BEHAVIOR OF REFUSALS IN THE ELECTRICAL DISTRIBUTION SYSTEMS

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Abstract: At the present stage in the distribution systems of electric power take place a significant number of refusals, conditioned by various random factors of influence. The ensurance of continuity of electric supply to consumers is a very current issue for the Republican power system.

To increase the reliability of distribution systems is absolutely necessary to know the factors that cause the refusals of the installed equipment and their characteristics for planning grounds, technical, operational services activities.

This paper is devoted to assessing behavioral factors of influence on the process of electricity distribution and production of mechanism to ensure the continuity of this process.

Key-words: *Electrical equipments, power energetic systems, refusals in function, reliability of distribution systems.*

1.Introduction

In the Republican electrical distribution systems take place a significant number of refusals, which affect the reliability of electricity supply to all consumers, including those in agriculture. Factors that determine the behavior of these interruptions and determine their level of influence on the reliability of equipment installed in distribution systems, permit the development of the mechanism for ensuring continuity of electricity supply to consumers [1,5].

Causal factors of refusals and their impact on the reliability of distribution systems are currently not studied at the level stipulated by documents in force as to indicators of reliability [2,6]. Ensurance of continuity of quality power supply of consumer can be achieved only on the bases of profound knowledge of the phenomena that accompany this process, which permits a justified planning from technical and economic point of view, measures and activities of exploitation services of distribution systems in view to ensure the normal indicators of reliability [4].

2. Materials and methods

To determine the behavior of the factors of influence on the process of electricity supply of consumers all interrupts that have occurred in republican electrical distribution systems have been recorded. Records were made during the seven years (2006-2012).

To determine the causal factors of interruptions, the concept of analysis and systematization of experimental data on refusals of electrical distribution systems and the scheme of the classification of cuts was developed, which gave the opportunity to highlight factors influencing the process of electric supply.

As a result were determined 12 random factors that generated the appearance of refusals in the operation of the distribution systems and influenced the process of supply of electricity to consumers of all categories of reliability.

To assess the behavior of examined factors of influence the analytical algorithm for calculating the level of reliability that systematizes the sequence of operations performed in the assessment of reliability was developed. The algorithm for calculating and forecasting the reliability of distribution systems consists of the following operations:

- Selection and processing of experimental data on refusals of electrical distribution systems;
- Classification of interruptions according to the character of their origin (planned, random and maneuvers);
- Classification of random refusals according to the factors of influence for each system and season;
- Reporting of random refusals to a specific unit of length (100 km network);
- Establishing of regularities of occurrence of breaks and their parameters (X media, D, σ, V, X min, X max, K l. up, K l. down);
- Determining the basic indicators of reliability of distribution systems (λ, μ, τ, T med);
- Estimate the ponderabilities of factors of influence on the reliability indicators (Kp.1, Kp.2, Kp.2, ..., Kp.12);

- Prognosis of factors of influence and of the parameters of conditioned breaks.

Based on the foregoing, the random factors were examined taking into account three parameters:
- Frequency of appearance of conditioned refusals in the distribution systems for each season;
- Duration of these refusals;
- Number of energy consumers affected.

3. Results and discussion

Using the classification scheme and the concept developed for processing of interruptions, the frequency of appearance of refusals due to each random factor, for 100 km of line, for each system depending on the season was determined. All this has made it possible to simplify the calculation and determine the distribution of interruptions for all random factors of influence, depending on frequency of appearance per system and season, for determining the complex structures and to frame measures to increase the reliability of distribution systems.

It was established that to prognosticate the behavior of random factors on the reliability of electricity distribution systems, it is imperative to determine the distribution laws of refusals caused by respective factors and parameters of these distributions. In accordance with the observed the experimental distributions and theoretical were considered for the following indicators: frequency of refusals on the system and season, length of refusals and number of consumers disconnected.

To determine the parameters of distributions refusals depending on their appearance per system and season the frequencies of their appearance for 100 km of network were analyzed, for all factors of influence.

Table 1 shows the established distributions parameters of random interruptions that occur each year in a specific unit (100 km network) in the systems studied (average number of interruptions, dispersion D, standard deviation σ, coefficient of variation, minimum and maximum interrupts, the marginal values of the confidence interval, coefficients of asymmetry and excess).

Table 1. Parameters of distributions refusals caused by factors of influence

No	Factors	Average number of interruptions	D	σ	Coefficient of variation	Number of the minimum of nterruptions	Number of the maximum of interruptions	Diapason of interruptions	Lower limit of interruptions	Uper limit of interruptions	Coefficient of asymmetry	Coefficient of exces
1	Acts of vandalism	1,54	0,56	0,75	0,49	0,26	3,18	2,92	1,23	1,85	1,18	0,29
2	Actions of animals and birds	0,84	0,53	0,73	0,86	0,11	3,93	3,82	0,54	1,14	1,79	1,49
3	Actions of mechanisms	0,63	0,25	0,50	0,79	0,10	2,12	2,02	0,43	0,84	1,17	1,68
4	Damages caused by vegetation	1,33	0,49	0,70	0,53	0,18	2,81	2,63	1,04	1,62	0,52	-0,41
5	Quality of electric energy	0,11	0,00	0,07	0,61	0,00	0,29	0,29	0,08	0,14	1,26	1,50

6	Climatic conditions	15,86	48,01	6,93	0,44	2,84	30,89	28,05	13,00	18,72	0,14	-0,20
7	Defects caused by consumer	3,29	5,18	2,28	0,69	1,23	10,18	8,95	2,35	4,23	1,61	1,01
8	Defects in equipment	18,58	28,82	5,37	0,29	8,45	33,75	25,30	16,36	20,79	1,26	1,49
9	Defects in transport networks	0,80	0,47	0,69	0,86	0,18	2,52	2,34	0,52	1,09	1,45	1,90
10	Defects at PDC	2,84	12,15	3,49	1,23	0,49	14,14	13,65	1,41	4,28	1,98	1,80
11	Errors of exploitation	0,08	0,00	0,05	0,66	0,00	0,25	0,25	0,06	0,11	1,57	1,86
12	Unstated factors	17,70	72,24	8,50	0,48	3,12	30,76	27,64	14,19	21,20	0,04	-1,21

The values of examined parameters in accordance with the developed criterion allow to predict which is the expected number of interruptions caused by each random factor in part in the 100 km network, in any distribution system. The use of the criterion of prognosis has the margin of error of 5% and makes it possible to establish the mechanism to ensure continuity of supply of electricity to consumers.

4. Conclusions

1. After analyzing experimental data regarding the refusals in the republican systems of distribution it was found that random interruptions in terms of their occurrence per system and season is characterized by Normal-Gaussian distribution for all 12 factors of influence.

2. The values of examined parameters in accordance with the developed criterion allow to predict which is the expected number of interruptions caused by each random factor in part in the 100 km network, in any distribution system.

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