



# Introduction to DIgSILENT PowerFactory

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# Energynautics' Areas of Expertise

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## SUSTAINABLE DEVELOPMENT FOR POWER AND ENERGY

Renewable Energies

Electromobility

Grid Codes

Smart Grids

Combustion Engine Power  
Plants

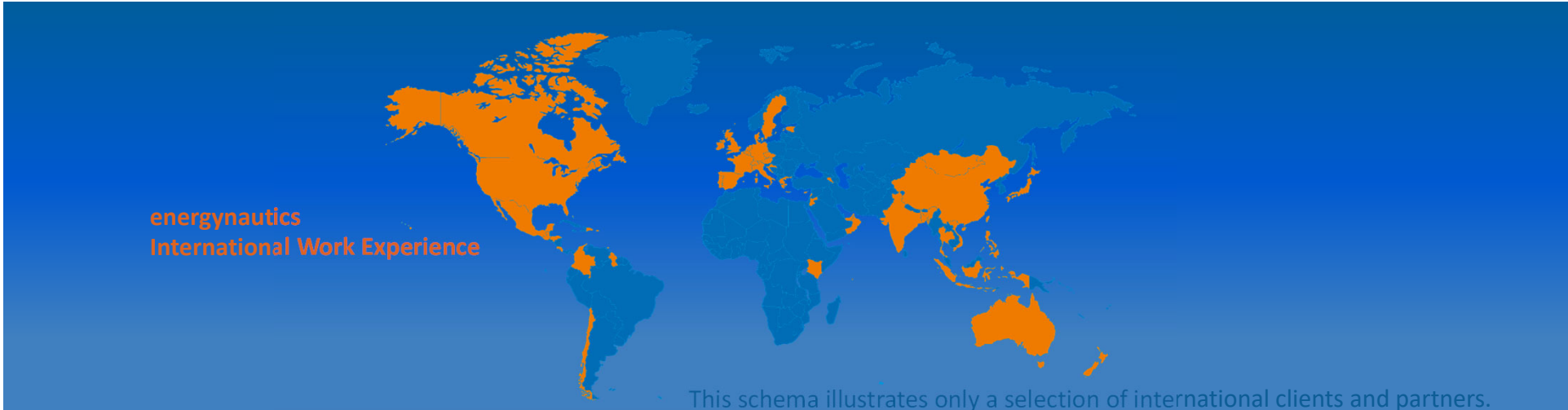
Electricity Markets

Distribution Systems

Island & Microgrids

Transmission Systems

# Energynautics' Clients and Partners International

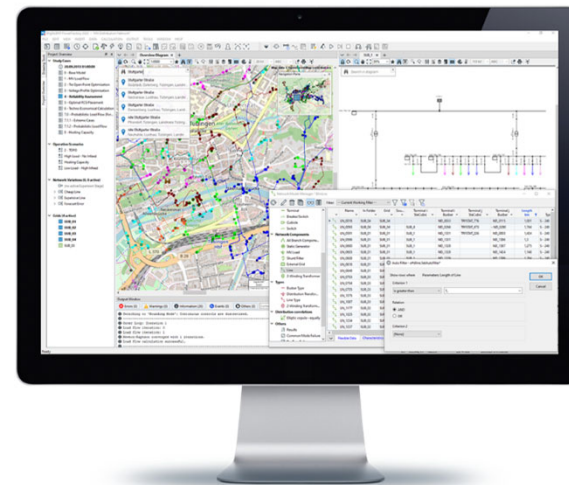


This schema illustrates only a selection of international clients and partners.

# Our expertise with PowerFactory



- **Many years of PowerFactory experience**
- **Close collaboration with DigSILENT team**
  - Collaborated on consultancy projects
  - Supporter of Energynautics' solar and wind integration workshop
- **Diverse studies**
  - Geographic scope: Microgrids to Europe
  - Temporal extent: Milliseconds to decades

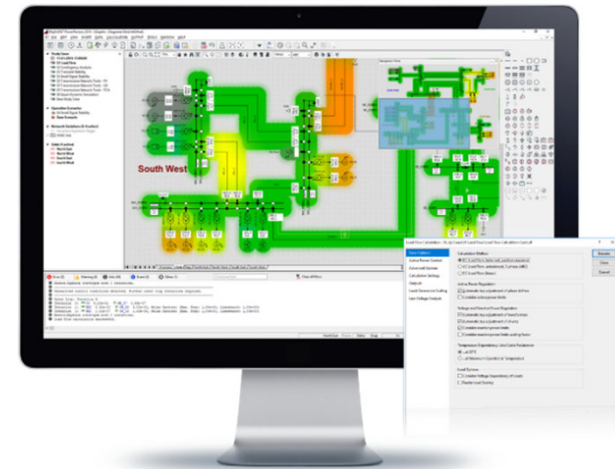


**DIG  
SILENT**



# PowerFactory Features

- Load Flow Analysis
- Short-Circuit Analysis
- Sensitivities / Distribution Factors
- Basic MV/LV Network Analysis
- Power Equipment Models
- Network Representation
- Network Model Management
- Network Diagrams and Graphic Features
- Results and Reporting
- Data Converters



# PowerFactory Advanced Features

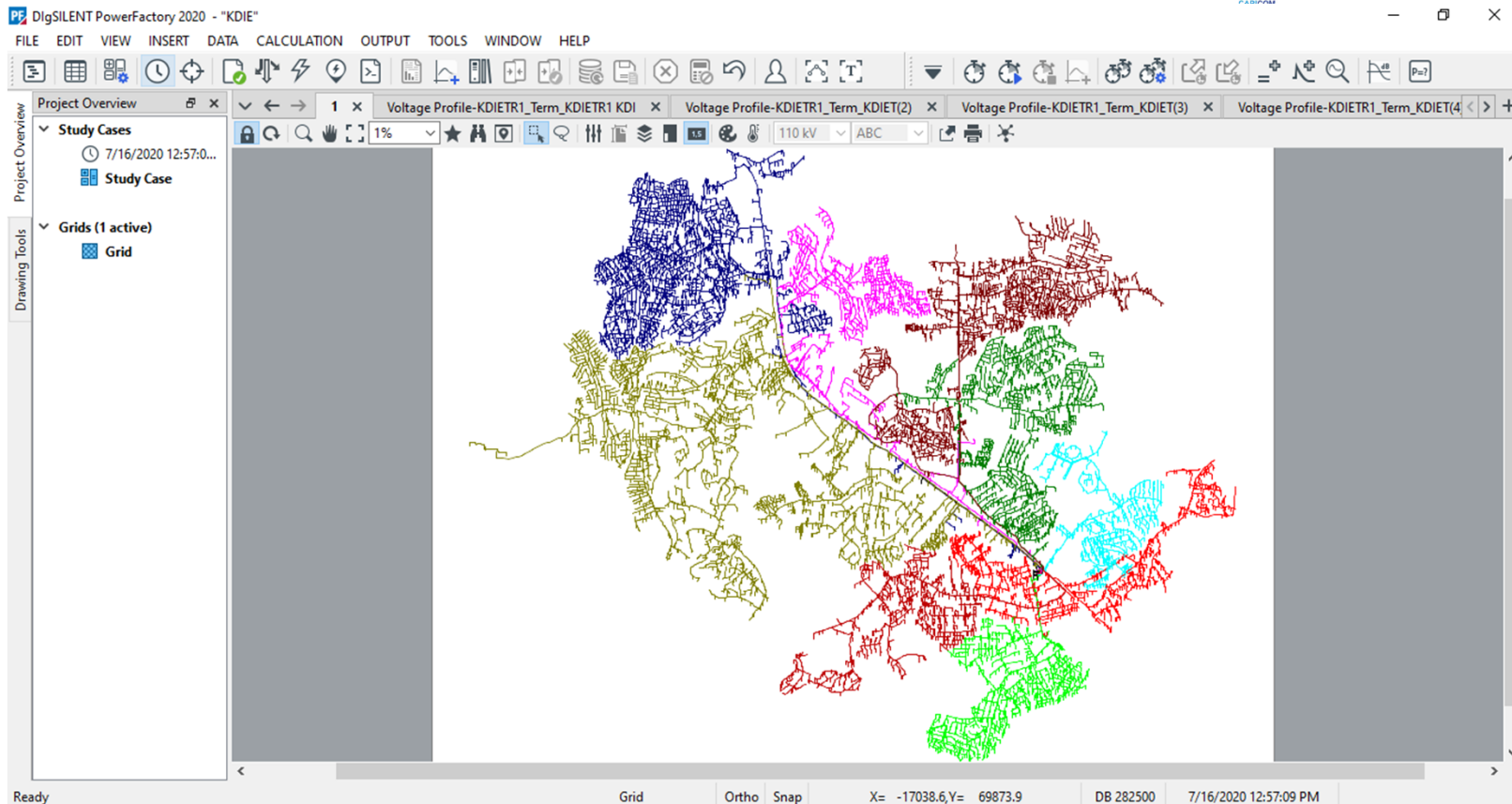
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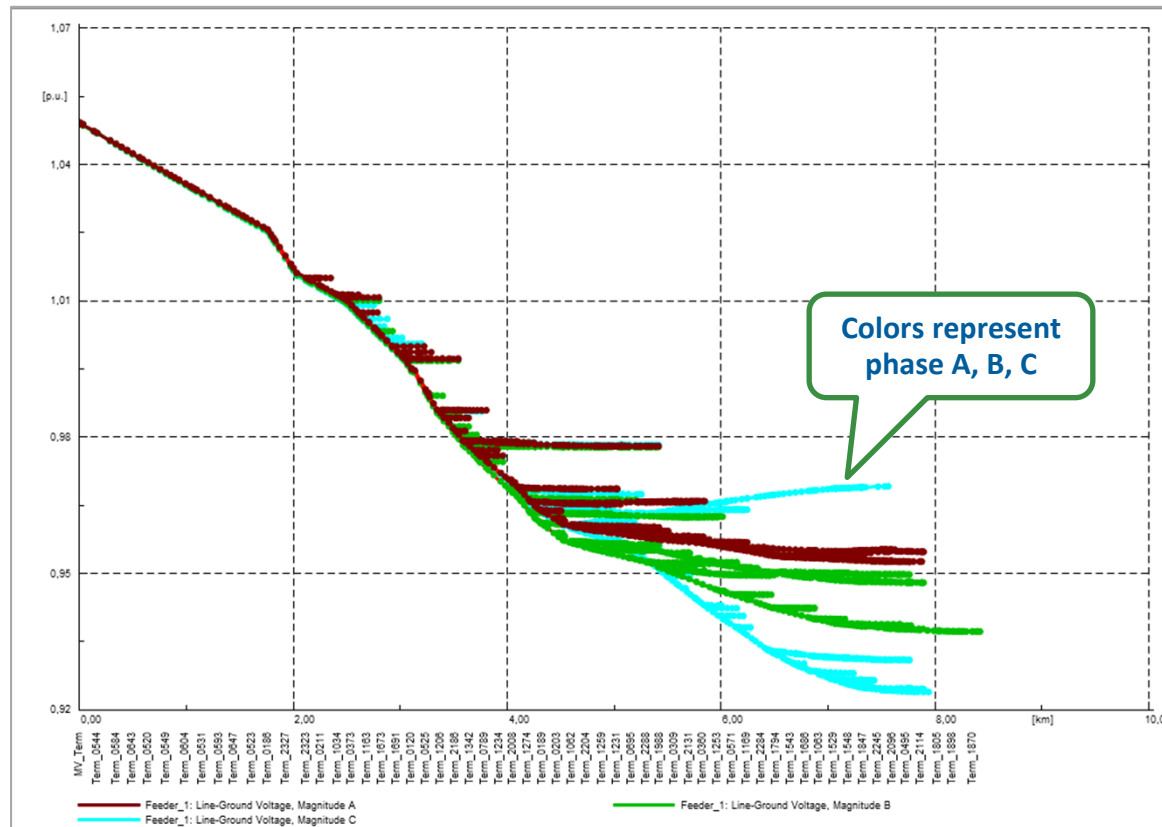
- Contingency Analysis
- Quasi-Dynamic Simulation
- Network Reduction
- Protection Functions
- Distance Protection
- Arc-Flash Analysis
- Cable Analysis
- Power Quality and Harmonic Analysis
- Connection Request Assessment
- Transmission Network Tools
- Distribution Network Tools
- Outage Planning
- Probabilistic Analysis
- Reliability Analysis Functions
- Optimal Power Flow (OPF)
- Unit Commitment and Dispatch Optimisation
- Economic Analysis Tools
- State Estimation
- Stability Analysis Functions (RMS)
- Electromagnetic Transients (EMT)
- Motor Starting Functions
- Small Signal Stability (Eigenvalue Analysis)
- System Parameter Identification
- Interfaces
- Scripting and Automation



# Distribution: Dominican Republic study on the impact of PV

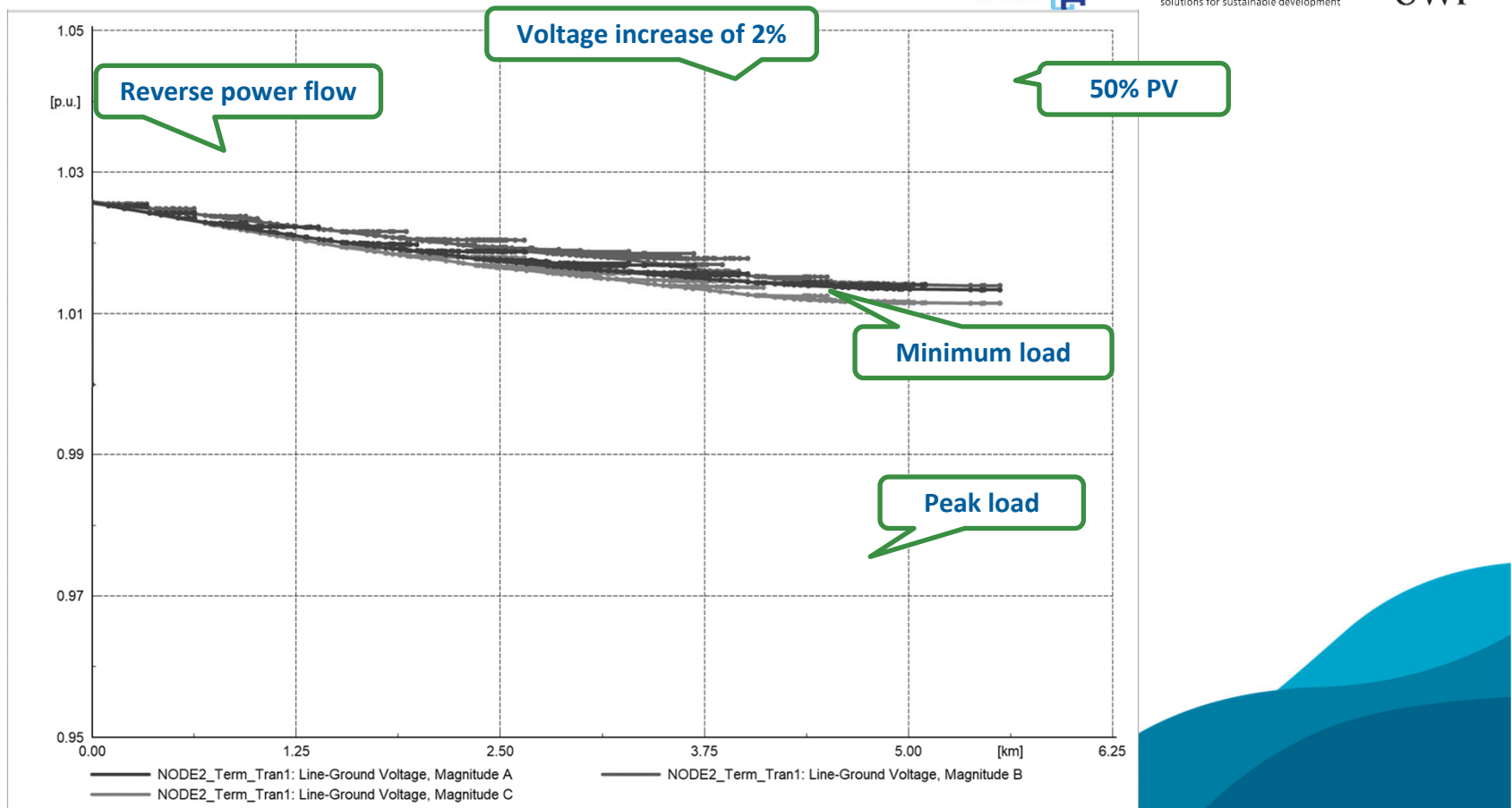


# Distribution: Dominican Republic study on the impact of PV

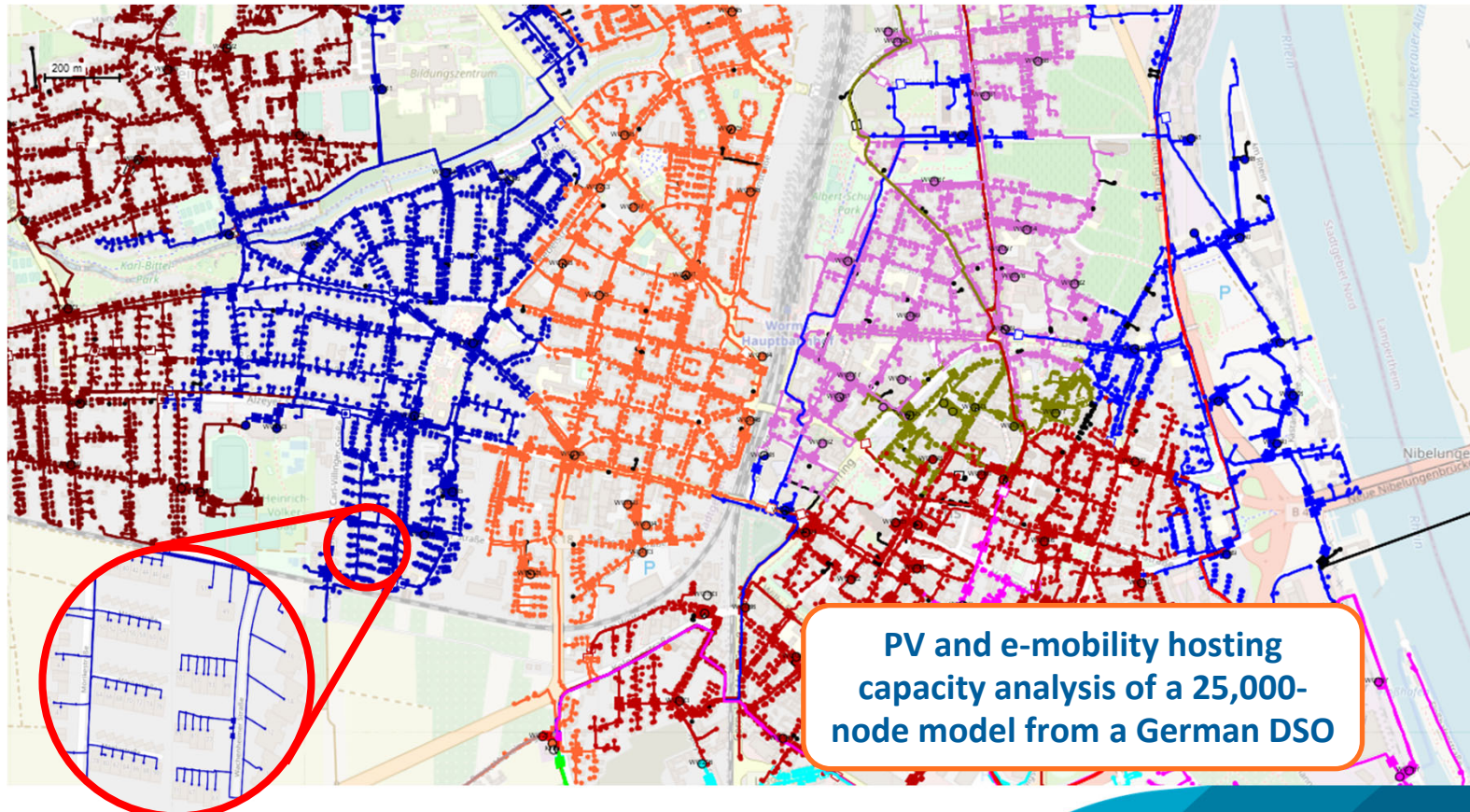




# Distribution: Dominican Republic study on the impact of PV



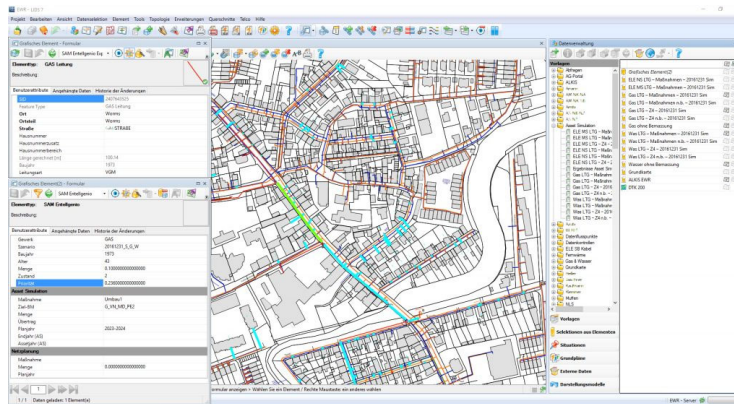
# Distribution: German grid studies – GIS-based Network model



# Distribution: German grid studies– GIS-PowerFactory Converter



GIS



Requires very good data accuracy of the GIS

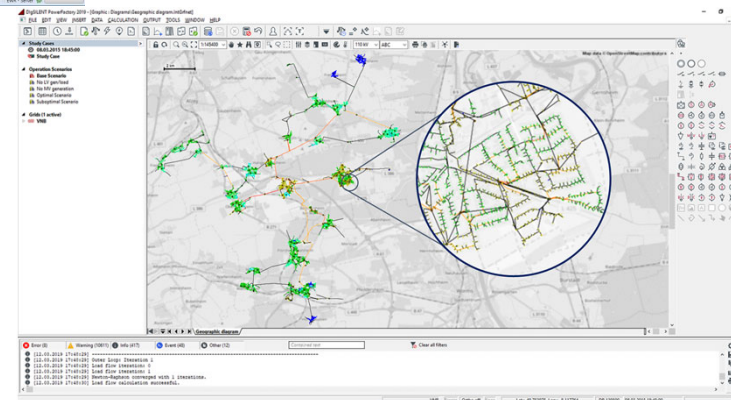


GIS-PF Converter

PowerFactory

## Applications:

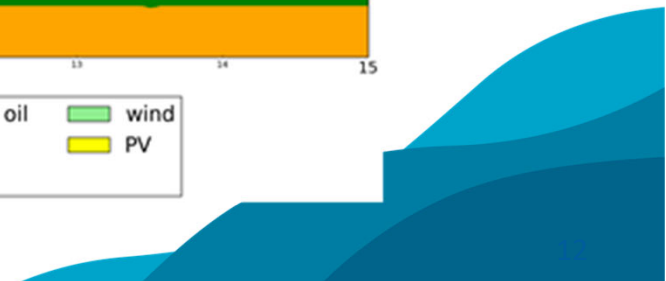
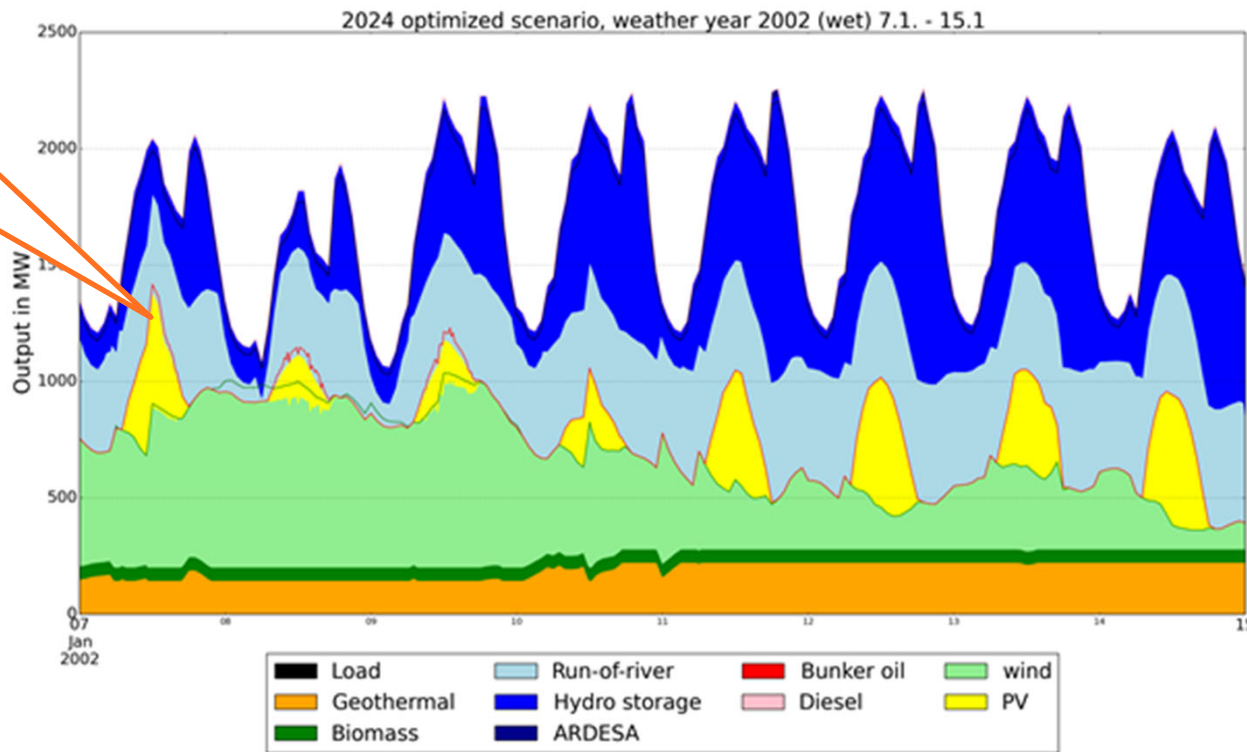
- Power system planning
- Grid connection applications
- Voltage optimization
- Tie open point optimization
- Power system operation
- Network state analysis
- Hosting capacity assessment
- etc.



# Transmission: Analysis of specific dispatch situations



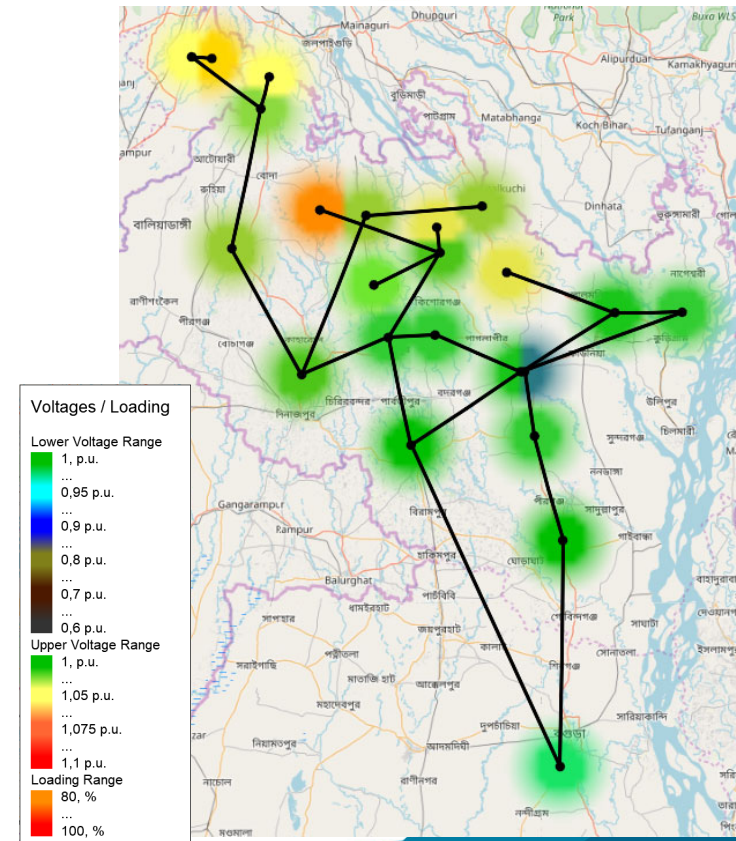
Power System Studies will look at such critical situations



# Transmission: PV Impact Analysis in Bangladesh



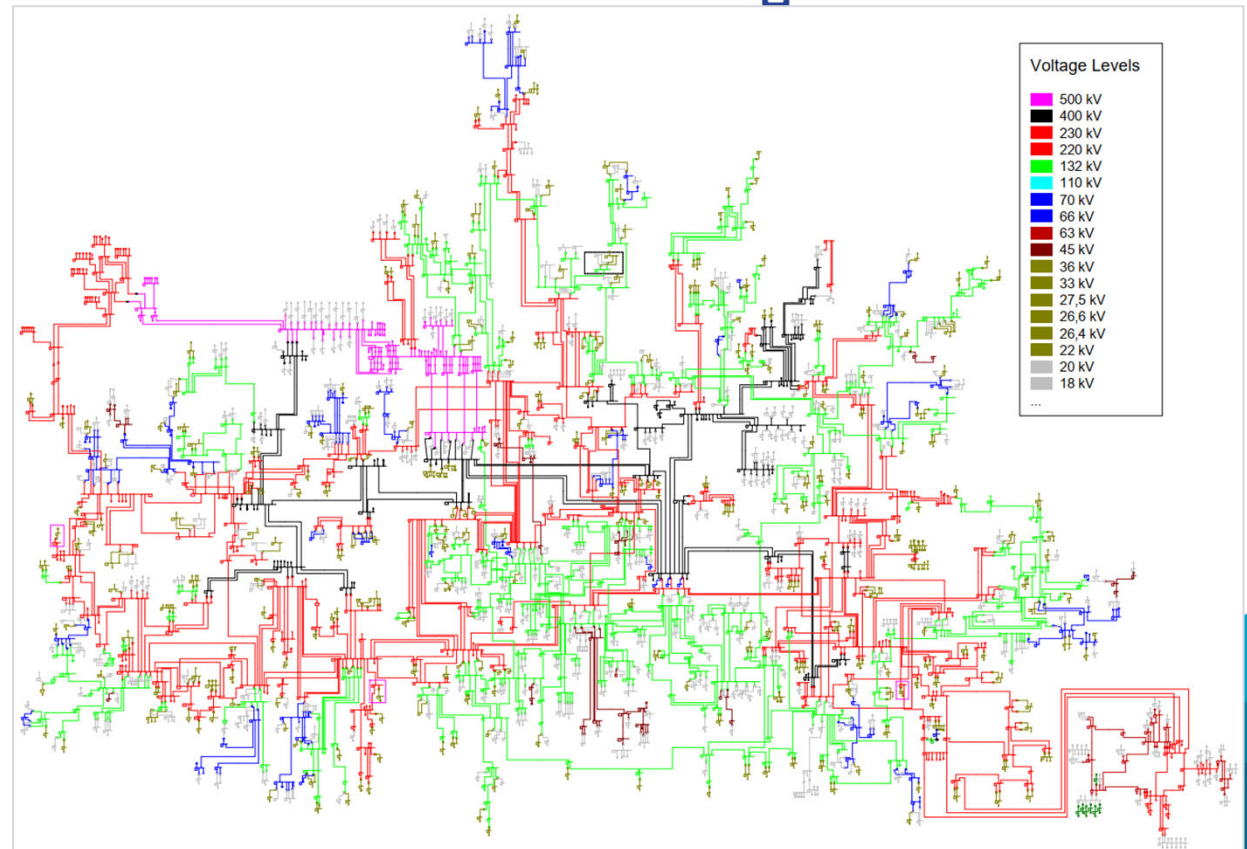
- Investigation of the impact of PV during peak and offpeak situations
- Reactive power support from PV for voltage regulation
- Analysis of advanced inverter capabilities such as STATCOM-capability (also known as Q@night)



# Transmission: Ethiopia transmission grid modelling



- Detailed transmission grid model of Ethiopia
- PV impact studies for large-scale PV plants (> 100 MW)
- Dynamic stability analysis

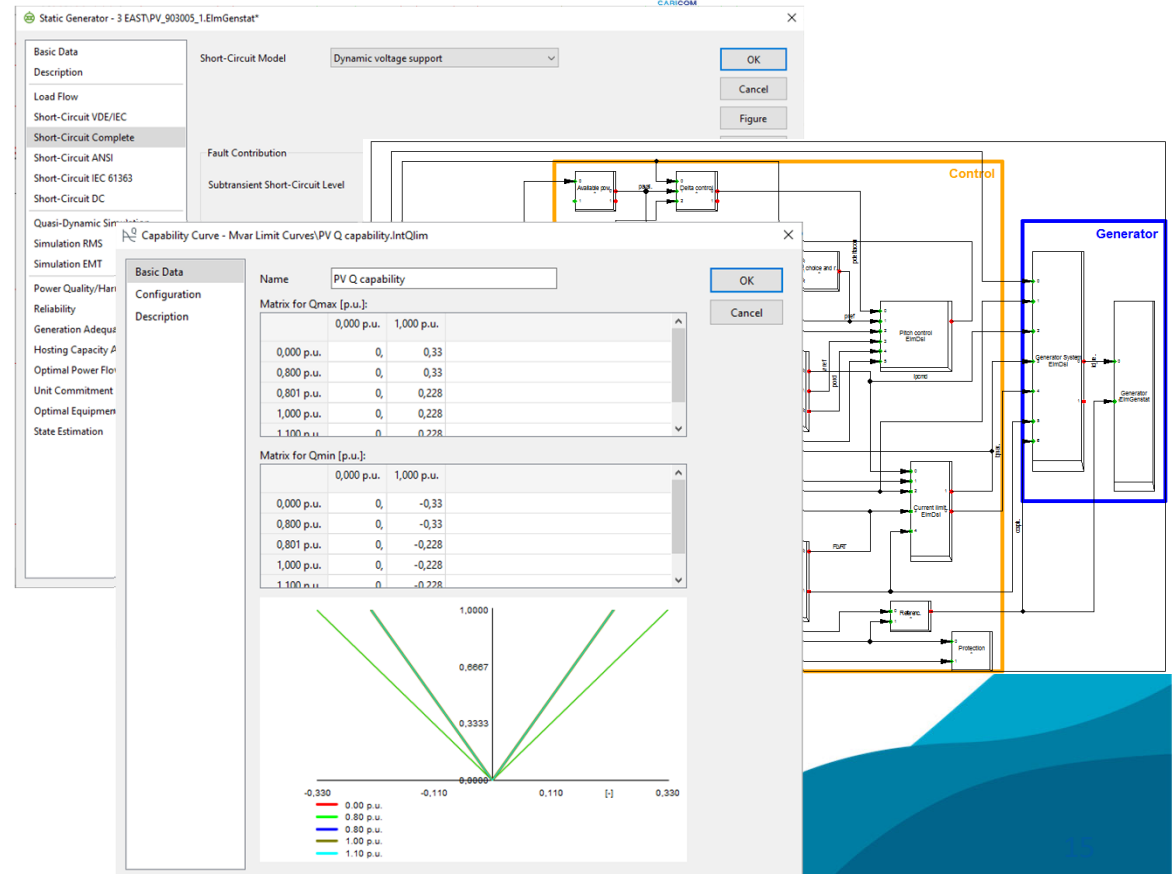


# Transmission: Impact Studies for Renewables



Answers to questions such as:

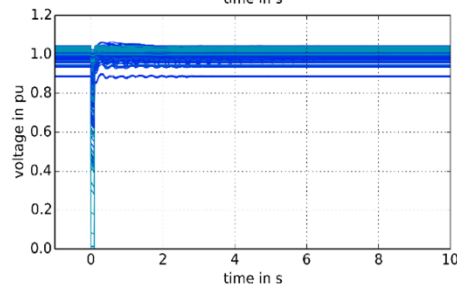
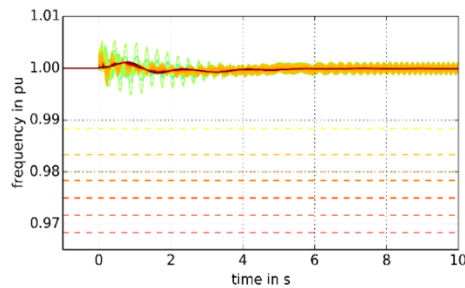
- Are there any voltage problems or overloading?
- Will protection equipment be impacted from changing short-circuit currents?
- Is dynamic stability maintained?
- Can PV support voltage and frequency control?



# Transmission: Dynamic Stability

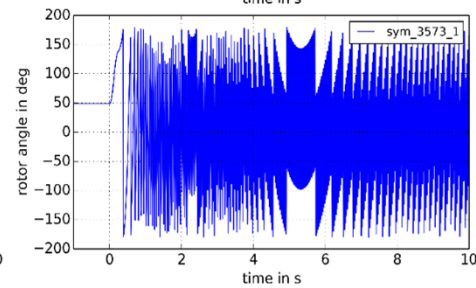
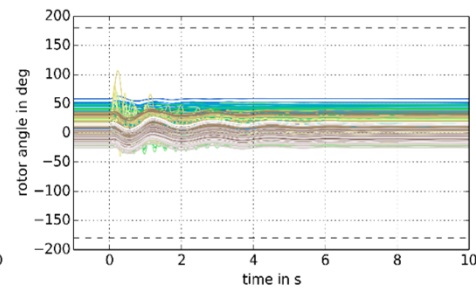


Frequency stability: Adequacy of inertial response and primary reserves



Voltage stability: Does the voltage return to a stable value after disturbance?

Rotor angle stability (power system): Does the entire system lose stability?



Rotor angle stability: Do individual generators lose stability?





## In Summary

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- **DIGSILENT PowerFactory is one of many powerful tools for performing power system analysis**
- **Needed for detailed distribution and transmission planning**
- **Data accuracy and integration with other systems (e.g. GIS) essential**
- **Complexity increases in high-renewable power systems, increasing the need for modelling**
- **Investigation through:**
  - steady-state analysis (load flow, short-circuit analysis, protection, contingency analysis, time-series analysis)
  - dynamic/transient analysis (RMS, EMT)
- **PowerFactory offers many specific tools to help power system operators in their analysis**



# Thank you for your attention!

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