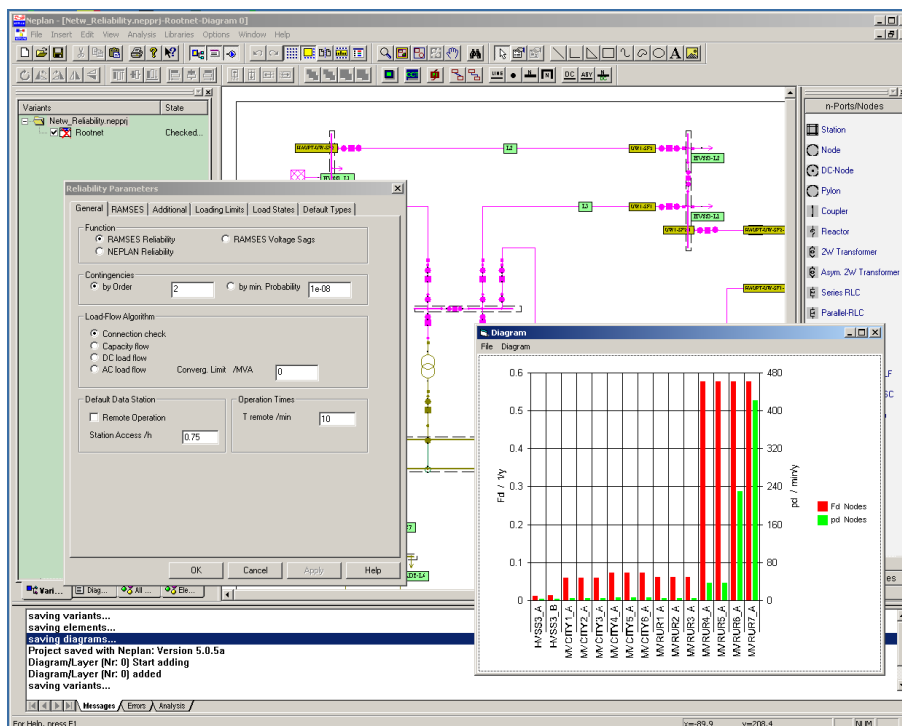


## Probabilistic Reliability Analysis

Determining the frequency, average duration and cost of network component failures, leading to supply interruptions.

### Consideration of

- Outage behavior (failure rate and repair times) of network equipment
- Network operation in normal state and for multiple order network contingencies
- Admissible short-time component overloading
- Protection concept including protection failures
- Realistic generation patterns and load curves



### Reliability Analysis is imperative for

- Optimum asset allocation and cost-benefit analysis for investments in transmission and distribution networks
- Design and evaluation of innovative substation layouts
- Weak-point analysis in existing networks
- Design of automation concepts in public and industrial distribution networks
- Detailed and objective discussion of network connection concepts for high-demand customers and power plants
- Cost-effective mitigation of power quality problems (voltage sags)
- Add-on for NEPLAN-Main – a tool to apply Reliability Centered Maintenance (RCM) Strategy, which leads to substantial reduction of maintenance expenses

## Procedure of Reliability Analysis

### Relevant component failures

#### Single order contingencies:

- Stochastic failures
- Common-Mode failures
- Spontaneous protection tripping

#### Second order contingencies:

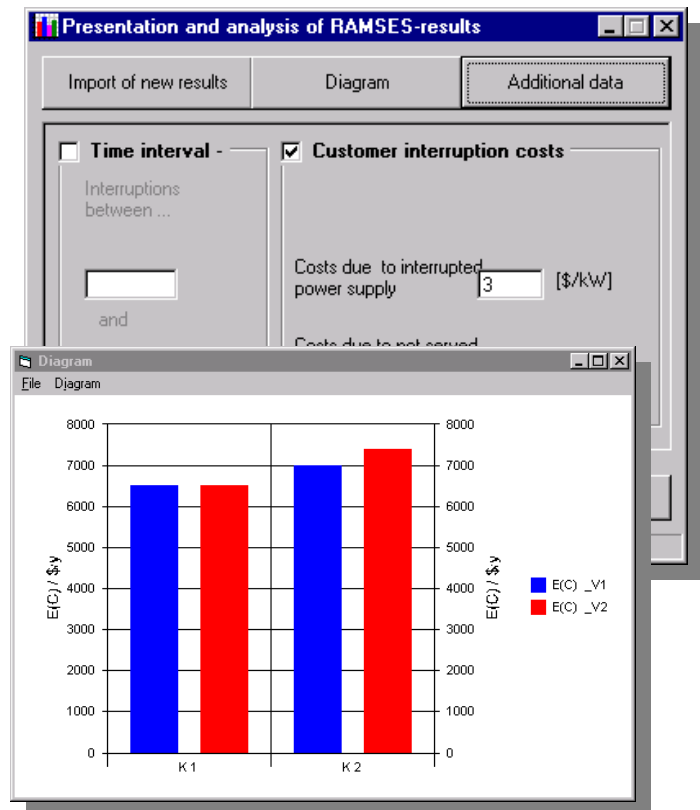
- Overlapping independent stochastic outages
- Failure occurring during the maintenance of the backup components
- Protection failure or overfunction
- Multiple earth-faults

### Calculated results

- |                                       |                |           |
|---------------------------------------|----------------|-----------|
| - Frequency of supply interruptions   | fd             | in #/yr   |
| - Probability of supply interruptions | qd             | in min/yr |
| - Mean interruption durations         | Td             | in hrs    |
| - Energy not served in time           | Wd             | in MWh/yr |
| - Interruption cost                   | C <sub>d</sub> | in \$/yr  |

### Presentation of results

- Result values printed at load nodes in network plan
- Color shading of the network graph in dependence of the reliability results
- Various filter functions implemented for detailed analysis
- Integrated flexible diagram functions to visualize the calculation results
- Results fully exportable for use in tables and diagrams



### Evaluation functions

- Consideration of power/energy-specific interruption cost
- Filter to investigate component contributions to load node interruptions
- Copying of diagrams into clipboard
- Shading of network diagram in dependence of load node results
- Analysis of system reaction after faults