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MATHEMATICAL MODELS FOR THE GAS SUPPLY OPTIMIZATION

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Demand on natural gas in Europe is continuously growing. The network of gas pipelines becomes more and more complex. On the European gas market are involved a lot of companies which are located in different countries. Operation in such complex structure can be done more optimal by using mathematical models. Recently a model for European gas supply network does not exist. Each country has different legislation and therefore, each gas market player has different rules for operating. From this point of view not all companies are interested in a general model for the European gas grid. In some cases such model can contradict the business model of the company. This is the background, why the movement towards the European gas supply model is so slowly.

The optimization of gas networks even in stationary case is a difficult problem. This is because in the case of network optimization it is impossible to stay purely on the base of linear programming (if the flow directions are not known in advance). The flow direction in the pipes can be either in one or other direction. So we obtain an integer programming problem (IP) (at this stage we assume, that the equations describing flow in pipes are linear). IP problems are LPs in which some of the variables are constrained to be integers. In [2] the authors claim: " IP is an NP-hard optimization problem. Consequently, such problems are harder to solve in practice than LPs. The inherent complexity for solving IPs stems from the nonconvexity of their feasible region, which makes it difficult to verify the optimality of a proposed optimal solution in an efficient manner". It is not easy to get a data about gas networks.

In [1] a model for describing of the Belgian gas network is proposed. In the model an important restriction is introduced: the possible compressors in pipelines are accounted in a very special way (by using so called active pipes). Such approximation for example does not allow to account the total power of compressors used in the network .In the talk a more exact model for compressors will be proposed. Several examples of mathematical problems for solving of gas network optimization problems will be analyzed. For such kind of problems available solvers play a very important role. The success of optimization process can depend on the concrete version of solver. For a given problem not always the newest version of solver gives the best results. The sensitivity of solution in dependence on different parameters will be analyzed.

REFERENCES

[1] D. de Wolf and Y. Smeers. The gas transmision problem solved by an extention of the simplex algorithm. *Management Science*, **46** (11), 2000, 1454 – 1465.

[2] K.H. Rosen, J.G. Hichaels, J.L. Gross, J.W. Grossman and D.R. Shier. *Handbook of discrete and combinatorial mathematics*. CRC Press LLC, 2000.