NAP

Network Analysis & Planning

NAP is a comprehensive software package for planning and analysis of electric power networks. A single graphical user interface allows to access several calculation models:

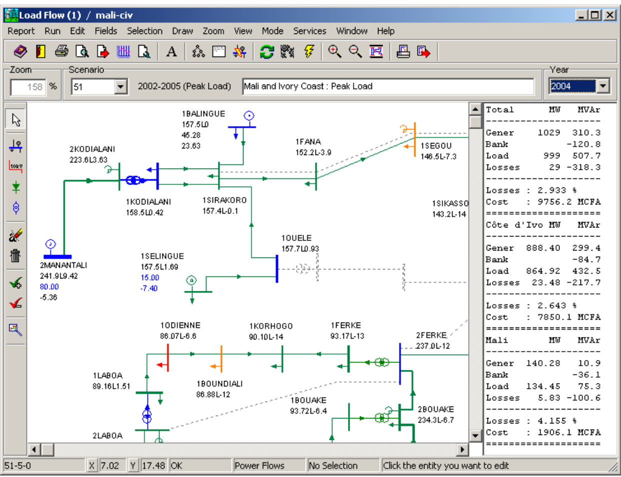
- **Initial Load Flow (ILF)**
- **Constrained Power Flow (CPF)**
- **Optimum Power Flow (OPF)**
- **Short Circuit (SCC)**
- **Contingency Analysis (OUTSIM)**
- **Stability (STABIL).**

A state-of-the-art software

NAP is the result of more than 30 years of Systems Europe experience in load flow models, new research on mathematical and physical systems and modern Object Oriented Programming techniques. Our primary objectives were always to develop a software that is:

- Simple to use: no specific skill is required to handle NAP interface because it is based on Windows standards.
- Planning oriented, i.e. several scenarios can be defined, commission and retirement years are taken into account, as well as load growth.
- Based on reliable, flexible and powerful algorithms.

Graphical Network Display

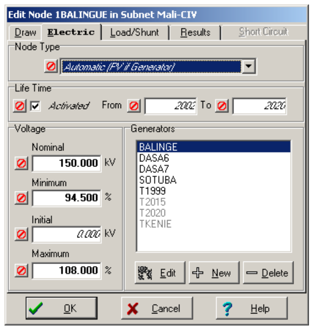


Networks are displayed in a one-line diagram schematic representation. The user may edit data and results to display on this network drawing. Moreover, any data or result may determine the colour and thickness of the network elements. Several windows can also be simultaneously opened, allowing to analyse at a glance different network alternatives. Standard drawing functions, such as zoom facilities, are of course available.

Interactivity

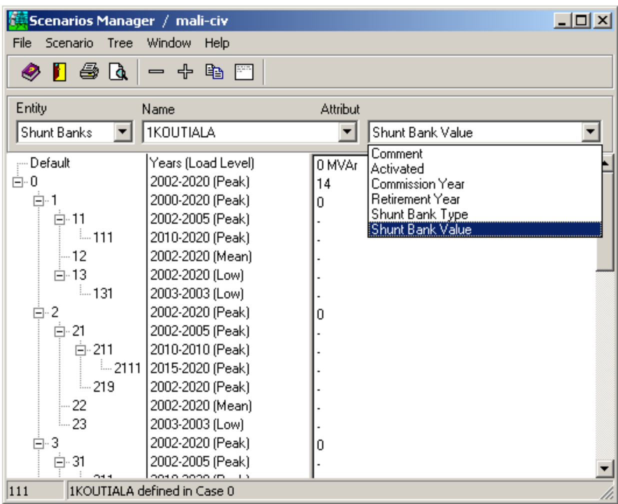
Network elements, i.e. nodes, lines, DC lines and transformers are created by simply drawing them on the network display. Click and drag is also available in order to move them.

By simply clicking on any network element, the user can edit any of its data and visualise its results. All data are in physical units (MW, km, Ω...), forget prerequisite per unit conversion.



Scenario manager

Scenarios are organised into a hierarchical structure based on inheritance. It means that, if a particular data is not defined in a scenario, its value equals the value defined in its parent scenario. This parent value can inherit from its own parent, and so on. This method is the best for defining variants and avoiding data redundancy. For planning, scenarios can differ by technical data or investments strategies.



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Network Calculation Models

Load Flow

The optimal load flow has to solve a cost minimisation problem in which the variables are restricted by:

- Equality constraints: the power flow equations.
- Inequality constraints: operating limits on controllable variables.

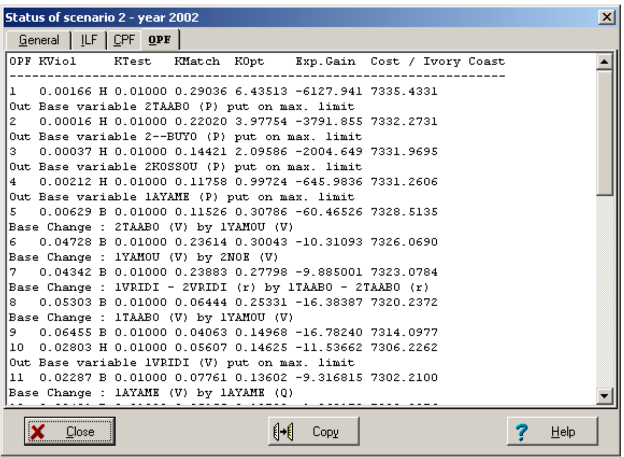
Calculation is divided into 3 steps: ILF, CPF and OPF.

ILF - Initial Load Flow

This first step consists of solving a standard power flow problem ignoring the inequality constraints, using the Newton-Raphson mathematical technique.

CPF - Constrained Power Flow

As the ILF solution may be unfeasible, this second stage consists of moving the ILF solution into the feasible subspace, satisfying all voltage, generation, transit and tap transformer constraints. If no feasible solution is found, the unsatisfied constraints are highlighted.



OPF - Optimum Power Flow

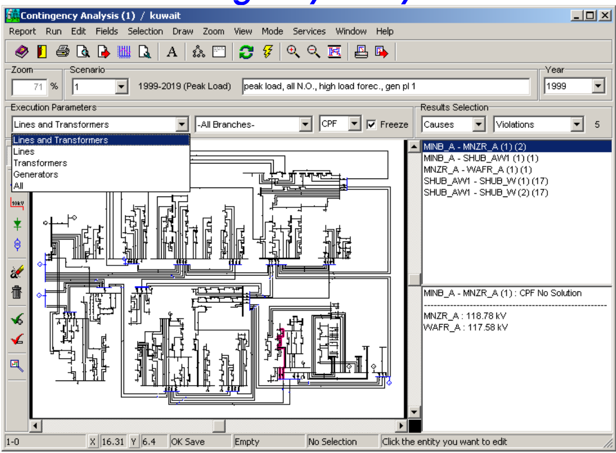
This third step consists of finding the power flow solution, which minimises the generators operating cost while not violating the inequality constraints.

Due to this powerful approach, the OPF also calculates the marginal costs of real and reactive demand at each node. This information is a powerful help when designing new systems or upgrading existing ones.

SCC - Short Circuit

The objective of the Short Circuit simulation is to estimate the status of the generation and transmission system a few voltage cycles after the occurrence of a fault. Transient or sub-transient responses can be analysed. The program simulates symmetrical faults (3 phases to ground) and non-symmetrical faults (1 phase to ground, 2 phases to ground, or phase to phase). The OPF solution is used as the pre-fault status of the system.

OUTSIM – Contingency Analysis

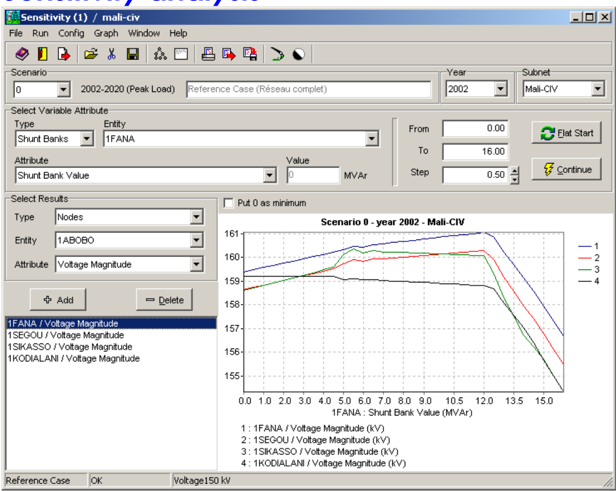


OUTSIM is a N-1 incident simulator, i.e. it simulates lines, transformers and generators outages one by one. Starting from the OPF solution, a full AC power flow simulation is performed in order to predict the impact of outages on branch loading, voltages limits and generation capacity.

STABIL - Transient Stability

STABIL simulates the dynamic behaviour of an electric power system during the first few seconds following a major disturbance of that system (e.g. a short-circuit, the loss of a generator or a major branch opening). The main result is a set of curves describing the evolution of the generator rotor angles during the simulation period (generator swing curves). Additional phenomena can also be studied such as the action of the voltage and speed regulators.

Sensitivity analysis



This model analyse the evolution of any result as a function of any data varying between user-defined limits.

Other functions

- Report builder: create your own reports thanks to filter, selection and order tools.
- Import: XML, IEEE, PSS/E, ASCII files and clipboard.
- Saving Configurations: display, reports, selections…
- Export reports, charts and network display into another software like Microsoft® Word or Excel.
- Multiple network elements selection.
- Scripting tool and DDE server.

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