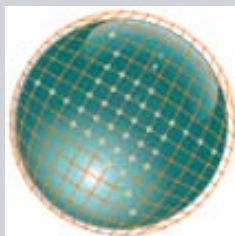


Smart DER integration
in MV & LV grids
Austrian project examples

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4th International Conference on
**Integration of
Renewable and Distributed
Energy Resources**
December 6-10, 2010
Albuquerque, NM, USA

Introduction

DER Integration MV - Advanced Network Operation

DER Integration LV – Bringing Eyes to the LV grid

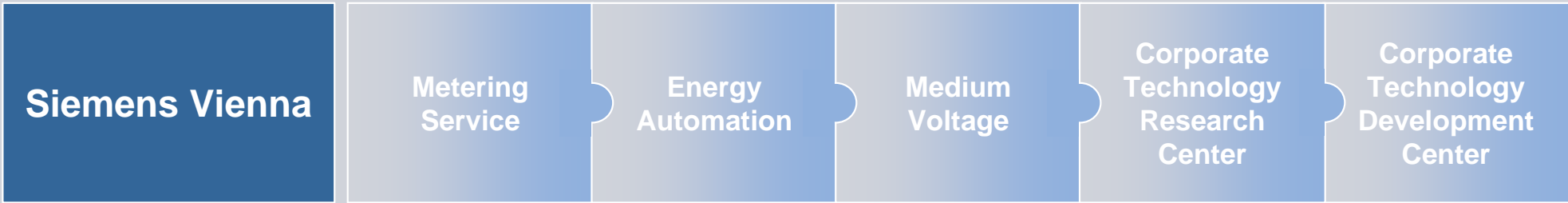
Summary



Siemens Vienna



One of the Siemens Smart Grid Competence Centers



Competences							
	MDM	AMIS	DEMS	Power Electronics	Grid Intelligence	Research	Development

References						

Corporate Technology CEE (CT CEE)

Core competence Smart Grids

SIEMENS

Sustainability by intelligent Smart Grids

Active Distribution Grids and **Decentralized Energy Management** are our core competence at CT CEE.

Deep know-how and experience at customer's site in forecasting, optimizing and operating decentralized energy systems makes CT CEE a reliable partner for smart grids.



Reference Project Areas

■ Active Distribution Grids – MV and LV

Optimized Grid Integration of Distributed Energy Resources (DER) like PV, Biomass, Hydro, etc... and e-mobility

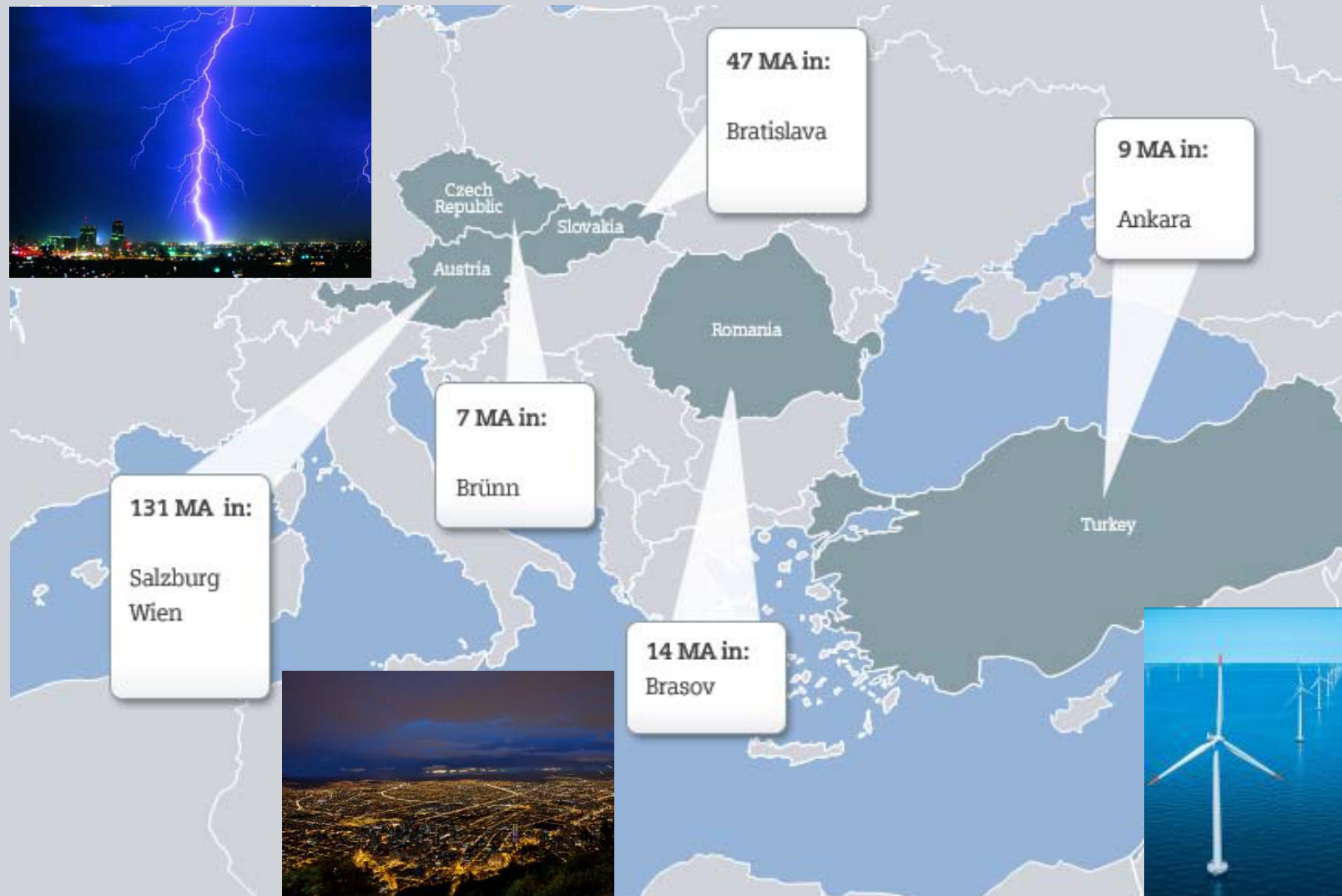
■ Decentralized Energy Management

Integration of DER and e-mobility in the energy market, Virtual Power Plants (VPP)

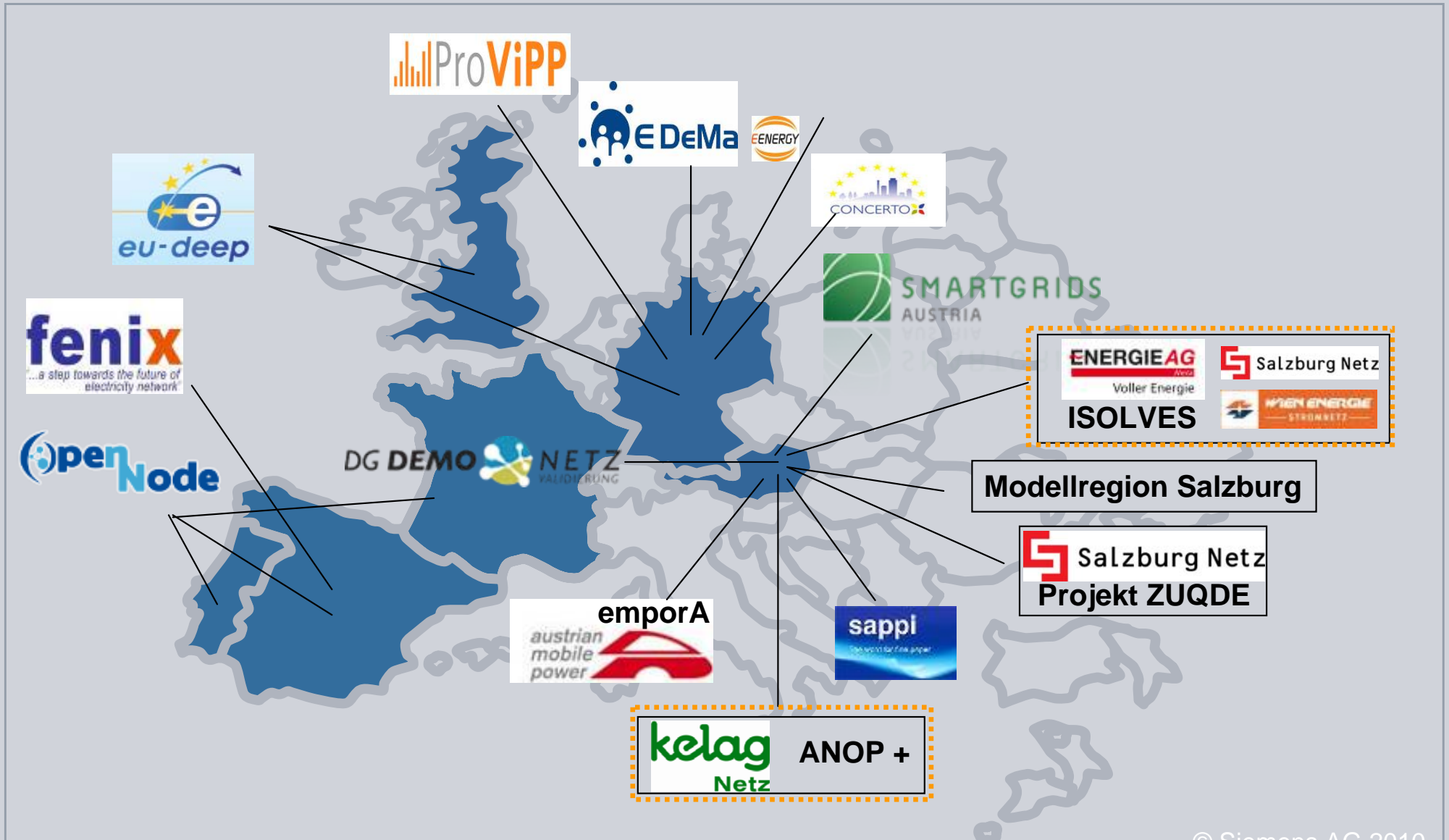


Corporate Technology CEE (CT CEE)

Smart Grids competence within Cluster CEE (10/06/2010)



Smart Grid R&D and D projects in Europe with participation of Siemens CT CEE Experts



Austrian Smart Grid R&D and D focus*

* Source: BMVIT – Austrian Federal Ministry for Transport, Innovation and Technology & Smart Grids Austria

Distributed Generation
mainly based on renewable sources in
Distribution Networks

Distribution Network planning and operation

Extended Distribution
management systems in
MV grids
Control concepts for the
integration of distributed
generation (voltage control,
virtual power plant,...)



Demand Side Management

Load management
Customer response
Customer integration

**Integrated planning AND operation of distributed networks with consumer
integration (load management, e-mobility;...) and high share of DER**

Introduction

DER Integration MV - Advanced Network Operation

DER Integration LV – Bringing Eyes to the LV grid

Summary



Advanced Network Operation

Austrian Example – KELAG, DNO of Carinthia, Austria

- **Distributed generation:**

- Many hydro power plants (0,5 MW – 40 MW)
- Upcoming PV
- Upcoming wind parks



- **Full functionality of Advanced Network Operation System**

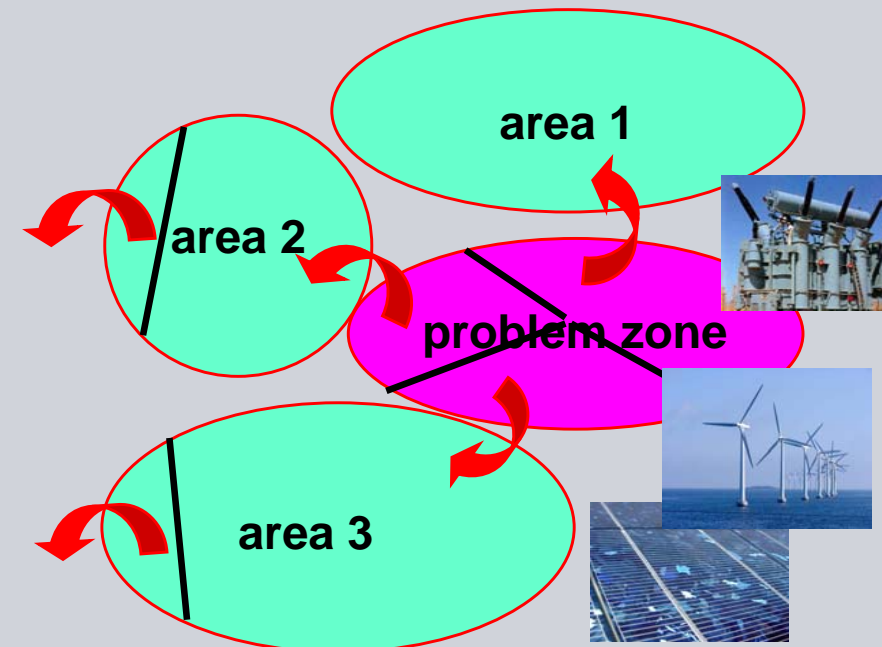
- operational planning, emergency planning, real-time operation
- cares about continuous supply of customers & DG
 - 1.choice: network reconfiguration
 - 2. choice: network reconfiguration + setpoints for generators
 - 3. choice: network reconfiguration + setpoints + smart load shedding



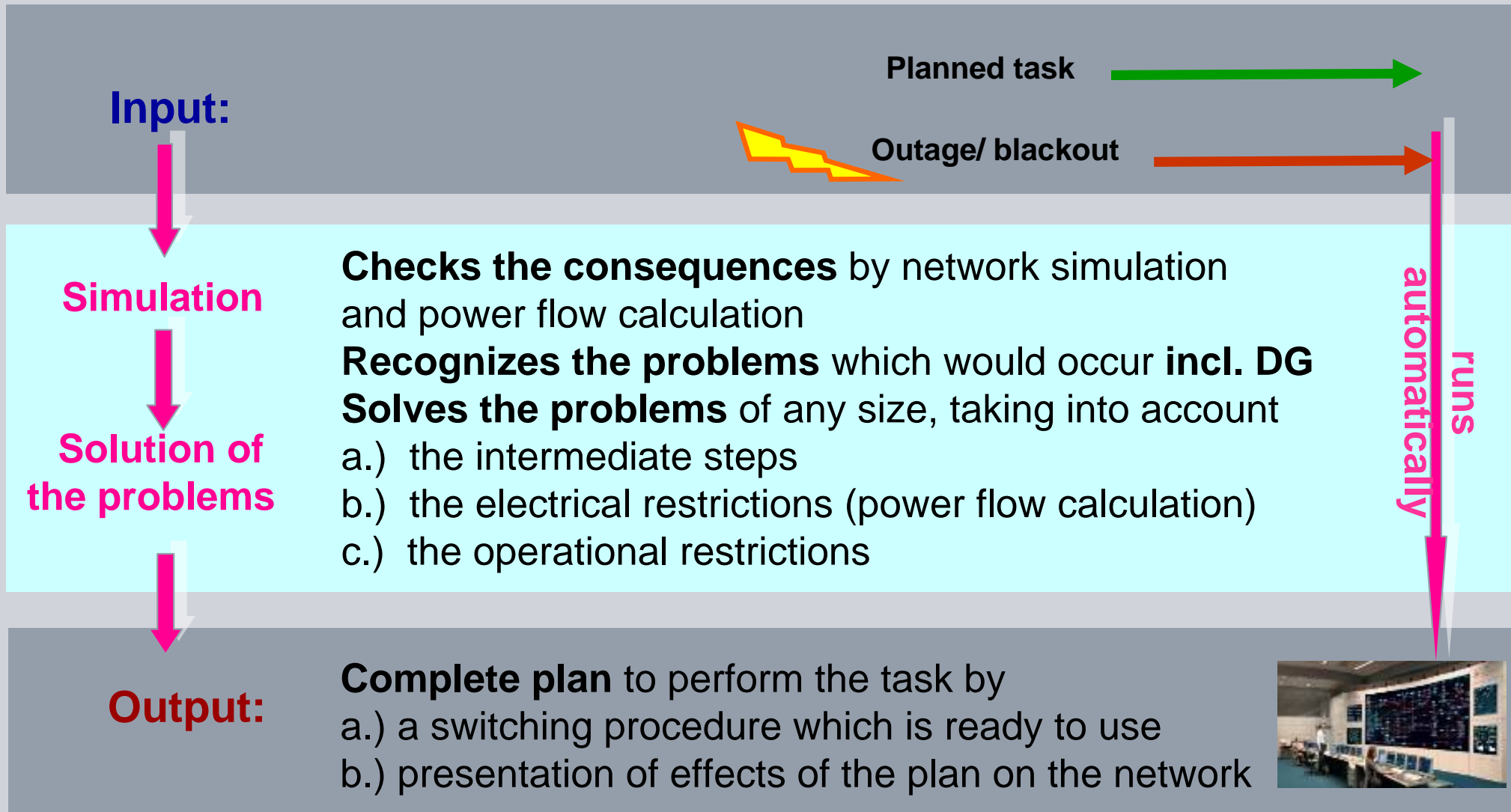
Advanced Network Operation Overview

Module for automated preparation of operational tasks in distribution networks (DN)

- Produces **authentic** and **extensive solutions** for **operational tasks** and consequences of **distributed generation** to control the DN
- Takes necessary amount of adjacent feeders (direct and higher level feeders) = **solves any size of problem**
- Splits problem zone into several groups = **respects electrical & operational restrictions**
- Takes the minimum adjacent feeders necessary to solve the problem = **minimum change of topology**
- Considers the right sequence of switching steps = **keeps continuously energized the customers**

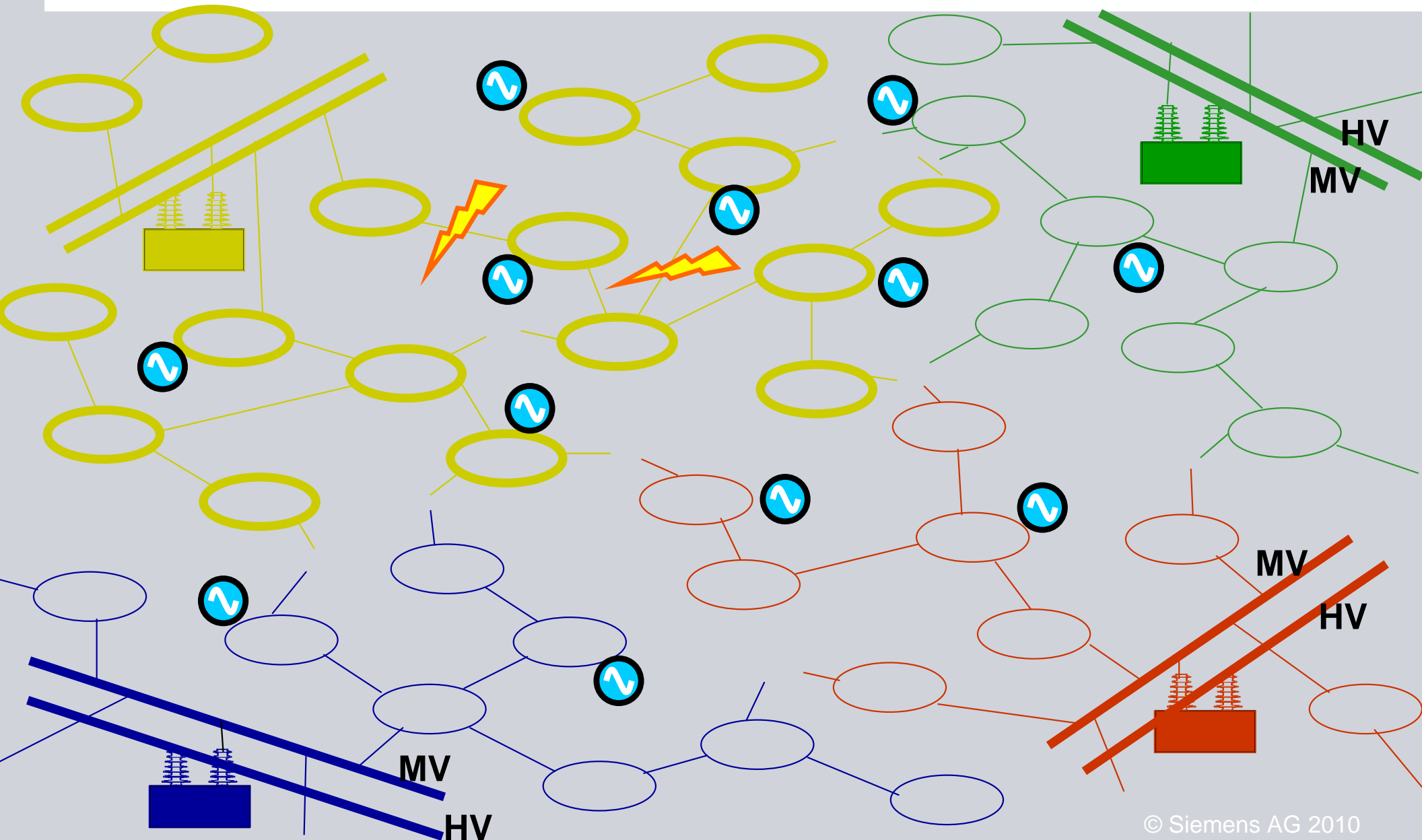


Advanced Network Operation Overview



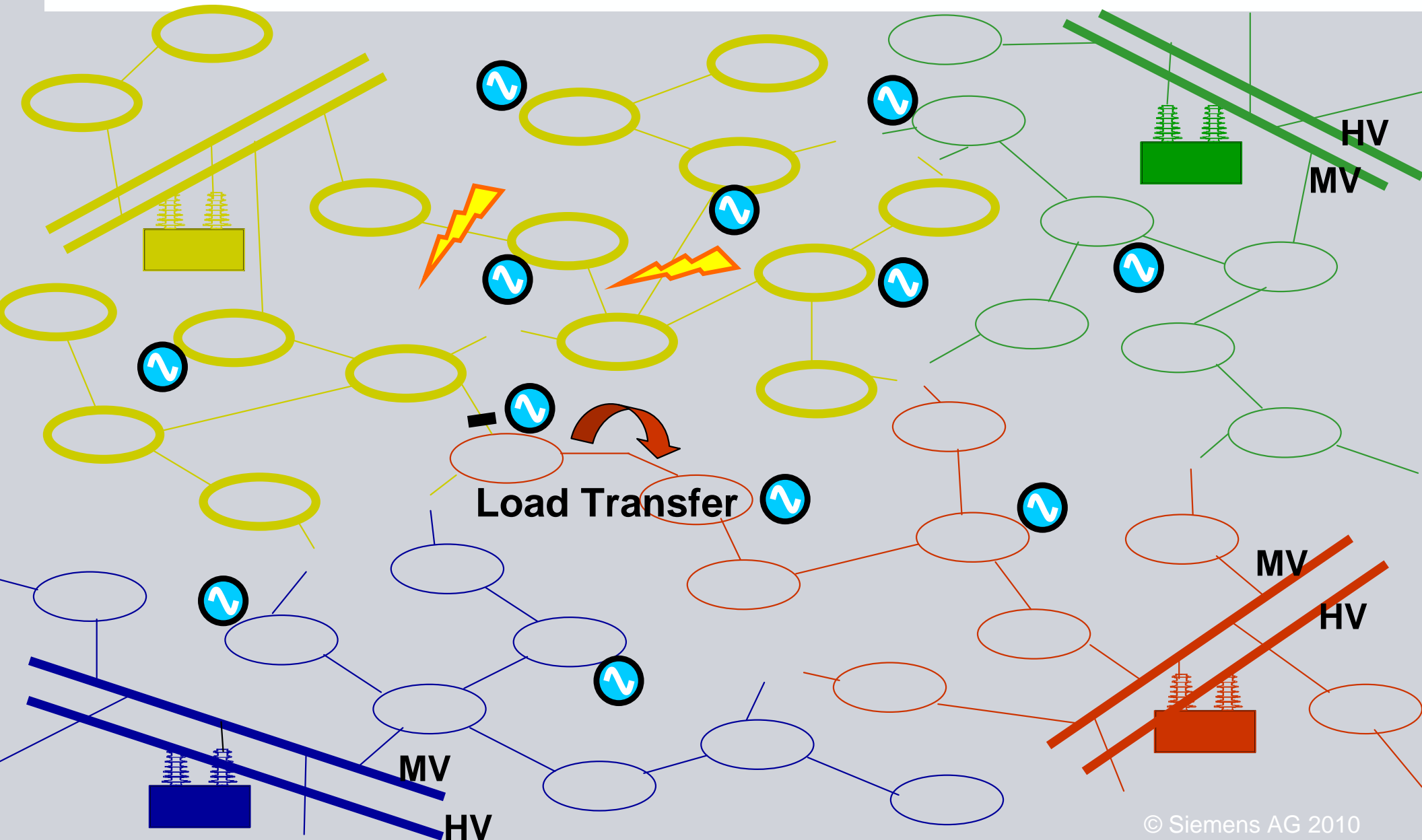
Advanced Network Operation

Example for problem in feeder with DG – Overloaded Line



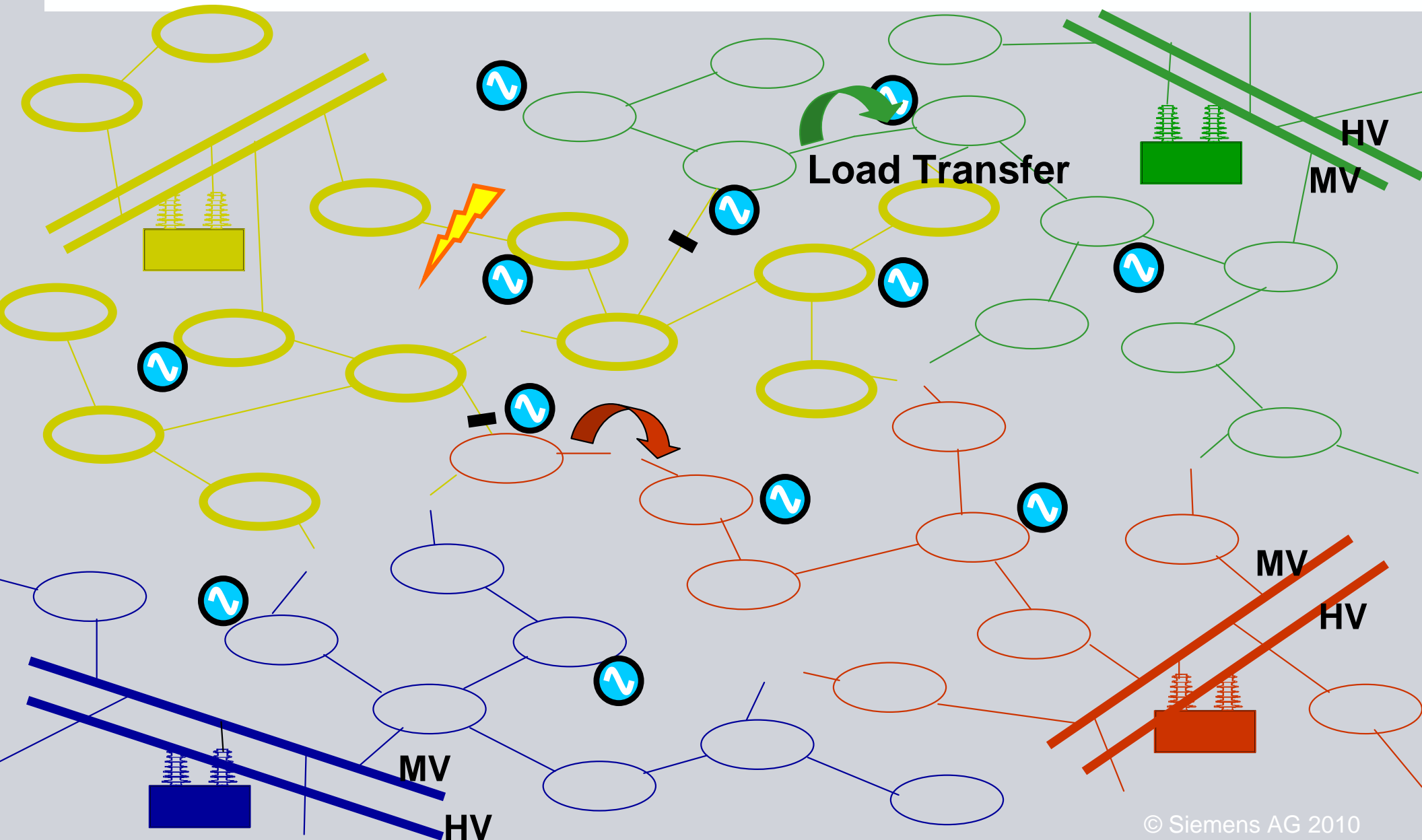
Advanced Network Operation

Example for problem in feeder with DG – Overloaded Line



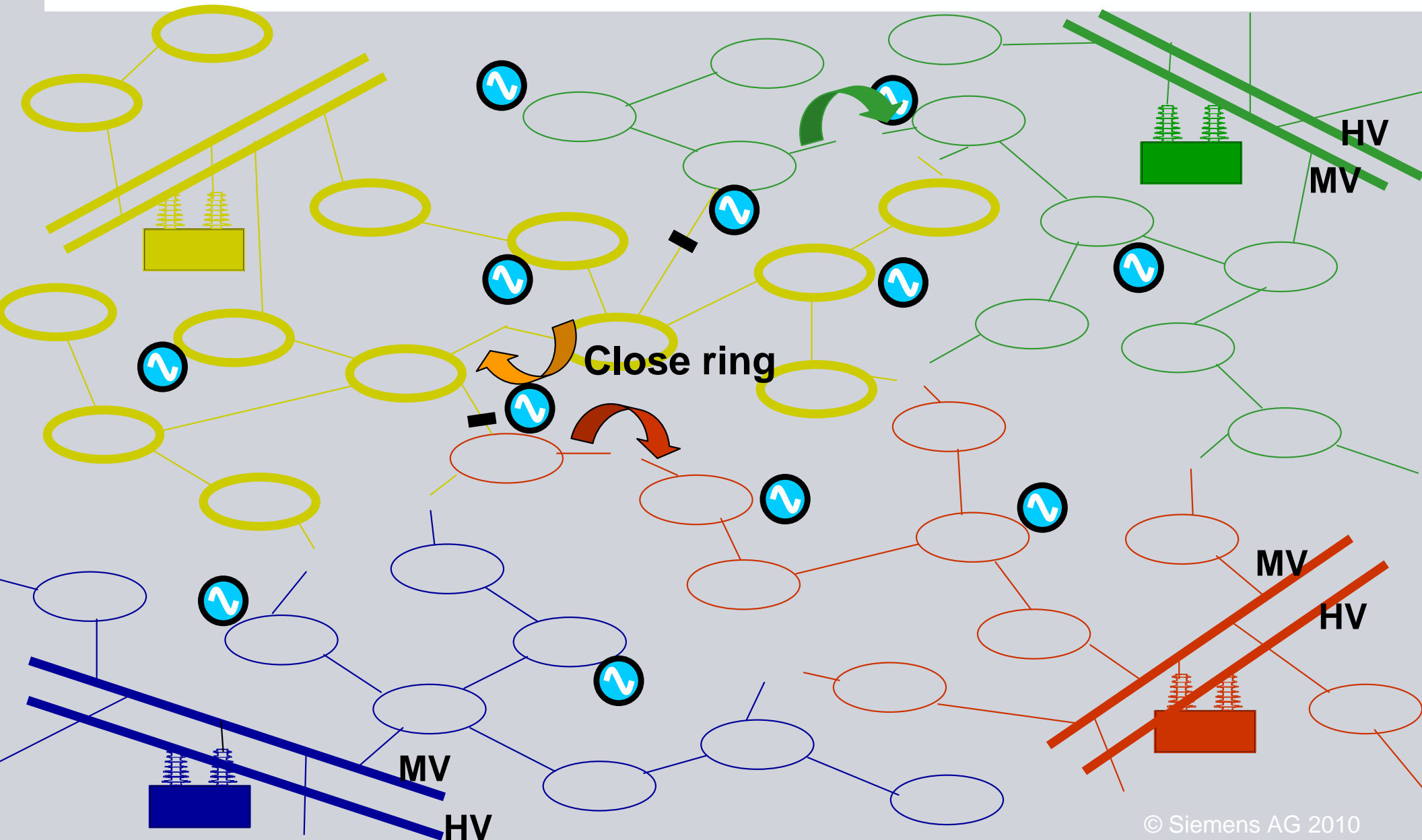
Advanced Network Operation

Example for problem in feeder with DG – Overloaded Line

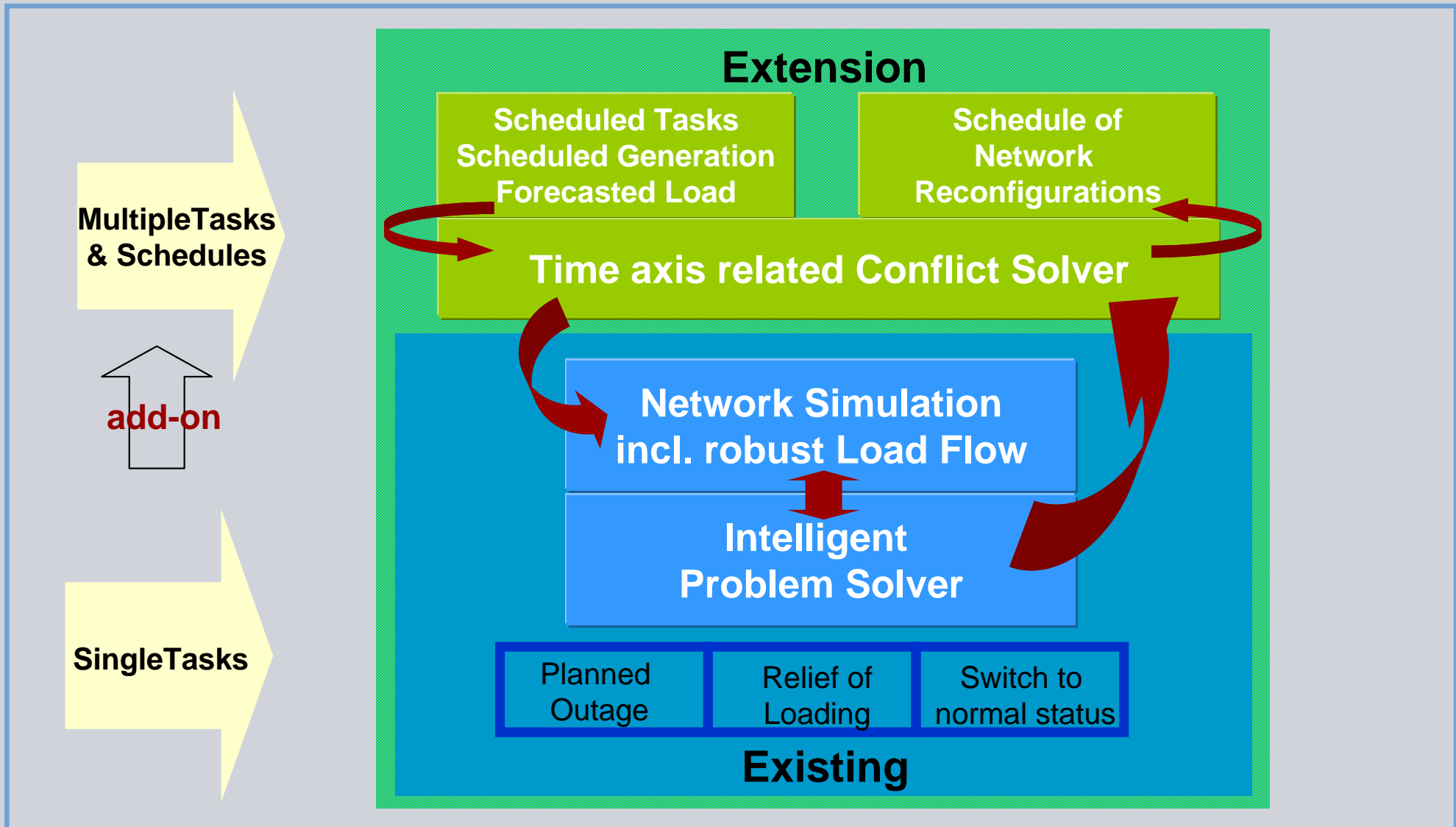


Advanced Network Operation

Example for problem in feeder with DG – Overloaded Line



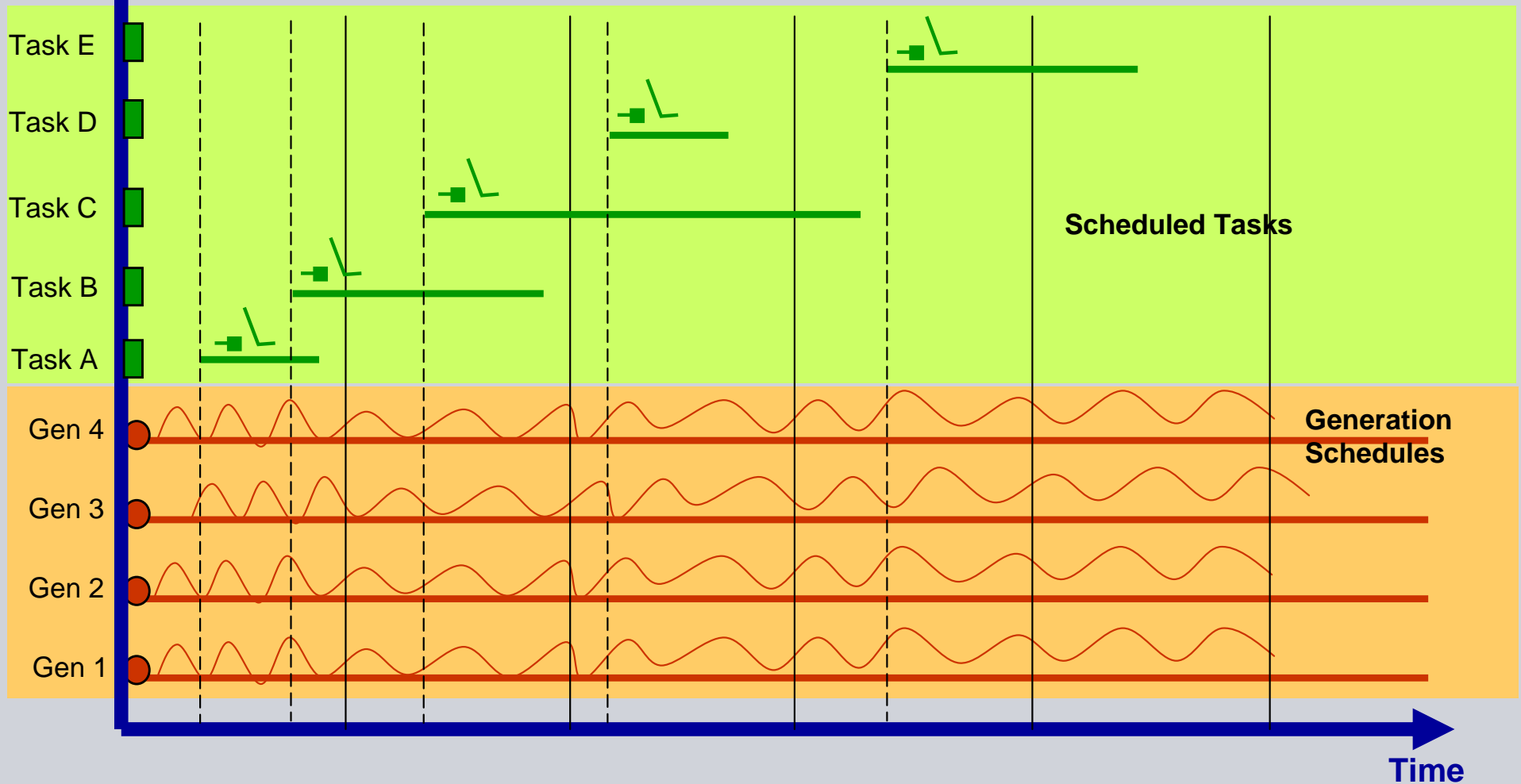
Advanced Network Operation + Objectives of actual R&D project



Advanced Network Operation + Objectives of actual R&D project

Schedules

Schedules of Tasks and Decentralized Energy Resources (DER)



Advanced Network Operation

References



PG Singapore	22 kV City (Singapore)
KELAG Austria	20 kV City & Province
MERALCO Phillipines	34, 13 kV City (Manila)
TIWAG Austria	20 kV City & Province
ADWEA Abu Dhabi	33, 11 kV City & Province
KFDCS Taiwan	22, 11 kV City (Kaohsiung)

ENELVEN Venezuela	24 kV City & Province
EON Hungary	20 kV City & Province
VSE Slovakia	20 kV City & Province
EAG Austria	20 kV City & Province
MEW Kuwait	33, 11 kV City & Province
DEWA Dubai	33, 11 kV City & Province

Introduction

DER Integration MV - Advanced Network Operation

DER Integration LV – Bringing Eyes to the LV grid

Summary



ISOLVES* – Bringing Eyes to the LV grid!

Austrian Example – EAG, DNO of Upper Austria

- **Main requirements of network operator:**
 - DNO's know few about low voltage grids
 - DNO planning is based on assumptions / simple estimations
 - DG – especially PV-systems- and in future e-mobility are upcoming issues
 - Detailed knowledge about low voltage grids, would allow a more efficient use!
- **Objectives:**
 - Use Smart Metering System (Siemens Metering System "AMIS") for measuring real conditions in LV grids (Gain real four wire modelling data)
 - Building the base for Smart Grid solutions to integrate Distributed generation

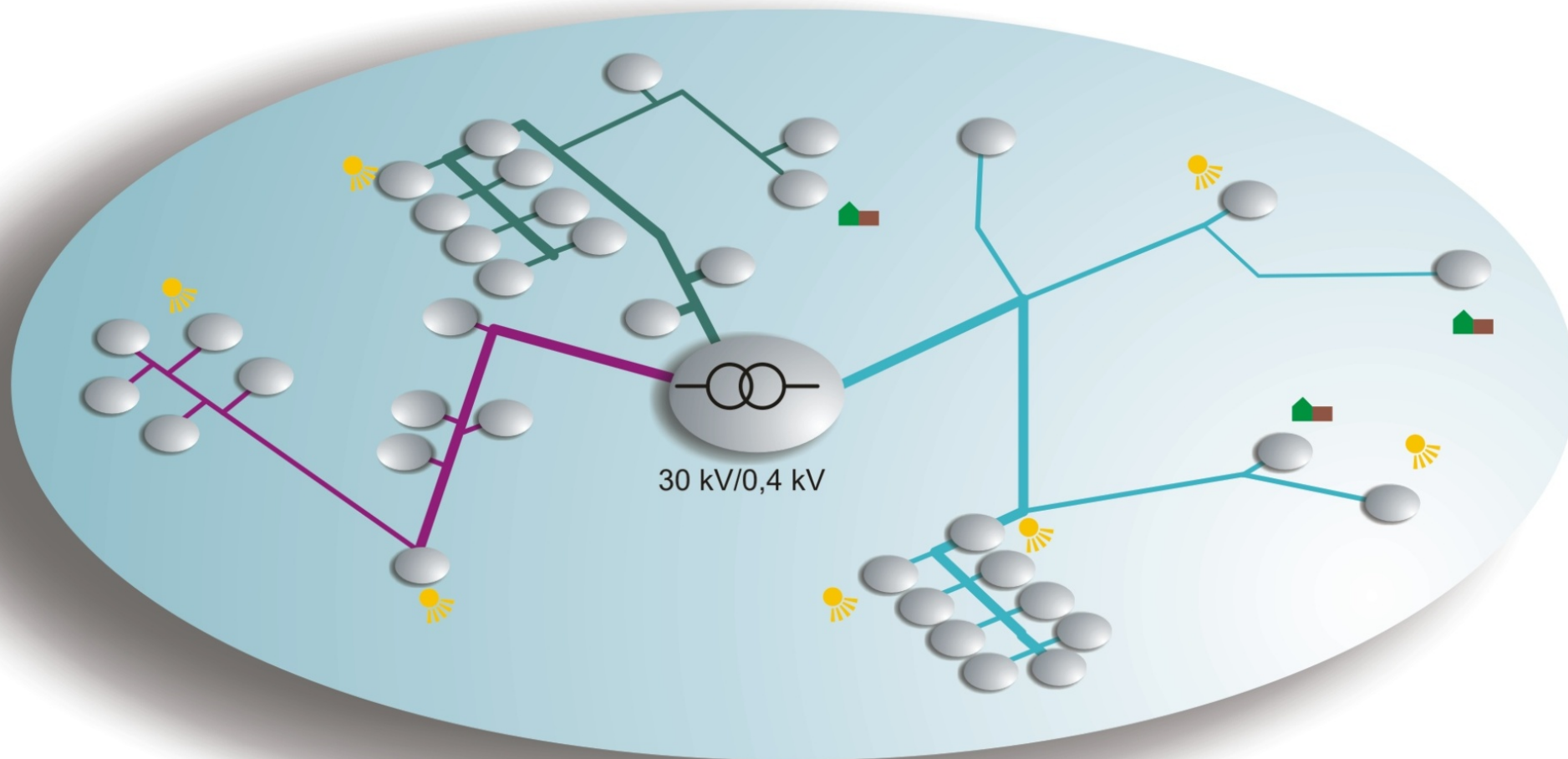


* Innovative Solutions for Optimization of Low Voltage Electrical Systems

ISOLVES – Bringing Eyes to the LV grid!

What do we know about LV grids?

Typical rural European LV Grid today

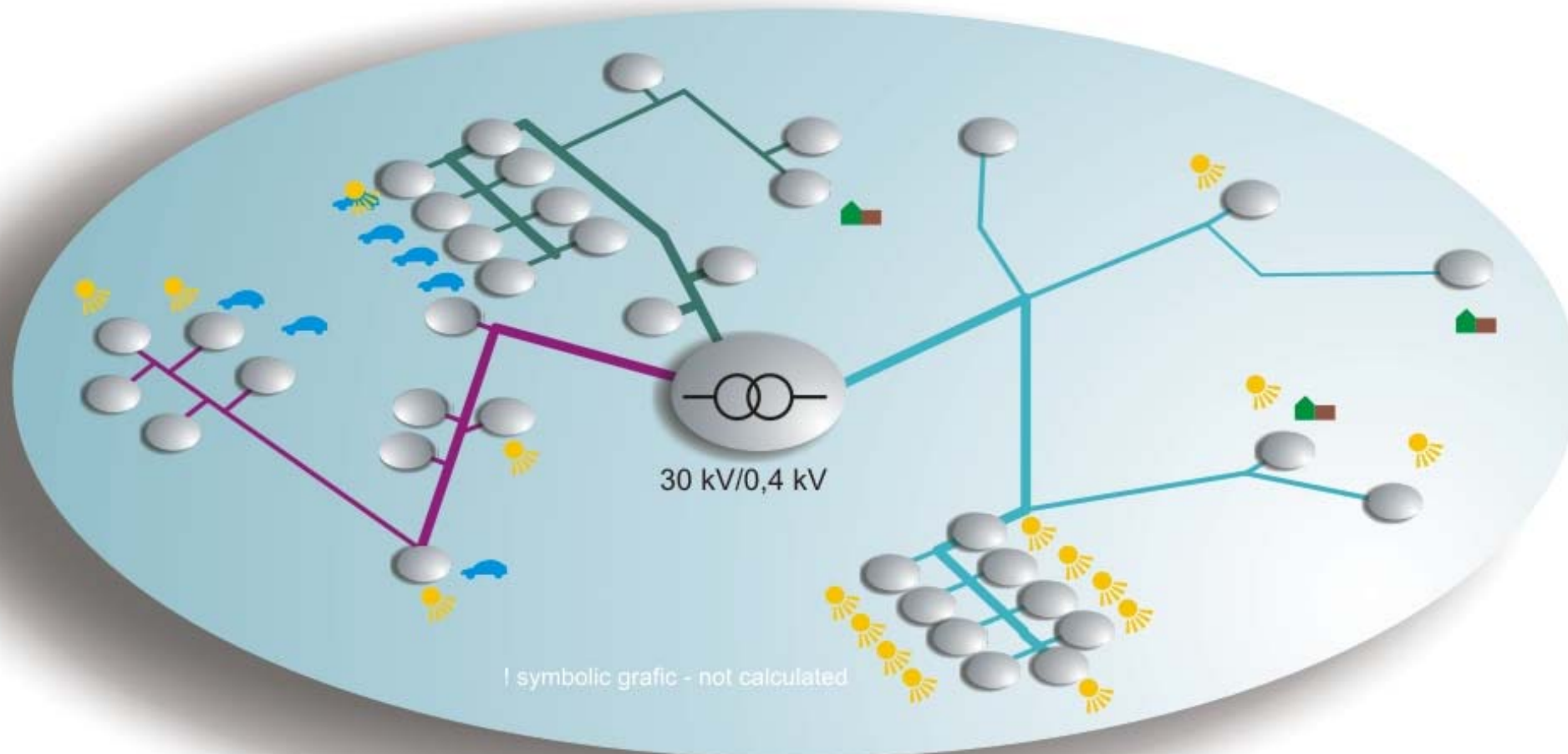


Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

What do we know about LV grids?

Actual and future problems arising by PV and e-mobility



Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Solution 1: Long term + wide area voltage band observations

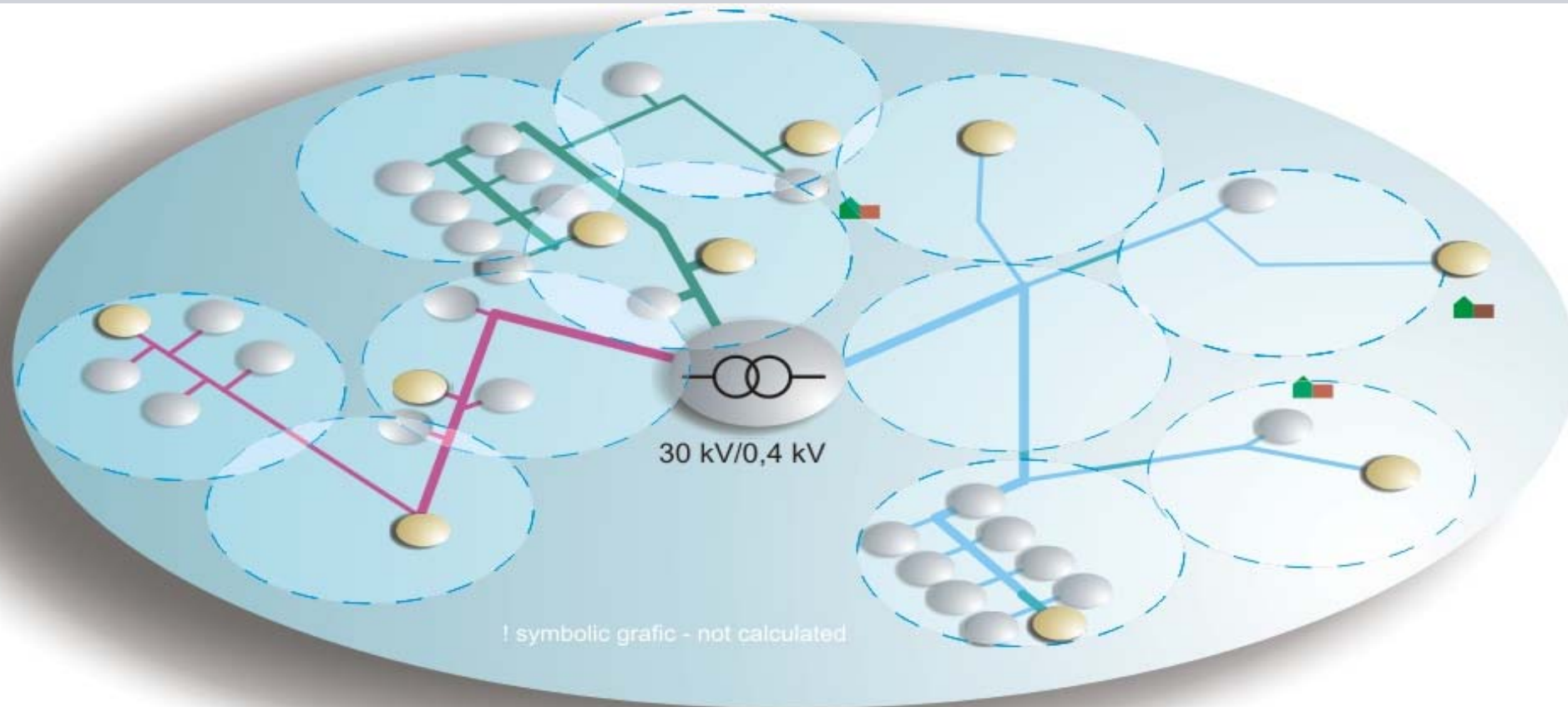
- **Status Quo:** Rural distribution grids are planed in respect to voltage levels – urban grids in respect to maximum current.
- **Required:** Long term and wide area observations using low cost systems (investment & operation)
- **Solution:** Using smart meters for doing weekly statistics of voltage levels and maximum load
 - Each meter contains a measuring and processing units providing voltage, power and reactive power. Results can be transmitted automatically

- **Technical & functional aspects:**
 - a fully automated organization and presentation of data
 - a compression of data for transmission and storage
 - it is presupposed that a standard meter can be programmed for these functions without any additional costs for extensions of hardware.

ISOLVES – Bringing Eyes to the LV grid!

Solution 1: Long term + wide area voltage band observations

Weekly histograms: 15-min-AVG, -MIN, -MAX, balance; just histogram data
maximum distance of points of observation 50...70 m



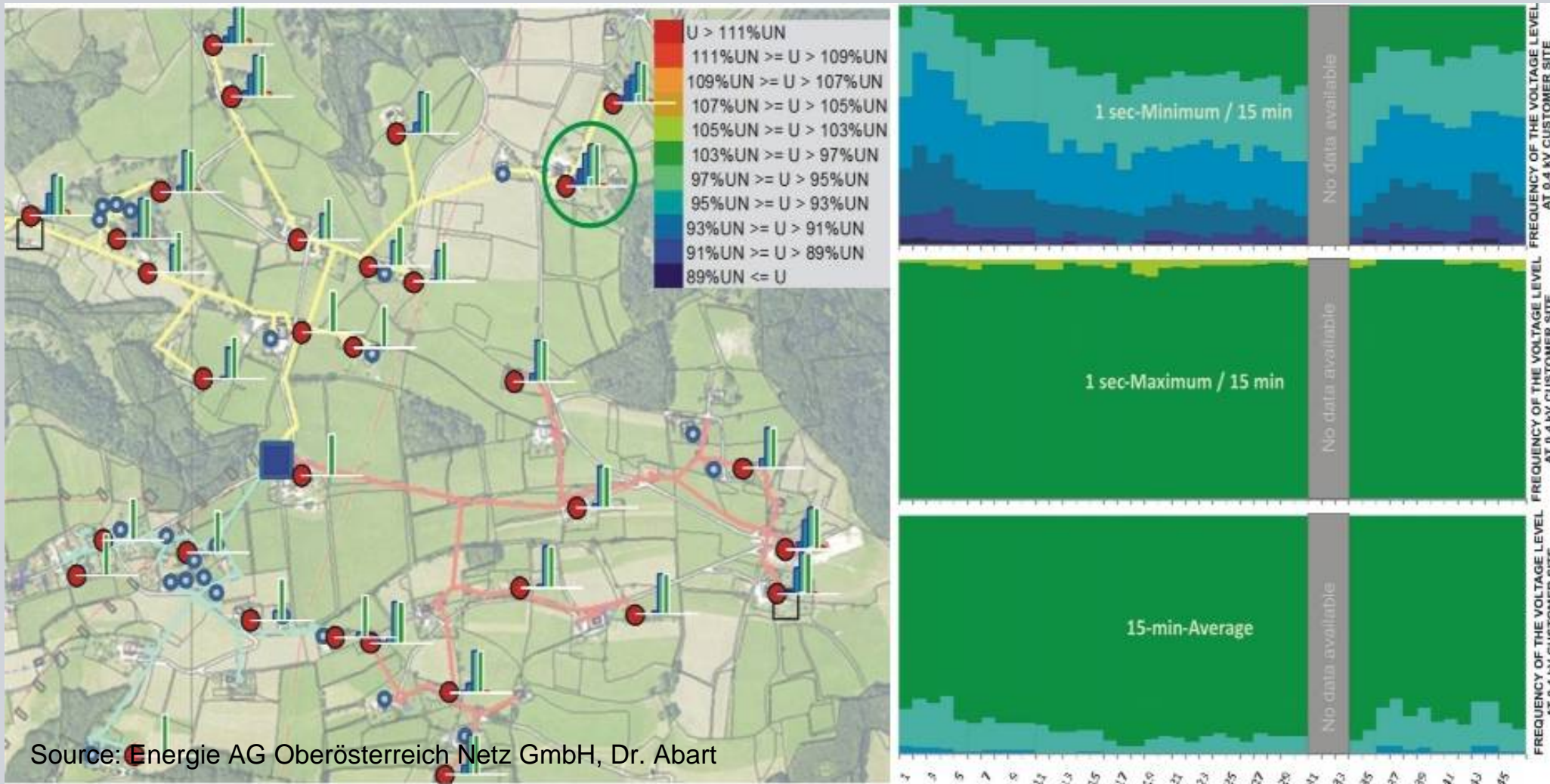
Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

3 branches, 38 Meters, 10 PQ-Meters/ PSSA-Trigger

ISOLVES – Bringing Eyes to the LV grid!

Solution 1: Long term + wide area voltage band observations

Weekly histograms: 15-min-AVG, -MIN, -MAX, balance; just histogram data
maximum distance of points of observation 50...70 m

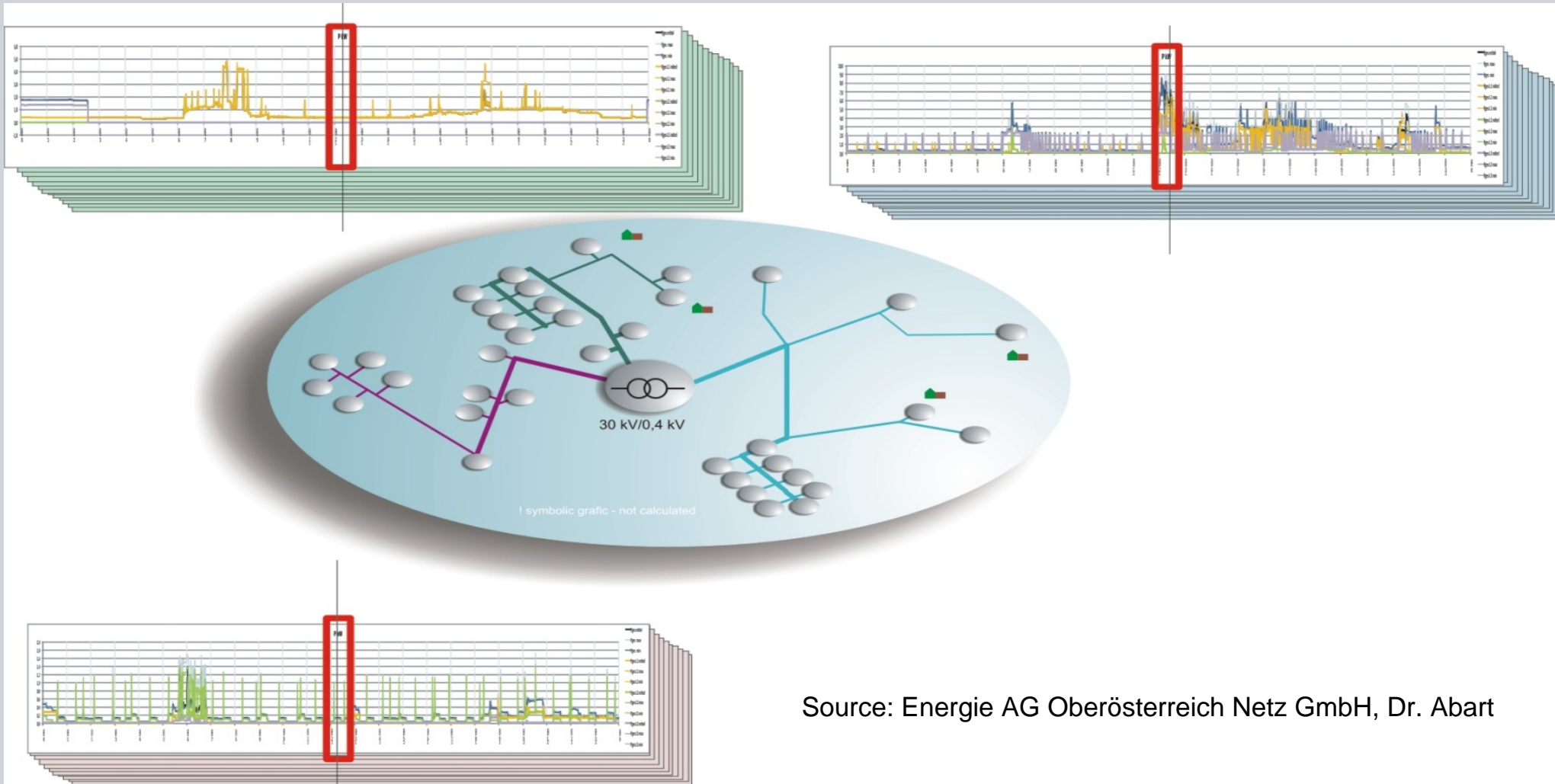


Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Solution 2: Power Snap Shots

measuring 1-sec-rms in synchronous intervals at each meter:
3 x Voltage, 3 x Power and 3 x reactive Power;

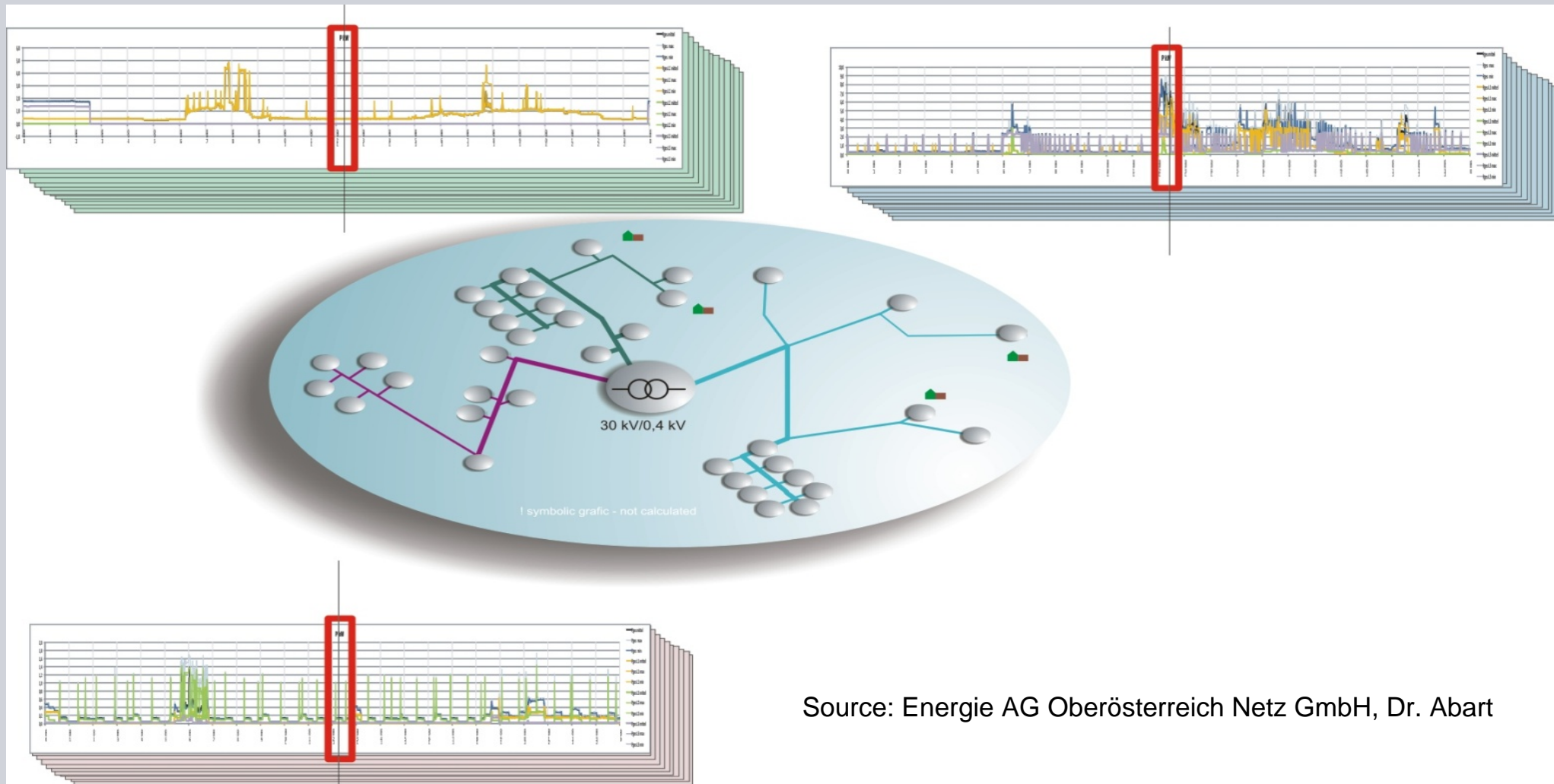


Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Solution 2: Power Snap Shots

About 20% of meters are defined to propose trigger. Proposals are sent to the data concentrator where the trigger moment is selected



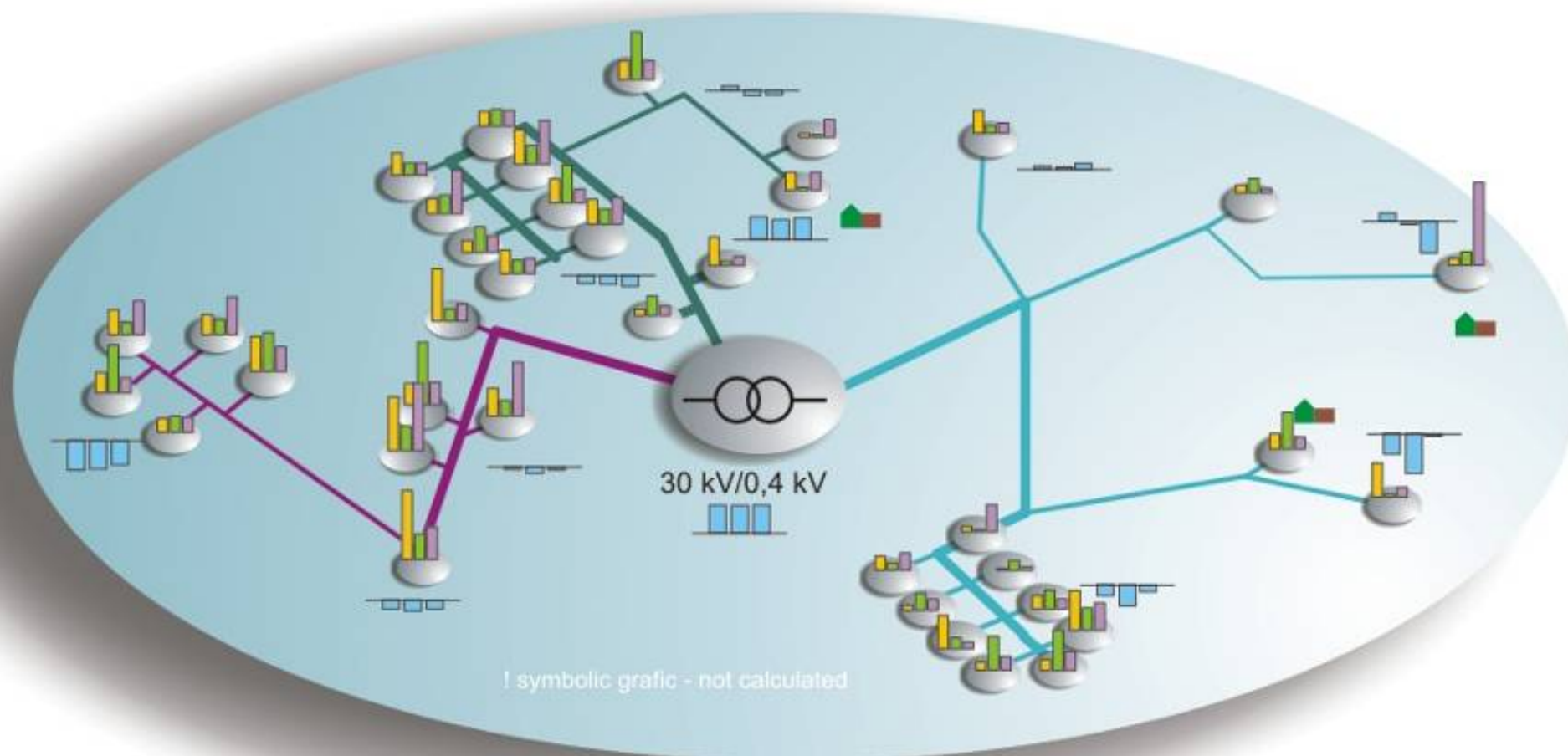
Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Solution 2: Power Snap Shots



PSS of a real LV grid today



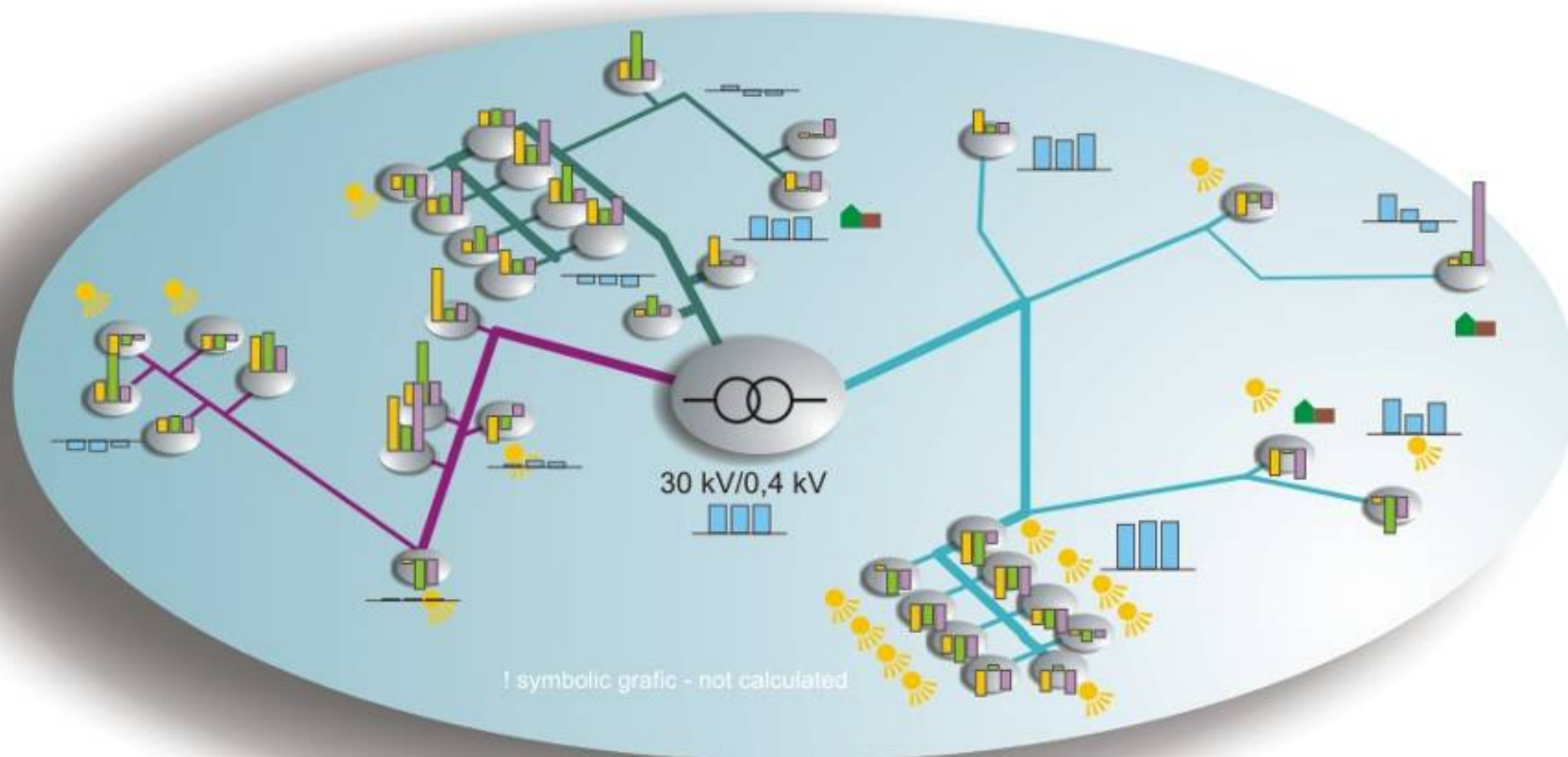
Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Solution 2: Power Snap Shots



PSS of a real LV grid tomorrow



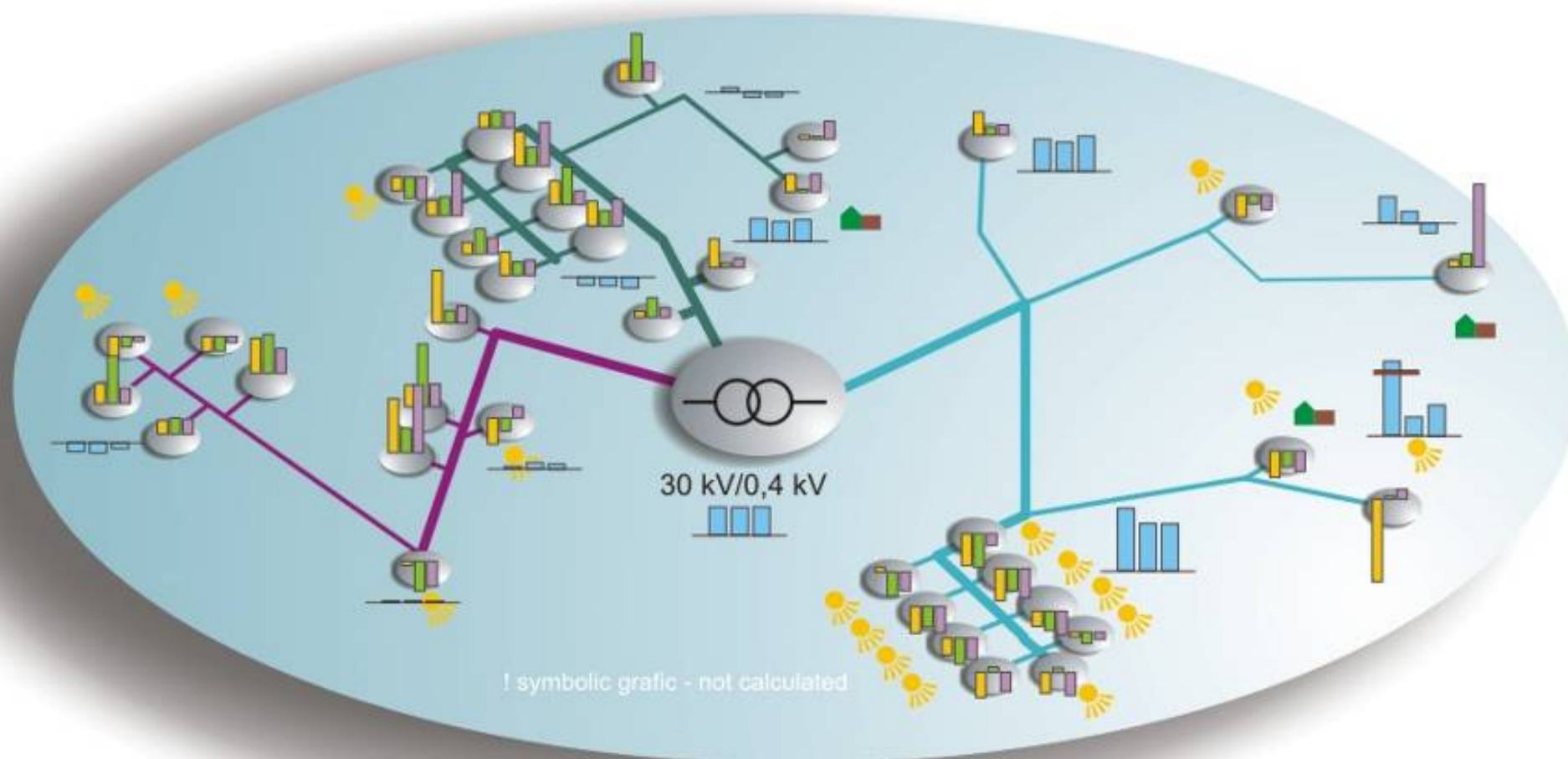
Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Solution 2: Power Snap Shots

SIEMENS

PSS of a real LV grid tomorrow – single phase

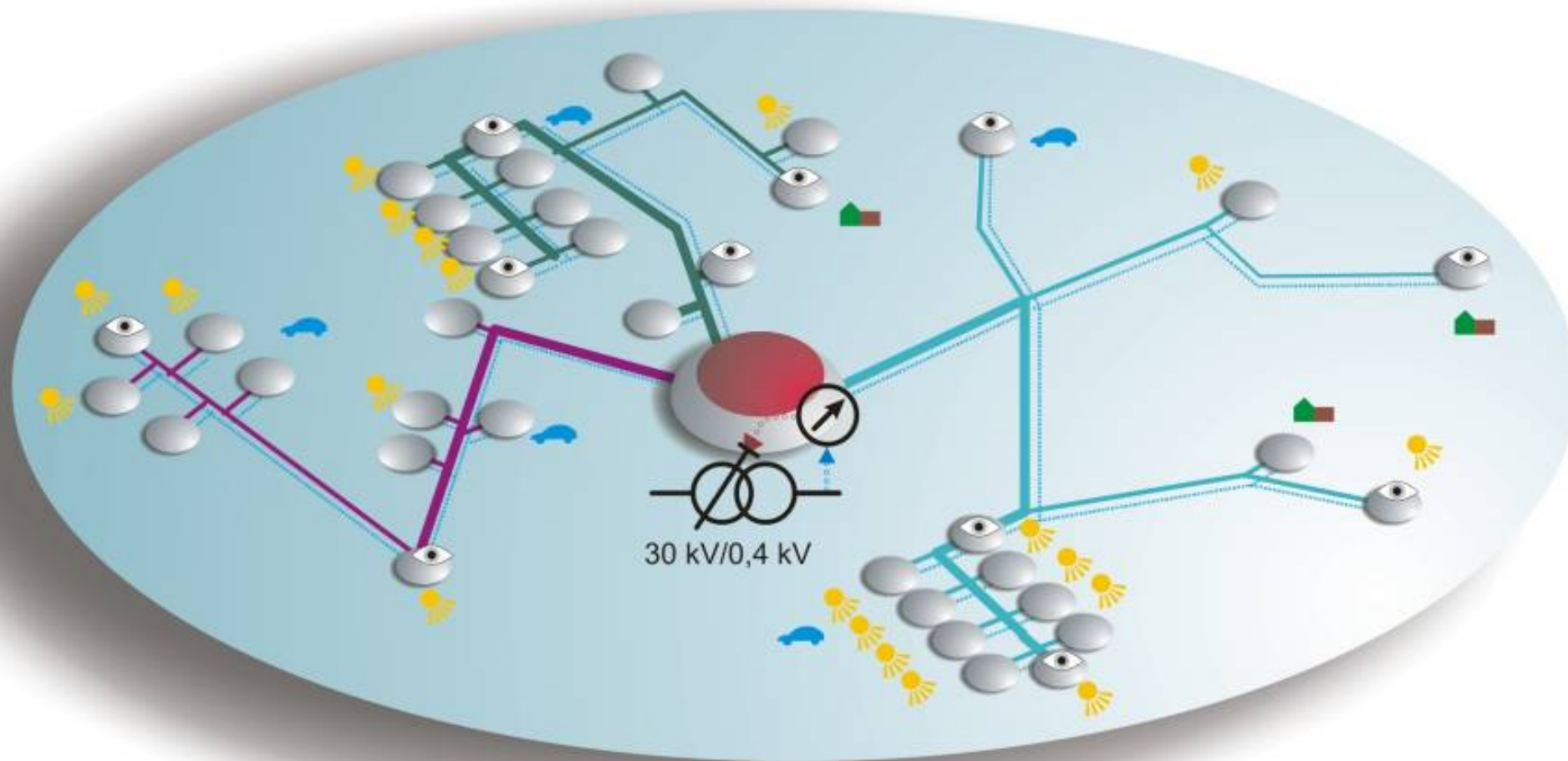


Source: Energie AG Oberösterreich Netz GmbH, Dr. Abart

ISOLVES – Bringing Eyes to the LV grid!

Potential future Smart Grid solution for LV grids

Voltage Control at Secondary Substation Node – based on Smart Metering inputs



Quelle: Energie AG Oberösterreich Netz GmbH, Dr. Abart

Introduction

DER Integration MV - Advanced Network Operation

DER Integration LV – Bringing Eyes to the LV grid

Summary



- **Austrian R&D and Demo Focus:**

- Integrated planning AND operation of distributed networks with consumer integration and high share of DER



- **Active Distribution Grids and Decentralized Energy Management** are the **core competences** of **Siemens CEE**.

- **Advanced Network Operation System can handle:**

- operational planning, emergency planning, real-time
- cares about continuous supply of customers & DG / DER



- **Smart Metering System (Siemens System “AMIS”)** can be used for:

- measuring real conditions in LV grids (Gain real four wire modelling data)
- build the base for Smart Grid solutions to integrate DG / DER