

IMPACT EVALUATION OF DISTURBING LOADS ON SECONDARY AND PRIMARY **DISTRIBUTION NETWORKS**

SESSION 2 – PAPER 0767





- 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.



GIS environment

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

Parameters obtained with an evolutionary algorithm





Starting analysis

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Voltage X Time



TARIFF STRUCTURE BASED ON A NEW DEFINITION OF CUSTOMER RESPONSIBILITY IN POWER DISTRIBUTION SYSTEMS

SESSION 6 - PAPER 0563



- 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.



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





 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

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



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



Load profiles classification using statistical correlation

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

SESSION 5 - PAPER 0565



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

USP, Brazil.

Result of the time series forecast

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TECHNICAL LOSS CALCULATION BY DISTRIBUTION SYSTEM SEGMENT WITH CORRECTIONS FROM MEASUREMENTS

SESSION 5 - PAPER 0752



- 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.





Non-technical losses:

$$E - E E E l_r^2 E E$$

Load curve calculated at the transformer



Database

SOFTWARE PERTEC TECHNICAL LOSSES CALCULATION





	Mod.Especiais													
	Energia Injetada	- Charles and a local state												
Empresa Note Iocalidade 1 APA AAA AAA AAAA 1301 AAAA 1302 AAAA 1303 AAPA 1303 AAPA 1304 RAPA 1304 RAPA 1391 NVE Localidade 2 JGR Sul Localidade 3 SMA	0.00	Mwh	Perdas não técnica:	negativas signific	am erros de cada	istro e/ou manob	ras realizadas na	rede						
	Employa Barring	das nasdas nos	and an and an											
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	Energia Montante Ik/w	21.527	203.52 21.527.203.5	2 21 527 203 52	21.370.610.47	21 370 610 47	21,370,610,47	20.863.610.54	19,959,376,13	19.862 768 38	19 828 90			
	Perda (% Energia Mon	tante)	8.3	7 0.66	1.87	0.27	0.01	3.94	0.44	0.15				
	Perda Rel (% Perda Te	vial) -	100.0	0 7.90	22,16	3.25	0.17	45.63	4.87	1,71				
	Perda (% Energia Injet	adal												
	K. m													
	Emoresa - Pordas	detalbadas nor se	omenio											
	SE Rede MT	SE Rede MT RT BC ET/EP Rede BT Ramal Lig Medidor					🙀 Ord: Regional 💌 🕫 Asc 🔿 Des 🔽							
	14 + FI (") Energia e Demanda a montante do segmento (energia e demanda entregues ao segmento)													
	Regional	Localidade	SE	Alimentador	Perda (kWh)	Perda E (%)	Perda (kW)	Perda D (%)	Energia (kWh)"	Demanda (k	WT ^			
	Nonte	Localidade 1	APA F	APA 1301	31.556,69	1,46	73,30	1.64	2.168.756,8	3 4.4	.81,95			
	Norte	Localidade 1	APA F	APA 1302	32,184,34	1,72	86,47	1,9	1.876.505,1	7 4.4	.07.77			
	Norte	Localidade 1	APA F	APA 1303	11.557,72	0,84	25,98	0,93	1.379.376,6	4 27	85,36			
	Norte	Localidade 1	APA F	APA 1304	13.665,63	0,91	32,19	1,04	1.499.586,8	7 3.1	06,51			
	Nonte	Localidade 1	APA F	APA 1391	0,00	0,00	0,00	0,0	0,0	D	0,00			
	Norte	Localidade 2	JGR J	GR02	0.00	0,00	0,00	0,0	0,0	0	0,00			
	Norte	Localidade 2	JGR J	GR03	0,00	0,00	0,00	0,0	0,0	D	0,00			
	Norte	Localidade 2	JGR J	GR04	33.392,96	4,35	67,19	4,01	766.785,3	7 1.6	74,18			
	Nonte	Localidade 1	NVE N	VE02	71.290.00	6,76	145,11	5,75	1.054.782,8	7 25	24,66			
	Norte	Localidade 1	NVE N	IVE03	8.224,55	0,66	19,75	0.73	3 1.237,498,1	5 2.7	04,27			
	Norte	Localidade 1	NVE N	IVE04	35.552.78	2,00	71,04	1,8	1,776.845,2	3.9	34,35			
	Norte	Localidade 1	NVE N	VE05	14.597,70	1,24	28,63	1,17	1.178.512,7	3 2.4	40,57			
	Norte	Localidade 1	NVE N	IVE06	752,45	1,34	0,97	0,77	7 56.188,4	7 1	26,57			
	Norte	Localidade 1	NVE N	VE07	12.432,52	2,23	37,25	2,8	557.420,8	1.2	94,15			
	C.4	Localidade 3	SMA S	MA01	10.141,62	0,58	24,77	0,67	1.758.934,8	5 3.6	98,87			
	Su		PA 4 4	MAR2	5.657,57	0,46	12,69	0,48	1.226.392,9	3 2.7	81,26			
	Sul	Localidade 3	SMA S				C0 01							
	Sul Sul	Localidade 3 Localidade 3	SMA S	MA03	24.845.90	1,31	60,31	1,5	1.895.393.9	3.9	26.26			
	Sul Sul Sul	Localidade 3 Localidade 3 Localidade 3	SMA S SMA S SMA S	MA03 MA04	24.845.90 34.796.52	1,31 2,66	63,07	2,10	5 1.895.393.9 0 1.310.141.8	0 3.9 9 3.0	126.26 03.03			
	Sul Sul Sul Sul	Localidade 3 Localidade 3 Localidade 3 Localidade 3	SMA S SMA S SMA S SMA S SMA S SMA S SMA S	MA03 MA04 MA05	24.845.90 34.796.52 10.518.89	1,31 2,66 2,35	63,07 20,84	2.10	5 1.895.393.9 0 1.310.141.8 2 447.953.5	0 3.9 9 3.0 3 8	126.26 03.03 62,19			

RESULTS

Method applied to 8 substations and 83 primary feeders.

Segment	Energy Los Without Corre	ss oction	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	



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