Analysis Environment for LV Networks

Analysis of LV Network Model Parameters by Smart Meter Measurements

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Content

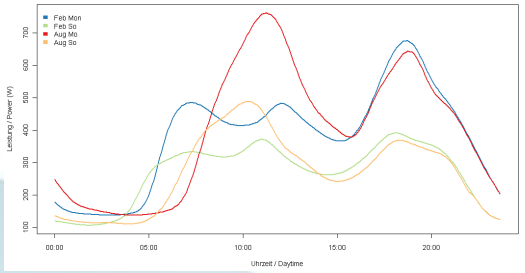
- Introduction
- PSSA Method
- Simulation of the PSSA
- PSS Host – Analysis Environment
- First Power SnapShot
- Outlook and first findings

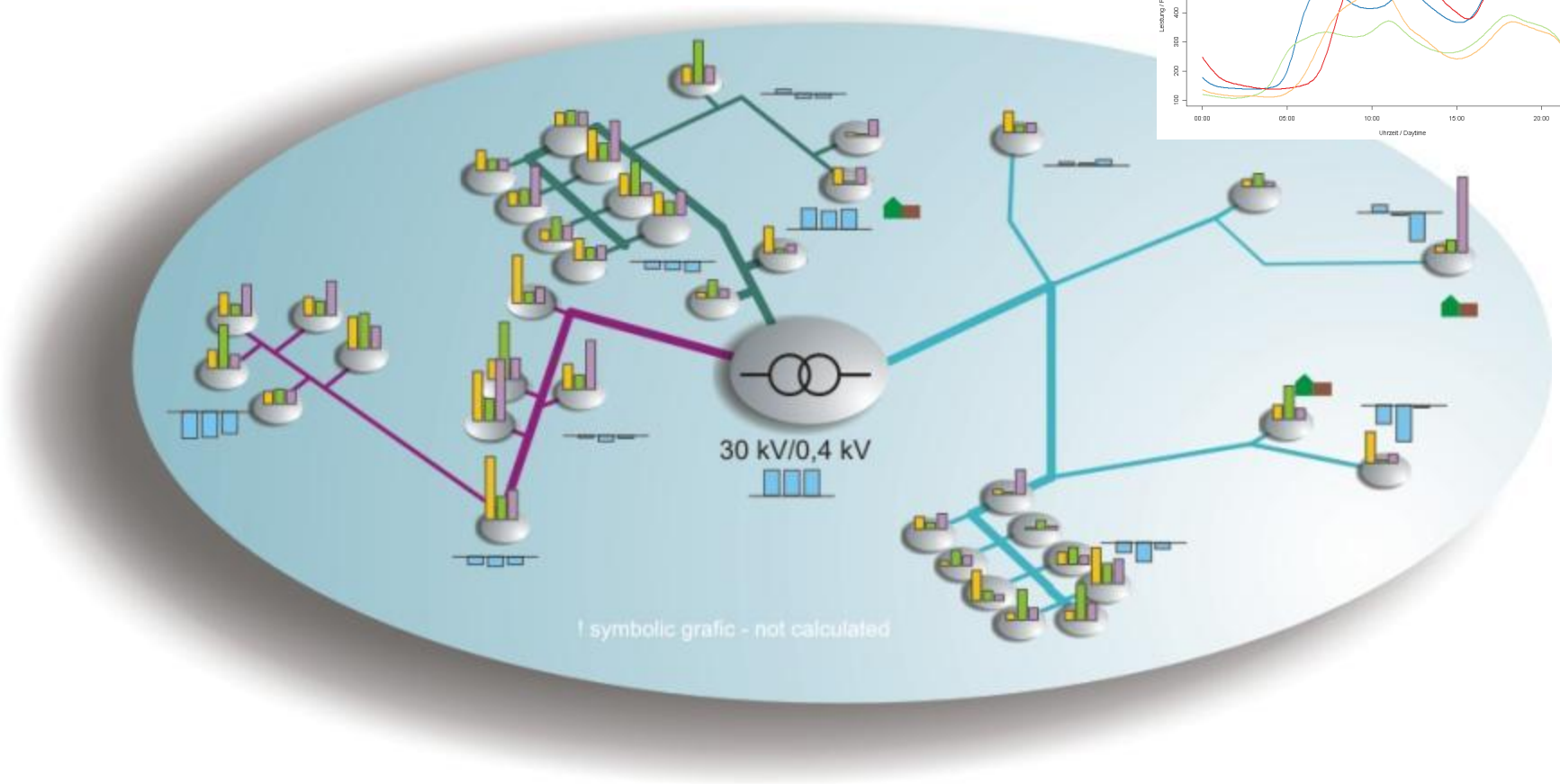
Low Voltage Distribution Networks

Status quo in planning and operation

Low Voltage Networks

Current state of operation and planning methods

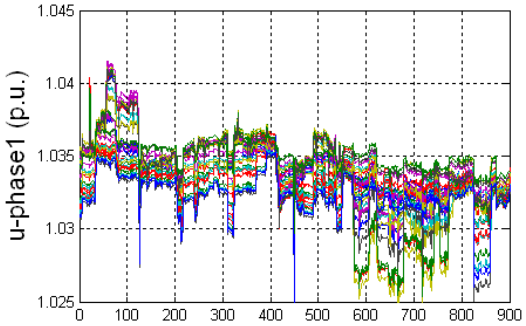


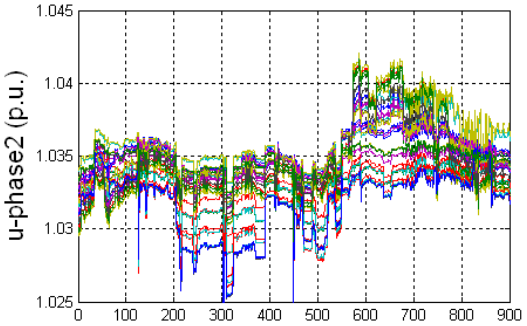


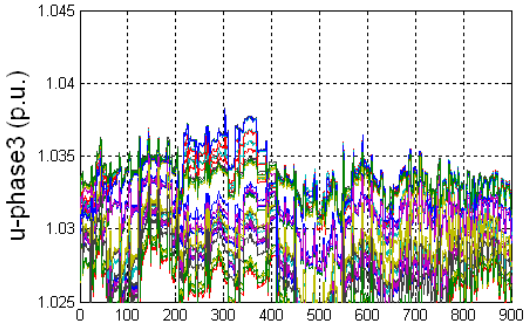
Low Voltage Networks

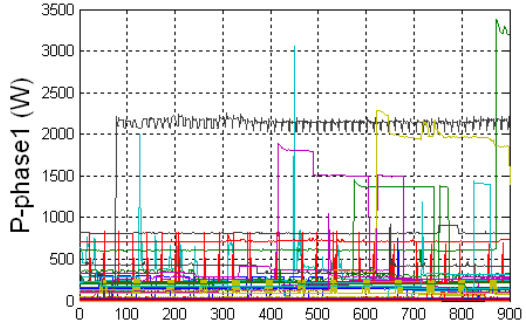
Real voltage and power profiles

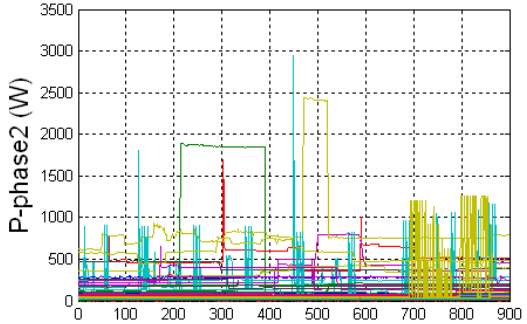
- 900 1-sec RMS values of voltages and powers of all nodes

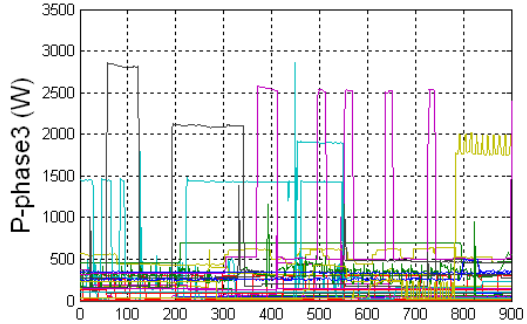












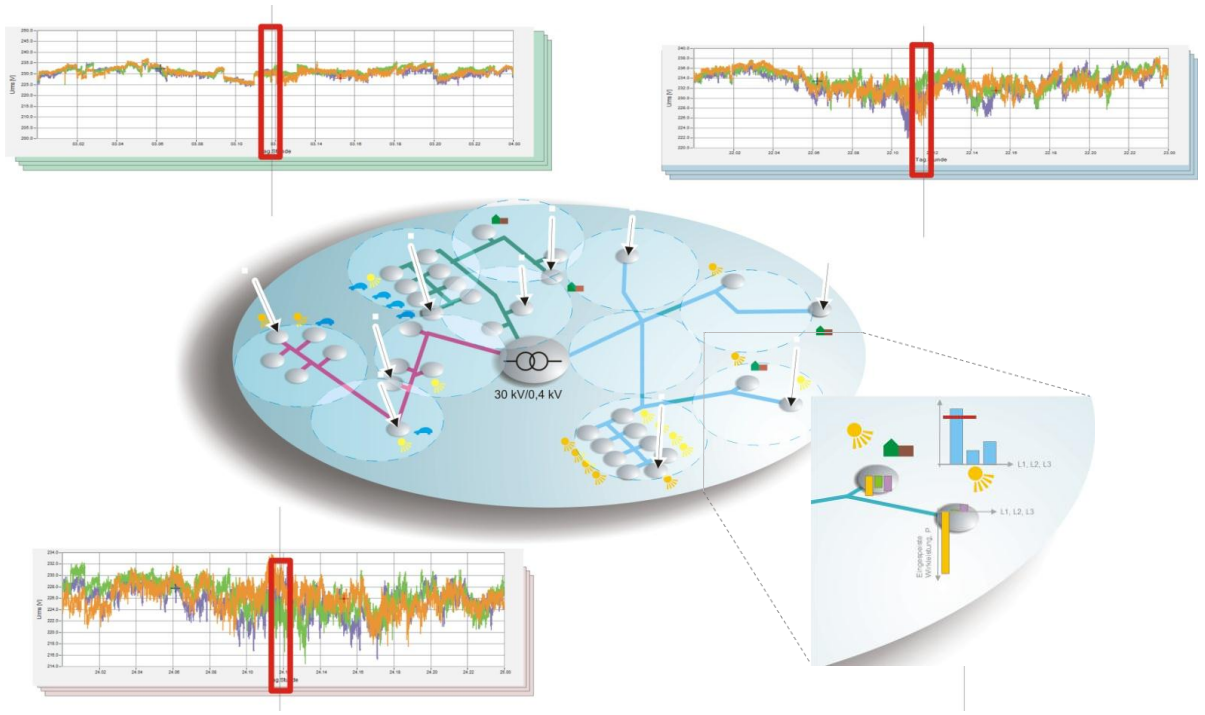
PSSA Method

Power SnapShot Analysis

PSSA Method

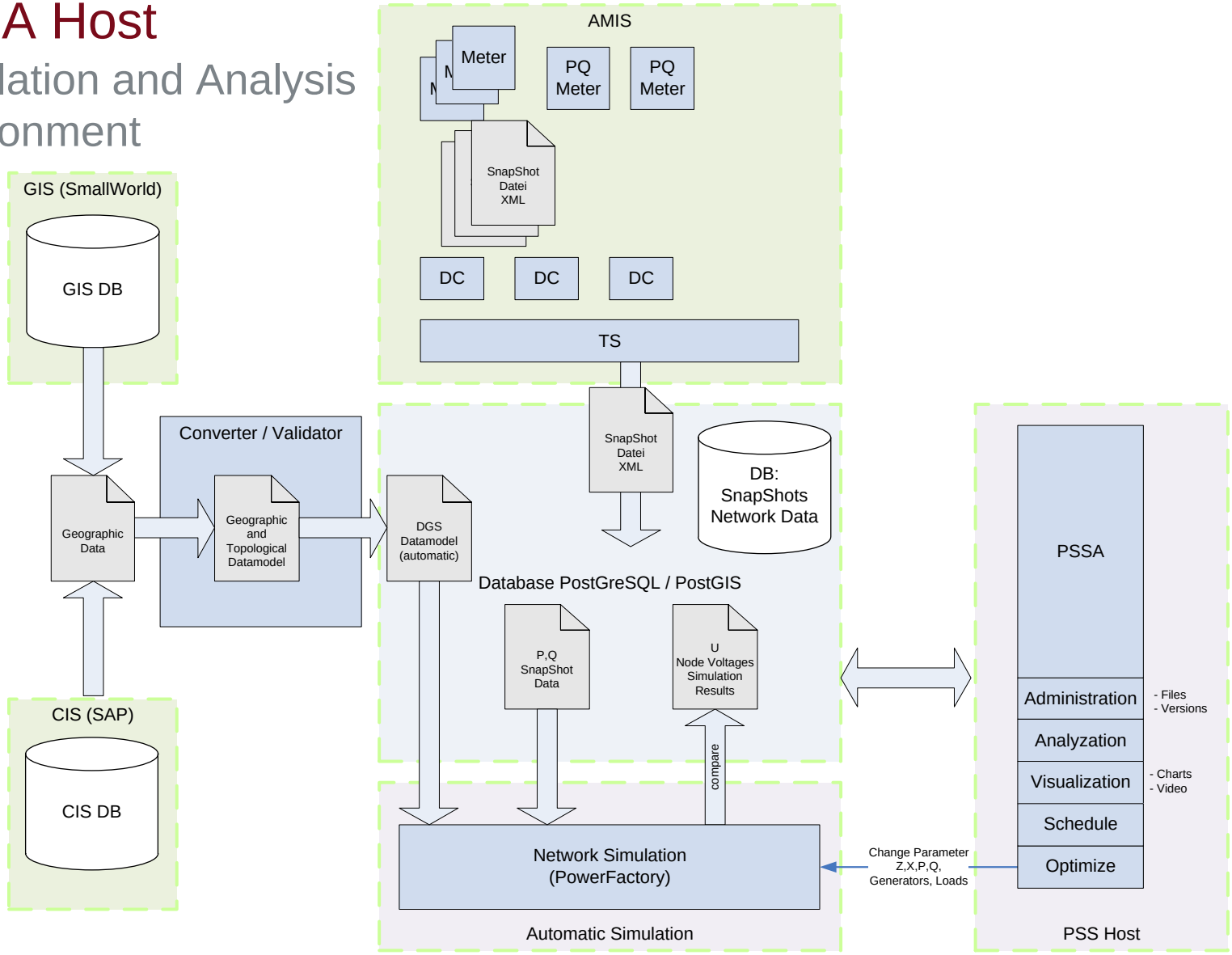
Power SnapShot Analysis

- **Synchronized measurements** per meter (1 sec-RMS)
  - 3x voltages, 3x current, 3x active and 3x reactive power
- **Trigger suggestions** sent to dataconcentrator, where triggers are selected



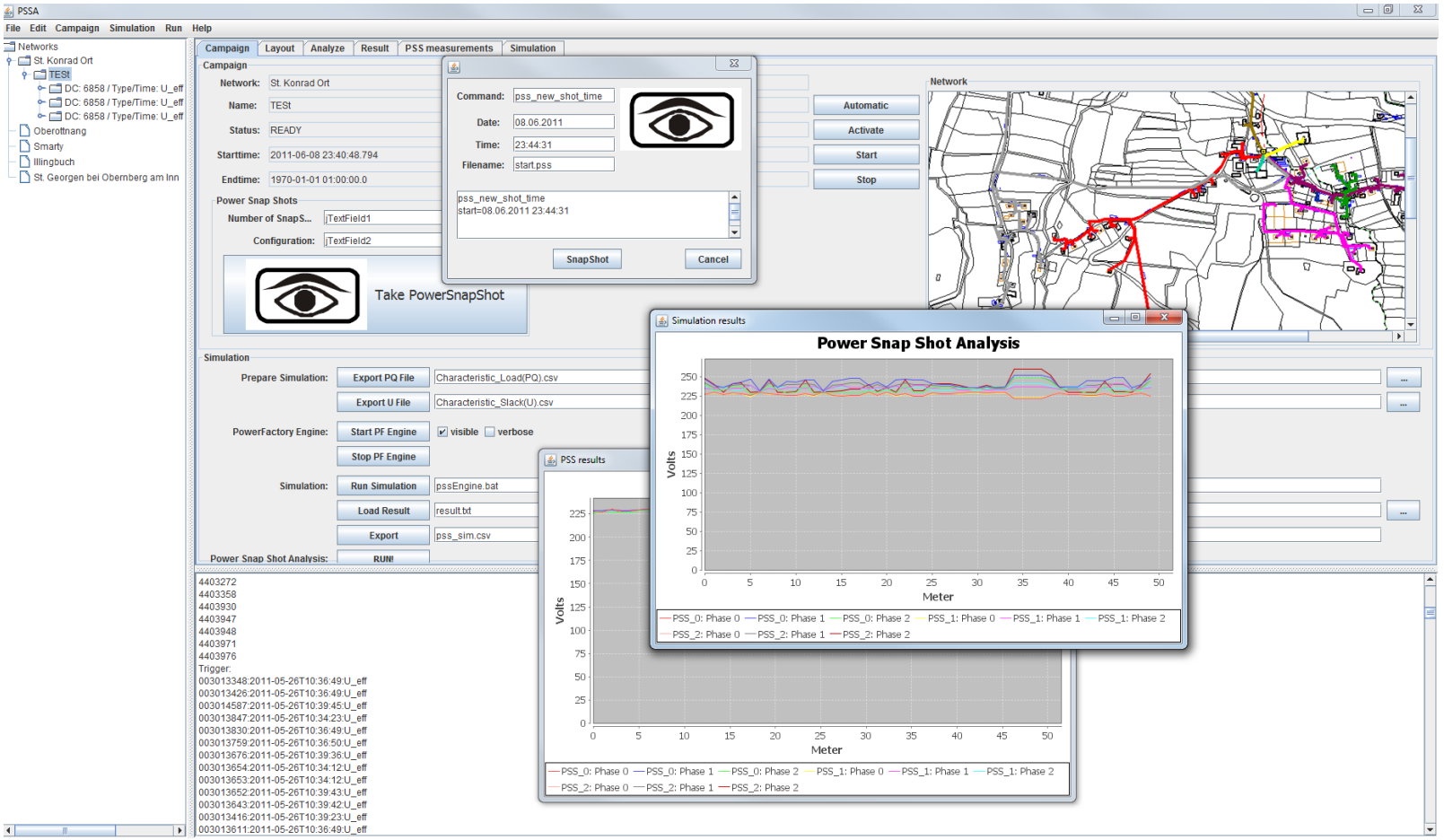
PSSA Host

Simulation and Analysis Environment



PSS Host

- Management and analysis of the Power SnapShots

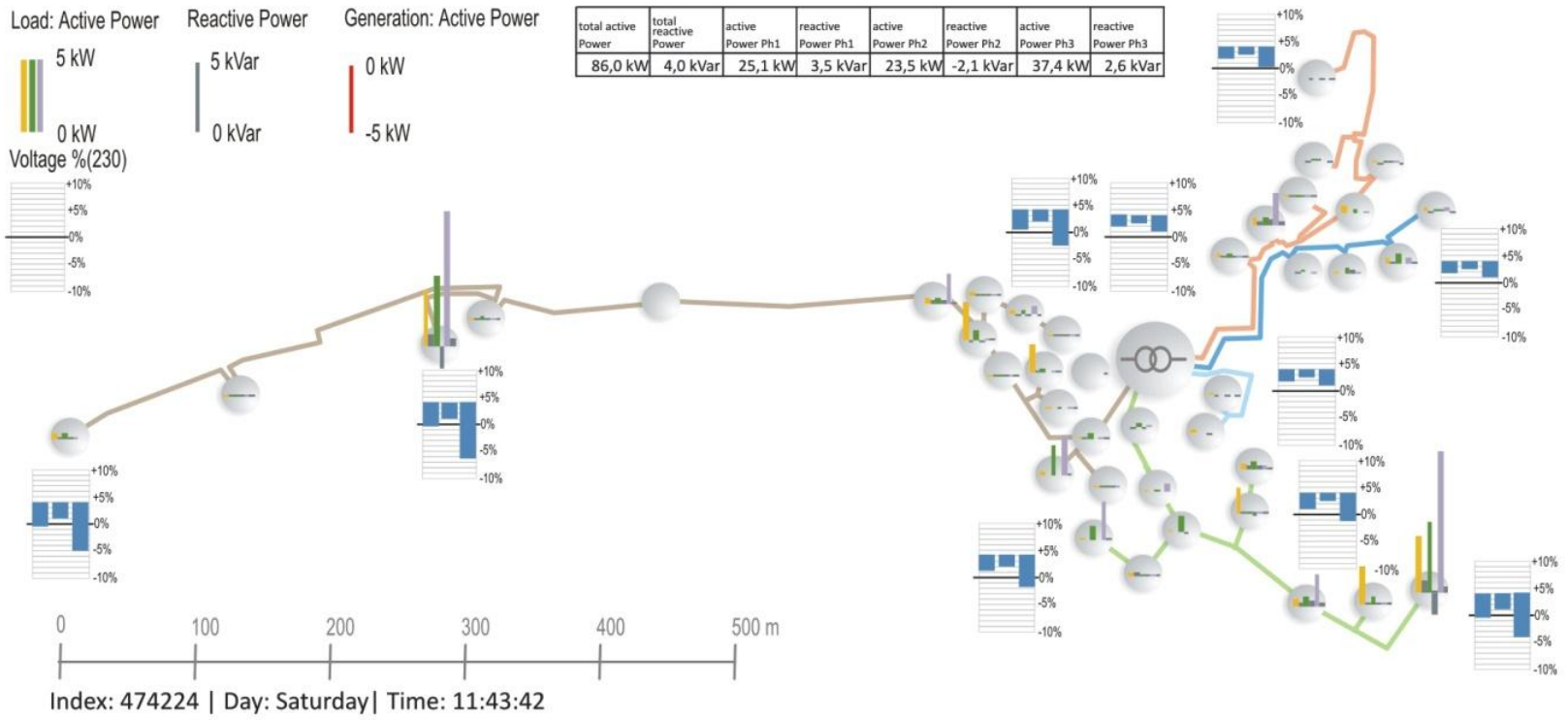


Simulation of the PSSA Method

Power SnapShot Analysis

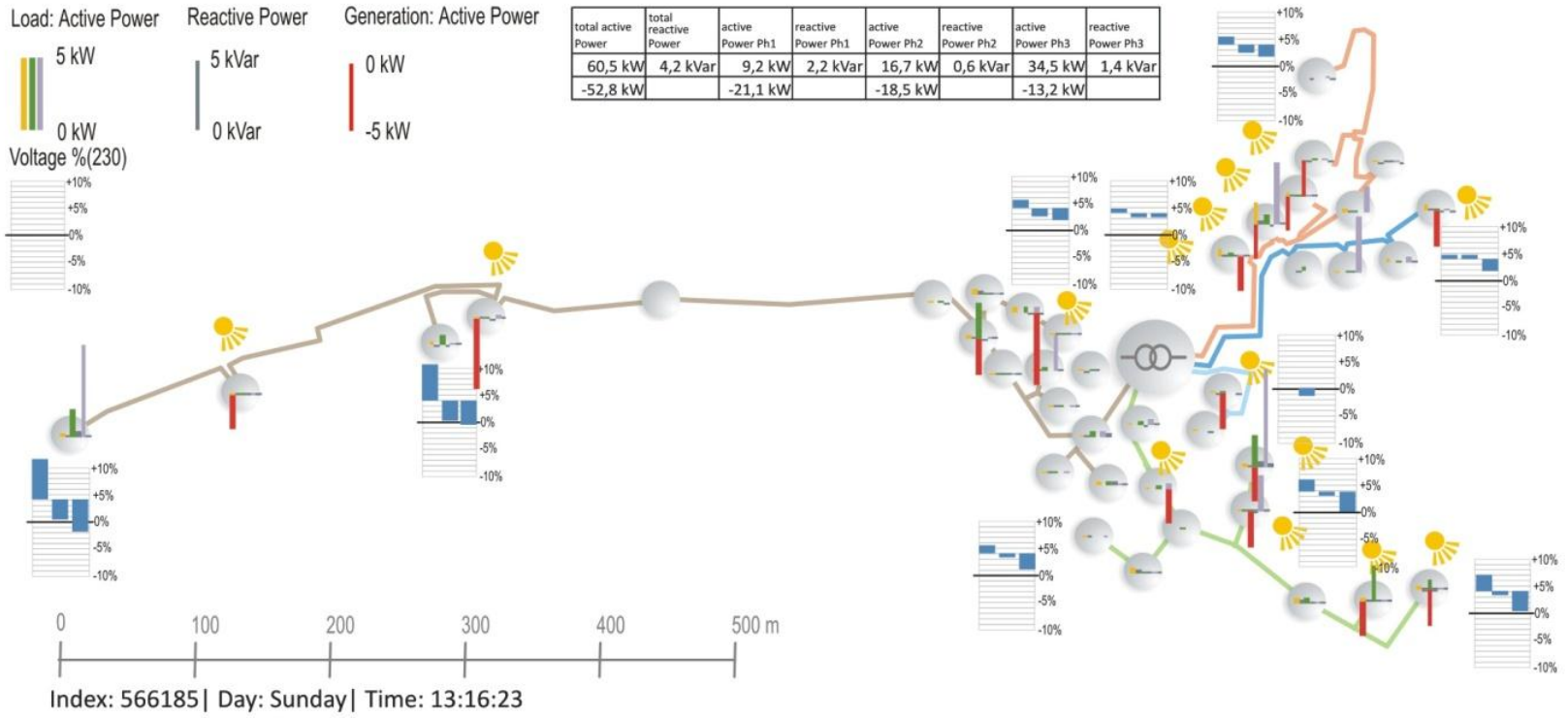
Simulation of the Power SnapShot Analysis

- Power SnapShot in the Smartie Grid



Simulation – Scenarios with PV

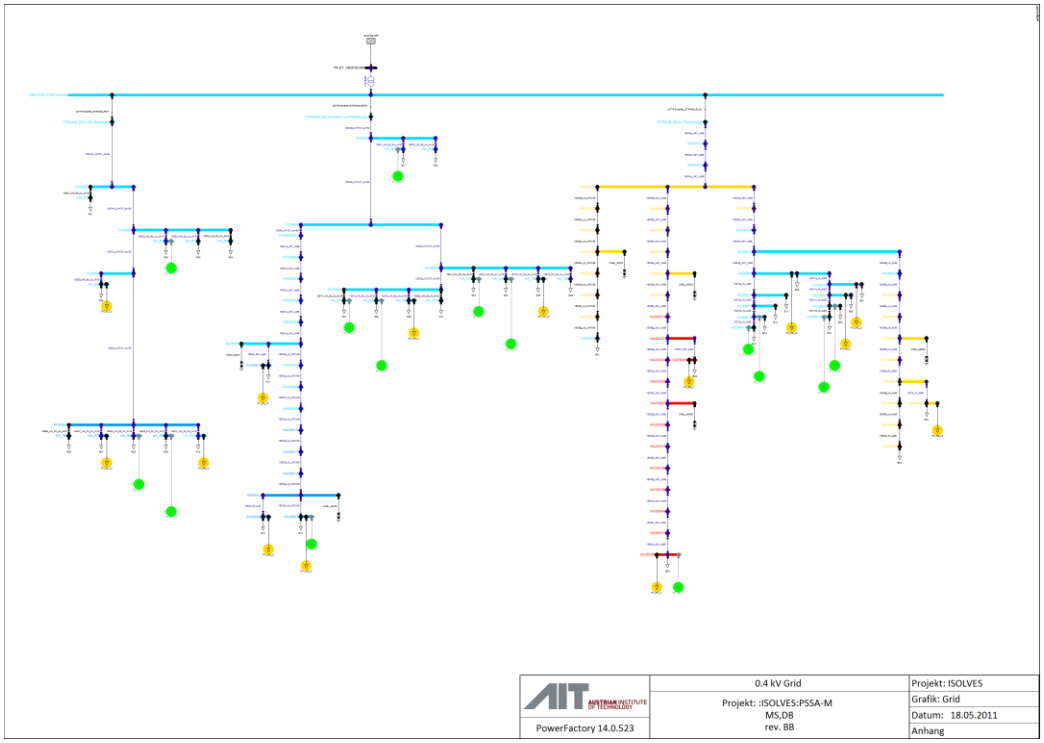
- Power Snap Shot with additional single phase PV



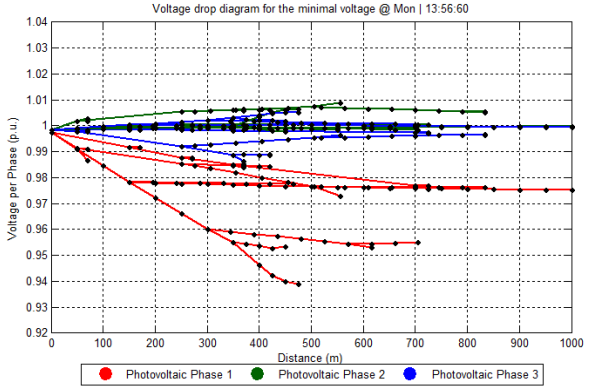
total active Power	total reactive Power	active Power Ph1	reactive Power Ph1	active Power Ph2	reactive Power Ph2	active Power Ph3	reactive Power Ph3
60,5 kW	4,2 kVar	9,2 kW	2,2 kVar	16,7 kW	0,6 kVar	34,5 kW	1,4 kVar
-52,8 kW		-21,1 kW		-18,5 kW		-13,2 kW	

Simulation – voltage drop diagram

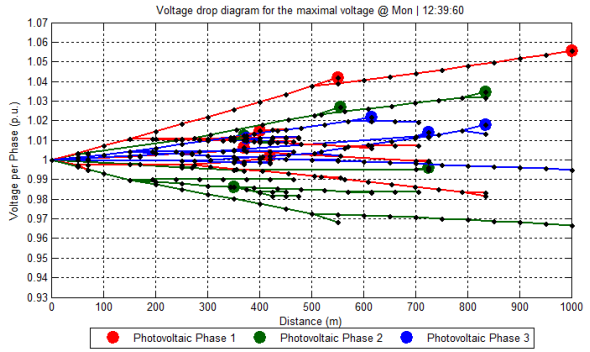
- Smartie Grid



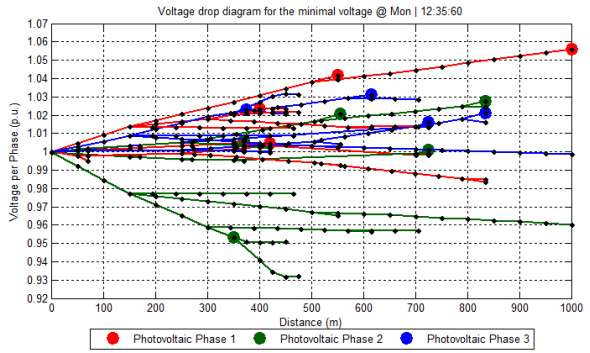
no PV
no EV



with PV
no EV

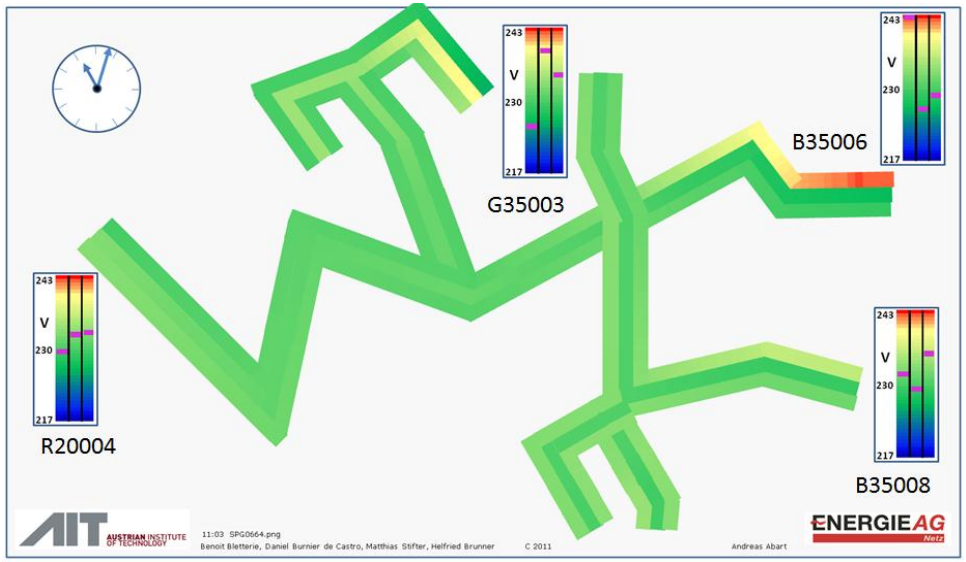


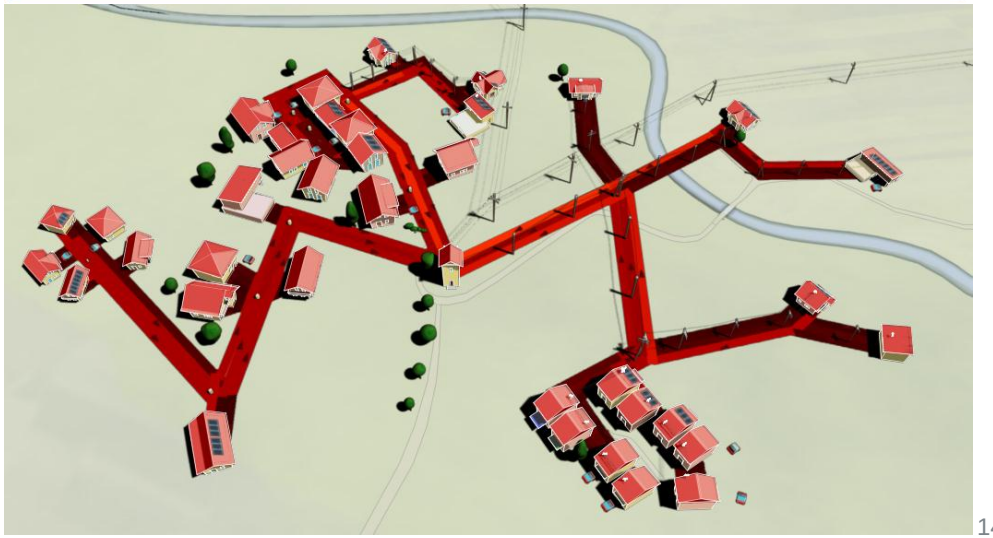
with PV
with EV



Visualisation of the network state during a day

- **Voltage rise** due to (single phase) PV
- **Reverse** of the **power** flow



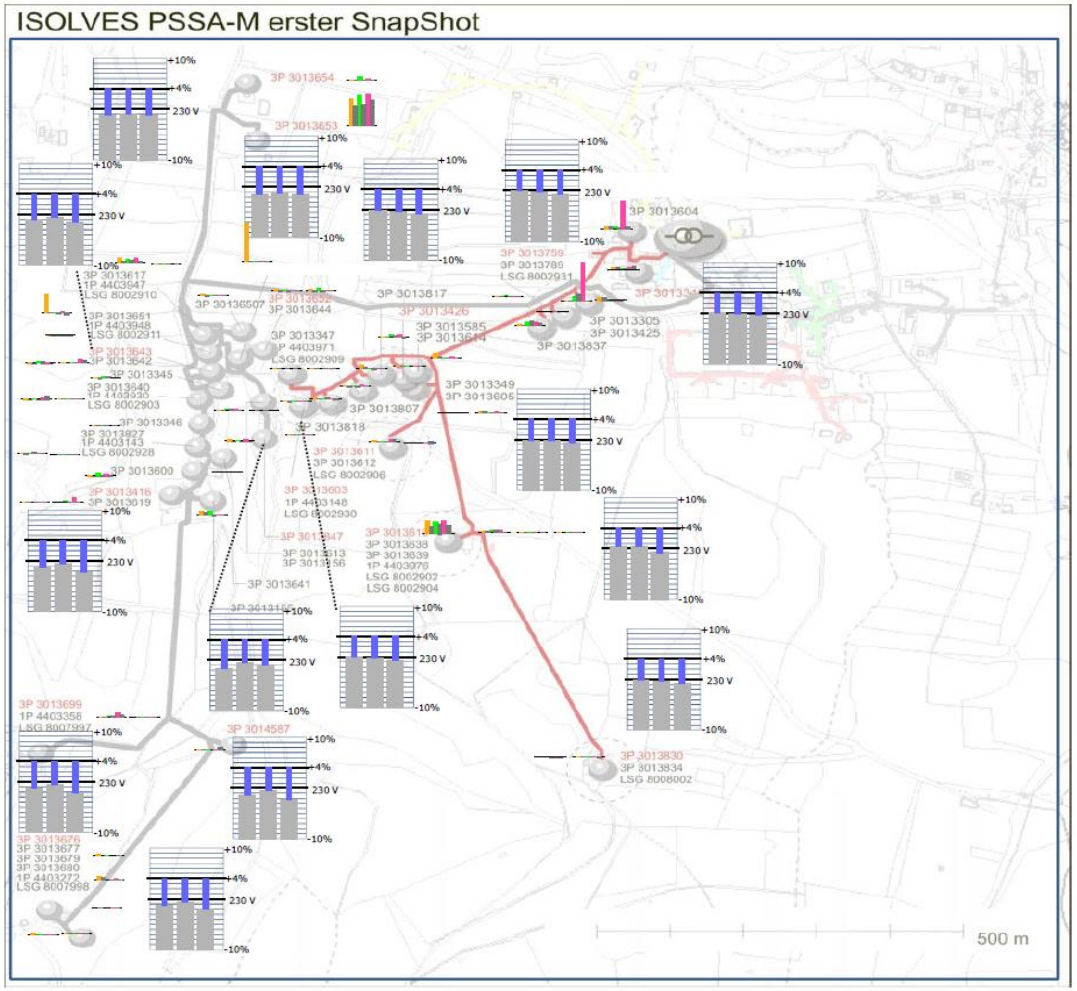


PSSA

Power SnapShot Analysis in Action

First Power Snap Shot

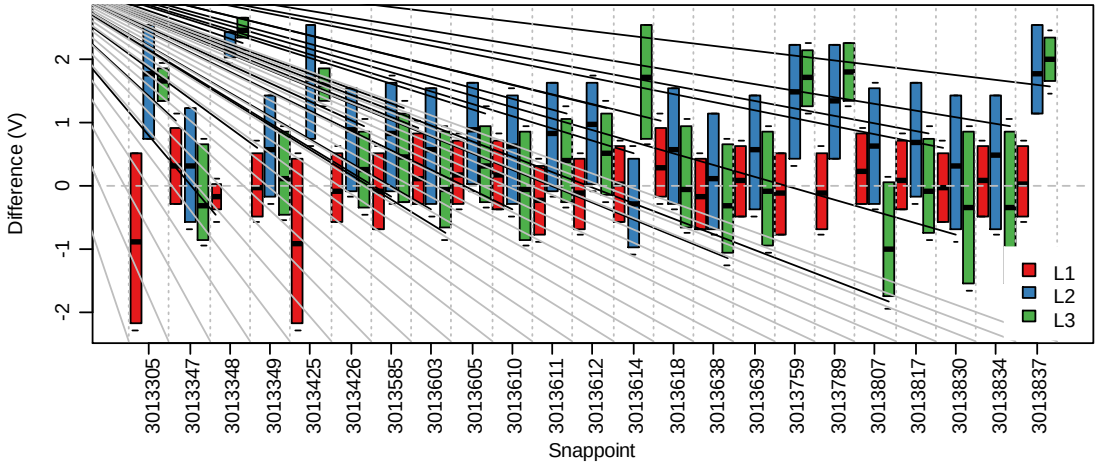
- Smart Grids Week 2011 in Linz



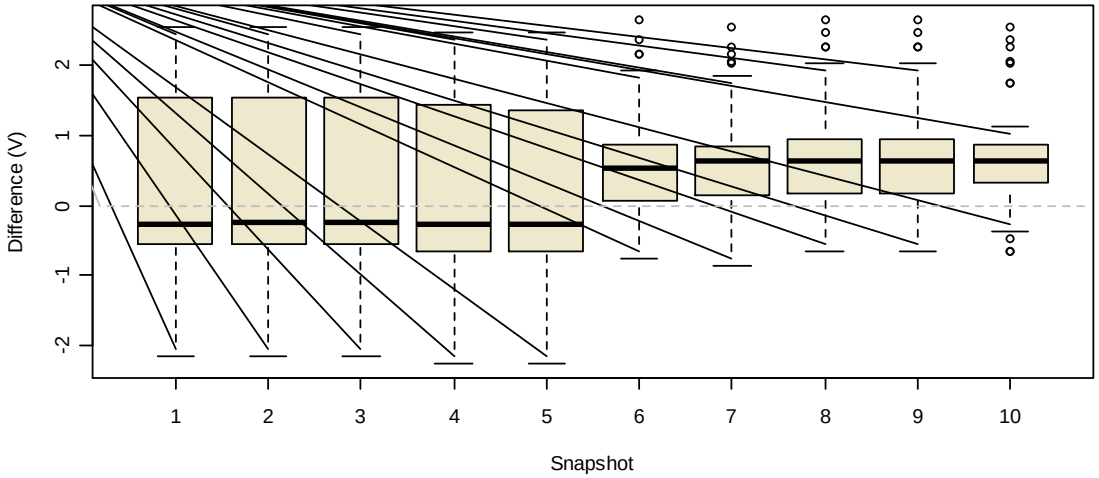
Validation of models

Box plots of the deviations

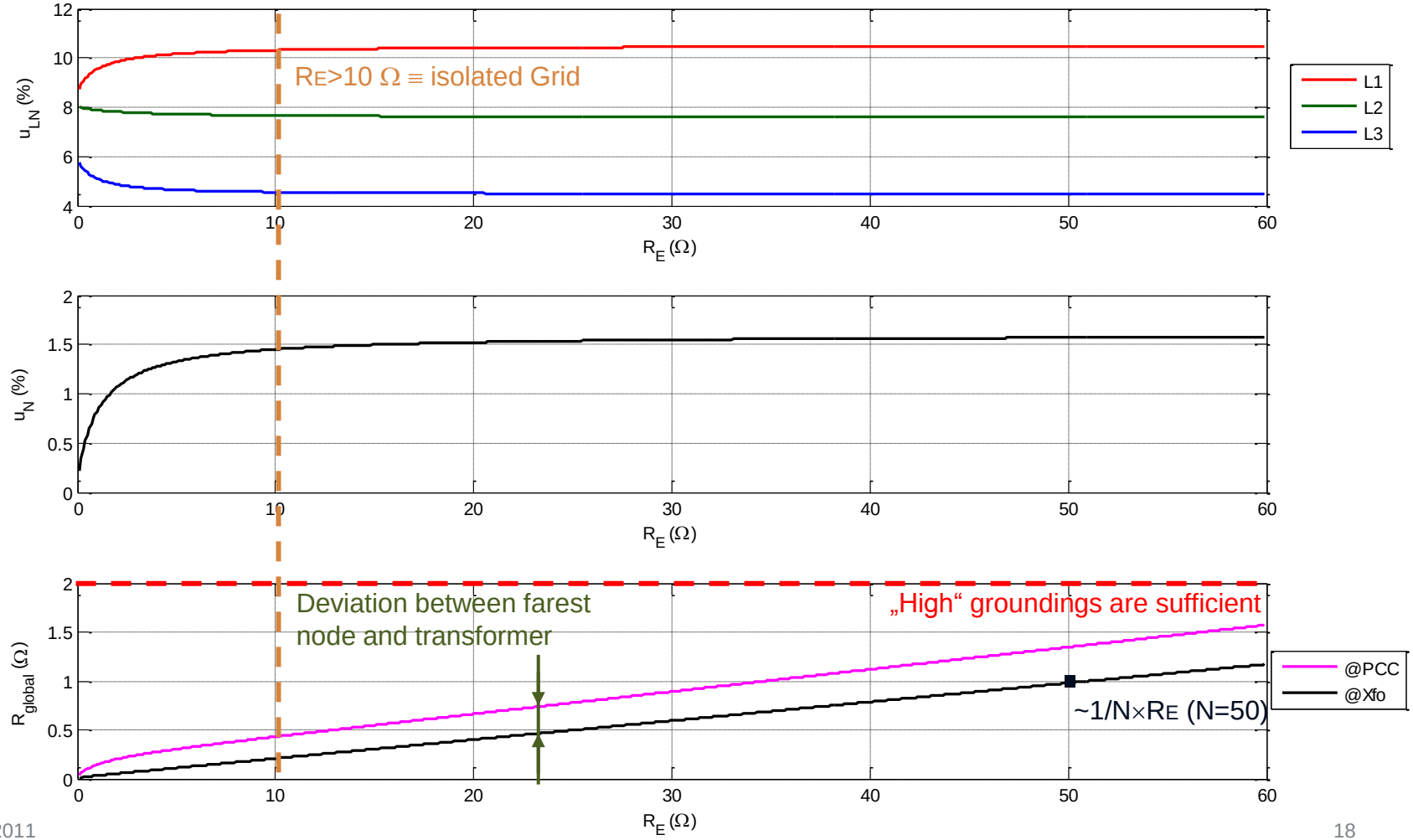
- One snap shot



- 10 snap shots



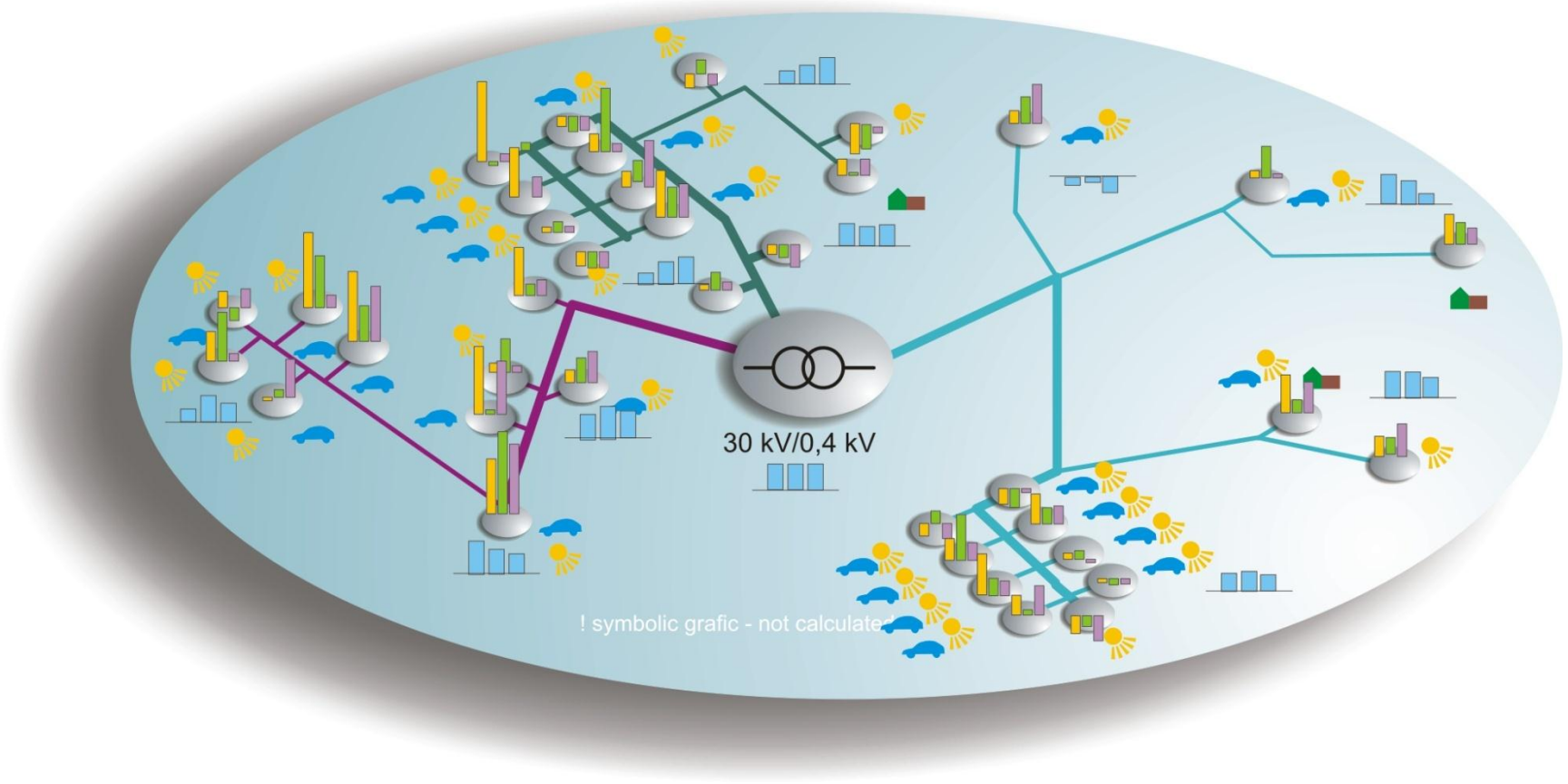
Influence of the grounding on the voltage level (sensitivity analysis of single phase PV)



Towards a ‚Smart LV Grid‘

PV und Electric Vehicles are the main drivers for a Smart LV Grid

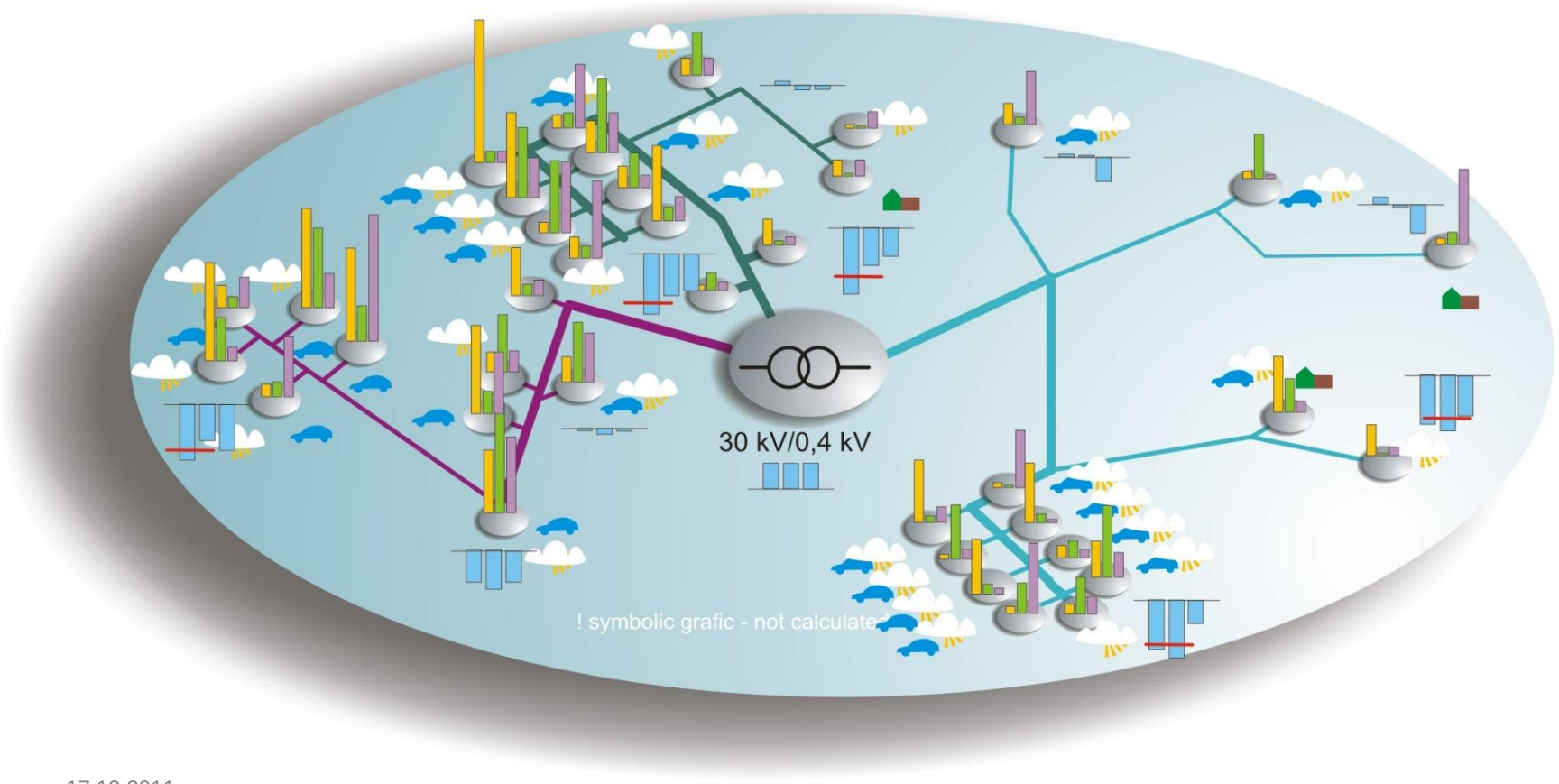
- PV and EV



Towards a ‚Smart LV Grid‘

PV und Electric Vehicles are the main drivers for a Smart LV Grid

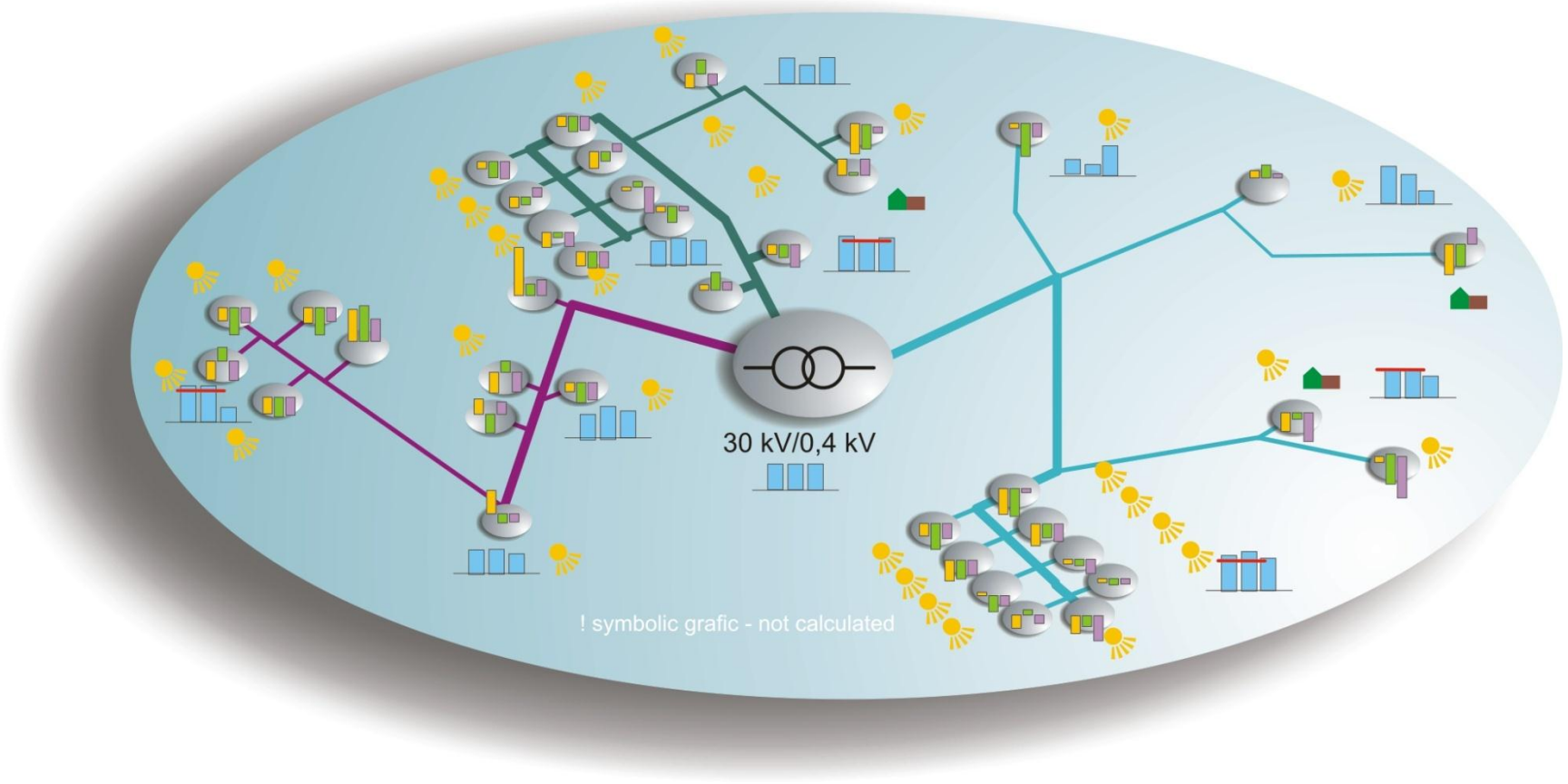
- No PV



Towards a ‚Smart LV Grid‘

PV und Electric Vehicles are the main drivers for a Smart LV Grid

- No EV



Towards a ‚Smart LV Grid‘

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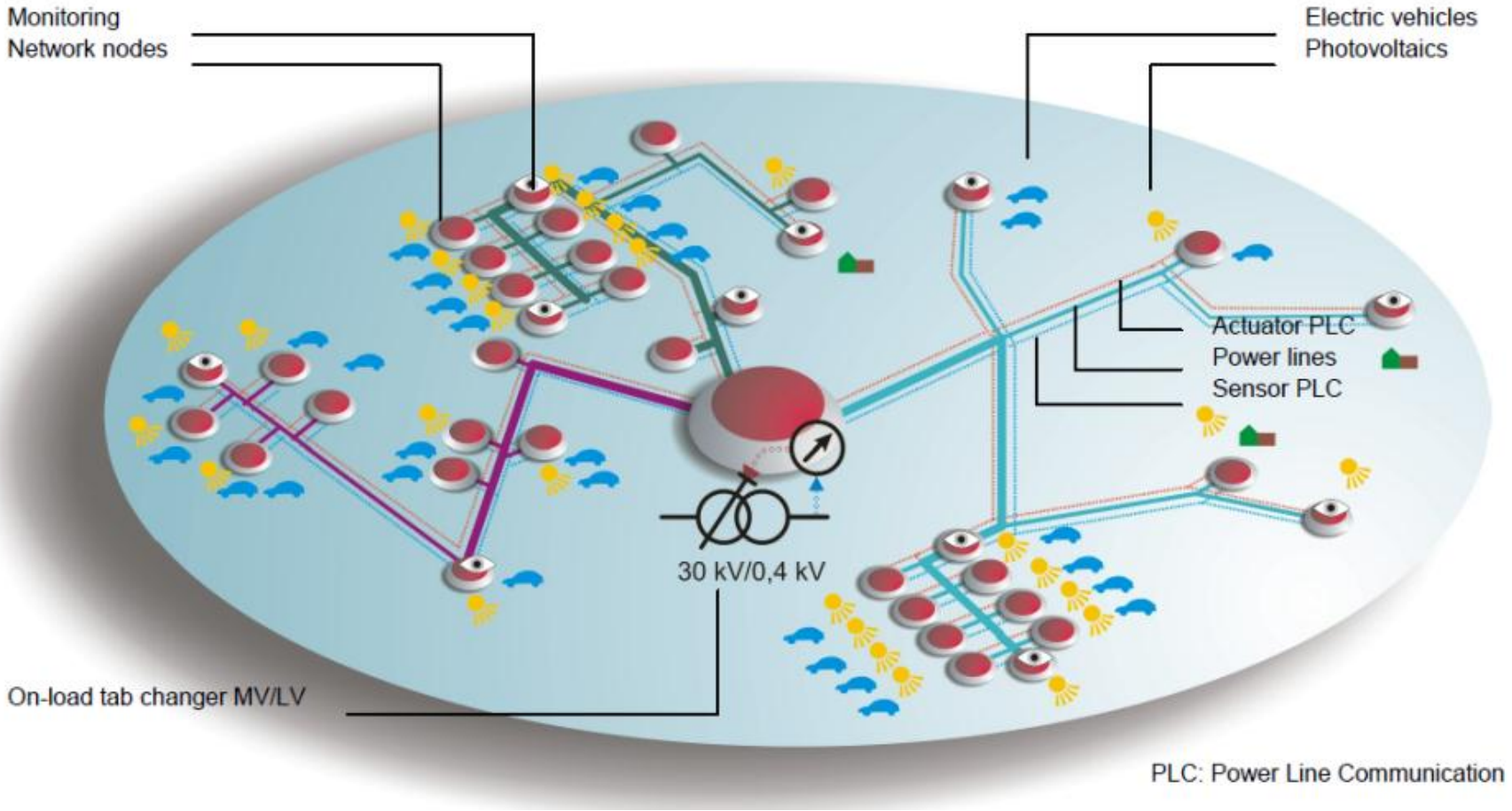

Conclusion and Outlook

Preliminary findings

- **Power SnapShot Analysis** in distribution networks
  - ~35 rural
  - ~3 urban
- **Investigation** and **detailed analysis**
  - on asymmetry / neutral point displacement voltage
  - Influence of grounding
- **Simulation of scenarios**
  - Single / three phase PV
  - EV
- **Meter Measurement** will result in improving
  - planning → interconnection assessment
  - operation → critical voltage conditions, fault conditions
  - Control → voltage control, intelligent charging, topology

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