20TH INTERNATIONAL CONFERENCE ON ELECTRICITY DISTRIBUTION
PRAGUE, 8 – 11 JUNE 2009

IMPACT EVALUATION OF DISTURBING LOADS ON SECONDARY AND PRIMARY DISTRIBUTION NETWORKS

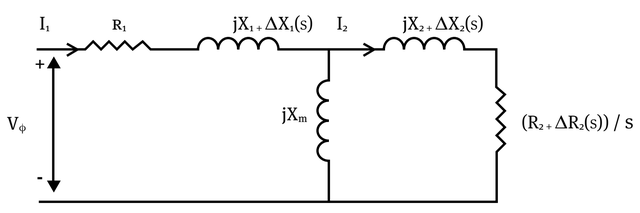
SESSION 2 – PAPER 0767

OBJECTIVES

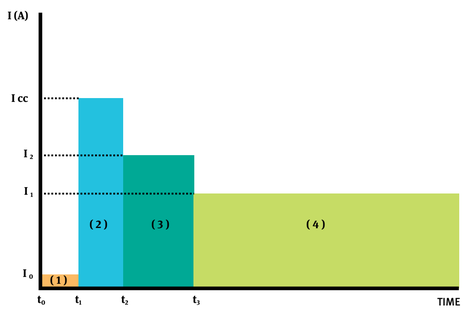
- Development of calculation models in order to evaluate the impact of disturbing loads on the distribution system.
- The disturbing loads considered are: induction motor, x-ray device, welding machine and electric arc furnace.

APPROACH

- Network and Load Models.
- Induction motor model for the transient condition.
- Acquisition of the electrical equivalent circuit through the nameplate data using an evolutionary algorithm.
- Models for X-ray devices, welding machines and arc furnace.

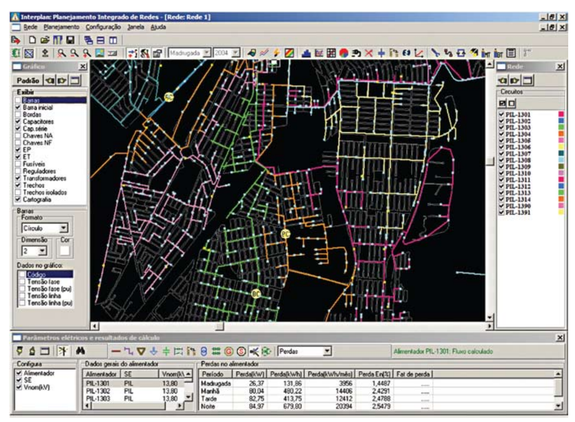


Electrical equivalent circuit for the induction motor taking into account parameters variation

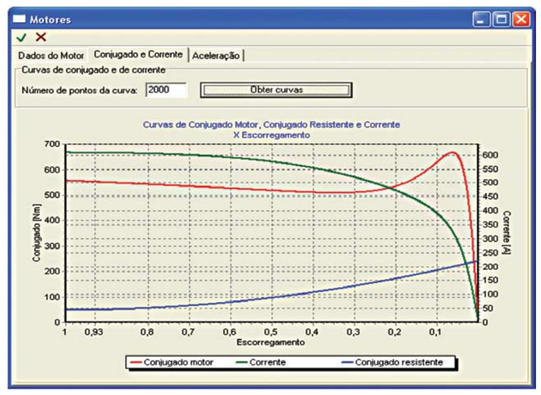


Current drained by the welding machine

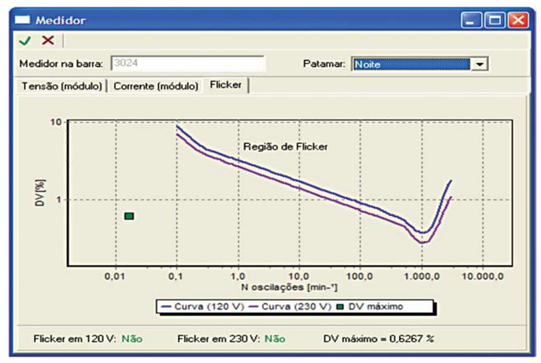
COMPUTATIONAL TOOL



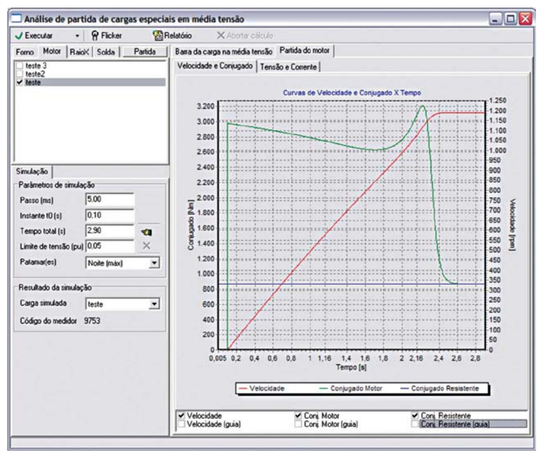
GIS environment



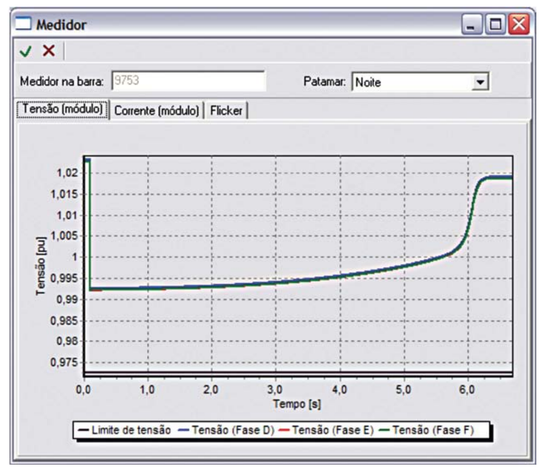
Parameters obtained with an evolutionary algorithm



Flicker analysis



Starting analysis



Voltage X Time

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20TH INTERNATIONAL CONFERENCE ON ELECTRICITY DISTRIBUTION
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TARIFF STRUCTURE BASED ON A NEW DEFINITION OF CUSTOMER RESPONSIBILITY IN POWER DISTRIBUTION SYSTEMS

SESSION 6 – PAPER 0563

OBJECTIVES

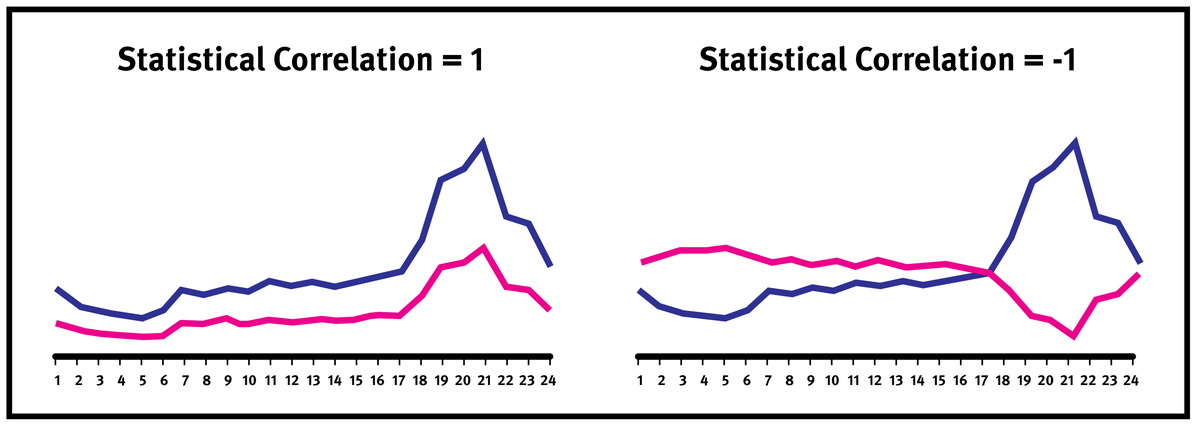
- To identify customer-types' responsibilities on marginal costs
- To design a tariff structure for efficient allocation of the utility's permitted revenue

APPROACH

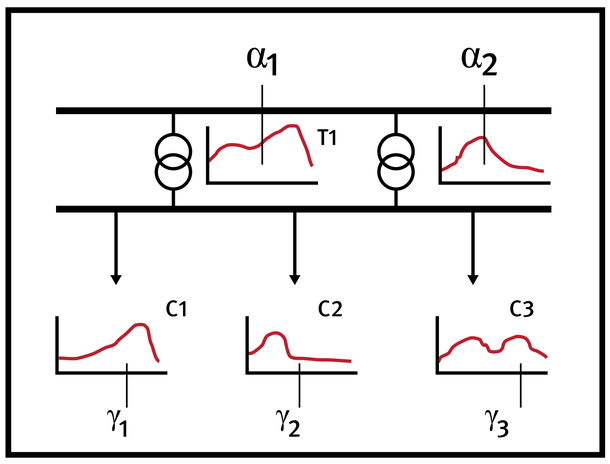
- For several customers, active power is measured in a 5-minute interval for several days.
- Chosen Load curves are grouped using statistical correlation instead of k-Means with Euclidean distance.
- Customer responsibility is defined using a statistical correlation function.
- Optimization process is formulated for solving the conditional probabilities problem.

RESULTS

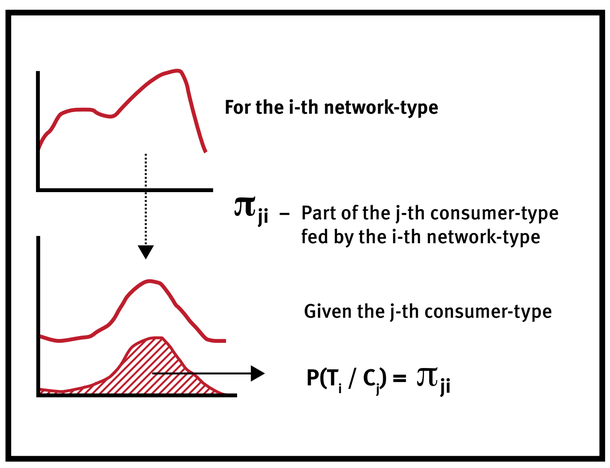
- Simpler and more efficient method for classifying customer load curves.
- Consistent tariff structure, based on customers' responsibilities on the usage of the distribution network



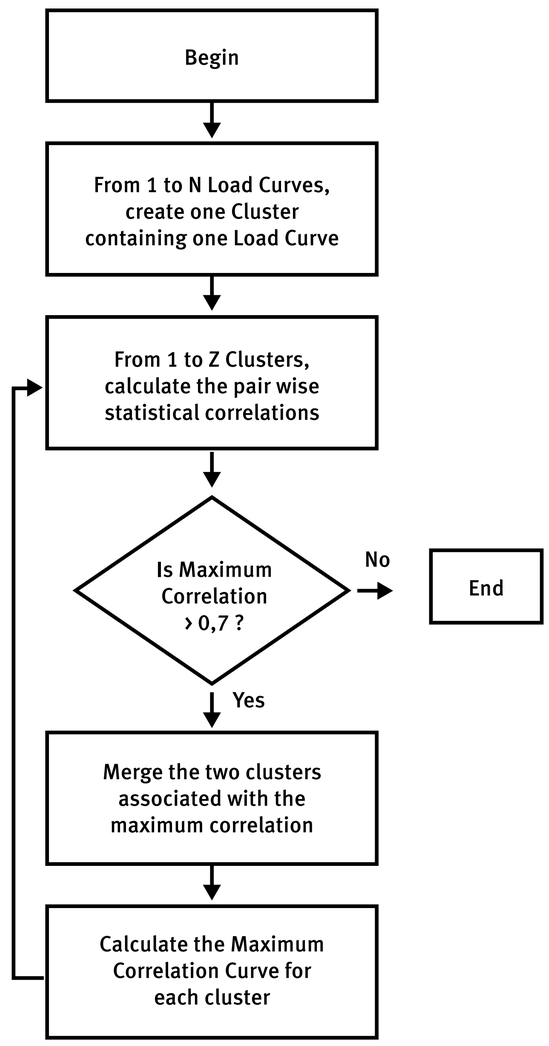
Evaluating similarity between two load profiles using statistical correlation between two data series



Two network-type load profiles and three customer-type load profiles



Definition of the "π" variables, indicating how a customer-type will be fed by a network-type load profile



Load profiles classification using statistical correlation

Fábio Sismotto El Hage — *Daimon Engenharia e Sistemas, Brazil*
Nelson Kagan — *University of São Paulo, Brazil*

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INTEGRATED MODEL OF SPATIAL AND GLOBAL LOAD FORECAST FOR POWER DISTRIBUTION SYSTEMS

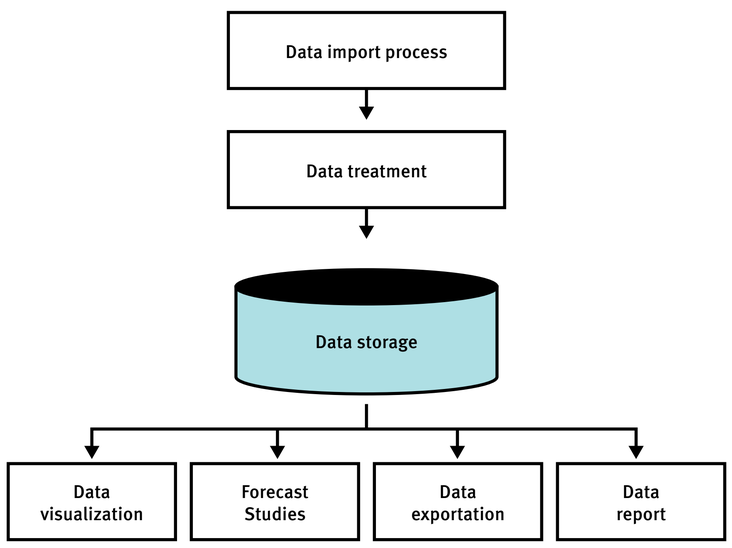
SESSION 5 – PAPER 0565

OBJECTIVES

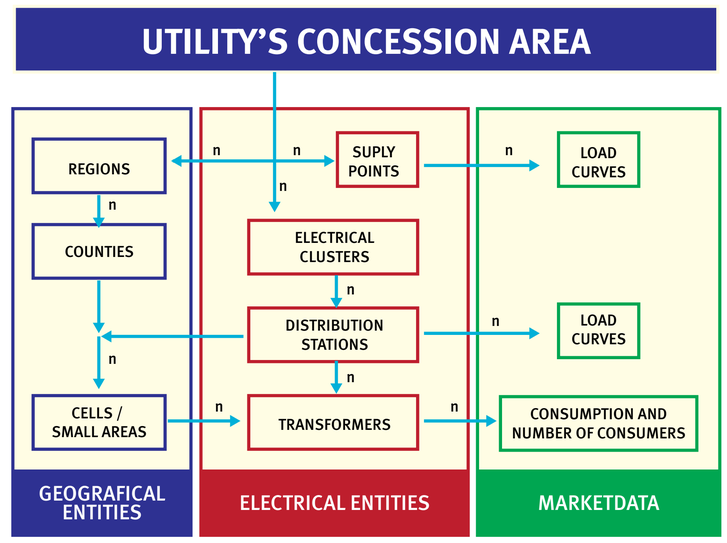
Presents the methodology and the application of a market study model based on Geographic Information System for electrical load studies.

APPROACH

- Forecast studies: global forecast and spatial forecast.
- ARIMA Model (Box-Jenkins).
- Model in accordance with the Brazilian Regulatory Agency procedures.

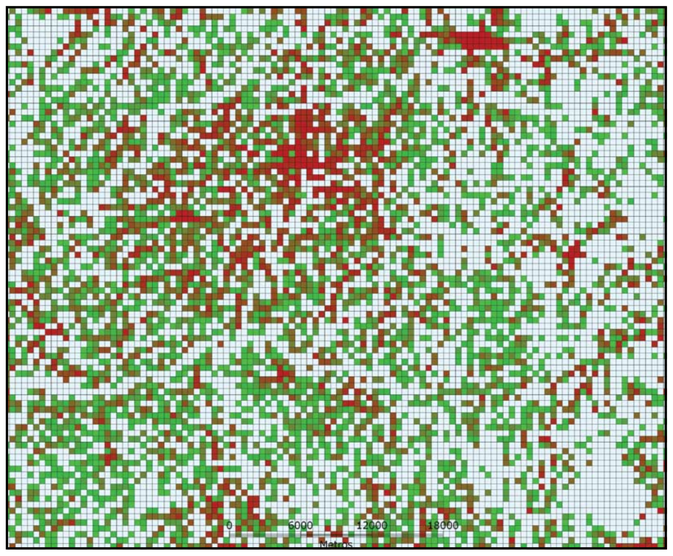


Integrated Model for the Spatial and Global Load Forecast for Power Distribution processes

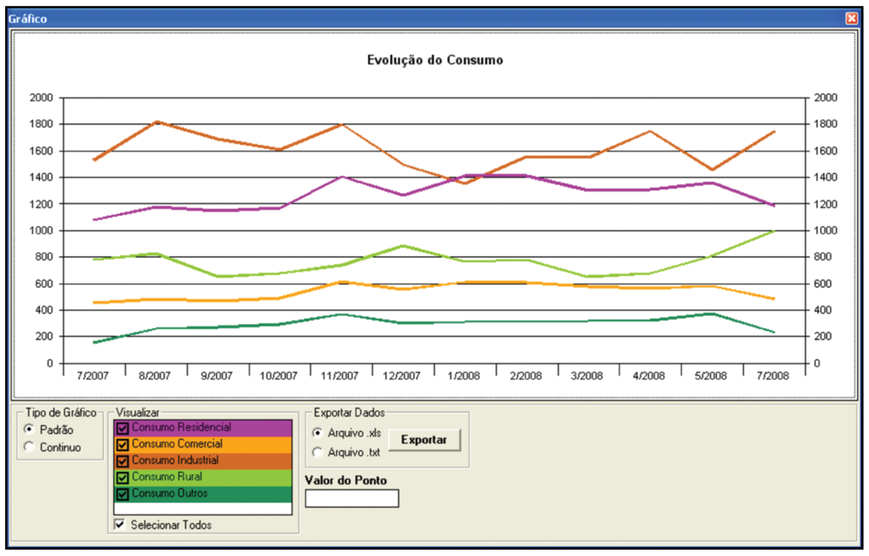


Integrated Model for the Spatial and Global Load Forecast for Power Distribution processes

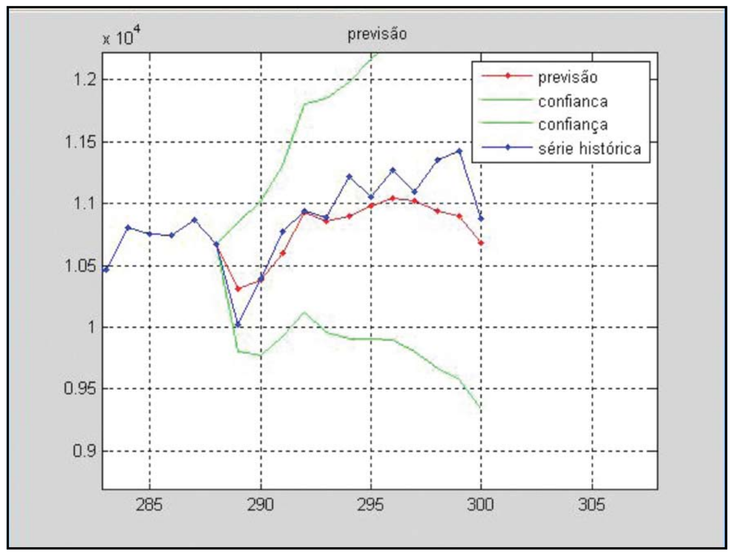
RESULTS



Geo-referenced representation of the consumption per geographical entity



Historical series for the total consumption and customer type



Result of the time series forecast

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Fábio Sismotto El Hage — *Daimon Engenharia e Sistemas, Brazil.*
Carlos César Barioni de Oliveira — *Daimon Engenharia e Sistemas, Brazil.*

20TH INTERNATIONAL CONFERENCE ON ELECTRICITY DISTRIBUTION
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TECHNICAL LOSS CALCULATION BY DISTRIBUTION SYSTEM SEGMENT WITH CORRECTIONS FROM MEASUREMENTS

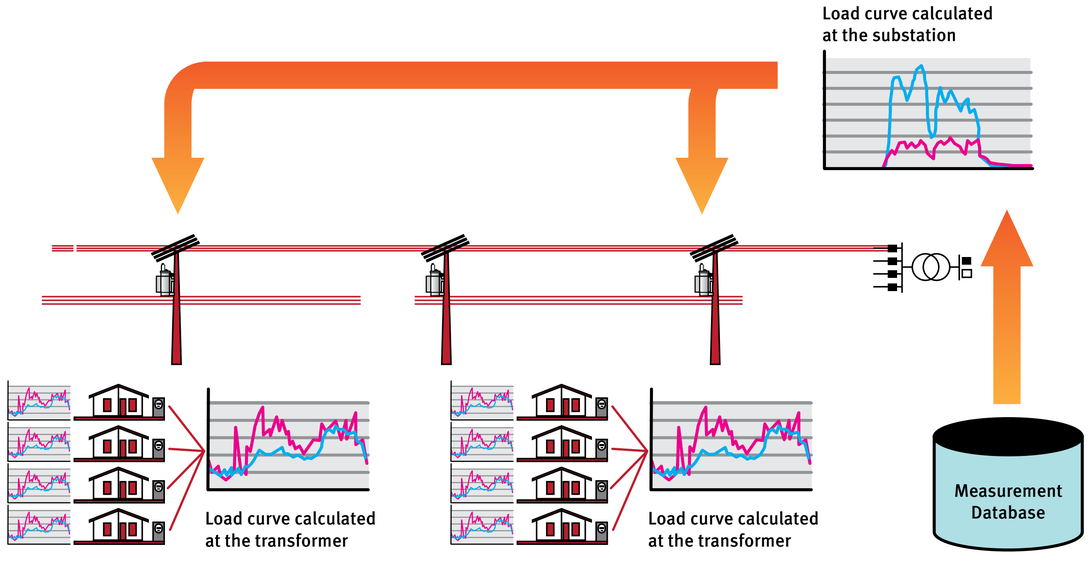
SESSION 5 – PAPER 0752

OBJECTIVES

- Presenting a method for calculating technical losses with corrections from measurements.
- Calculating non-technical losses considering energy not billed.

APPROACH

- From topological, billing and measurement databases, a correction factor is calculated.
- This factor is applied to billed energy and variable losses.



Estimated energy:

$$E_{est} = E_{MV} + E_{LV} + E_{lvar} + E_{lfixed}$$

Variable and fixed losses:

$$E_{lvar} = e_{cc} + e_{sn} + e_{dt,Cu} + e_{pn}$$

$$E_{lfixed} = e_{pm} + e_{dt,Fe}$$

Measured energy:

$$E_{meas} = E_{MV} + k_e \cdot E_{LV} + k_e^2 \cdot E_{lvar} + E_{lfixed}$$

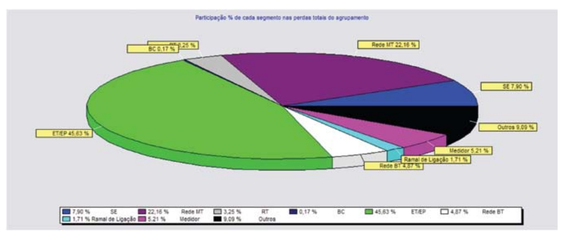
Correction factor:

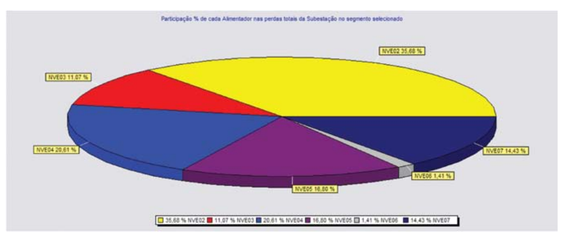
$$k_e = \frac{-E_{LV} + \sqrt{E_{LV}^2 - 4 \cdot E_{lvar} \cdot (E_{lfixed} - E_{meas} - E_{MV})}}{2 \cdot E_{lvar}}$$

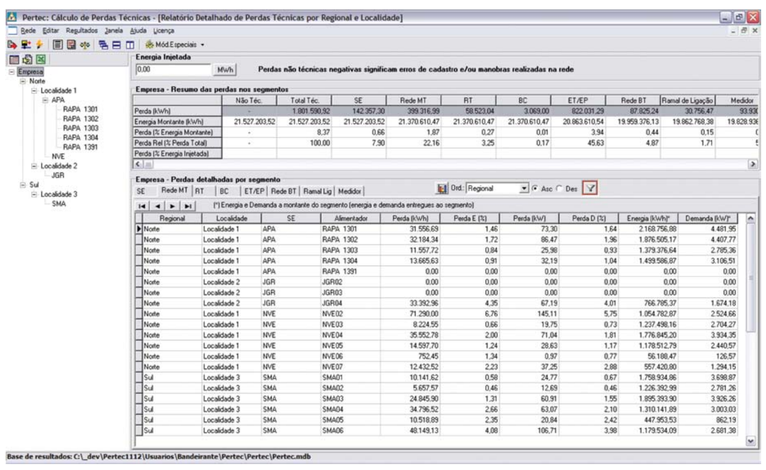
Non-technical losses:

$$E_{NTL} = E_{meas} - E_{MV} - E_{LV} - k_e^2 \cdot E_{lvar} - E_{lfixed}$$

SOFTWARE PERTEC TECHNICAL LOSSES CALCULATION







RESULTS

Method applied to 8 substations and 83 primary feeders.

Segment	*Energy Loss Without Correction*		*Energy Loss With Correction*	
	[kWh]	*[%]*	*[kWh]*	*[%]*
Distribution Substation	886,416.56	0.75	1,208,268.21	0.77
MV Network	926,523.29	0.79	1,859,674.44	1.19
Distribution Transformer	1,867,897.58	2.59	2,571,956.99	2.55
LV Network	793,703.35	1.13	1,563,717.50	1.59
Customer Connection	219,445.15	0.32	381,670.78	0.40
Power Meter	253,261.72	0.37	253,261.72	0.26
Others	494,724.77	0.42	783,854.96	0.50
Technical Losses	5,441,972.42	4.63	8,622,404.60	5.47
Non-Technical Losses	-	-	36,957,776.46	23.44

André Meffe — *Daimon Engenharia e Sistemas, Brazil*

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