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ZYRA E RREGULATORIT PËR ENERGJI
REGULATORNI URED ZA ENERGIJU
ENERGY REGULATORY OFFICE



RULE ON DEVELOPMENT OF CHARACTERISTIC LOAD PROFILES IN POWER SYSTEM IN KOSOVO

Pristina, June 2022

The Board of Energy Regulatory Office, in line with Article 9, paragraph 1, sub-paragraph 1.7, Article 25, Article 26, paragraph 1, sub-paragraph 1.1 of the Law on Energy Regulator no. 05/L-084, Article 28, sub-paragraph 1.29 of the Law on Electricity No. 05/L-085, in the session held on 24.06.2022, approved the:

RULE ON DEVELOPMENT OF CHARACTERISTIC LOAD PROFILES IN POWER SYSTEM IN KOSOVO

CHAPTER I GENERAL PROVISIONS

Article 1 Purpose, objectives and scope

1. This Rule specifies the requirements for development and implementation of the Characteristic Load Profiles of groups of customers who are not equipped with interval meters, as well as the development of the content, data processing, methodology, and timeline for updating these profiles for customers equipped with interval meters.

2. The objectives of this Rule are:
 - 2.1 Creating conditions for final customers market participation;
 - 2.2 Calculation of the load of final customers who do not have interval meters;
 - 2.3 Understanding of customer behaviour;
 - 2.4 Managing of consumption and load forecast;
 - 2.5 Calculation of imbalance of settlement of suppliers' consumption;
 - 2.6 Improving the correct allocation of costs by consumption categories and groups, i.e. determining tariff rates for distribution system users;
 - 2.7 Identification of needs for possible changes in tariff design;
 - 2.8 System construction planning; and
 - 2.9 Analysis and planning of distribution losses.

3. This Rule sets:

- 3.1. The process for development of Characteristic Load Profiles;
- 3.2. The Distribution System Operator's obligations in developing and publishing characteristic load profiles;
- 3.3. The methods for the construction of normalized load profiles;
- 3.4. The number of characteristic load profiles for different customer groups;
- 3.5. The intervals and seasonality of daily load profiles;
- 3.6. Consumption bands for different customer groups;
- 3.7. Data collection and data processing for development of load profiles;
- 3.8. DSO obligations to parties and reporting.

Article 2 Definitions and Interpretations

1. The terms used in this rule have the following meaning:

- 1.1 **Automatic Meter Reading (AMR)** is a system that automatically reads the interval meters that are installed in customers' premises and have the possibility of remote reading;
- 1.2 **Base load diagram** means a set of data on the final load diagrams of consumption categories and groups;
- 1.3 **Balance Responsible Party (BRP)** is a trading party acting for itself or on behalf of a balancing group for the purposes of collecting imbalances and imbalance payments, in accordance with the applicable Market Rules;
- 1.4 **Characteristic Load Profiles (CLP)** are load diagrams prepared by DSO that present the average load values of samples of a group or subgroup of consumption.
- 1.5 **Consumption group** - means a group of final customers within the consumption category sorted by the method of measuring active energy and power, the purpose of the facility and the peak load, as defined in the Tariff Methodology;
- 1.6 **Consumption category** – means a category of final customers with similar characteristics of electricity consumption, depending on the voltage at the place of data collection and the purpose of electricity use;
- 1.7 **Confidence interval** - means the percentage of probability, or certainty of the data measurements collected, which is usually 90% or 95% confidence level;
- 1.8 **DSO** – means the Distribution System Operator licensed by ERO;
- 1.9 **Database** - means a set of formed data on the characteristics of the customers, measurements and billing data, meteorological conditions data, data on sampled final customers, remote

reading data of sampled final customers, data on load diagram characteristics and load diagrams;

- 1.10 **ERO-** means the independent agency in the Kosovo Power Sector, established by the Law on Energy Regulator;
 - 1.11 **Interval meters** are meters that are installed at customers' premises and record how much electricity is consumed every 15, 30, or 60 minutes;
 - 1.12 **Load diagram** means a diagram of hourly load levels during the daily, weekly, monthly or annual time period, made on the basis of data taken from the interval meter;
 - 1.13 **Measurement cycle** means the time period for collecting data on samples reading for final customers;
 - 1.14 **Measurement interval** means the set time period of power metering (15 min., 30 min. or 60 min);
 - 1.15 **Precision factor** means the adopted percentage of permissible error that determines the required number samples by consumption categories, groups or subgroups;
 - 1.16 **Remote reading** means remotely collecting data from interval meters using one of the possible ways of communication between the AMR centre and the interval meter for remote reading;
 - 1.17 **Stratification** is the division of the population (population is statistical term that, in this case, refers to the total number of customers within each customer category subjected to the load research sample) into mutually exclusive, non-binding groups called stratum. It can increase the precision of the population sample estimation and/or reduce the overall size of the sample required if the individual groups (stratum) are more homogeneous than the population itself.
2. Other terms used in this Rule have the meaning as in the Law on Energy Regulator No. 05/L-084, Law on Energy No. 05/L-081, Law on Electricity No. 05/L-085 and other applicable laws in Kosovo.

CHAPTER II
METERING SYSTEM

Article 3
Installation of Interval Metering System

1. The installation of Interval Meters for customers connected at distribution system network is required for the following categories:
 - 1.1 All customers connected at 35 kV and 10 (20) kV (tariff group 1 and 2);
 - 1.2 All commercial customers connected at 0.4 kV (with usage of reactive energy) – tariff group 3;
 - 1.3 All commercial customers tariff group 4 (7/01 and 7/02) with annual consumption above 50.000 kWh;
 - 1.4 All household customers with annual consumption above 20.000 kWh – tariff group 5 and 6 (4/01 and 4/02).
 - 1.5 Public lighting with annual consumption above 20.000 kWh
2. For customer categories, identified in paragraph 1 of this Article, DSO, within 3 months of the entry into force of this Rule, shall submit to ERO the plan along with the schedules for installation of interval meters and the plan for required developments in information technology;
3. ERO will review the DSO plan as described in paragraph 2 of this Article and shall issue a decision with a reasonable term for installation of Interval Meters.

Article 4
Processing of data and reading of Interval Meters

1. The reading of data for customers equipped with interval meters, referred to in Article 3 of this Rule, should be as follows:
 - 1.1 The DSO collects metering data from interval meters by remote reading;
 - 1.2 In case remote reading is not possible, DSO takes the measurement data directly

from the memory of the measuring device. Retrieval of measurement data from the memory of the interval meter should be reconciled with the monthly reading periods.

2. The data collected from metering devices of final customers referred to in this Article, are processed and stored in a database created and maintained by the DSO.

CHAPTER III DEVELOPMENT OF LOAD PROFILES

Article 5

Preparation of Load Profiles for customers with Interval Meters

Based on collected data from customers equipped with interval meters with remote reading, referred to in Article 4 of this Rule, the DSO should prepare and publish the Load Profiles of these customers in aggregate graphic and tabular forms.

Article 6

Development of Characteristic Load Profiles

1. For customers that are not equipped with Interval Meters as per Article 3, the DSO shall also develop the Characteristic Load Profiles.
2. The DSO shall develop Characteristic Load Profiles for the following customer groups which are not equipped with Interval Meters until the installation of Interval Meters:
 - 2.1 Commercial customers tariff group 4 (7/01 and 7/02) with annual consumption below 50.000 kWh;
 - 2.2 Household customers tariff group 5 and 6 (4/01 and 4/02) with annual consumption below 20.000 kWh; and
 - 2.3 Public Lighting tariff group 8 with annual consumption below 20.000 kWh.

Article 7

The methods for development of Characteristic Load Profiles

1. The characteristic load profiles for all final customers who are not equipped with interval

meters shall be calculated based on collected data of sampled final customers in the cycle of measurement performed in the period of one year. Measurement cycles shall be triggered every two years.

2. In the first measurement cycle, the DSO is required to develop hourly characteristic load profiles for every day of the calendar year.
3. The methodology for development of characteristic load profiles of sampled final customers consists of the following steps:

3.1 Determination of daily load profile eligibility

For each interval metered customer (from the observed consumption category), only the days that meet the eligibility criterion of the permissible number of consecutive missing data; i.e. up to eight consecutive 15-minute periods, i.e. two consecutive hours ("eligible days") are considered;

3.2 Interpolation of missing data (gaps in metered load profiles):

Small gaps (≤ 2 hours) in daily load profiles are to be filled up through linear interpolation (explanations in Annex 1);

3.3 Determination of characteristic load profiles for each customer:

Based on the daily load profiles of the eligible days, $12 \times 3 = 36$ daily load profiles are determined for each customer, which are typical daily profiles for 12 calendar months and three typical week days (working day, Saturday, and Sunday/holiday):

- $LP_{WDi}(t)$ (Load Profile for working day)
- $LP_{STi}(t)$ (Load Profile for Saturday)
- $LP_{Sui}(t)$ Load Profile for Sunday/holiday).

Even if individual customers have 15-minute, half-hourly, or hourly metering, the LPs of typical days will be hourly profiles (24 values) expressed in kWh per hour as a result of this step of the procedure;

3.4 Determination of characteristic load profiles for each consumption category:

For each customer in the observed consumption category, $12 \times 3 = 36$ characteristic load profiles (CLP) are determined. They represent the average daily load profile in the observed calendar month for each characteristic day (working day, Saturday, and Sunday/holiday).

The characteristic load profiles should be divided into 4 seasons:

- Spring season,
- Summer season,
- Autumn season,
- Winter season.

4. The illustration of the methodology and a sample example is given in the Annex 1 of this Rule.

Article 8 **Selection of samples**

1. During the process of developing characteristic load profiles, the DSO should plan for sample selection for various consumption categories, groups, and subgroups;
2. When selecting samples, the DSO is obliged to take into account whether the final samples are sampled customers typical representative of the category, group or subgroup of consumption;
3. DSO should use the known methods when selecting samples, taking into account quality criteria, the number of sampled customers, and economic justification;
4. DSO should select the samples according to the following criteria:
 - 4.1 the amount of electricity consumption;
 - 4.2 method of consumption (whether electricity is used for heating/cooling);
 - 4.3 type of consumption measurement;
 - 4.4 type of facility (industrial, commercial, household – respectively according to tariff groups);
 - 4.5 types of settlements; and
 - 4.6 geographical location.
5. The number of samples per category, group or subgroup of DSO consumption is determined on the basis of:
 - 5.1 precision factors (i.e., maximum allowed error) – usually 5 %, 10%, 15% or 20%;
and
 - 5.2 confidence interval – usually 90% or 95 %

Article 9

Sampling Methodology

The following should be included in the Sampling Methodology for development of the characteristic load profiles referred to in Article 8:

- Sampling on area (country) level of different customers' categories;
- Exclusion of customers in all categories with annual consumption 0, and up to 1.000 kWh; Exclusion of customers with annual consumption above threshold referred to in Article 3 of this rule;
- Use of the stratified random sampling methodology, according to the definition in Article 2, paragraph 2.17 of this rule;

Article 10

The number of Load Profiles for customers equipped with interval meters

1. The DSO should publish in its official website, the representative load profiles for customers equipped with interval meters referred to in Article 3 of this Rule as follows:
 - 1.1 Two (2) representative profiles for customers connected at 35 kV (tariff group 1/2):
 - 1.1.1 Customers with annual consumption ≤ 600.000 (kWh) and
 - 1.1.2 Customers with annual consumption > 600.000 (kWh);
 - 1.2 Five (5) representative profiles for customers connected at 10 (20) kV (tariff group 1/3):
 - 1.2.1 Customers with annual consumption ≤ 60.000 (kWh)
 - 1.2.2 Customers with annual consumption > 60.000 (kWh) and ≤ 120.000 (kWh)
 - 1.2.3 Customers with annual consumption > 120.000 (kWh) and ≤ 360.000 (kWh)
 - 1.2.4 Customers with annual consumption > 360.000 (kWh) and ≤ 600.000 (kWh)
 - 1.2.5 Customers with annual consumption above 600.000 (kWh)
 - 1.3 Five (5) representative profiles for commercial customers connected at 04 kV (with usage of reactive energy tariff group 3):
 - 1.3.1 Customers with annual consumption ≤ 9.600 (kWh)
 - 1.3.2 Customers with annual consumption > 9.600 (kWh) and ≤ 36.000 (kWh)
 - 1.3.3 Customers with annual consumption > 36.000 (kWh) and ≤ 120.000 (kWh)
 - 1.3.4 Customers with annual consumption > 120.000 (kWh) and ≤ 600.000 (kWh)
 - 1.3.5 Customers with annual consumption above 600.000 (kWh)

1.4 Four (4) representative profiles for commercial customers connected at 04 kV (tariff group 7/01 and 7/02):

- 1.4.1 Customers with annual consumption >50.000 (kWh) and ≤ 60.000 (kWh)
- 1.4.2 Customers with annual consumption > 60.000 (kWh) and ≤ 120.000 (kWh)
- 1.4.3 Customers with annual consumption >120.000 (kWh) and ≤ 180.000 (kWh)
- 1.4.4 Customers with annual consumption above 180.000 (kWh)

1.5 One (1) for public lighting with annual consumption above 20.000 kWh.

Article 11

The number of Characteristic Load Profiles for different customer groups

1. The DSO will develop the 10 characteristic load profiles for different customer groups without interval meters as follows:

1.1 Six (6) for commercial customers' tariff group 4 (7/01 and 7/02):

- 1.1.1. Offices;
- 1.1.2 Institutions, both public and private (schools, kinder gardens, universities, health centres, hospitals, homes for older people, etc);
- 1.1.3 Coffee shops & restaurants
- 1.1.4 Bakery & pastry
- 1.1.5 Markets and shops
- 1.1.6 Small businesses (shops) with annual consumption up to 5000 kWh.

1.2 Three (3) for household customers tariff group 5 and 6 (4/01 and 4/02)

- 1.2.1 Customers with annual consumption up to 7.200 kWh;
- 1.2.2 Customers with annual consumption up to 12.000 kWh;
- 1.2.3 Customers with annual consumption up to 20.000 kWh;

1.3 One (1) for public lighting with annual consumption below 20.000 kWh.

CHAPTER IV DATABASE FOR LOAD PROFILES

Article 12

The database for development of Characteristic Load Profiles

1. The DSO plans, conducts, and implements the measurement cycle in accordance with the established plans and activities for developing characteristic load profiles.
2. During the entire metering cycle, DSO data is attempted to be read once a day for the previous day and reported for each customer metering point sampled at 60 minute intervals.
3. DSO collects data from measuring devices based on the installed equipment referred to in Article 4 of this Rule.
4. The collected data serve as the foundation for the development of characteristic load diagrams, which include active energy and power values with collection timelines for sampled final customers with interval meters.
5. The DSO must implement a processing procedure for all the data collected for the load, as well as the evaluation and editing of the data report.
6. The DSO should develop and maintain a database for Characteristic Load Profiles, installing high-quality software for downloading, storing and processing data.
7. Data in the database include metering data from final customers that have installed interval meters, measurement data from sampled final customers, load diagrams, and calculated values based on the processing of sampled remote reading data from final customers.
8. The load diagram database includes:
 - 8.1 recorded load diagrams for final customers with interval meters,
 - 8.2 characteristic load diagrams for consumption categories and groups that do not have the obligation to install interval meters, and
 - 8.3 distribution system load diagram.

Article 13

Meteorological data and data on characteristics of sampled final customers

1. During the measurement cycle, the DSO is required to continuously download and store data from competent institutions relevant to measurement intervals on air temperature and weather conditions for all geographical areas where the sampled final customers are metered.
2. When forecasting consumption and loads, data from the database on air temperature and weather conditions, as well as the database on the characteristics of the sampled final customers are used.

Article 14
Access to data in databases

1. The DSO creates and maintains the database on the Characteristic Load Profiles, in line with the criteria of the Law (no. 06/L-082) on Protection of Personal Data.
2. According to the defined rules of procedure for database formation, management, and servicing database users, the following entities have the right to use data:
 - 2.1 Energy Regulatory Office
 - 2.2 Transmission System and Market Operator (KOSTT),
 - 2.3 The Balance Responsible Party (hereinafter: BRP),
 - 2.4 Suppliers licensed to supply final customers connected to the DSO distribution network, and
 - 2.5 Final customers connected to the DSO distribution network.
3. The manner and criteria for the use of the DSO database will be regulated by mutual agreement between the users of the database in accordance with the provisions of the primary energy laws, rules, regulations and codes in the energy sector as well as in accordance with the relevant acts relevant that regulate the way of storing and using the processing of personal data.

CHAPTER V
DSO OBLIGATIONS AND REPORTING

Article 15
The DSO obligations

1. In accordance with the provisions of this Rule, the DSO has the following obligations:
 - 1.1 provide conditions for continuous reading from interval meters for final customers;
 - 1.2 provide the infrastructure required to carry out the measurement cycle;
 - 1.3 define the measurement cycle's methods, deadlines, and monitoring;

- 1.4 create a report on sample selection;
- 1.5 plan and direct the entire process of producing characteristic load diagrams;
- 1.6 create and implement a procedure for the creation and application of characteristic load profiles;
- 1.7 create a report on the measurement cycle that has been completed;
- 1.8 create a procedure for creating databases, managing them, and providing support to database users, information;
- 1.9 Create and manage databases and provide database services to authorized users;
- 1.10 Prepare Characteristic Load Profiles for each category of customers for a period of at least one calendar year.

Article 16 **The DSO reports**

1. The DSO is required to submit sample selection reports to ERO for review no later than 30 days before the commencement of the measurement cycle, along with an explanation of the precision factors and confidence interval used. This report does not limit the DSO to clearly defined criteria, and the samples may be changed and/or modified in order to produce high-quality diagrams to present the load, which must be reported to ERO without delay.
2. The DSO is required to submit reports on the completed measurement cycle to ERO no later than 60 days following the completion of the measurement cycle, which should include the following information:
 - 2.1 Normalized load diagrams of customers with interval meters;
 - 2.2 Characteristic load diagrams based on consumption categories and groups;
 - 2.3 Impact analysis of the obtained results and characteristics of the load diagram the same in terms of total system load;
 - 2.4 An examination of the effect of consumption categories and groups on total system load for the purpose of cost allocation for distribution capacity; and
 - 2.5 Proposal for the formation of new customer groups or subgroups in order to achieve the highest quality in production of load diagrams.

Article 17
Obligations of DSO towards market participants

1. Within the KOSTT deadline, the DSO will provide the hourly realization load for each individual supplier on a daily basis.
2. At the end of each month, the DSO will submit to KOSTT the realized hourly and daily data from each supplier.
3. The DSO will provide the BRP with a calculation of the realized hourly loads for each day for each supplier with whom the BRP has a contractual relationship.
4. The DSO will provide each supplier with the total daily realized hourly loads of customers with whom the supplier has a contractual relationship.
5. The DSO will publish the normalized and characteristic load diagrams for each customer category and group on its website.

Article 18
**Amendme
nt**

1. ERO is entitled to change or modify any provisions of this Rule
2. The procedure for amendment or modification of this Rule will be the same as for its approval

Article 19
Interpretation

If there are uncertainties regarding the provisions of this Rule, the Board will issue clarifying information.

Article 20
Entry into force

This Rule enters into force on the day of approval by ERO Board and will be published on ERO's electronic website.