ECOLOGICAL ASPECTS OF THE WORK OF THE DIDTRIBUTIVE POWER SUBSTATION WITH SF_6

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1. Overview

In the article one presented the proposal for wider use of transformer stations with SF_6.It is assumed that such a scenario is very likely in the context of increased demand for energy. This will refer mainly to cities with high density of buildings, where such stations due to their small dimensions will allow recreation of network models. The future network infrastructure will be characterised by longer networks of medium voltage with significant reduction of low voltage networks. This will lead to greater reliability of supply and significant reduction of energy losses. The article presents technical and economic analysis of such solutions. Conclusions indicate that proposed solutions are feasible.

Switchgears with SF_6 are built mainly for the use with cable lines and transformers in these stations are located in close proximity to the switchboards. One of the main benefits of switchgears with SF_6 is a very small area they occupy. It is only a few percent of the area required for overhead station with a similar system calls. Cubic capacity of these stations is only a few percent of capacity of station built in traditional way. Especially beneficial a comparisons made towards highest voltage. Created opportunities enable location in urban and industrial areas, often in the basement of large office and residential and commercial premises. Although the cost of the station is a bit higher than the traditional channels, these stations are more commonly used. In economically developed countries, 25-50% of the total number of high and medium voltage stations built up contain switchgears of sulphur hexafluoride

2. Methods

Many technical and economic analyses have been conducted in order to check feasibility of the proposed model in practice. They were based on the existing distribution network in one of the typical municipal area. First, it was checked what are the investment costs of the network for the changing proportion between the length of the medium voltage network and the length of the low voltage network, which is connected with switching to SF_6 stations. It was assumed that in line with the development of the new energy model, the length of the medium voltage network will be growing as well as the number of stations of medium and low voltage. Such scenario will lead to significant reduction of the length of low voltage cables.

3. Results

All aspects have been taken together into account and analyses have been conducted [1,2]. Results of these analyses are depicted in Figure 1. They are very promising. Investment costs of the distribution network have been heavily reduced from PLN 216 million to PLN 188 million. Analyses presented on Figure 2 include two aspects: unit change of the SF_6 station price and the share of these stations in the total number of stations operating in the analysed region. Changes in the level of $0 \div 25$ % have been assumed.

The use of SF_6 gas as an arc quenching medium in medium voltage switchgears contributes significantly to the reduction of their size and thus to the reduction of the size of containers in which they are mounted. Often, small size of container station is the decisive argument for choosing this kind of station.

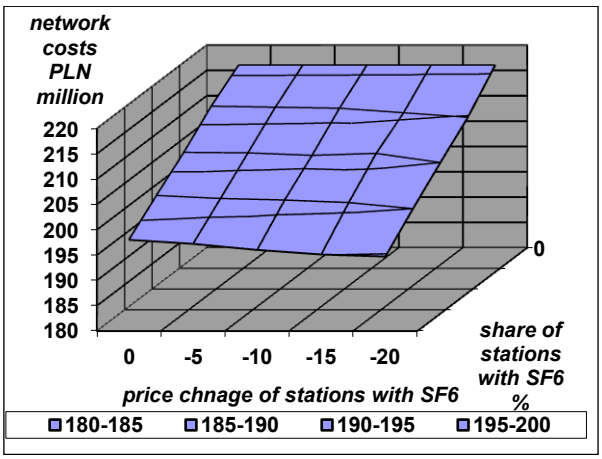

Figure 1 Investment costs connected with the increase of SF_6 stations and unit change of these stations (source about costs [18])

4. Conclusions

The conducted analyzes provide the basis for the creation of the harmonious development of the distribution network, taking into account the aspect of energy safety. These issues begin to play a vital role in the national energy policy. There is a need to use multiple instruments from different areas in order to raise the level of its importance. In this regard, reference is made to the following areas and methods of impact on energy safety: political, legal, economic, technological and cultural instruments [3]. Among technological tools that can improve the safety level, the change in the structure of energy systems is mentioned. This method is in line with the proposal of changing the model of network infrastructure that has been presented in the article. Therefore justified are further studies and analyses that take into account all aspects of the distribution of electricity, not included at this stage of the research. It should also be noted that the proposed changes lead in parallel to the increase of the efficiency of energy distribution in medium and low voltage networks.

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