

THE EVOLUTION OF DISCONNECTIONS FROM THE DISTRIBUTION ELECTRICAL SYSTEMS FROM REPUBLIC OF MOLDOVA

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Abstract: At the current stage, in electrical distribution systems from Republic of Moldova, take place a significant number of unplanned disconnections, which considerably reduce quality and continuity of the distribution process and power supply. Knowing the evolution of these disconnection for long periods, offers the possibility to elaborate a credible prognosis, which helps to establish solutions to ensure the reliability of these systems.

In this work, is presented a study regarding evolution of unplanned disconnections from electrical republican distribution systems and the results of this study allow developing the insurance mechanism of the reliability indicators and quality of power supply, for Republic of Moldova.

Key-words –Electrical distribution systems, reliability of operation, unplanned disconnections, reliability indicators.

1. INTRODUCTION

In electrical distribution systems with the voltage of 10 kV from Republic of Moldova, there is a significant number of unplanned disconnections, which reduce the reliability of the power supply with electricity of all republican consumers, including those in the agrarian system. Knowing the evolution of these disconnections and cause factors which directly influences the reliability of the installed equipment in distribution systems, allow the development of the insurance mechanism of the continuity of consumer supply with quality electric power[1-4].

Ensuring reability of the power supply with electricit of consumers from Republic of Moldova can be achieved only on the basis of profound knowledge of the phenomena that accompany this process and their evolution on time intervals, which allows a justifiable planning from a tehcnical and economic point of view of measurments and exploitation services activities of distribution sustems, in order to ensurc the standard reliability indicators[3-7].

The work is aimed at conducting a study regarding to the evolution of unplanned disconections from electrical distribution systems, from Republic of Moldova, haring as objectives elaboration of the processing criteria of the experimental data with regard to disconnection flows from these systems and the elaboration of the forecasting mechanism amd ensuring continuity of supply with electricity for consumers, from Republic of Moldova.

2. MATERIALS AND METHODS

The researches were carried out on the basis of the 10 kV voltage distribution systems of the Republic of Moldova in the period 2014-2018. Five systems were examined, comprising 20 subsystems with a total length of distribution networks of 13 425 km. In order to assess the evolution of unplanned disconnections in the electricity supply process of the consumers connected in the Republican energy system, the concept of analysis and systematization of the experimental data on the disconnections in the electrical distribution systems and the calculation and processing algorithm was developed to highlight the factors of influence on the functioning of the systems and to systematize the sequence of the studies performed.

The processing of experimental data on unplanned disconnections in the examined systems was performed using a standard analysis and computation method, which consists in using the specific unit length (100 km network) concept. This concept gave the opportunity to determine and compare predicted indicators for all electrical systems, regardless of the length of their networks.

In this study the following were used:

- the theory of graphs and matrices;
- probability theory;
- methods of statistical analysis and processing of experimental data;
- mathematical modeling;
- Computing with software Microsoft Excel, StatGraphics, EasyFit 5.5 Professional.

3. RESULTS AND DISCUSSION

At the first stage of assessing the reliability of the investigated systems, an analysis of the unplanned disconnections caused by the influence factors was made. For the entire period considered (2014-2018), all disconnections that have taken place in the distribution electrical systems have been recorded and processed according to the proposed concept and algorithm, based on standard analysis and calculation procedures. Table 1 shows the results of disconnection processing.

To compare the number of disconnections in the investigated systems, the proposed analysis concept was

used, according to which all unplanned disconnections were reported at a specific length unit (100 km of network). This gave the opportunity to homogenize the initial information and to obtain compatible and comparable results for systems with different lengths of networks.

Figure 1 shows the annual distribution of specific refusals (reported at a 100 km of line) for the five examined systems.

Table 1. Annual evolution of unplanned disconnections in the examined systems

System	Subsystem	The number of unplanned disconnections						
		2014	2015	2016	2017	2018	Mediate	%
1	1.1	260	250	460	277	379	325	3,6
	1.2	412	235	309	237	320	303	3,3
	1.3	680	415	1011	596	650	670	7,4
	1.4	498	472	875	383	636	573	6,3
	1.5	130	198	265	372	495	292	3,2
	TOTAL	1980	1570	2920	1865	2480	2163	23,9
2	2.1	330	580	340	286	481	403	4,5
	2.2	411	240	320	283	407	332	3,7
	2.3	520	468	650	485	546	534	5,9
	2.4	359	202	320	208	233	264	2,9
	TOTAL	1620	1490	1630	1262	1667	1534	16,9
3	3.1	243	250	220	231	313	251	2,8
	3.2	259	165	270	245	360	260	2,9
	3.3	297	195	349	316	391	310	3,4
	3.4	324	350	301	396	492	373	4,1
	TOTAL	1123	960	1140	1188	1556	1193	13,2
4	4.1	1102	907	1093	858	1112	1014	11,2
	4.2	749	353	377	501	566	509	5,6
	TOTAL	1851	1260	1470	1359	1678	1524	16,8
5	5.1	270	186	403	425	573	371	4,1
	5.2	651	614	567	524	644	600	6,6
	5.3	1040	1160	840	622	645	901	10,0
	5.4	529	458	530	403	567	497	5,5
	5.5	311	222	261	484	384	272	3,0
	TOTAL	2801	2640	2501	2458	2813	2642	29,2
TOTAL SYSTEMS		9375	7920	9661	8132	10194	9056	100,0

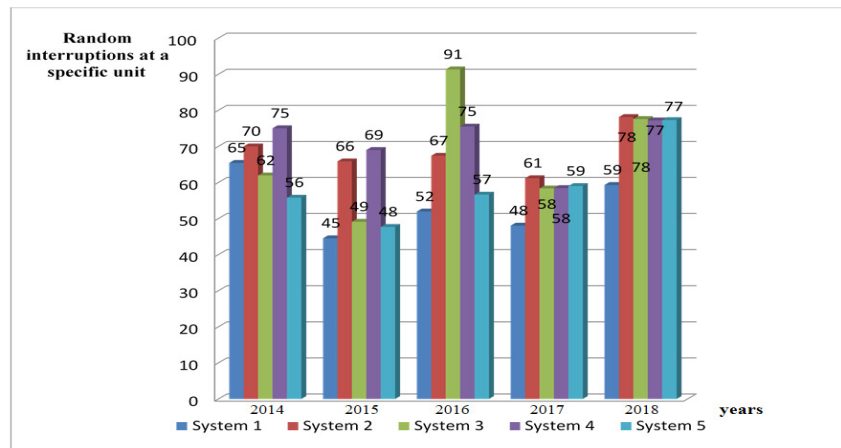


Fig.1. Annual distribution of disconnections, reported to a specific length unit(100 km of line)

By analyzing the distribution of unplanned disconnections and the examined parameters over the determined time interval it can be seen that their distribution is close to Gaussian. The significant number of disconnections that occurred due to unforeseen random factors influenced the reliability of these systems throughout the reviewed period (2014-2018). Due to this, their impact on the reliability of the systems can be diminished only by forecasting these events and developing the justified planning mechanism for the exploitation works.

Based on the analysis of the time evolution of the recorded disconnections, an assessment was made of the reliability of the examined systems, based on the continuity of the electricity supplied to consumers. Over the time tested for the operation of the investigated distribution systems, there were 54,340 defects in the installed equipment, which interrupted the energy supply process and influenced the continuity indicators. After examining the cause factors and their effect on reliability, it was found that most of the defects (87%) of the electrical equipment installed in the distribution systems take place under the influence of random factors that interrupt the process of energy supply electric consumers.

The results obtained on the evolution of unplanned disconnections allow the elaboration of the forecasting and reliability mechanism of the equipment installed in the distribution systems, offering the possibility of technically and economically justified planning of the measures for ensuring the reliability indicators of the electrical distribution systems from Republic of Moldova.

CONCLUSIONS

The study has shown that unplanned disconnection flows in electrical distribution systems have significant values and differ from one system to another but being reported to a specific unit of length have been found to have a distribution close to the Gaussian one regardless of the unevenness of the occurrence per system and the length of networks.

The results allow us to forecast the annual number of disconnections for each system, offering the possibility to plan technically and economically justified service activities throughout the year to ensure

the reliability of the power distribution systems from Republic of Moldova.

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