Conclusion

To sum up, it is necessary to believe that all of us must do our best to be as green and as environmentally friendly as possible. The whole future of the planet is in our hands.

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CASE STUDY OF THE "TITANIUM VALLEY" POWER SUPPLY

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Power supply problems are very urgent and different official events are devoted to the discussion of this problem. One of the most popular forms of public discussion is forum. Forum is place used for debates in which anyone can participate during open discussions on various urgent issues. With the development of communication technologies new forms of forums are held through Skype, but some discussions can build up without all users having to be online at the same time.

One of the technique used during the forum held from 22th to 29th of August, 2016 in Sverdlovsk region was a case study. The term "case study" is used loosely in various sources of scientific and professional literature. The key features of a "case study" are its scientific contribution and its evidence base for professional applications [2]. In spite of a lot of works devoted to the concept "case study" little attention is paid to the usefulness of this method. Case study is defined as analyses of people, events, decisions, periods, projects, policies, institutions, or other systems and is the subject of the inquiry of a class of phenomena that provides an analytical frame — an object — within which the study is conducted and which the case illuminates and explicates.

All participants of the forum called "Energy of Youth" were divided into 3 teams solving the same problem at different stages.

The first stage was focused on the analysis of Sverdlovsk region energy efficiency. Energy efficiency is the ratio between power generation and power consumption. To carry out the analysis on energy efficiency Sverdlovsk region was chosen. The choice of the above mentioned region can be explained by the ambitious plans to build a special economic zone called the "Titanium valley".

“Titanium valley” is the construction of a special economic zone (SEZ) of industrial / production type in Sverdlovsk region where special preferential conditions for the development of industrial production and national or international entrepreneurs have been created. Titanium valley is a limited territory with special legal status in relation to the rest of other territories. The priority directions of this specialized SEZ are titanium products production, manufacturing of components and equipment for metallurgy, mechanical engineering, production of construction materials. It is to be emphasized that the power load will have been increased on 180 MW by 2020. This abrupt power demand is due to the implementation of the Titanium valley. Consequently there will be the increase in both commercial and residential sectors. The table below illustrates the forecast of power load by 2017, 2019 and 2023.

Tab. 1. The forecast of power load increase in Sverdlovsk power system by 2017, 2019 and 2023 (%)

№	Power Plants	2017	2019	2023
1.	Serovsk Power Plant	+0,65%	+1,85%	+4,23%
2.	Nizhnetagil'sk Power Plant	+0,62% (+0,63%)	+1,83% (+1,85%)	+4,27% (+4,28%)
3.	Zapadnye Power Plant	+0,58%	+1,77%	+4,17%
4.	Vostochnye Power Plant	+0,61%	+1,79%	+4,19%
5.	Talick Power Plant	+0,57%	+1,75%	+4,15%
6.	Artjomovsk Power Plant	+0,58%	+1,79%	+4,18%

The results obtained upon the analysis and calculations are as follows: Sverdlovsk region is a region which generates power in excess and is able to cover both commercial and residential sectors. The maximum generation of this region is 9416.9 MW, but the maximum consumption in 2015 was only 6328MW

The second stage involved the development of special techniques of power supply of this “Titanium valley”. The first step was to find out the power needs necessary to decide the necessity to build a special power plant. 3 types of power plants were considered: nuclear power plant, hydropower plant and thermal power plant. Since the nuclear power plant is intended for generation of power in accordance with its specified capacity some additional facilities must be built to get extra power required. This fact confirms the inefficiency of this project. Hydropower plants need some specific conditions since most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. The most advantageous type is thermal power plant, but warmth produced by this plant is not required.

Upon thorough analysis it was decided to give up the idea of power plant construction. Instead it was proposed to find efficient ways for power transmission. To transmit power over long distances some special facilities are required either underground cables or overhead lines. Overhead lines were chosen due to some advantages over underground cables. Type of overhead lines was determined by nominal voltage which is 220 KV. However, it was confirmed that to transmit power adequately 2 overhead lines each intended for 220 KV are required. In the case of any faults with one line other line will be able to transmit the desired power. The comparison of overhead lines and underground cables is presented in Table 2.

Tab. 2. Comparison of overhead lines and underground cables [1]

Overhead Lines	Underground Cables
Advantages	Disadvantages
1.The size of conductor for same amount of power is small	1. The size of conductor is quite large in underground system.
2. The amount of insulation is less as overhead lines are open to atmosphere and hence air provides the necessary insulation.	2. Very high degree of insulation is required as the underground system is laid under the ground hence area is very compact.
3. Heat can be dissipated easily in the surroundings as overhead lines are open to atmosphere.	3. Heat dissipation is very difficult and. Hence number of insulating layers are added to the cable.
4.Overhead system is very cheap as no insulation coating is used over the conductors i.e., the conductors used are bare conductors	4. Very costly, because a number of insulation layers has to be used to provide sufficient insulation.
5.Faults can be detected easily	5. Fault detection is very complicated.
6. Maintenance work is very simple.	6. Maintenance work is very complex.
7. It is used for long distance transmission.	7. It is used for short distance transmission or distribution.
Disadvantages	Advantages
8.Public safety is lower.	8.Public safety is higher.
9. Faces problems due to interference with neighboring communication system.	9. No interference with the communication lines.
10. They are liable to hazards from lightning discharges.	10. Not liable to the hazards from lightning discharges.
11. This system can’t be used near submarine crossings.	11. It can be used near submarine crossings.

Thus, this comparison illustrates the advantages of overhead lines over underground cables.

The third state involved the calculation of the above chosen technique

Calculations:

	N...	Region	Gc	Load	Dp	Cons	Inner
1	1	Serovsk Power Plant	168	813	27,24	840	-672
2	2	Nizhnetagil'sk PP	239	558	16,25	574	-335
3	3	Zapadnye Power Plant	328	1 295	35,10	1 330	-1 002
4	4	Vostochnye Power Plant		913	31,17	944	-944
5	5	Talick Power Plant	6	111	8,07	119	-113
6	6	Artjomovsk Power Plant		140	13,37	153	-153
7	7	FSC_220_500	4 382	287	57,56	345	4 038
8	8	Nizhnetagil region	145	926	36,13	962	-817

Current load of overhead lines

	Nin	Nfin	Name	I_in	I_fin	I_add	I_add	I_add	I/I_dop
1	411	254	pjatiletka	255	255			390,0	65,5

	N...	Region	Gc	Load	Dp	Cons	Inner
1	1	Serovsk Power Plant	168	817	27,49	844	-676
2	2	Nizhnetagil'sk PP	239	561	16,32	577	-338
3	3	Zapadnye Power Plant	328	1 302	35,11	1 337	-1 009
4	4	Vostochnye Power Plant		917	31,45	948	-948
5	5	Talick Power Plant	6	112	8,18	120	-114
6	6	Artjomovsk Power Plant		141	13,43	154	-154
7	7	FSC_220_500	4 406	287	58,46	345	4 060
8	8	Nizhnetagil region	145	930	36,40	966	-821

Name	I_in	I_fin	Place	I_add	I/I_dop
Tagil_1AT - Tagil	860	1 636	BH	938,0	91,7

Fig 1. Current load of overhead lines

Conclusion

To sum up, upon the conducted analysis within the case study, it was concluded that 2 overhead lines are necessary to supply the “Titanium valley” with continuous uninterrupted power and are able to overcome problems associated with some faults and abnormal conditions.

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