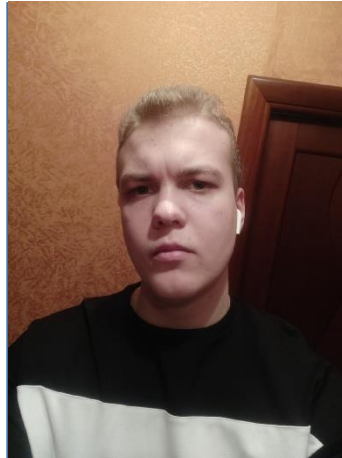


The Use of National and International Standards in Developing CAD Models of Electrical Substations

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- The use of CAD in the electric power industry can significantly simplify the preparation of design decisions and design documentation.
- Many large electricity companies include the introduction of CAD in their innovative development programs.
- One of the most serious difficulties that limits the spread of CAD is the presence of differences in the regulatory documents of both different countries and individual organizations operating in the territory of one country.

Ways to solve this problem:

- Development of local CAD versions that meet the requirements of a particular customer or processing programs that meet local regulatory requirements.
- The use of programs with a modular structure, in which for each end consumer the composition of CAD is formed from a set of modules that meet his needs.
- Development of CAD systems that have established ways to harmonize national and foreign standards.

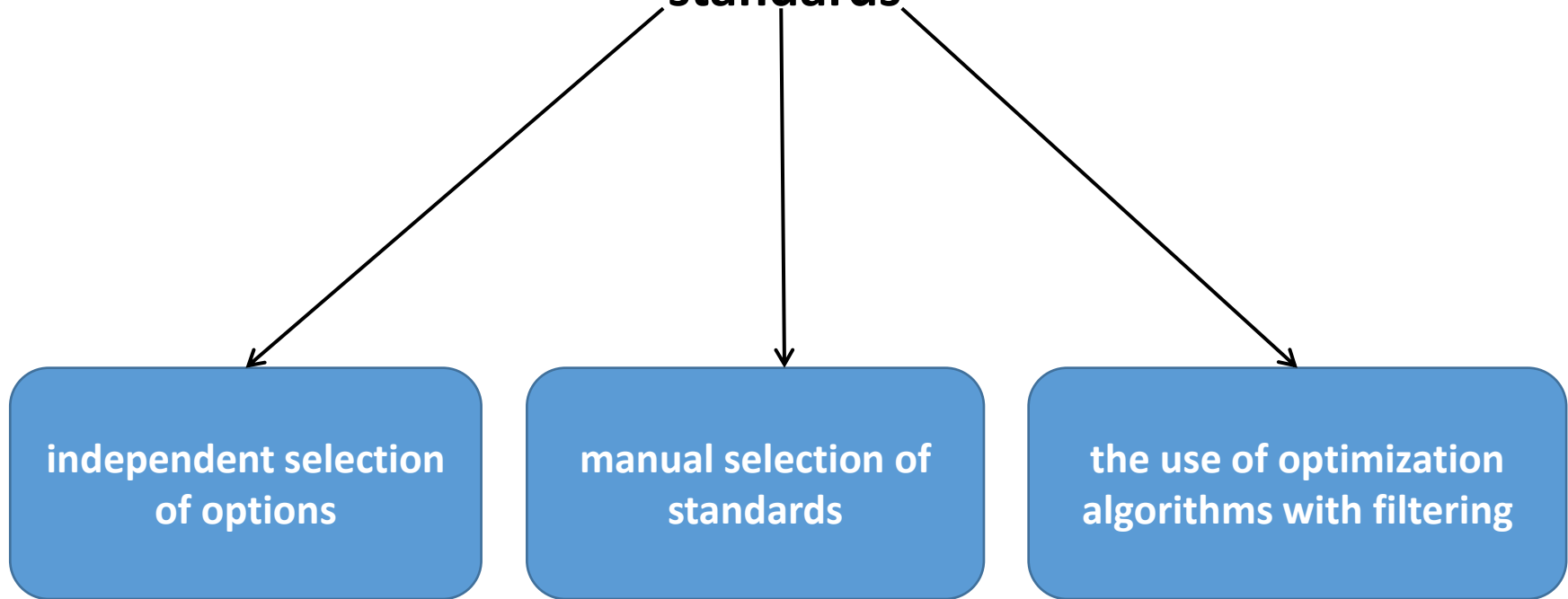
DATABASE PREPARATION

- During the creation of databases for all elements, the task was to provide CAD with the necessary amount of source data.
- The database contains information necessary for conducting an economic comparison of options, as well as weight and size parameters of equipment and data on current manufacturers of this electrical equipment.
- It was taken into account that, in some cases, regulatory documents may have common initial data, in other cases, direct analogs in domestic and foreign regulatory documents.

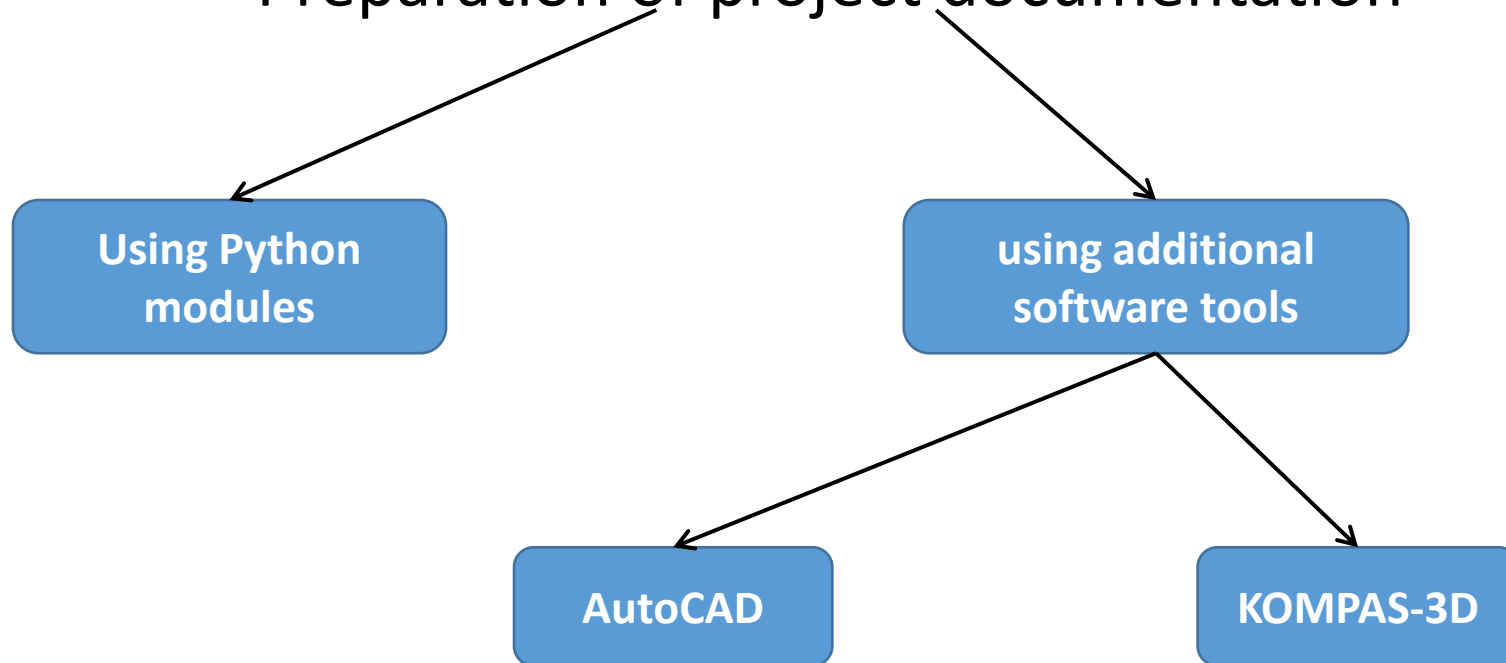
SOURCE DATA FOR THE DEVELOPED CAD SYSTEM

The initial data in the developed CAD system information was based on the normal modes of electricity consumption by consumers, relating to various voltage levels, which were presented in the form of daily load graphs of the characteristic days of the summer and winter season; data on the features of the high voltage network (number of connections, features of incoming power lines, voltage ranges and short circuit currents from the power sources, calculated without taking into account the designed substation), as well as the preferred number of step-down transformers.

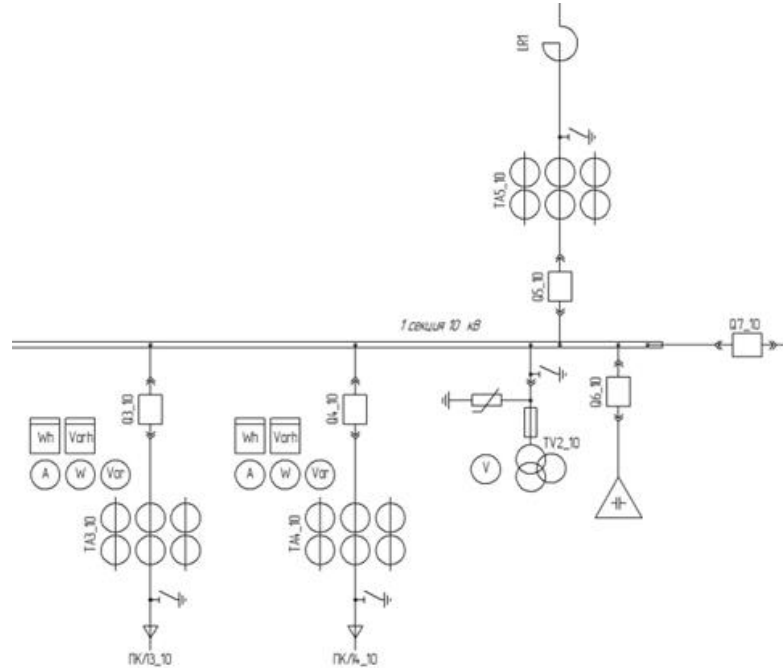
Harmonization of requirements of national and international standards



Preparation of project documentation



The main electrical circuit of the designed substation 110/35/10 kV (10 kV low voltage switchgear circuit fragment)



CONCLUSION

- A pilot project has been developed for the training and research CAD of electrical substation, intended for use in the educational process, which allowed testing well-known domestic and foreign standards that determine the requirements for the selection of design solutions for electrical substations.
- Alternative methods of accounting for domestic and foreign regulatory documents that establish requirements for the design of step-down electrical substations are proposed and tested.
- Prepared databases of the main power electrical equipment of electrical substations, suitable for use in the developed training and research CAD.

CONCLUSION

- An algorithm is proposed for optimizing the selection of options when performing the selection and verification of electrical equipment for compliance with domestic, foreign and corporate regulations.
- In the Python programming language, CAD of step-down electrical substations with two and three voltage levels is implemented.
- Prepared options for documenting CAD results using Python tools and the KOMPAS-3D program.
- Verification of the results of the software and information software developed by CAD is completed.
- Methodological foundations for the further development of CAD of electrical substations have been developed.

Thank you for attention!

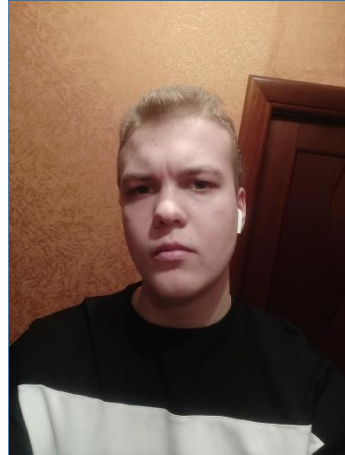
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