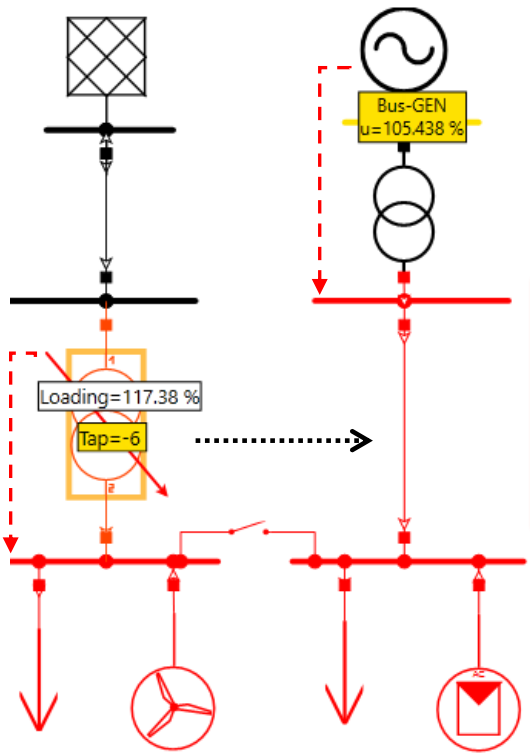
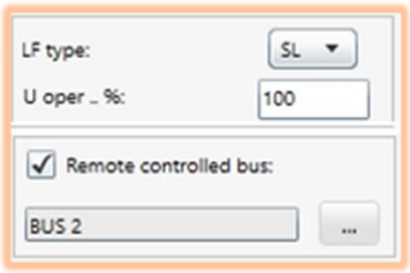
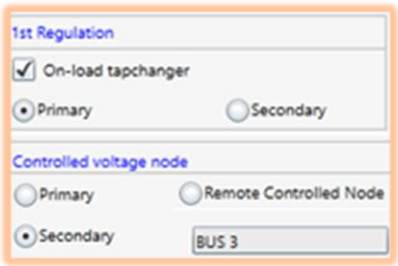
Load flow Analysis

This module performs load Flow studies to analyze the steady-state performance of the power system under various operating conditions. It can be used in balanced/unbalanced, radial /meshed , AC and DC networks from HV to LV systems. The module has a numerically robust solver and provides several methods in order to achieve the best calculation accurately and efficiently.
The power flow module has a seamless interface with other modules such as time simulation load flow, and contingency (N-1), etc. For real-time application, these modules can be embedded into your enterprise application (e.g. SCADA/GIS) and deployed as smart grid application.

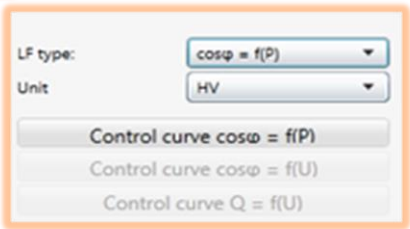




Generator remote voltage control



LTC voltage control



PV reactive power support

- Abnormal conditions highlighted on single line diagram
- Reactive power optimization using AC disperse generators
- Advanced voltage control using voltage controlling devices

Solution with load flow analysis using NEPLAN

Abnormal conditions (Voltage)	• Voltage controlling devices (LTCs/Voltage regulators) • Shunt inductor	Increase transfert capacity of transmission lines	• Serie compensation (TCSC) • Fixed series capacitors
Abnormal conditions (Overloads)	• Cable sizing • Feeder-Reinforcement • Switching optimization	Improve the voltage stability	• P-V and Q-V curves • U-Q Sensitivity analysis • Q-U Modal analysis
Reduce network losses	• Shunt compensation(SVC) • Shunt capacitor (switchable) • Switching optimization • Phase swapping	Improve network security	• Contingency (N-p) • Optimal restoration strategy
Eliminate congestion on transmission lines	• Phase shifting transformer • FACTS (UPFC)	Identify off-peak load, duration of overload and energy loss calculation	• Time simulation load flow

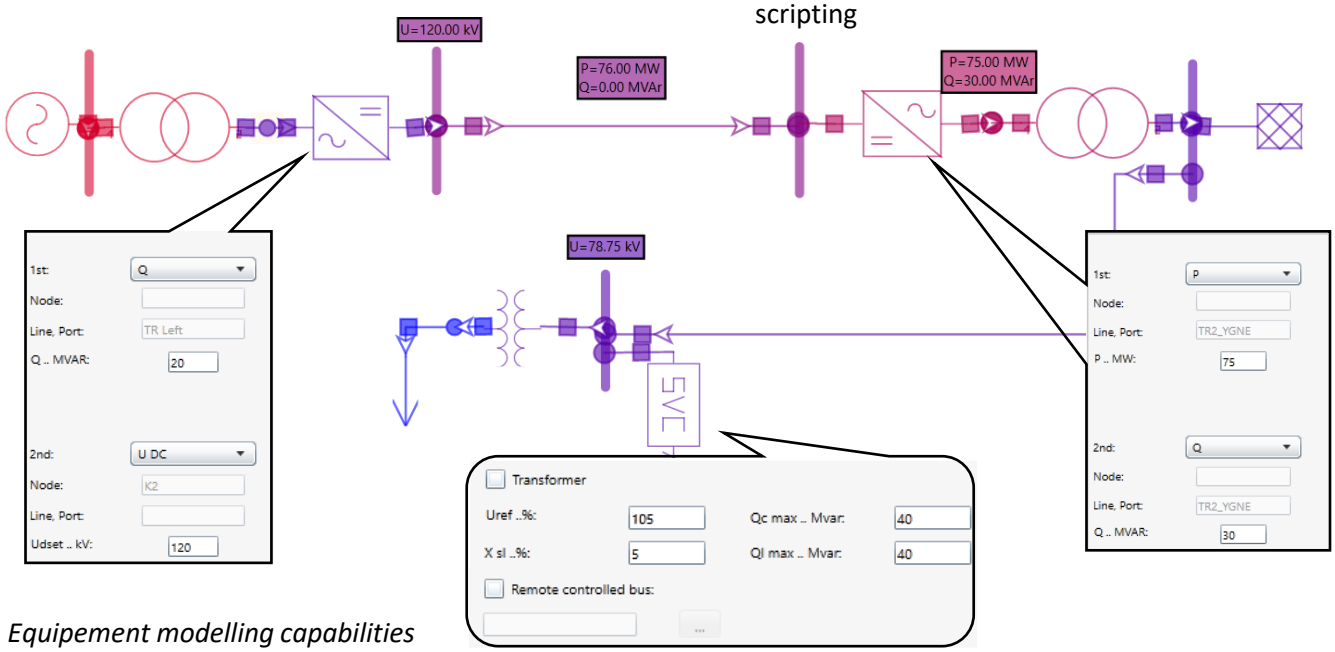
NEPLAN®
Smarter Tools

Modelling capabilities

- Flexible AC Transmission Systems with their associated controls (SVC,UPFC,STATCOM,TCSC)
- Phase shifting transformers with active power control
- Comprehensive modelling of HVDC with rectifier and inverter control
- Accurate representation of Power-electronic-based devices (e.g. PWM) with advanced control strategies
- Switchable shunt capacitors/Inductors with the following control types: Voltage, reactive power and power factor
- Local or remote control for tap changing transformers
- AC disperse generator including Photovoltaic (PV) and Wind Energy Conversion Systems (WECS)
- Detailed equipment modelling of DC-Batteries, DC-Fuel cells, DC-Voltage source, DC-Photovoltaic panels
- Multiple slack buses allowed
- Distributed slack node to emulate the behavior of the Economical Dispatch Control (EDC)
- Reactive power sharing for multiple devices of the same type controlling the same nodal voltage (e.g. multiple synchronous generators controlling the same node)
- Prioritization mechanism for multiple devices of different types controlling the same nodal voltage (e.g. Wind Farm and step-up transformer LTCs controlling the same node)
- Advanced reactive power control for smart grid applications:
  - Reactive power: Q=f(U), cosϕ=f(U) cosϕ=f(P)
  - Active power: P=f(U), P=f(f)

Calculation features

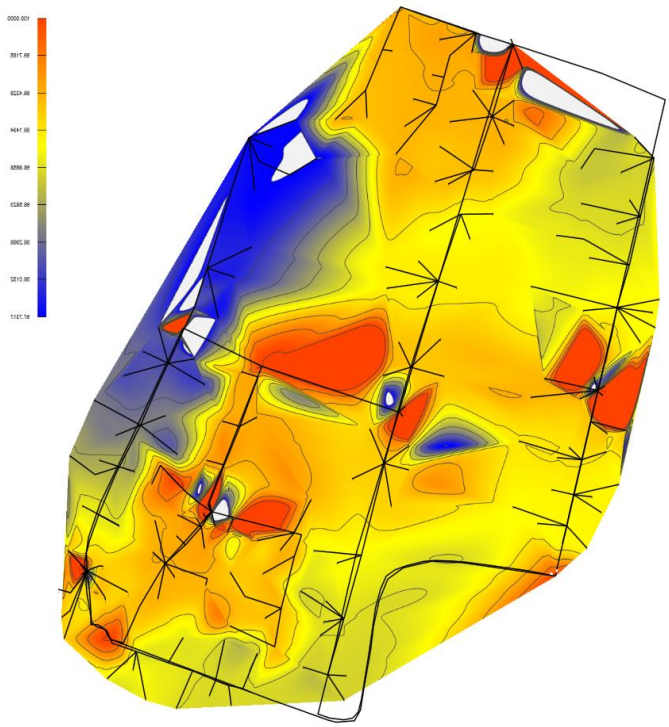
- Computation methods: Current Iteration, Newton Raphson, Extended Newton Raphson, Voltage Drop (per-phase), DC load flow
- Powerful convergence control and user-controlled initialization parameters
- Predefined and user defined scaling factors for both loads and generations
- Model validation and data consistency of the network
- Power interchange between area / zones (area interchange control) to emulate the behavior of the Automatic Generation Control (AGC)
- Limit check and automatic conversion during load flow process
- Advanced load flow time simulation suitable for:
  - Identification of the off-peak load that go undetected using typical peak condition
  - Computation of the overloading duration for aging asset and economical feeder reinforcement
  - Energy loss calculation
  - Assessment of the impact of Distributed Energy Resources (DER) on LTCs, voltage regulators and switchable capacitor banks
- Contingency (N-p) that answers the question "What-if“ situation
- Computation of Power Transfer Distribution Factors (PTDF) on transmission lines
- Measurement data import for load balancing
- Planning variant management (versioning)
- Batch analysis for automated application using scripting



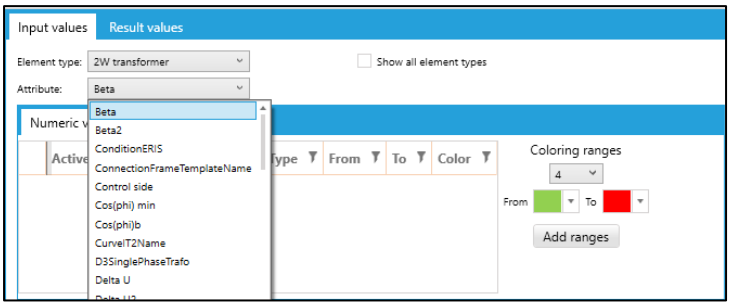
Equipement modelling capabilities

Results

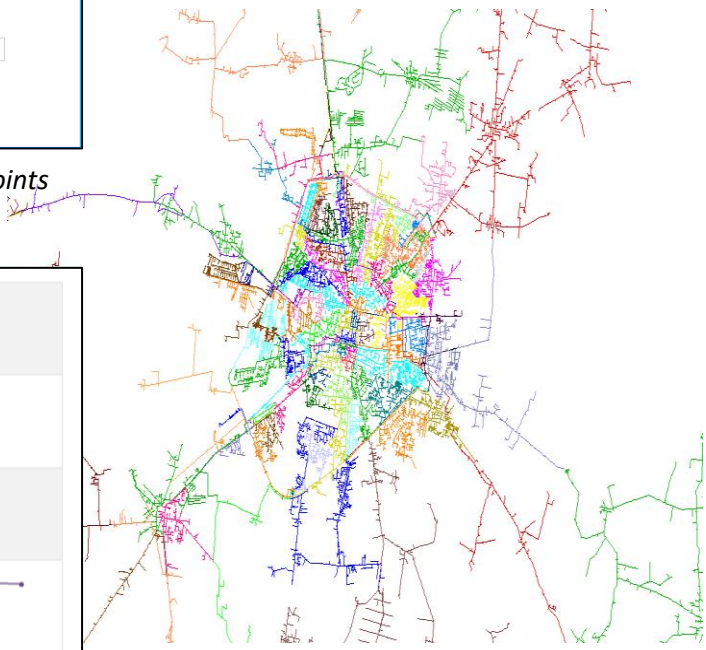
- Key short-circuit results:
  - Power flow (P,Q and S)
  - Voltage (Magnitude and angle)
  - Loading (% or Amp)
  - Losses
  - Tap position
- Voltage profile along the feeder
- Blinking option to flag the abnormal conditions on the one-line diagram
- The direction of active and reactive power flow can be displayed
- Results can be visualized with heat map
- Color coding on the one-line diagram according to different criteria (e.g., voltage level, feeders, zone, area, overloading, etc.)
- Application to coloring range concept according to the results or inputs
- Table output: for the whole network, individually for each area / zone. Listing of power flows between areas/zones, overloaded
- The results are provided under several formats



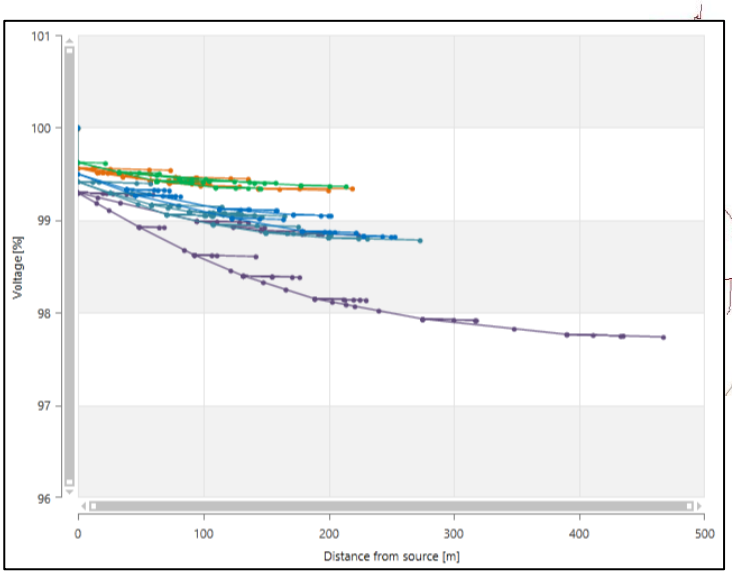
Heat map



Color ranges of any input or result to identify weak points



Color coding on the one-line diagram



Voltage profile along the feeder