Evaluation of the Profitability of High Temperature Low Sag Conductors

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I. Introduction

Since an expansion of the transmission grid will be required, it is necessary to utilize the existing infrastructure of the transmission grid with maximum extension of new technologies into the existing power line systems with less economic investment and a high level of technical security. The use of High-Temperature Low Sag (HTLS) conductors is an important method for improving and upgrading the existing transmission network nowadays. For the comparative assessment, conductors of the conventional core design and HTLS conductors [4], [6] are presented.

IV. A Comparative Assessment of the Examined Conductors

The comparative evaluation of the selected conductors was based on technical and economic aspects.

Concerning the technical comparison, it was divided according to two main criteria:

1) mechanical limitations – mechanical tension, conductor sag and the permissible span; in this case, the special program "SAPR LEP 2011" was used [12] (see Fig. 3, 4 (f.v.), 5 (f.v.), 6 (f.v.), 7);

2) thermal limitations – the capacity of the line and the permissible conductor temperature (see Table II (f.v.)).

Firstly, the mechanical comparative evaluation will be discussed.

Fig. 3 shows that the mechanical tension of the examined conductor types in a line for the heat-up mode at +35°C is higher for the ACCC and ACCR conductors as compared with the traditional type conductors, in this case AS and ACSR.

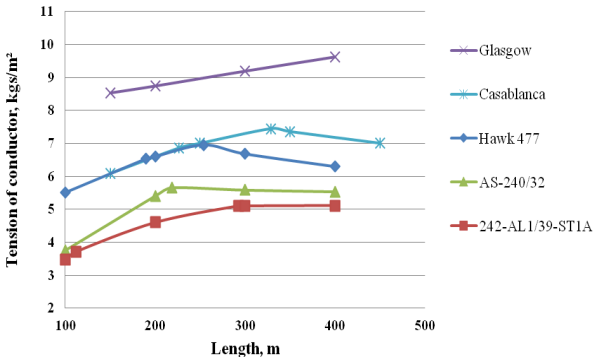
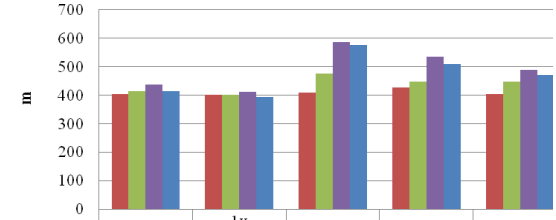


Fig. 3. The tension-length relationship in a conductor heat-up mode at +35°C of the different types of conductor of a line LN-266

As far as the conductor sag is considered, it can be concluded that for the heat-up mode at +35°C the largest sag occurs in conductors of conventional core designs like AS and ACSR compared with the HTLS conductors like ACCR and ACCC (see Fig. 5 (f.v.)).

Fig. 7 presents simulation results regarding the permissible spans of the examined conductors, which show that the wind spans (L_{wind}) are the decisive spans of all the described conductors.



	2xAS-240/32	1x 242AL1/39-ST1A	1x Glasgow	1x Casa-blanca	1x Hawk 477
Lwind	403.6	400.0	409.3	425.4	403.4
Lweight	414.3	400.0	476.3	446.1	445.8
Lcl at +35°C	436.5	411.8	585.9	533.3	487.4
Lcl at +70°C	414.0	393.0	574.9	508.2	470.1

Fig. 7. The allowable wind (L_{wind}), weight (L_{weight}) and clearance (L_{cl}) spans of the different types of conductor of a line LN-266

Secondly, the thermal comparative evaluation will be reviewed.

Table II (f.v.) shows that the HTLS conductors like ACCC and ACCR have the highest permissible conductor temperature compared with the ACSR and AS conductor.

The economic comparison is based on the quantity of tension and intermediate towers as well as on the total amount of required material and equipment (see Fig. 8 (f.v.)). Therefore, an approximate calculation of the total investments (C_{Σ}) consists of five main parts and is determined by the following formula:

$$C_{\Sigma} = C_c + C_s + C_f + C_{str} + C_{\Sigma i}\ , \qquad (2)$$

where C_c – the cost of a conductor, r.v.; C_s – the cost of a tower, r.v.; C_f – the cost of a foundation, r.v.; C_{str} – the cost of a string, r.v.; $C_{\Sigma i}$ – the total installation costs, r.v.

V. Conclusions

The comparative evaluation of different types of conductor showed the profitability of replacing a conductor of the conventional core design with a HTLS conductor by technical and economic criteria. Besides, the application of HTLS conductors could be more productive, if the high price of the ACCC and ACCR conductor types will be reduced. At the same time, it can be one of the reasonable methods for increasing the limited capacity of the existing overhead lines.

References

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[12] The special program "SAPR LEP 2011" description. Modern design System. [Online]. Available: http://www.bsapr.ru/prod/progs/element.php?ID=250 [in the Russian language].