

A DSS based on multiple criteria decision making for maintenance planning in an electrical power distributor

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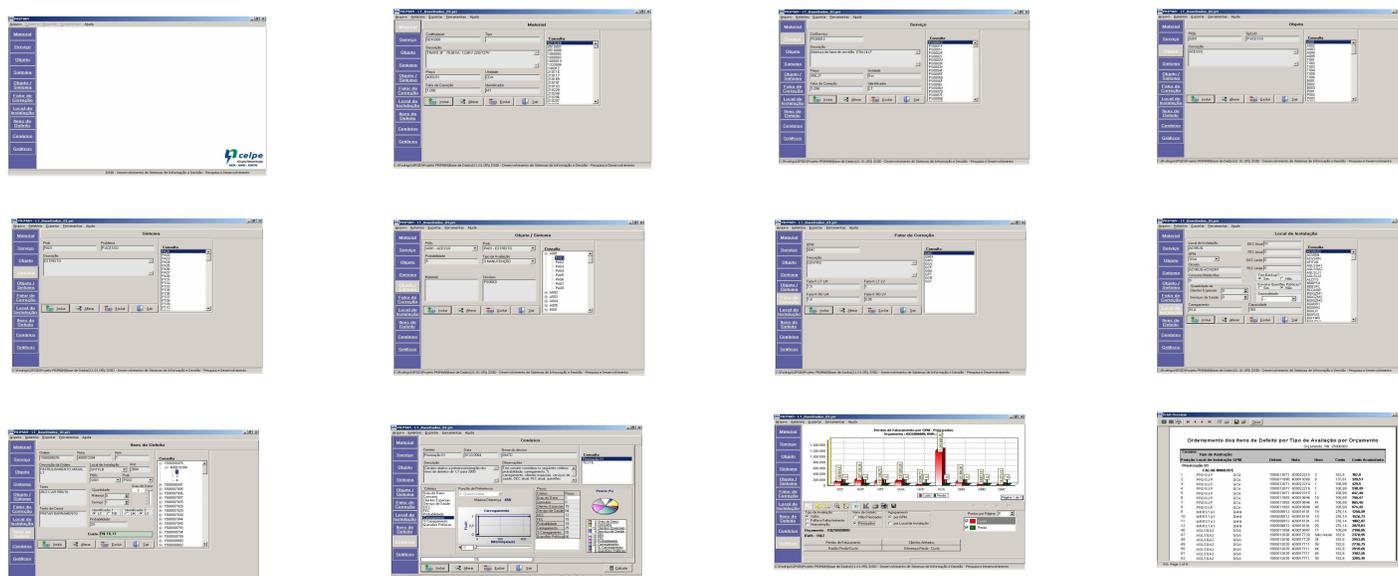
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A power distribution network is a complex system:

- 3.1 million customers
- Almost 200 cities, comprehends 98,546.70 km²
- 12,266,246 MWh delivered per year
- Distribution network – about 128,412.5 km
- 3,974.51 km - 69 kV and 138 kV
- 71,742.70 km - 13,8 kV
- 52.695.2 km - 380/220V
- A large number of components (voltage transformers, isolators, ...)

Inspection Policy:

- There is an inspection calendar which covers the entire power distribution network in a period of 10 years, which is based in periodical inspection activities that take place at one, two, five and ten year intervals
- Usually there are 25 thousand orders to repair potential failure built based on the company inspection calendar and recorded in the company's database for its enterprise resource planning (ERP) system
- In order to assure the quality of service there is a budget for preventive maintenance orders of potential failures.
- However the budget is not enough to perform the entire maintenance orders for the set of potential failures



There is a large number of possible preventive maintenance orders: ${}_n P_r = \frac{n!}{(n-r)!}$

Promethee II Method was used to rank orders: $\pi(a, b) = \frac{1}{W} \cdot \sum_{j=1}^k w_j P_j(a, b)$

$$\phi(a) = \frac{1}{n-1} \left[\sum_{\substack{b=1 \\ b \neq a}}^n \pi(a, b) - \sum_{\substack{b=1 \\ b \neq a}}^n \pi(b, a) \right]$$

- The main performance indexes considered by Aneel to measure quality of service are the DEC and FEC
- DEC is related to the duration of service disruptions whenever these occur and FEC considers the frequency of disruption to the service

The main sets of criteria identified for the decision model are:

- Degree of Damage (to installation and people, verbal scale), Average Affected Consumption, Electric Charge, % of Regional Network Electric Charge (considering the network branch), Special Clients Affected (subjected to regulatory special rules), Healthcare Services, Slack on DEC (difference between branch DEC and Aneel target for DEC), Slack on FEC (difference between branch FEC and Aneel target for FEC), Political Consequences of a Failure

PRIMAN allows Maintenance Engineering Manager also to sequence maintenance orders figuring a maintenance sequencing plan over its budget