

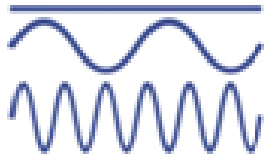
ENERGY REGULATORY COMMISSION
OF THE REPUBLIC OF MACEDONIA



NATIONAL LEGISLATION AND REGULATIONS – Case Study from Macedonia

Elena Markova Velinova, Member of ERC

**CEER-ECRB- EURELECTRIC Joint Workshop on “Voltage Quality Monitoring”
Brussels, 1 October 2012**

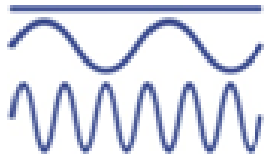


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EVN MAKEDONIJA as DSO and Retail Supplier





EVN MAKEDONIJA – Basic Data

Distribution network:

- 186 km at 110 kV
- 851 km at 35 kV
- 10.634 km at 20(10) kV
- 14.781 km at 0,4 kV

Number of transformer stations:

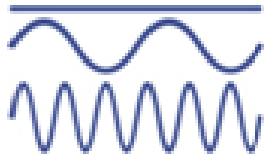
- 110/xx kV/kV: 13
- 35/20(10) kV/kV: 75
- 10/0,4 kV/kV: 6.865

Number of customers: 662.444

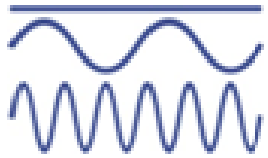
- tariff customers connected on 35 kV: 42
- tariff customers connected on 20(10) kV: 1.104
- tariff customers (others) connected on 0,4 kV: 70.961
- public lightening: 4.991
- tariff customers households: 585.345

Consumption of electricity for customers connected to the distribution system in 2011: 5.358.043.288 kWh

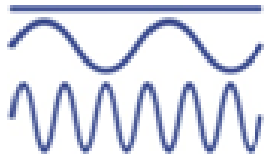
Total consumption of electricity in 2011: 7.613.647.941 kWh



- **Energy Law** (“Official Gazette of the Republic of Macedonia”, no.16/2011 and 136/2011)
- **Grid Code for transmission of electricity** (“Official Gazette of the Republic of Macedonia”, no.95/2006)
- **Grid Code for distribution of electricity** (“Official Gazette of the Republic of Macedonia”, no.87/2012)
- **Rulebook on the manner for performing control on the quality of electricity in distribution grid** (“Official Gazette of the Republic of Macedonia”, no.67/2009)
- **Standard MKS EN 50160:2009**



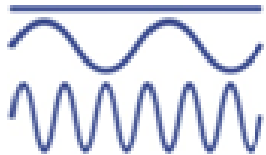
- Institutions with authorisation concerning voltage quality monitoring:
- **State Technical Inspectorate** – voltage quality control and monitoring
 - **TSO** - providing of services, measuring and monitoring
 - **DSO** - providing of services, measuring and monitoring
 - **Regulator** - monitoring and regulation of quality



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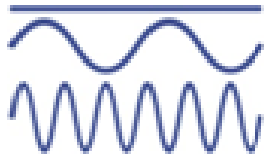
- Standard EN 50160 (included in Grid Code for distribution of electricity)
- Control and monitoring of:
 - Power frequency (± 1 % for 99.5 % of week)
 - Voltage deviations (Voltage magnitude variations, Rapid voltage changes, Supply voltage dips, Short interruptions of supply voltage, Long interruptions of supply voltage, Temporary overvoltages, Transient overvoltages, Supply voltage unbalance)
 - Flickers
 - Harmonics (THD)
- Under normal conditions, allowed range of Voltage magnitude variation from the nominal voltage values under voltage level may be as follows:
 - for voltage level over 110 kV, from: - 5% to + 5%;
 - for voltage level 110 kV, 35 kV, 20 kV, 10 kV and 6 kV, from: - 10% to + 10%;
 - for voltage level under 1 kV, from: - 10% to + 10%.



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- According to the Energy Law, voltage quality data shall be collected and stored by the State Technical Inspectorate.
- Control of the quality of electricity is performed by the State Technical Inspectorate with certificated meters (FLUKE 435), as official duty and by request of the customer.
- For the control, the State Technical Inspectorate prepares yearly plans with a monthly dynamic of 10 metering points.
- The metering points are determined according to the following criteria: to include all categories of customers connected to the distribution network and the regional representation of the customers.
- In the yearly plans State Technical Inspectorate has also to cover the specific delivery points between the assets of the DSO and TSO.
- The Inspectorate informs the DSO, at least 48 hours before the metering.
- The measures for control of the quality of electricity are performed by the State Technical Inspectorate in the presence of the DSO within a duration of 7 days.
- After the metering, the results are recorded by the Inspectorate and the Inspectorate keeps the data from the metering.
- If the results have shown that the quality is not in compliance with the parameters determined by the Grid Code, the Inspectorate shall take action according to the authority given to them by law.



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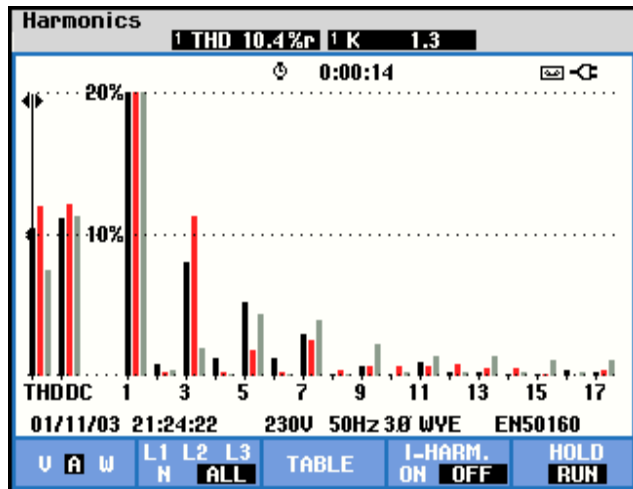


- The electricity customer shall request the DSO to measure the quality.
- The DSO should start the measurement within 8 days from the submitted request and the results from the measurement along with a statement on voltage quality should be delivered to the customer within the 8 days.
- If the customer has doubts, it shall request the State Technical Inspectorate to measure the electricity quality, or shall sign a contract with a certified inspection authority. With the request, the customer also submits the measurement data given by the DSO.
- On the request from the electricity customer, the State Technical Inspectorate, or any other inspection authority accredited in compliance with the Law on Accreditation, shall measure the quality under normal operation mode in the relevant system.
- The State Technical Inspectorate should start the measurement within 8 days from the submitted request and the results from the measurement along with statement on voltage quality should be delivered to the customer within the 8 days.
- After the metering, the results are recorded by the Inspectorate and the Inspectorate keeps the data from the metering.
- If the results have shown that the quality of electricity is not in compliance, the Inspectorate shall take action according to the authority given to them by law.

Connection of FLUKE 435 for measuring data Integrated EN 50160 standard in FLUKE 435



Measurement results from the FLUKE 435 according EN 50160



Power & Energy

FULL 0:00:07

	L1	L2	L3	Total
kW	64.6	58.9	62.0	185.5
kVA	66.0	61.6	62.7	190.4
kVAR	13.3	18.3	9.4	42.8
PF	0.98	0.95	0.99	0.97
Cosφ	0.99	0.97	1.00	
kWh	0.122	0.111	0.117	0.351
kVAh	0.125	0.116	0.119	0.360
kVARh	0.025	0.035	0.018	0.081

START 01/11/03 21:24:30 0:00:06

PULSE CNT ON OFF CLOSE ENERGY MANUAL COUNT+1 RESET ENERGY

Flicker

0:11:14

	L1	L2	L3
Pst(1min)	33.5	33.7	33.8
Pst	20.6	20.7	20.7
Plt	---	---	---
Dc(%)	0.0	0.0	0.0
Dmax(%)	19.4	19.0	18.8
TD<(s)	2.280	2.270	2.270

01/11/03 21:36:20 230V 50Hz 3Ø WYE EN50160

MAX-D VALUES PF5 TREND HOLD RUN

Unbalance

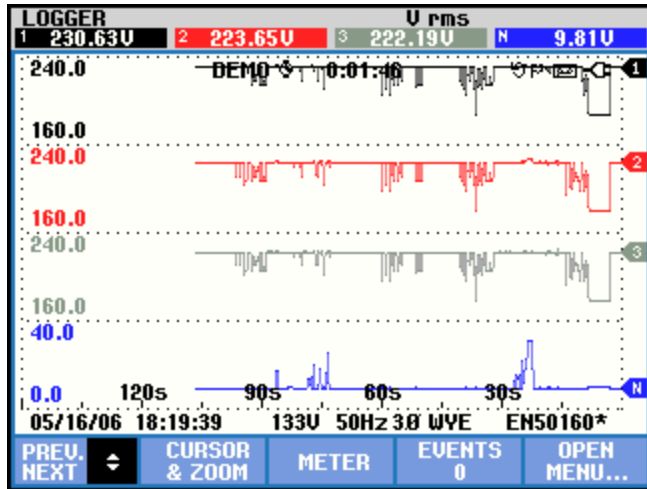
0:00:05

	Uneg.	Uzero	Aneg.	Azero
Unbal.(%)	2.0	0.7	9.0	6.7
	L1	L2	L3	N
Vfund	230.7	223.3	222.2	0.8
Hz	49.99			
	L1	L2	L3	N
φV(°)	0.0	-121.6	-240.3	-86.1
φA(°)	-7.8	-136.1	-240.5	-64.3
Afund	283	271	280	0.4

01/11/03 21:36:46 230V 50Hz 3Ø WYE EN50160

TREND HOLD RUN

Measurement results from the FLUKE 435



LOGGER EVENTS

START 05/16/06 18:22:30 EVENT 5 / 8

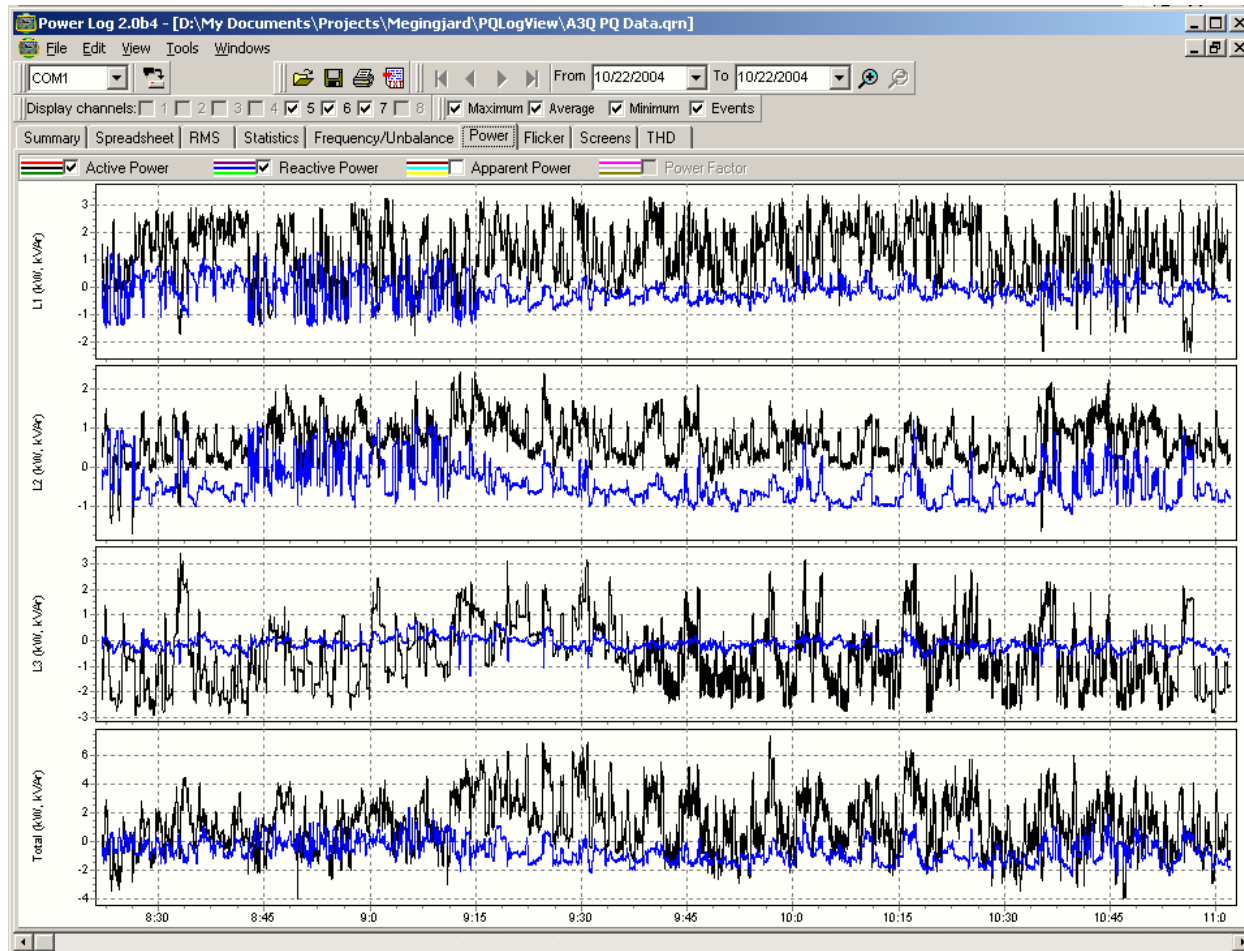
DEMO 0:28:18

DATE	TIME	TYPE	LEVEL	DURATION
05/16/06	18:29:54:757	L2 DIP	179.1 U	0:00:04:845
05/16/06	18:30:01:340	L3 THD	9.6 %	0:00:01:600
05/16/06	18:30:03:482	L3 DIP	217.9 U	0:00:01:720
05/16/06	18:30:02:472	L3 CHG	4.2 U	0:00:00:010
05/16/06	18:30:06:342	L3 DIP	212.4 U	0:00:01:400
05/16/06	18:30:06:326	L2 CHG	3.3 U	0:00:00:030
05/16/06	18:30:07:746	L2 DIP	218.1 U	0:00:00:010
05/16/06	18:30:09:339	L2 THD	9.3 %	0:00:01:600

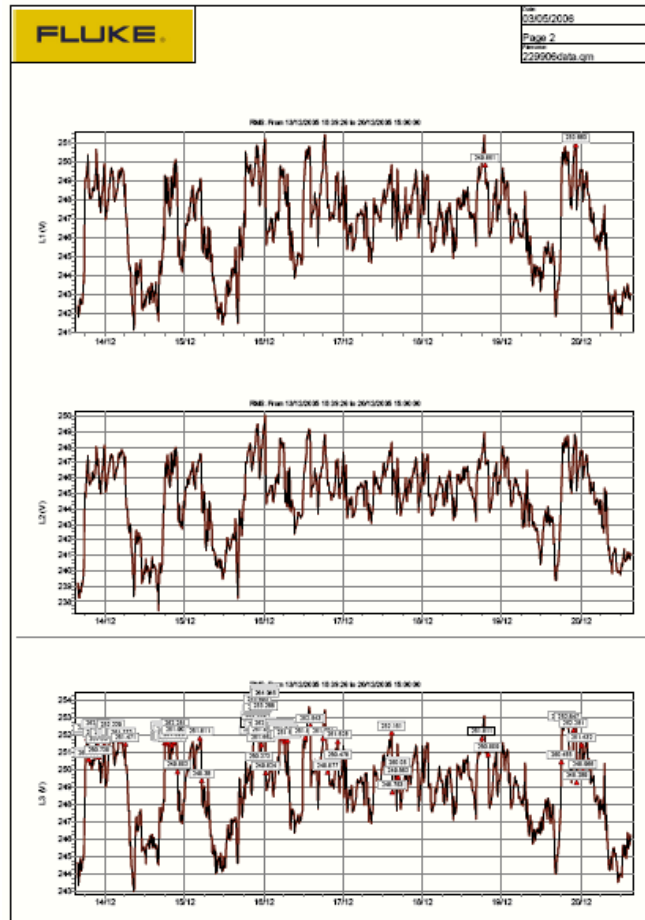
05/16/06 18:50:49 230V 50Hz 3Ø WYE EN50160*

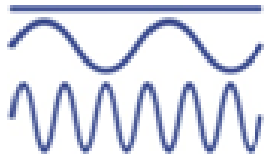
NORMAL METER TREND
DETAIL

Measurement results from the FLUKE 435 and treated with Power log software



Measurement results from the FLUKE 435 and treated with Power log software

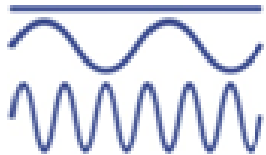




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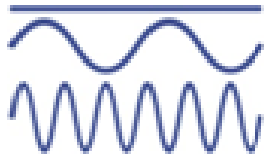
- On the proposal from the Minister of the Economy, the Government of the Republic of Macedonia shall stipulate the charge of measuring electricity quality performed by the State Technical Inspectorate, depending on the grid type and specific requirements related to quality measurement.
- The charge of measuring the electricity, performed by a certified inspection authority, shall be stipulated in the contract.
- When the results of measurements performed are in compliance with the quality rules, the charge of measurement performed shall be settled by the user.
- When the results of measurements performed by the State Technical Inspectorate or by an accredited inspection authority are not in compliance with the quality rules, the charge of measurement performed shall be settled by the system operator that failed to deliver electricity under the stipulated quality, where the charge cannot be higher than the amount stipulated in the regulation.



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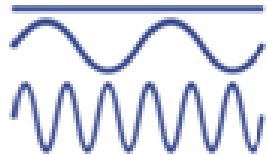
- The DSO has voltage quality measuring devices in 75 Substations installed on 35kV and 10kV.
- The DSO records the voltage quality at the beginning of the MV network. Also the DSO monitors big customers.
- The DSO has 150 fixed devices. The number of fixed devices is chosen according to the number of Substations that DSO needs to monitor. The DSO's fixed devices are installed to perform constant monitoring.
- The DSO has 13 portable devices, which are installed on different locations in MV and LV network. The DSO chooses locations according to the needs and interests. Furthermore, monitoring is performed in case of a customer complaint and bad voltage quality expected. The number of portable devices is according to the estimated number of measurements that the DSO performs in one year. The measurement period for mobile devices is minimum one week.



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- On the proposal from the State Technical Inspectorate, by 31 December of each calendar year, at the latest, the Minister of the Economy shall adopt the plan on electricity quality measurement, including the metering points and implementation dynamics for the next calendar year.
- By 15 March of each calendar year, at the latest, the State Technical Inspectorate shall submit to the Ministry of the Economy and the Energy Regulatory Commission, their report on implementation of the plan for the previous calendar year.
- The DSO is in charge of keeping a database for voltage quality. The DSO should define target levels on voltage quality and make plans for achieving the target level within two years of entry into force of the new Grid Code for distribution of electricity.
- ERC shall prepare a report on quality as part of the Annual report for operation of ERC, by 31 of March.



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THANK YOU FOR YOUR ATTENTION

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