

NEPLAN-Maintenance (RCM, CBM, TBM)

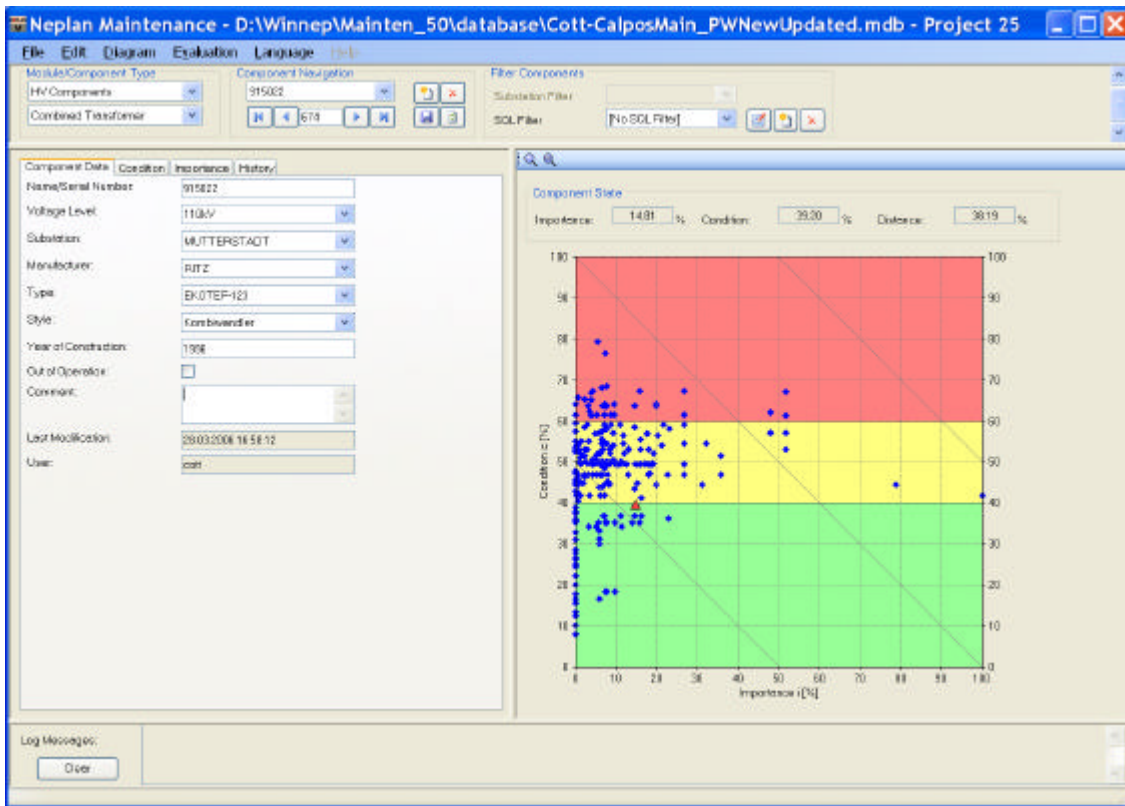
This document describes the software of the NEPLAN-Maintenance module. It is not intended to give an overview over the maintenance strategies. A good overview over different maintenance strategies and the NEPLAN-Maintenance philosophy can be found here:

www.neplan.ch/downloads/public/NEPLAN-Maintenance-Strategies_e.pdf

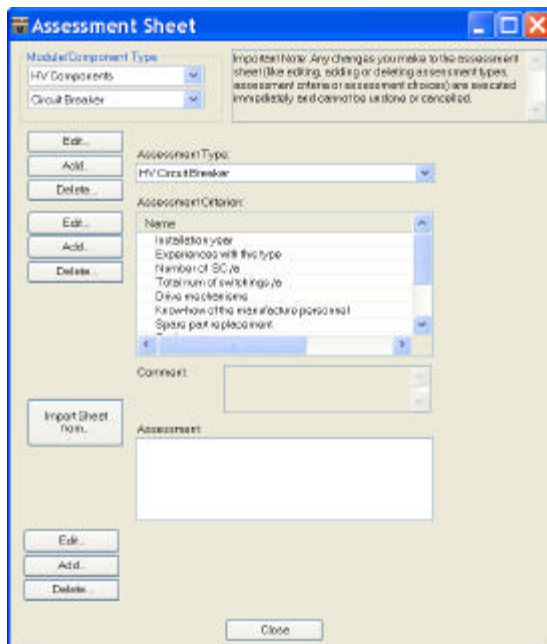
The main features of the NEPLAN-Maintenance module are:

- Available sub-modules are:
 - o HV Components
 - o HV AIS Substations
 - o HV GIS Substations
 - o HV/MV Overhead line
 - o MV Substations
 - o MV Local Substations
 - o MV Cables
- Data can be stored in any database (e.g. Oracle, MS-Access, SQL Server etc.)
- Allows easy integration to existing ERP systems (e.g. SAP)
- Assessment criterion can be added or changed by the user
- Allows quickly to assess the conditions of the components
- Different charts give a useful overview over the overall conditions of the components
- A budgeting evaluation tools is available, which calculates the costs for the following maintenance strategies:
 - o TBM Estimation (estimated time based maintenance)
 - o TBM (time based maintenance)
 - o CBM (condition based maintenance)
 - o RCM (reliability based maintenance)
- **Integrates smoothly with our famous NEPLAN-Reliability module**
- Can be excellently used a for reinvestment strategies

Overview NEPLAN-Maintenance Module



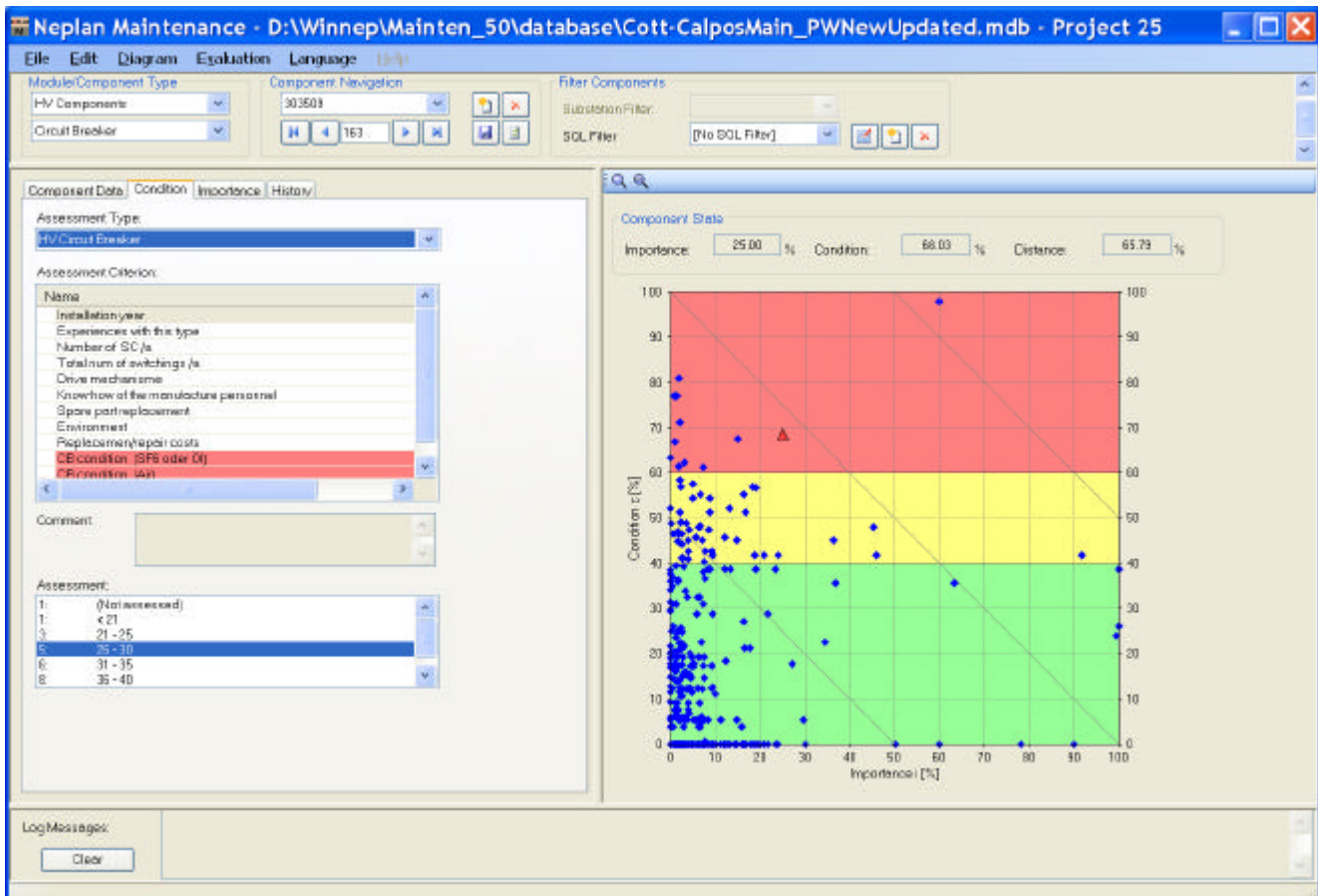
NEPLAN-Maintenance Software



The NEPLAN-Maintenance assessment sheet editor allows the user to freely configure any assessment sheets with his own criteria.

Component Assessment in NEPLAN-Maintenance

The picture below shows on the left side the assessment sheet of the current component. The diagram shows all conditions (y-axes) and all importances (x-axes) of all components (in this case circuit breakers). The actual circuit breaker to assess is colored differently. The user can define any filter to reduce the amount of displayed components.



The condition of each component can easily be assessed with the freely configurable assessment sheets.

Budgeting Evaluation Tool in NEPLAN-Maintenance

In NEPLAN-Maintenance a budgeting tool is included, which allows evaluating the costs of the different maintenance strategies:

- TBM Estimation (estimated time based maintenance)
- TBM (time based maintenance)
- CBM (condition based maintenance)
- RCM (reliability based maintenance)

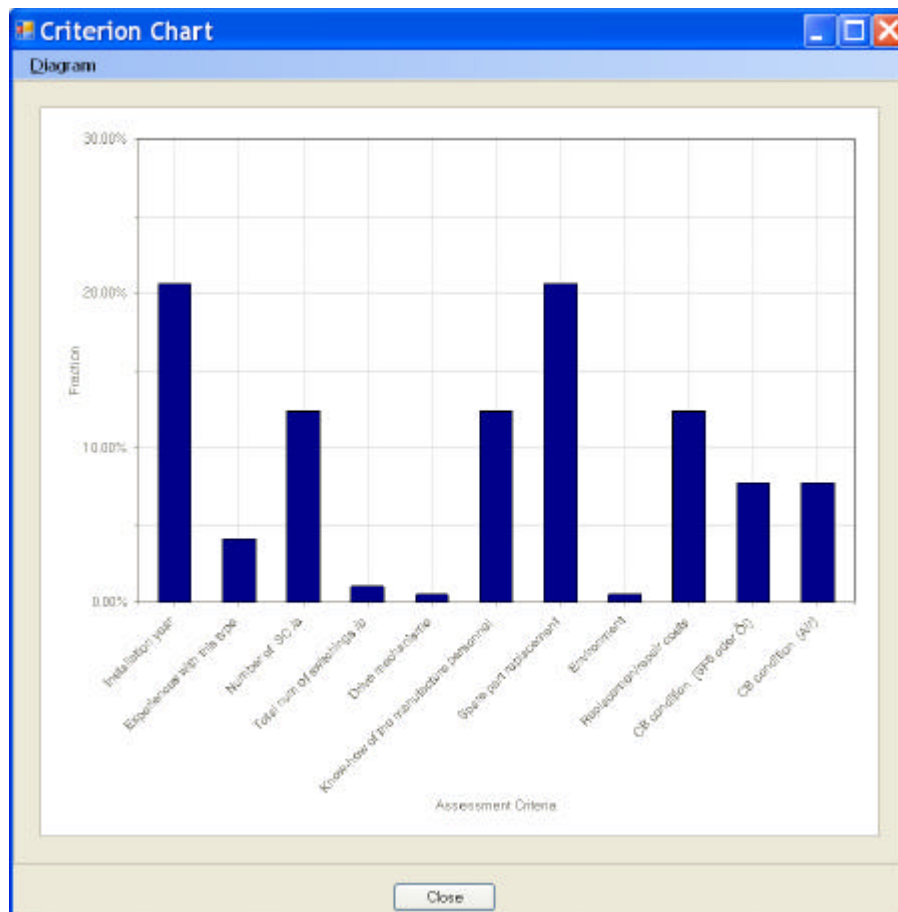
Name	Value
Type	Combined Transformer
Filter name	[No SQL Filter]
Comment	RCM
Start year calculation period	2007
Replacement costs	50000
Maintenance costs	8000
Replacement cycle	40
Maintenance cycle	10
Cr replacement limit	60
Cm maintenance limit	40.1
Dr replacement limit	60
Dm maintenance limit	40
Ir replacement limit	8
Lambda	0.05
Total components	936
Replacement info	D=31; I=704; T=166-12-24-57-6
Number of components for replacement	42
Maintenance info	D=172; T=126-93-24-61-59
Number of components for maintenance	35
Total costs replacement	2100000
Total costs maintenance	260000
Budget	2360000

Name	Value
Type	Combined Transformer
Filter name	[No SQL Filter]
Comment	TBM
Start year calculation period	2007
Replacement costs	50000
Maintenance costs	8000
Replacement cycle	40
Maintenance cycle	10
Cr replacement limit	60
Cm maintenance limit	40.1
Dr replacement limit	60
Dm maintenance limit	40
Ir replacement limit	0
Lambda	0.05
Total components	936
Replacement info	936
Number of components for replacement	58
Maintenance info	936
Number of components for maintenance	75
Total costs replacement	2650000
Total costs maintenance	584000
Budget	3234000

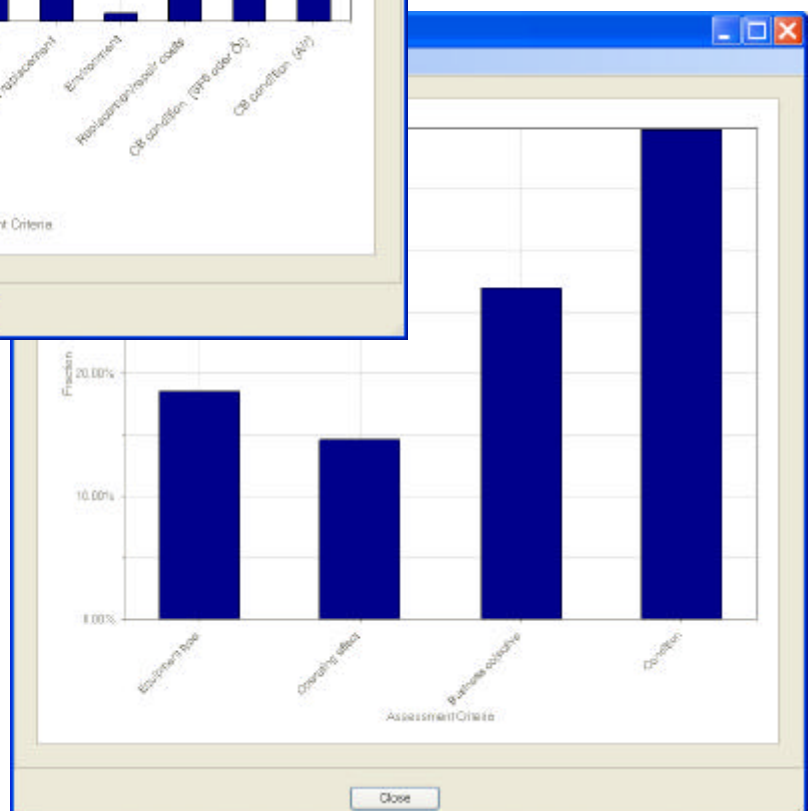
At your fingertips: budgeting of RCM and TBM can be easily compared

Chart Evaluation Tool in NEPLAN-Maintenance

The integrated chart manager shows for example the influence of each criterion to the overall conditions of all components. Each criterion can be assigned to a cluster (e.g. operating condition, component type, etc.). NEPLAN allows evaluating the overall conditions according to these clusters.



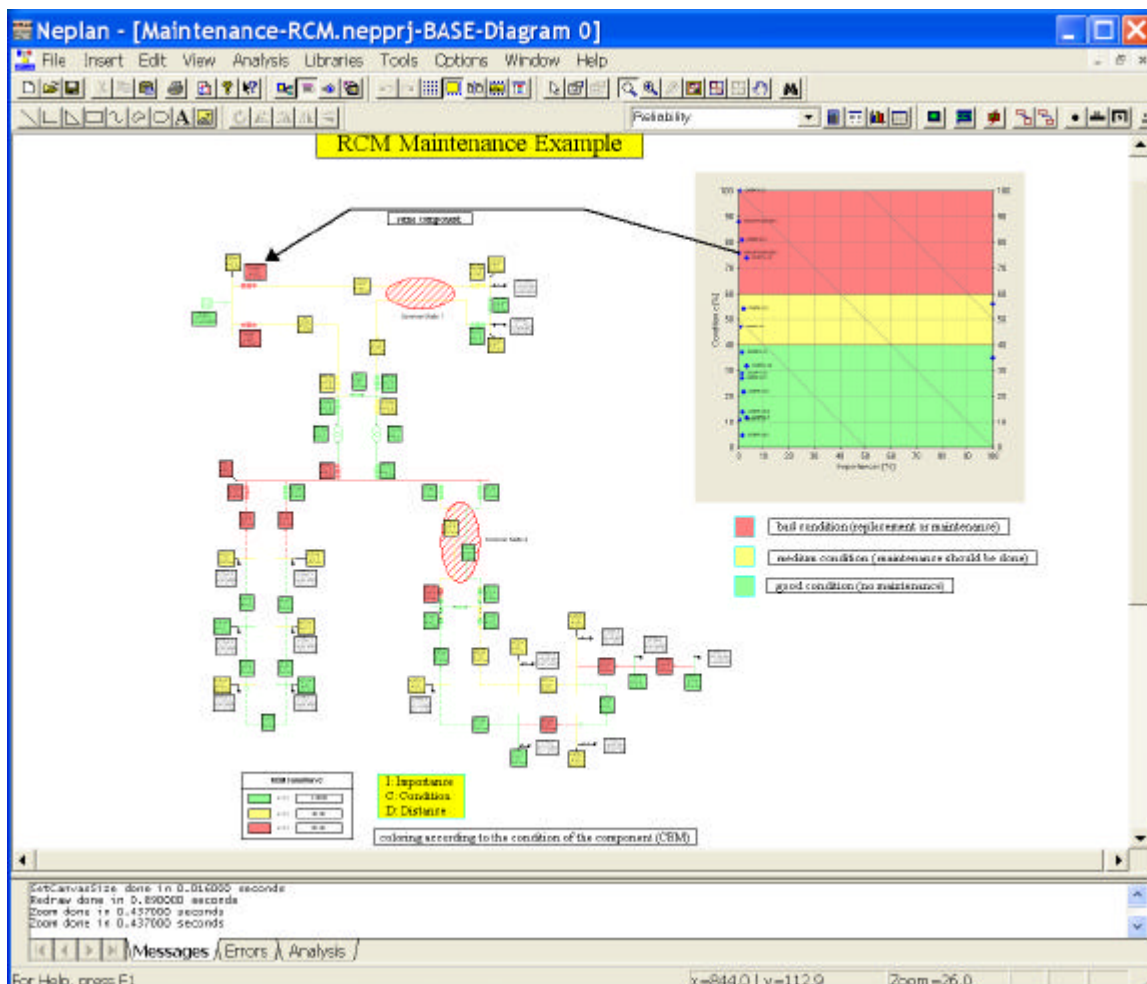
This chart shows the influence of different clusters to the overall conditions of all components. It shows for example the effect of all criteria which belong to the 'Operating Conditions' cluster compared to the other effects of the other clusters.



Integration with NEPLAN-Reliability Module

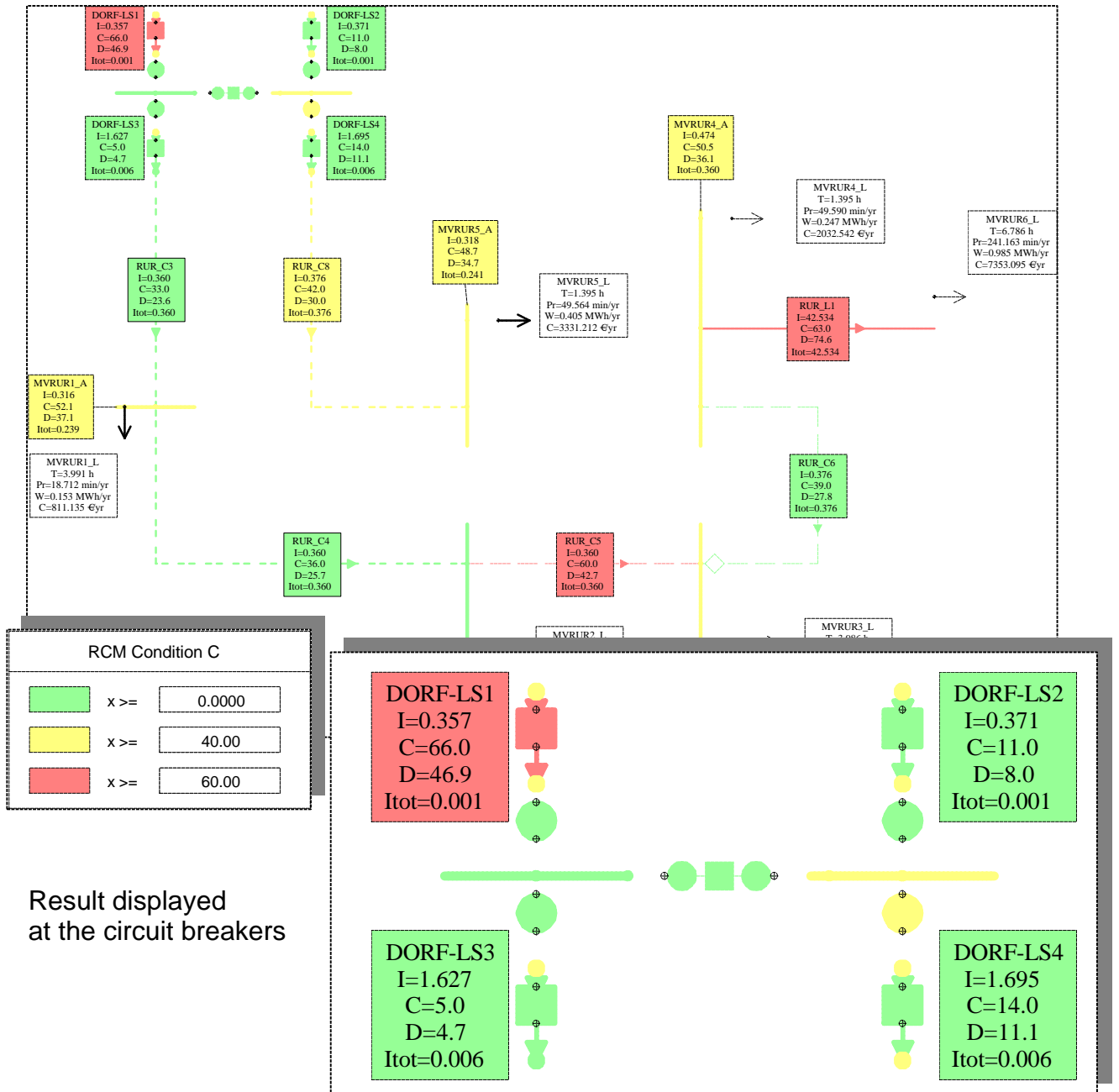
The NEPLAN-Maintenance module can make use of the calculated results of our famous NEPLAN-Reliability module. The NEPLAN-Maintenance module integrates smoothly to the NEPLAN single line diagram. The conditions C, importance I and the distances D (function of condition and importance, $D = f(C, I)$) can be displayed on the single line diagram. The coloring according to C, I and D shows very quickly which components must be replaced or maintained first.

The NEPLAN-Maintenance module is at the moment the only RCM module on the market, which integrates, with a robust network reliability module.



Integration of the NEPLAN-Reliability module with the NEPLAN-Maintenance module

Display of the maintenance and reliability results in the single line diagram



The results from the reliability calculation are combined with the condition evaluation of the maintenance module and displayed in the NEPLAN single line diagram. The coloring shows which equipment have to be replaced or maintained or just observed.

Display of the maintenance and reliability results in table form

	ID	Name	Type	I	C	D	I Total
14	638	DORF-L13	Circuit-Breaker (2)	1.399183	81	58.265	0.004784
15	639	DORF-L14	Circuit-Breaker (2)	3.380098	32	25.018	0.011557
16	628	HAUPT-UW	Circuit-Breaker (2)	0	76	53.74	0
17	629	HAUPT-UW	Circuit-Breaker (2)	0	88	62.225	0
18	640	DORF-L15	Circuit-Breaker (2)	1.399183	27	20.081	0.004784
19	641	DORF-L16	Circuit-Breaker (2)	1.462692	29	21.541	0.005001
20	642	DORF-L17	Circuit-Breaker (2)	1.462692	37	27.197	0.005001
21	272	EL34	Coupler	18.90618	0	0	0.148366
22	273	UW1-KU	Coupler	100	0	0	0.784749
23	274	DORF-KU	Coupler	0.244904	0	0	0.001922
24	327	DORF-TR1	Disconnect-Switch	95.953698	31	89.77	0.005562
25	328	DORF-TR2	Disconnect-Switch	100	34	94.752	0.005796
26	329	DORF-TR3	Disconnect-Switch	95.953698	36	93.305	0.005562
27	330	DORF-TR4	Disconnect-Switch	100	41	99.702	0.005796
28	357	SLACK	Feeder	100	0	0	0
29	35	CITY_C2	Line	0.436486	15	10.915	0.436486
30	38	CITY_C3	Line	0.436486	18	13.037	0.436486

Starting reliability analysis evaluation...
 Checking reliability analysis database file 'D:\neplan\neplan\user\kasko106.ncordb'...
 Data does not match actual project. Restart calculation first.
 Project file name: 06Reliab1104.ncordb
 Variant: 30 - 1
 Calculation time: 27 - Mar - 2006 11:48:04
 Reliability analysis evaluation terminated.

The results from the reliability calculation are combined with the condition evaluation of the maintenance module and displayed in the NEPLAN table, which can also be pasted into MS-Excel.

More Information

More information can be found here:

NEPLAN:

www.neplan.com

NEPLAN Brochure:

<http://www.neplan.ch/downloads/public/NeplanElectricity.pdf>

Maintenance strategies:

www.neplan.ch/downloads/public/NEPLAN-Maintenance-Strategies_e.pdf

Reliability:

http://www.neplan.ch/sites/en/neplan_elec_calcmo_d_reliability_analysis.asp

Contact

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