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Monitoring places of installation of compensating devices in the network as a means of improving energy effeciency

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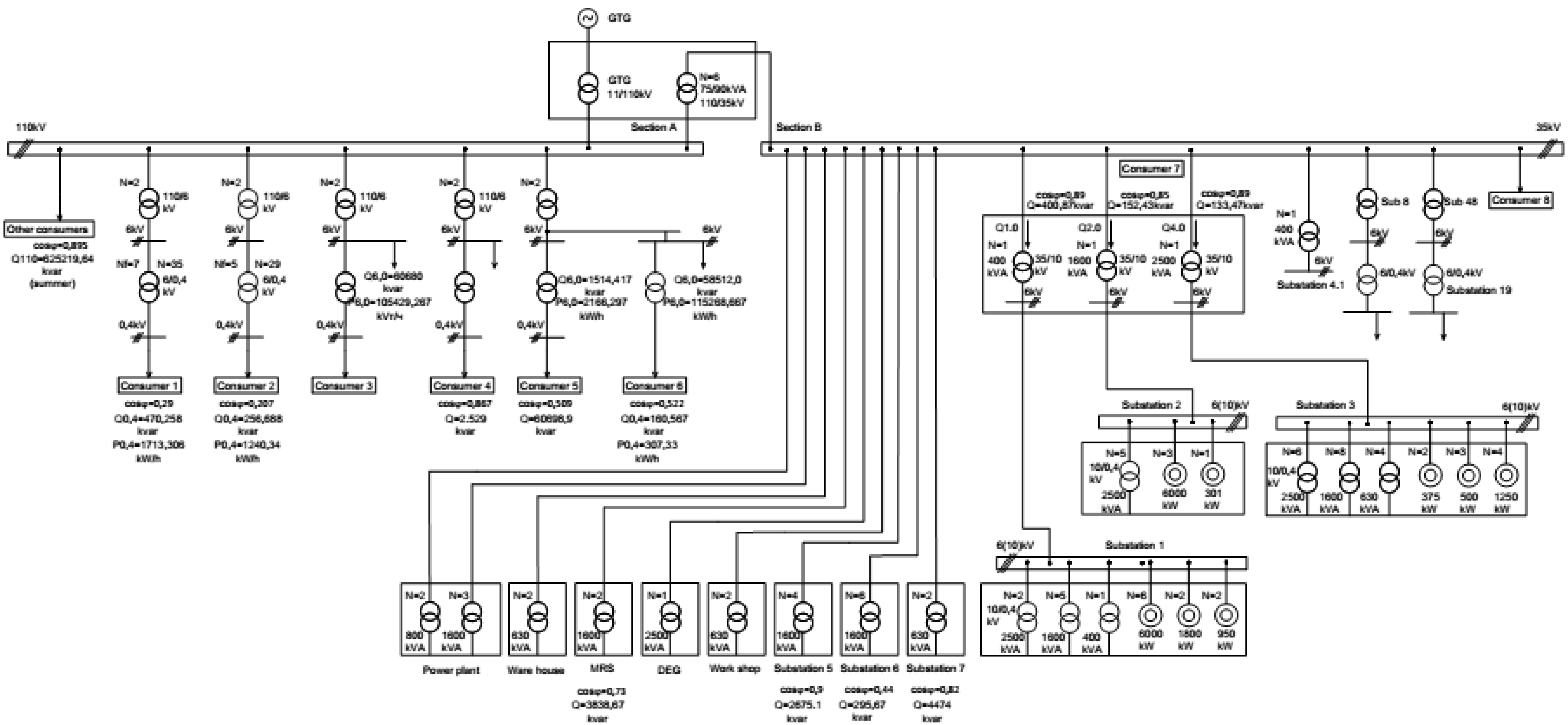
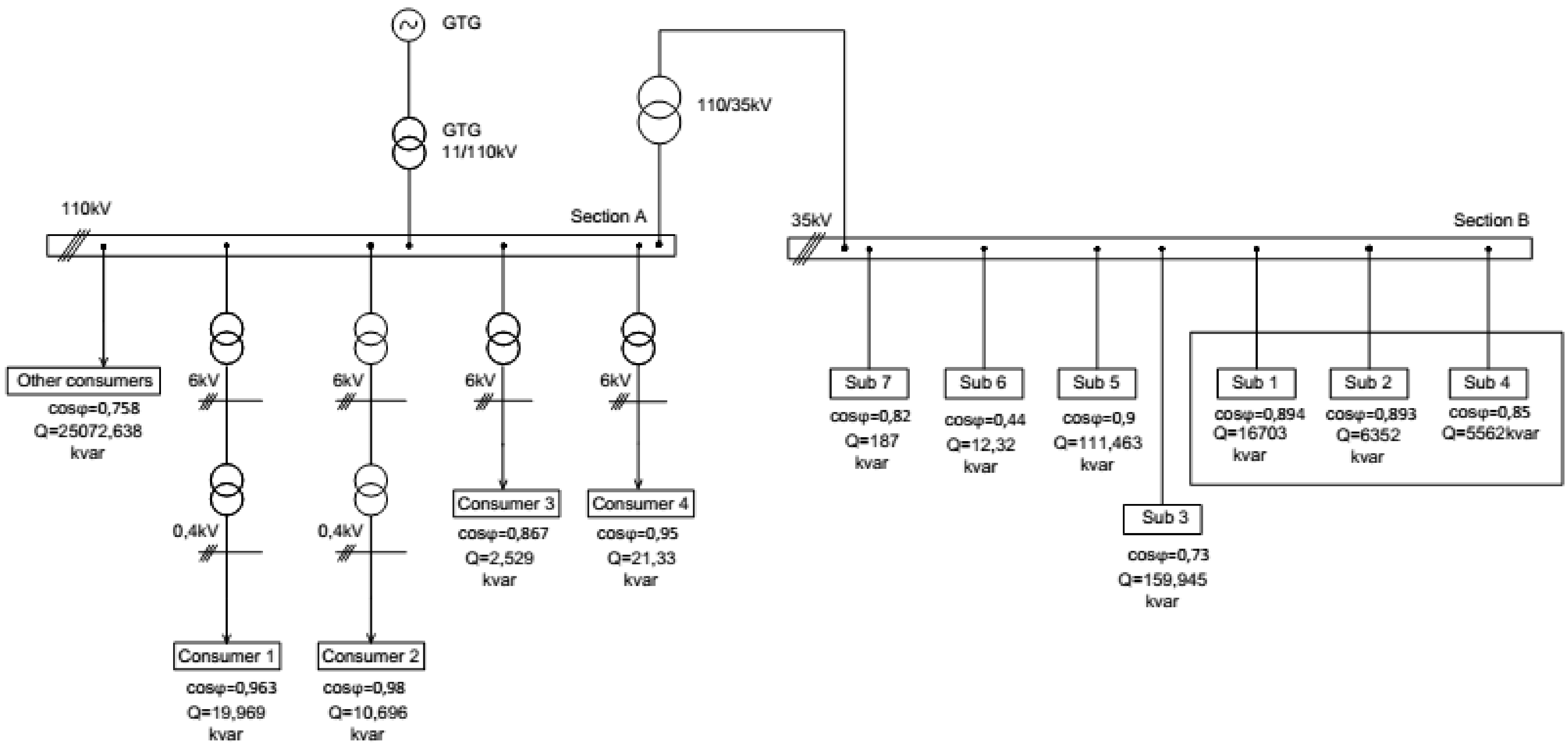
11th International Energy Conference, February 13-15, 2019, TU Wien, Austria

SCHEME OF SINGLE LINE POWER SUPPLY



SCHEME OF SIMPLIFIED POWER SUPPLY



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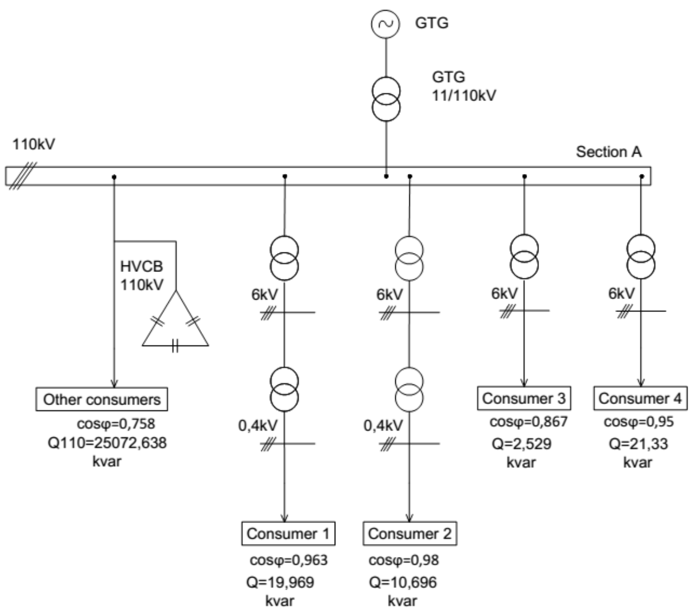
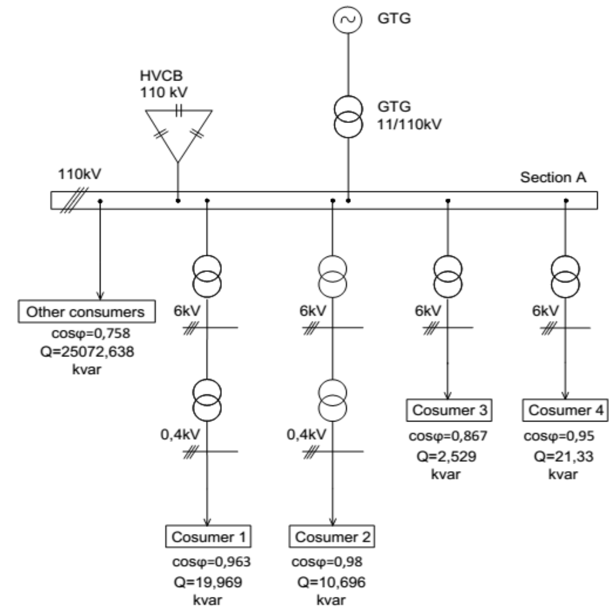
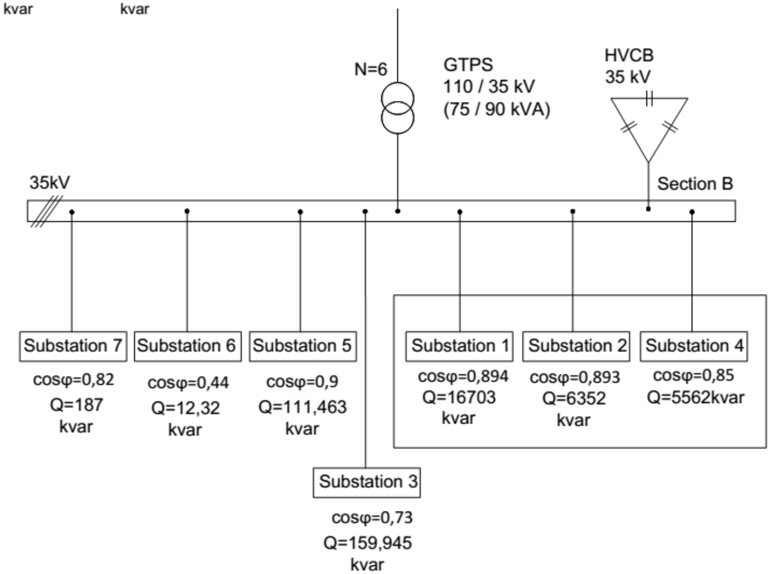
CALCULATION AND SELECTION OF COMPENSATING DEVICES



Option 1



Option 2



Option 3

CALCULATION AND SELECTION OF HVCB FOR OPTION 1

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Data on reactive power consumption of the following substations:

№	Substation	W_P, MW.h	W_Q, Mvar.h	P_{35}, MW	Q_{35}, Mvar	S, MV.A	cosφ
KPC							
1	Substation №1	23888	12026	33,18	16,7	37,146	0,894
2	Substation №2	9055	4573	12,58	6,352	14,093	0,893
3	Substation №4	6474	4004	8,99	5,562	10,572	0,851
Total for KPC substations:				54,747	28,617	61,775	0,887
Other substations							
4	Substation №5	169,294	80,253	0,236	0,12	0,265	0,9
5	Substation №6	4,358	8,87	0,0605	0,013	0,061	0,44
6	Substation №7	190,97	134,220	0,265	0,187	0,324	0,82
7	MRC	122,053	115,16	0,17	0,16	0,233	0,73
Total for other substations:				0,676	0,471		
Total 35 kV tires:				55,423	29,088	62,592	0,886

CALCULATION AND SELECTION OF HVCB FOR OPTION 2

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Data on the reactive power consumed by OL-135 and OL-136:

№	Substation	W_P, MWh	W_Q, Mvar.h	P_{35}, MWh	Q_{35}, kvar	S, MV.A	cosφ
1	OL (135+136)	209634	18052,3	29115,834	25072,639	38423,548	0,758

CALCULATION AND SELECTION OF HVCB FOR OPTION 3

Data on the consumed reactive power of the following substations and given to other consumers on OL-135, OL-136:

№	Substation	W_P, kW.h	W_Q, kvar.h	P_{35}, kW	Q_{35}, kvar	S, MV.A	cosφ
1	OL (135+136)	209634	18052,3	29115,834	25072,639	38423,548	0,758
2	«Consumer 1»	51319,166	14377,75	71,277	19,969	74,128	0,963
3	«Consumer 2»	37210,228	7700,63	51,681	10,696	52,775	0,98
4	«Consumer 3»	46764,144	15357,6	64,951	21,33	68,363	0,95
5	«Consumer 4»	3162,878	1820,4	4,393	2,529	5,069	0,867
6	Load from 35 kV tires			55423	29088	62592	0,886
Total:				84731	54215	100591,3	0,84

CONCLUSION

Summary table for the considered options CRM

№	Options	Before compensation					After compensation			
		P, MWt	Q, Mvar	S, MW.A	cosφ	Q_{HVCB}, Mvar	P, MWt	Q, Mvar	S, MW.A	cosφ
1	HVCB on tires 35 kV substations that power SUBSTATION	55,423	29,088	62,592	0,886	5	55,423	24,09	60,43	0,918
2	HVCB on the outgoing line 110 kV "other consumers"	29,115	25,072	38,423	0,758	10	29,115	15,07	32,784	0,89
3	HVCB on 110 kV GTU tires	84,731	54,215	100	0,84	10	84,731	44,21	95,573	0,887

CONCLUSION

The results should be considered only as a first approximation to the solution of the problem of optimizing the choice of installation sites for compensating devices. For a more accurate solution of this task, it is also necessary to take into account additional restrictions (on permissible voltage levels at network nodes, on operation modes of compensating devices, on load stability, etc.)

According to the results of the economic analysis, it will be possible to determine the optimal ratio between the reactive power consumed by the enterprise from the grid of the energy supplying organization and the reactive power generated by the compensating devices installed at the industrial enterprise. In addition, the electrical load schedule of an enterprise should be taken into account and the choice of the appropriate optimal method of reactive power compensation for each zone of the load graph should be made.

Thus, the choice of optimal installation sites for compensating devices and the optimization of the reactive power compensation process in industrial electrical networks as a whole is today an urgent practical task. Optimization of the reactive power compensation process will minimize the power losses in electrical networks caused by reactive power overflows, reduce the cost of industrial enterprises for electricity, increase the capacity of electrical networks and will contribute to the realization of energy-saving potential at industrial enterprises.

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THANK YOU FOR ATTENTION!

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