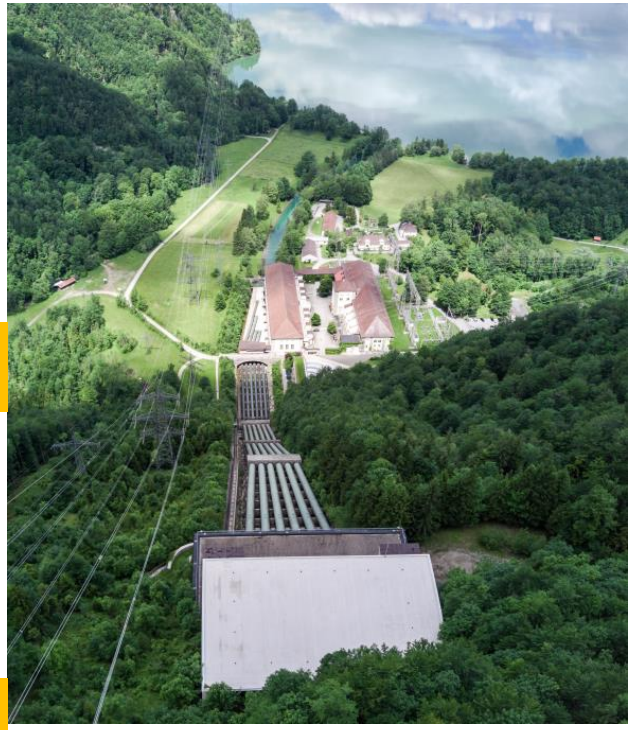
Quelle: IWR, Daten: IWR, WPM, GWEC

Growth of renewable energy and electric mobility

Electric mobility admissions worldwide



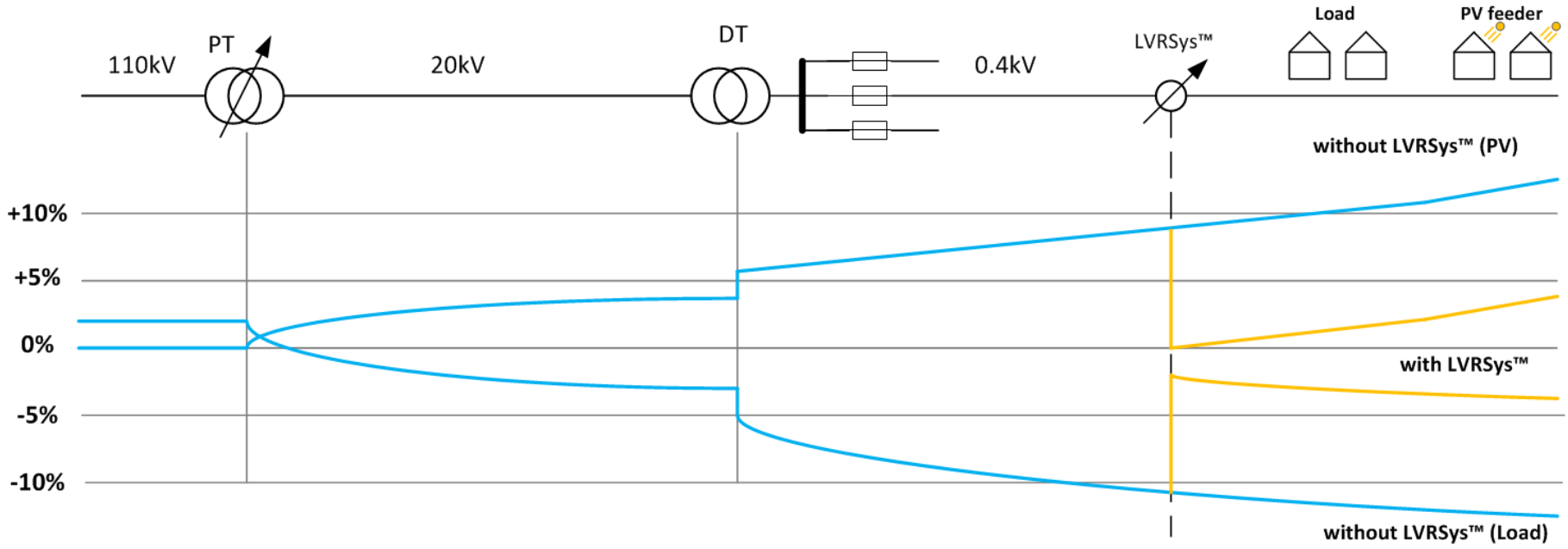
Why do I need a string regulator?



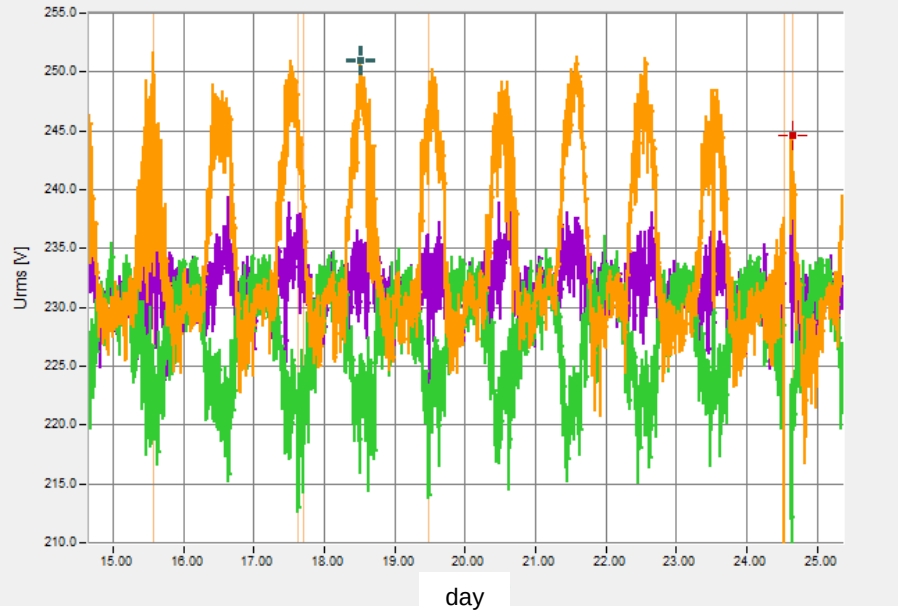
More voltage fluctuation in all grid levels!!!

String regulators avoid grid expansion costs!!!

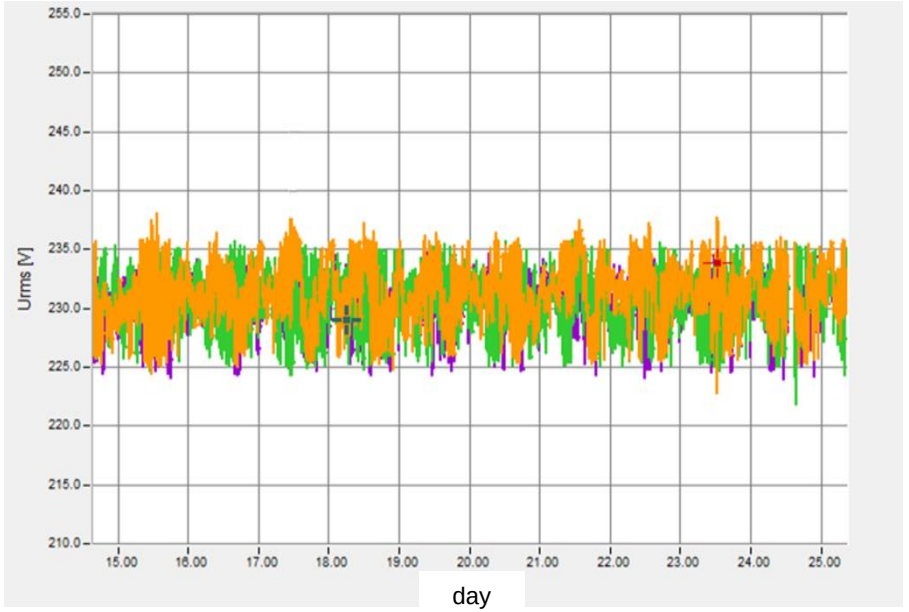
Voltage levels



Unregulated input voltage



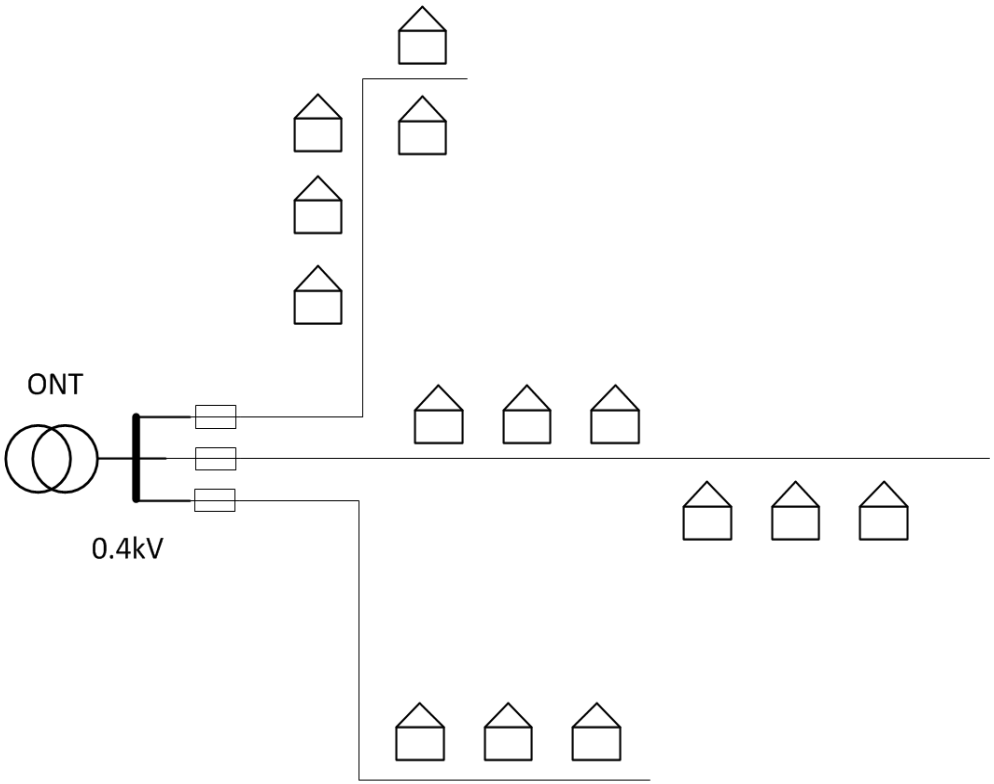
Regulated output voltage



Active regulation

Changing grids

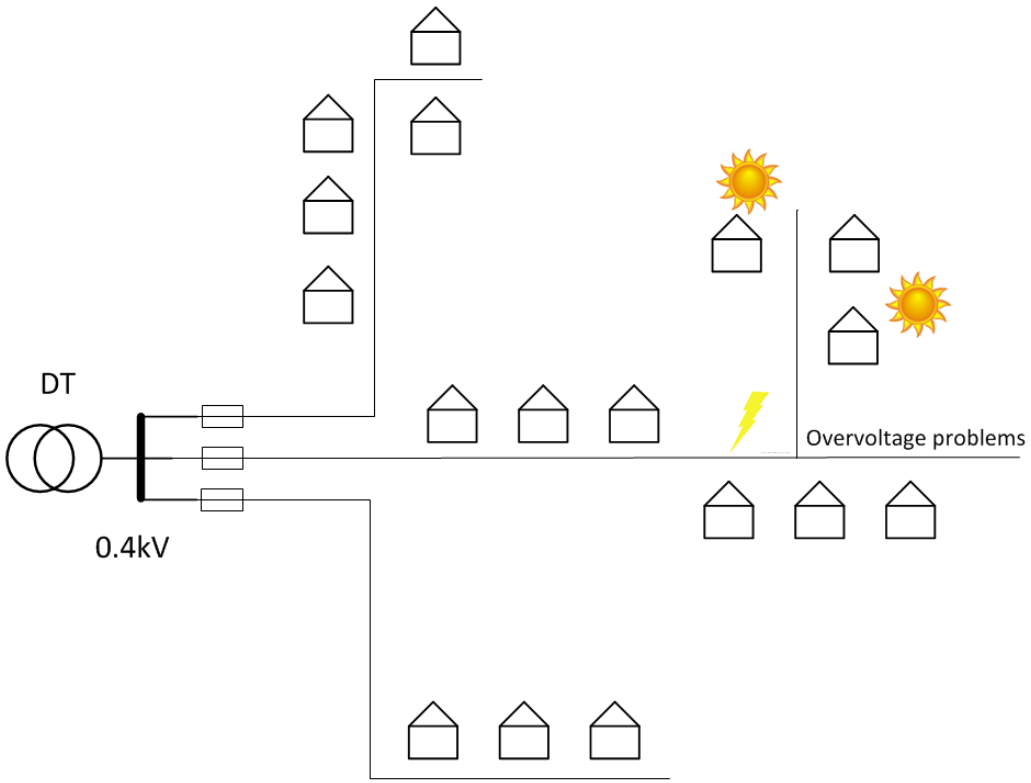
Low-voltage grid 2018



Active regulation

Changing grids

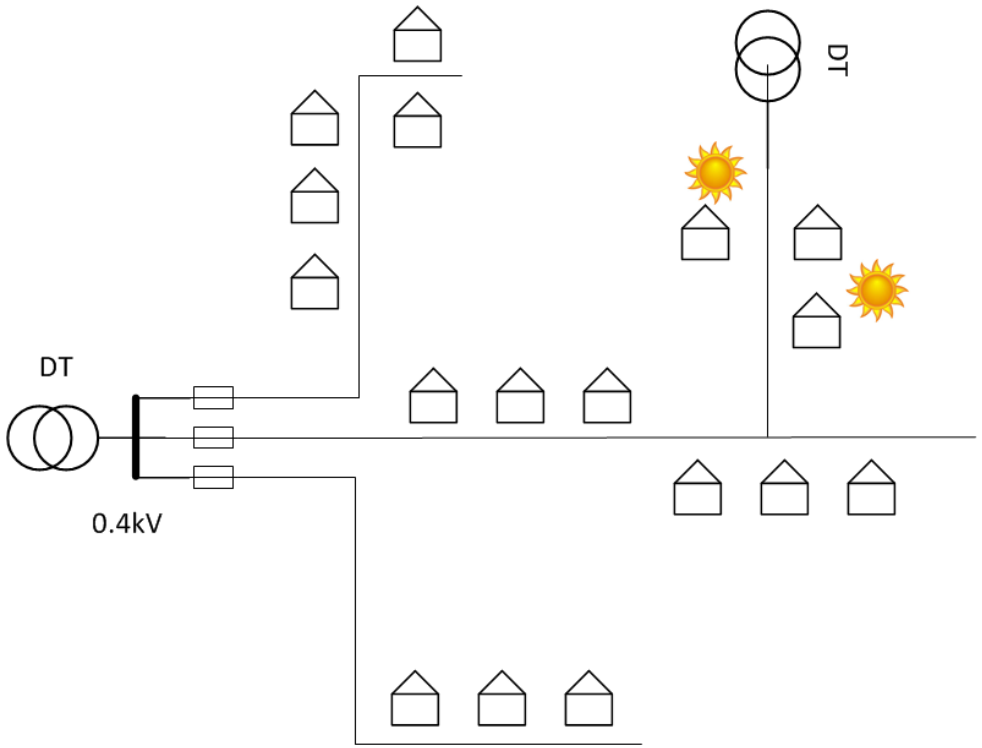
Low-voltage grid 2020



Active regulation

Changing grids

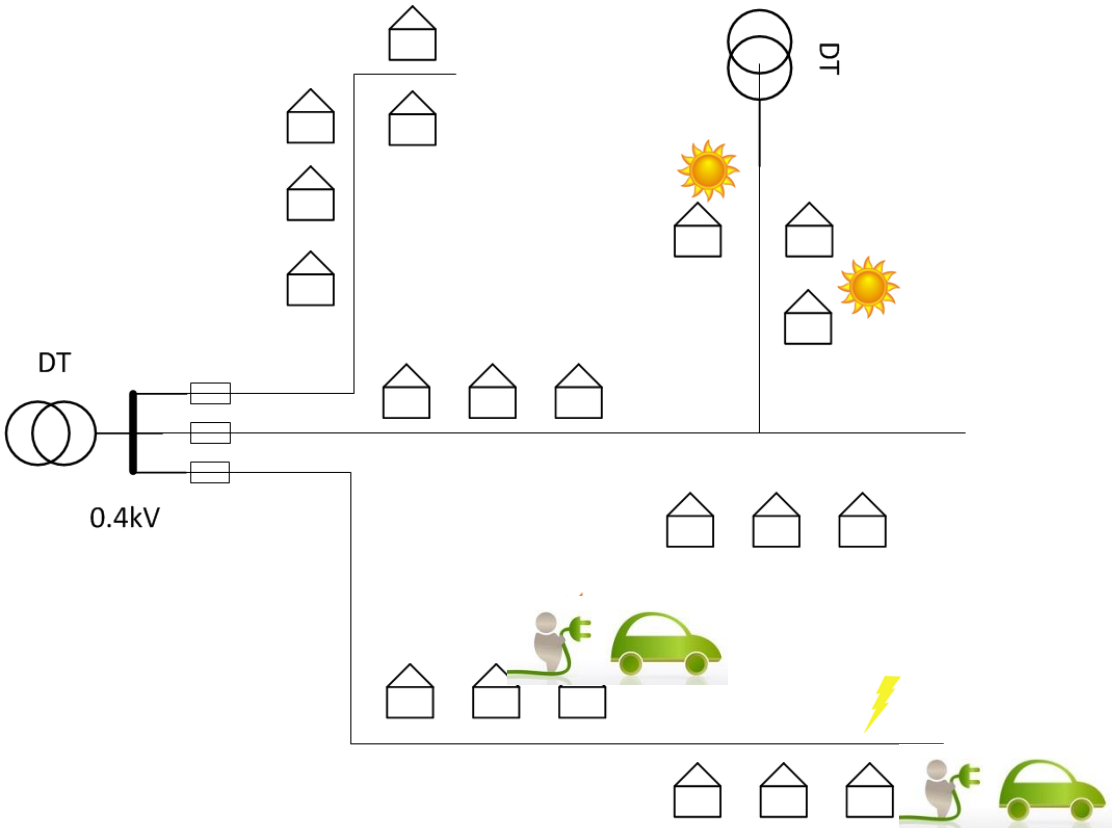
Low voltage grid 2020 / voltage variation problem solved with classical grid expansion



Active regulation

Changing grids

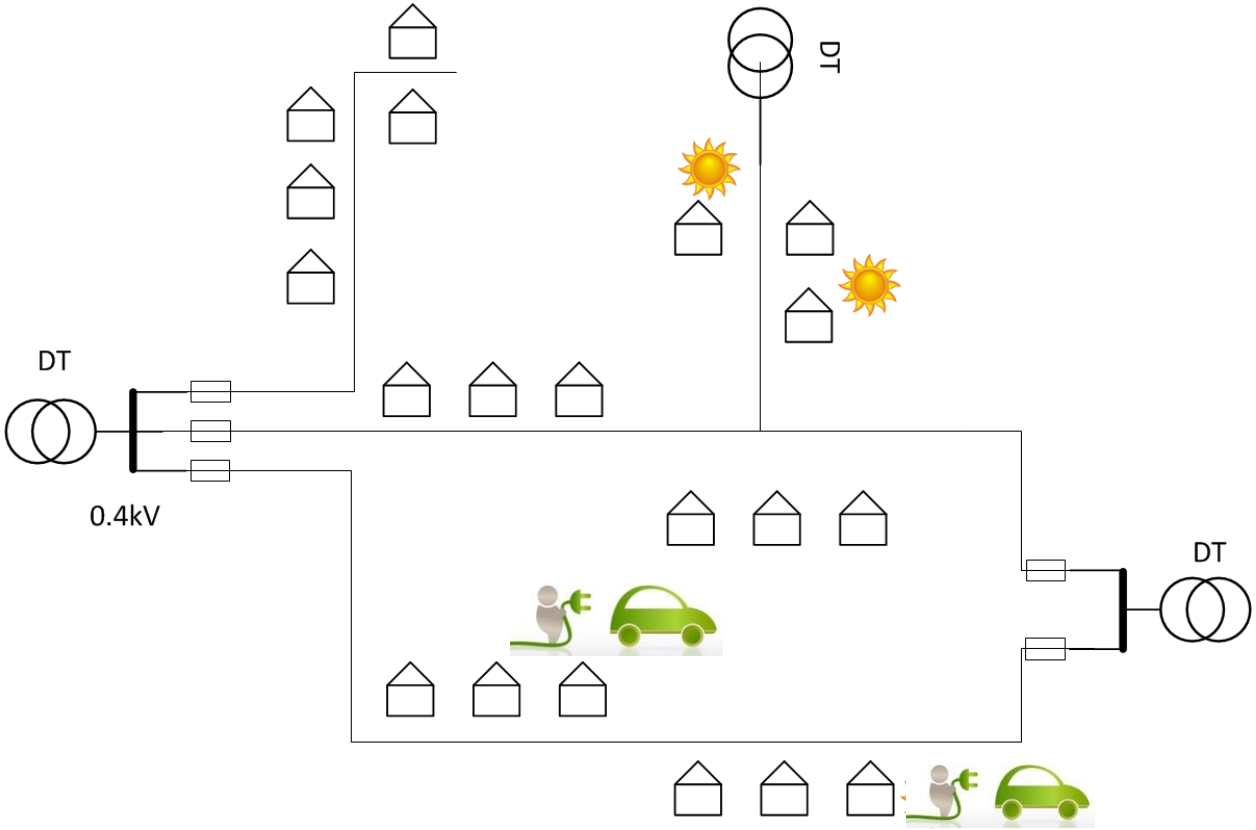
Low-voltage grid 2025



Active regulation

Changing grids

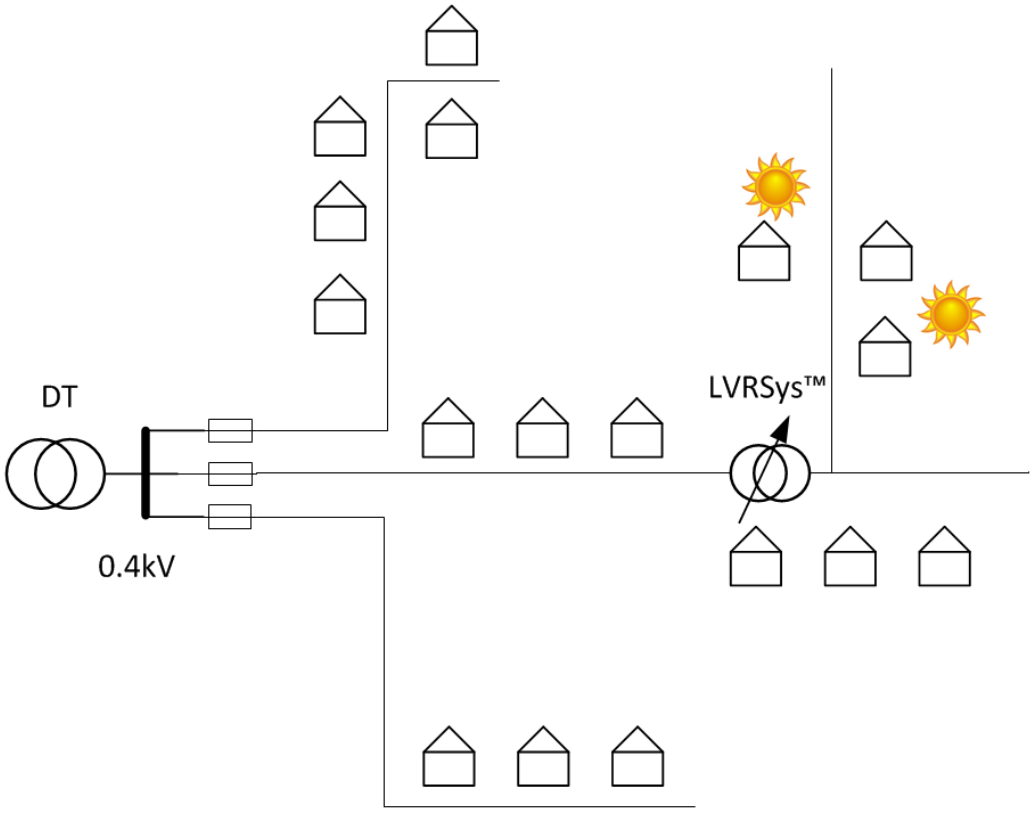
Low-voltage grid 2025 / Voltage variation problem solved with classic grid expansion



Active regulation

Changing grids

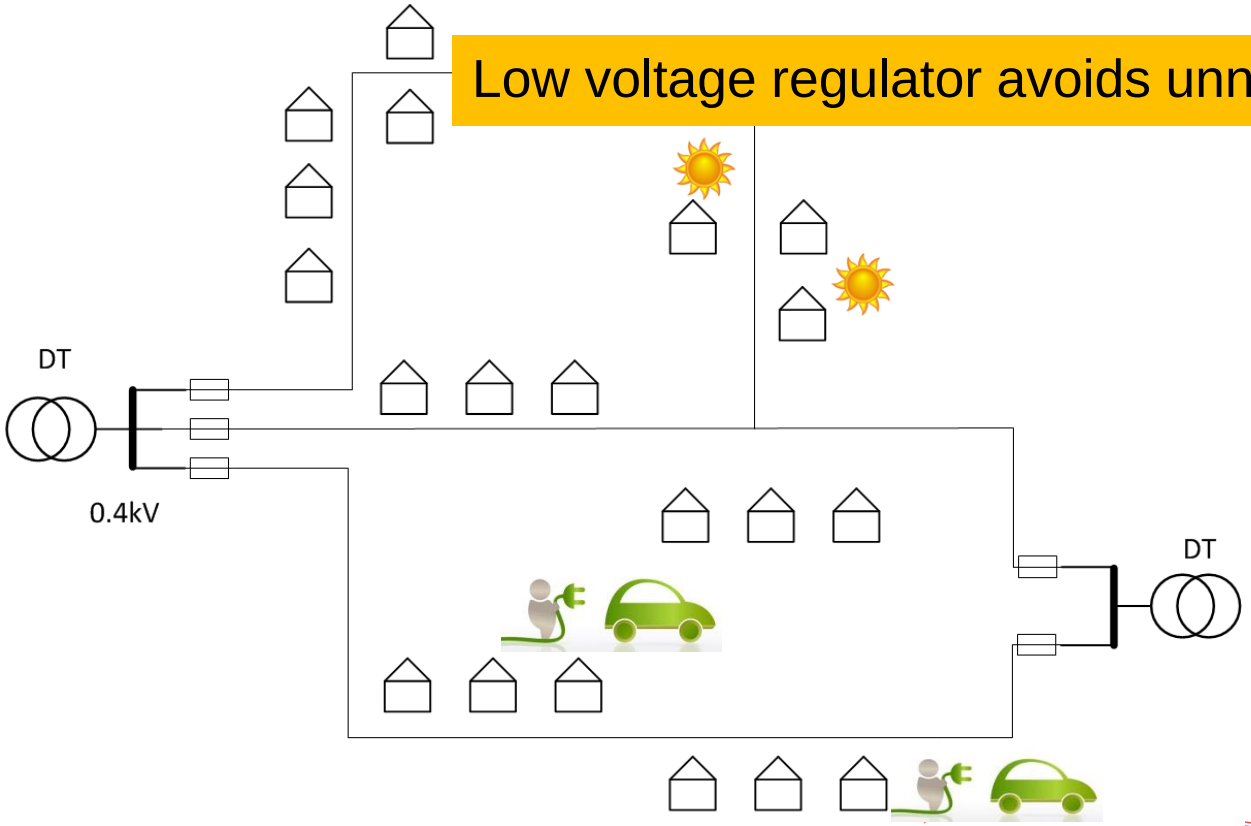
Low-voltage grid 2020 / Voltage variation problem solved with LVRSys™



Active regulation

Changing grids

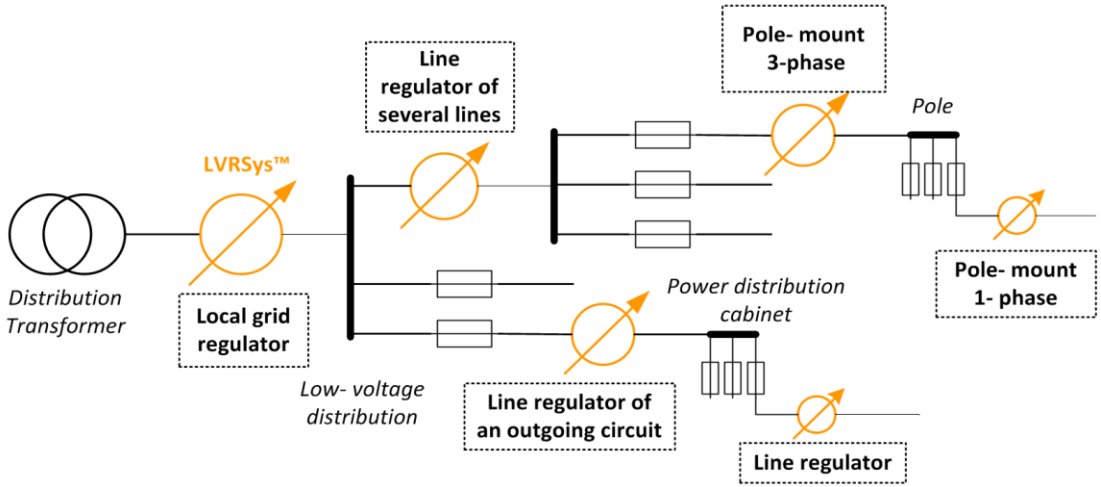
Low-voltage grid 2025



Low voltage regulator avoids unneccesarry investments!

Applications of LVRSys™ in the low-voltage network

Three- and single-phase / Power Utilities



- Power: up to 630 kVA
- Control range: ±6% / ±8% / ±10%
- Control range special application: up to ±24%

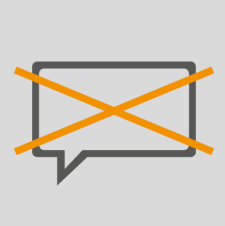
- Size of aluminum housing: w/d/h 120 cm / 40 cm / 135 cm
- Size of grp- housing: w/d/h 114 cm / 32 cm / 110 cm
  146 cm / 32 cm / 110 cm

LVRSys™ modular System

Properties

Robust

- Twenty billions of switches
- Short circuit proofed up to 50 kA
- High resistance to over voltages, direct and indirect lightning strikes



Grid compatibility

- No grid interference, causes no flicker or harmonics
- Balancing of the voltages via phase - independent regulation
- Interruption-free power supply guaranteed (Automatic Bypass)

Intuitive and secure

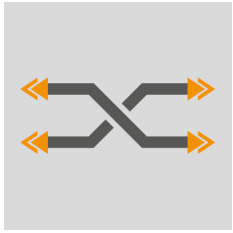
- Easy Installation as a cable distribution cabinet
- Common connection via NH-switch disconnector
- Commissioning via NH-switch disconnector or Circuit breakers
- Fully encapsulated system for maximum cotact protection

LVRSys™ modular System

Properties

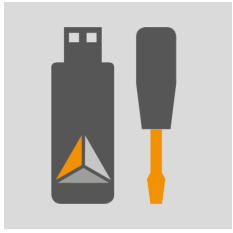
Reliable and economical

- **High efficiency**
- **Passive cooling even in direct sunlight**
- **Proofed from -40 °C up to +50 °C ambient temperature**
- **Electronics are moisture - proofed inside control cabinet (IP66)**



Flexible and fast

- **Adjustable response time of the controller < 30 ms up to 100 s**
- **Adaption of the control algorithms to different applications**
- **Load - dependent regulation, without additional communication**
- **Independent tolerance bands for dynamic- and static regulation**

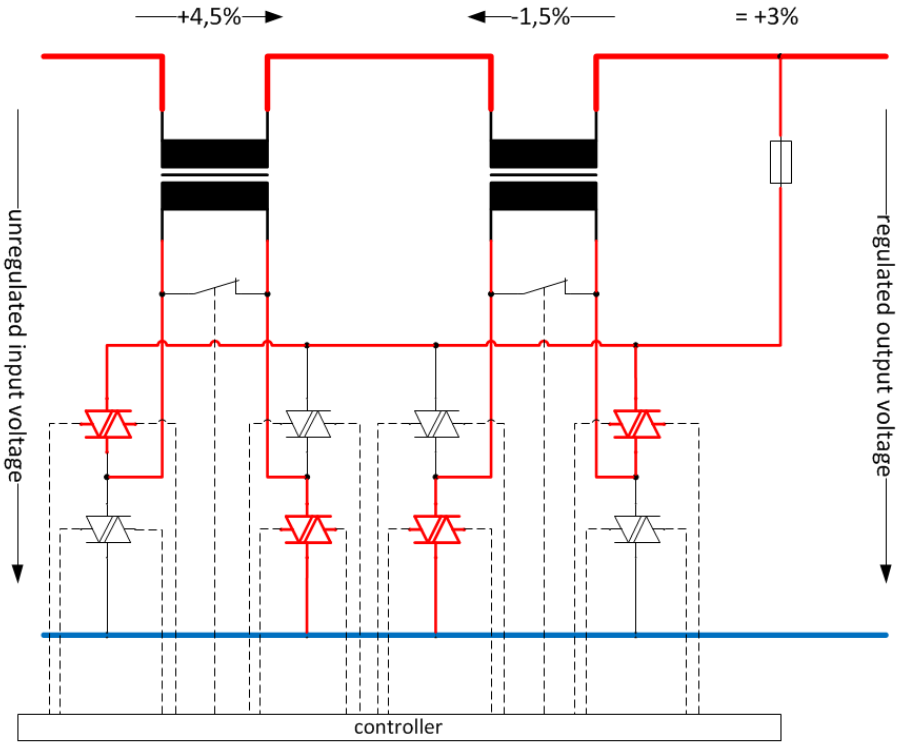


Easy

- **Data export via USB-stick in e. g. MS Excel**
- **Firmware update via USB-stick or SCADA system**
- **Communication interfaces, e. g. Modbus TCP / IP, IEC 60870-5-104**

Low voltage regulator

Characteristics / one phase principle



Raise voltage 4.5% by activating the 4.5% transformer

Lower the voltage by activating the 1.5% transformer but inverse

Result: total voltage is +3%

Contactors close in the event of failure, local grid continues to operate, but with-out control

Low voltage regulator applications

(1) Voltage stabilization in an industry grid

Kenya: Voltage Stabilization
ensures healthy operation of sensitive loads and reduces power losses

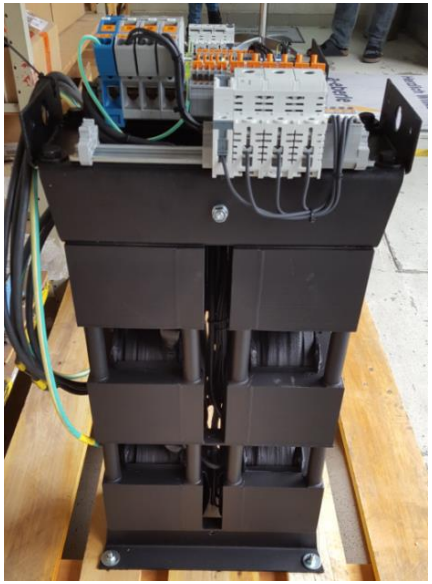
Low voltage regulator applications

(II)Voltage stabilization of the 400 V level in substations

Belgium: self consumtion control of a converter station 380 kV

Low voltage regulator applications

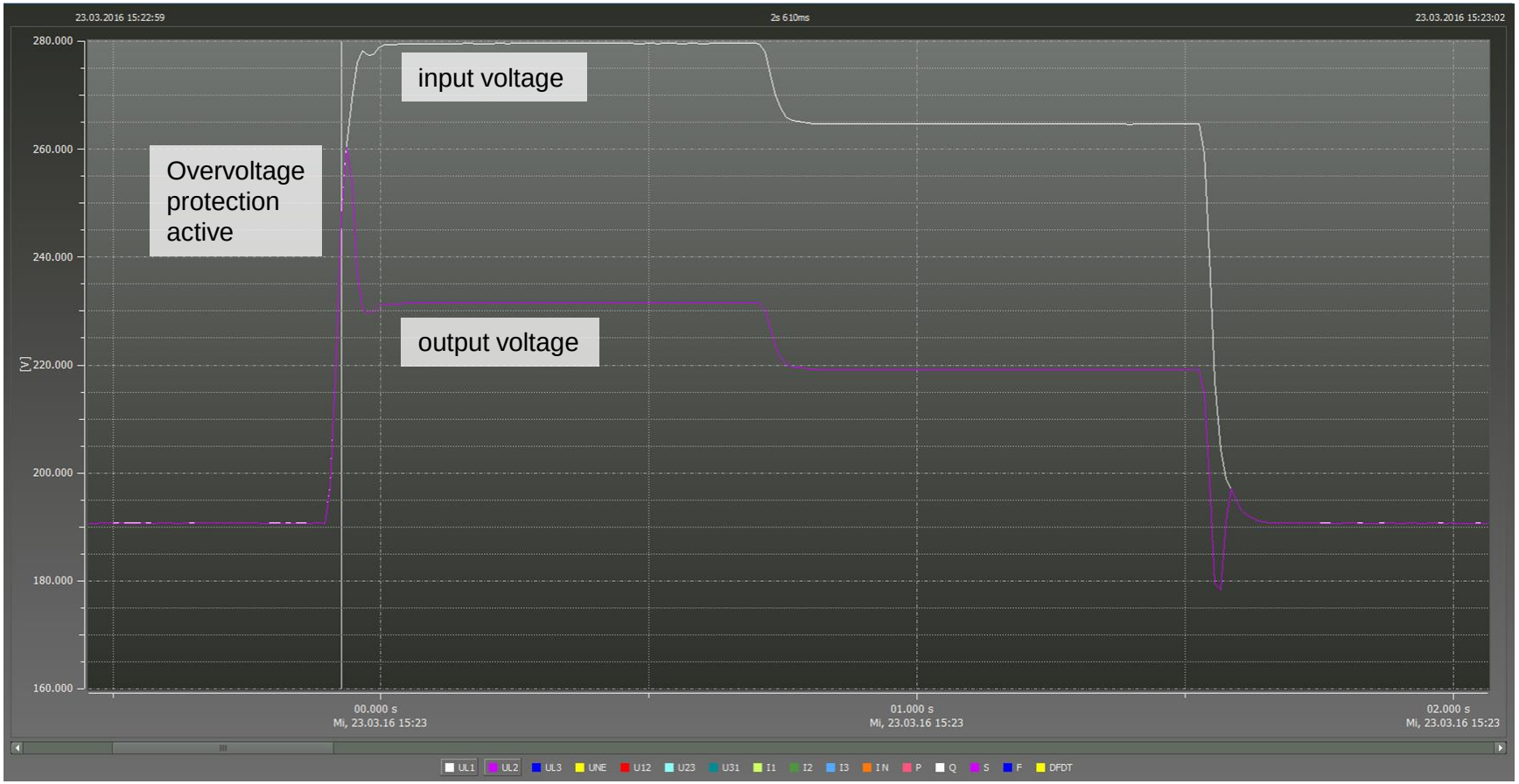
(III)Voltage stabilization and overvoltage protection of the 400 V levels in wind turbines



Technical connection requirements for renewables according to German standard (TAB)

- Wind
- Solar
- Bio mass
- Cogeneration unit

Low voltage regulator reaction while overvoltage occurs



Low voltage regulator applications

(IV)Voltage stabilization for power utilities

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Low voltage regulator applications

(IV)Voltage stabilization for power utilities

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Summary and outlook

- LVRSys™ avoids and shifts investmens
- LVRSys™ is a recognized technical equipment
- LVRSys™ equips the distribution grid of the future

Thank you

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