Selected factors of economic efficiency of underground gas storing

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Výber faktorov ekonomickej účinnosti pre uskladnenie podzemného plynu

Basic issues related with the economic efficiency of underground gas storing are discussed in the paper. There are presented unit capital costs, depending on the storage type, and the structure of exploitation costs. The influence of capital costs, constant and floating costs as well as the storage prices were determined for the Net Present Value (NPV). The influence of the used active storing capacity on the profitability of the underground gas storage process was analysed.

Key words*: underground gas storing, capital costs, floating costs*

Introduction

Underground gas storages play more and more a prominent role in the energy safety plans and the optimization of cost of gas deliveries to consumers. This stems out from a relatively low amount of energy in a unit volume of gas, causing that the transportation cost per volume unit is high. As a consequence, the cost of transportation makes up a considerable part of the bill paid by the end consumer. The gas consumption is seasonal in character, which does not correspond with the preferred policy of constant and high use of pipelines. In this case the sales would not match the demand.

Withouth the underground gas storages, both the productivity and transmissibility of transportation systems would have to constantly operate as a the peak season. Therefore, underground gas storages, with a high capacity, for supplying gas deliveries of the whole network in the periods of higher demands (heating season), as well as smaller, local ones, being a local back up for the peak periods, are a necessity now. Another important aspect providing uninterrupted gas deliveries is the case of stopped import, on which most EU countries strongly rely. This issue is especially important in the situation when Russia, the Europe's biggest source of gas deliveries, may use the „gas tap" argument in some political conflicts.

The basic issues related with capital costs for the gas storage construction, structure and the type of exploitation costs and the influence of various factors on the economic efficiency of the gas storing process is exemplified by the Polish underground gas storage.

Capital costs

The construction of storages is very expensive. The costs quoted in the literature range from 0.1 to 1 USD per 1 m^3 active capacity. They strongly depend on three factors [3]:

a, type of storage,
b, depth of storage, and
c, active capacity of storage.

The cavern storages are considered to be most expensive; storages made in depleted deposits and aquifers are similar. An increase of the active capacity causes that the unit cost decreases, and the growing depth of the host geological structure makes the construction more expensive. The Polish gas storages prove this rule. The smallest unit capital costs are observed for shallow storages in depleted deposits, i.e. about 0.45 PLN/m^3 (0.14 USD/m^3), and the highest ones – for the deep storages made in depleted deposits and for cavern-type storages, i.e. about 1.4 PLN /m^3 (0.44 USD/m^3).

In the case of storages made in depleted deposits or aquifers, the cost of the cushion gas, boreholes and pumping station mainly decide about the height of the capital cost (Fig. 1). It is slightly different from the cavern storages, where the capital costs mainly depend on the cost of leaching, and then the cost of the cushion gas and the boreholes.

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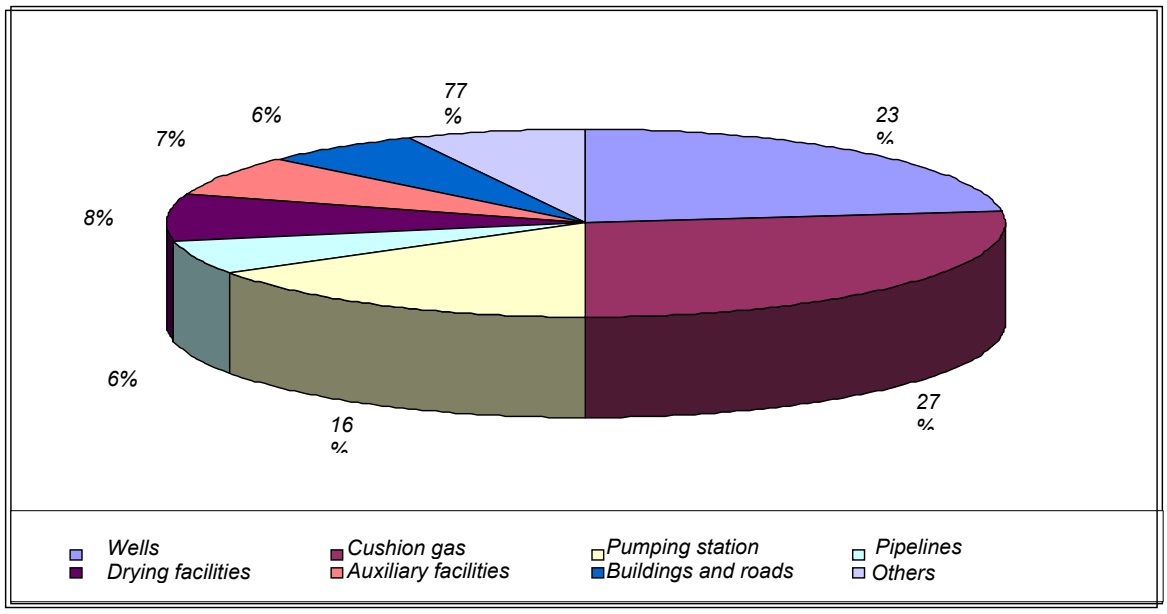

Fig. 1. Distribution of costs of storages constructed in depleted deposits and aquifiers.

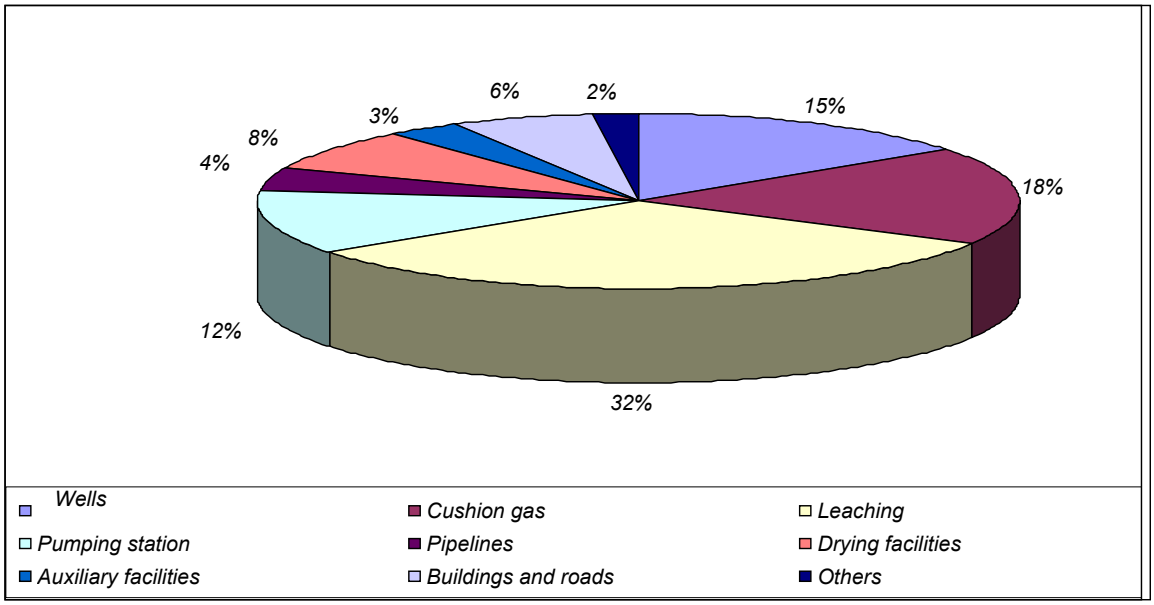

Fig. 2. Distribution of costs of storages made in salt caverns.

Structure of storing costs

The constant to the floatable costs ratio depends on the type of storage. As for the Polish gas storages, the floatable costs constitute the highest percentage in the case of cavern-type storages, i.e. about 38 %; for the remaining types - from 15 to 31 %.

The analysis of the constant costs of gas storages shows that their most important component is connected with wages and other payments made to the crew. The share of this cost usually ranges between 20 and 30 %. The servicing, repairs and the external services also have a significant share in the total cost of the investment.

Influence of various factors on the underground gas storage profitability

The changeability of the influence of various factors on the Net Present Value (NPV) was analysed for one of the Polish underground gas storages [1].

Figure 3 illustrates the calculation results accounting for the storing price, capital costs, level of constant and the floatable costs. It is clear that the storing price and capital costs have a decisive influence on the NPV. The influence of the constant and floatable costs on the NPV is relatively low.

When the capital costs increase, the NPV of investments for underground gas storages decreases; the reverse situation is observed for the storing prices – with the increasing price, the NPV significantly increases too.

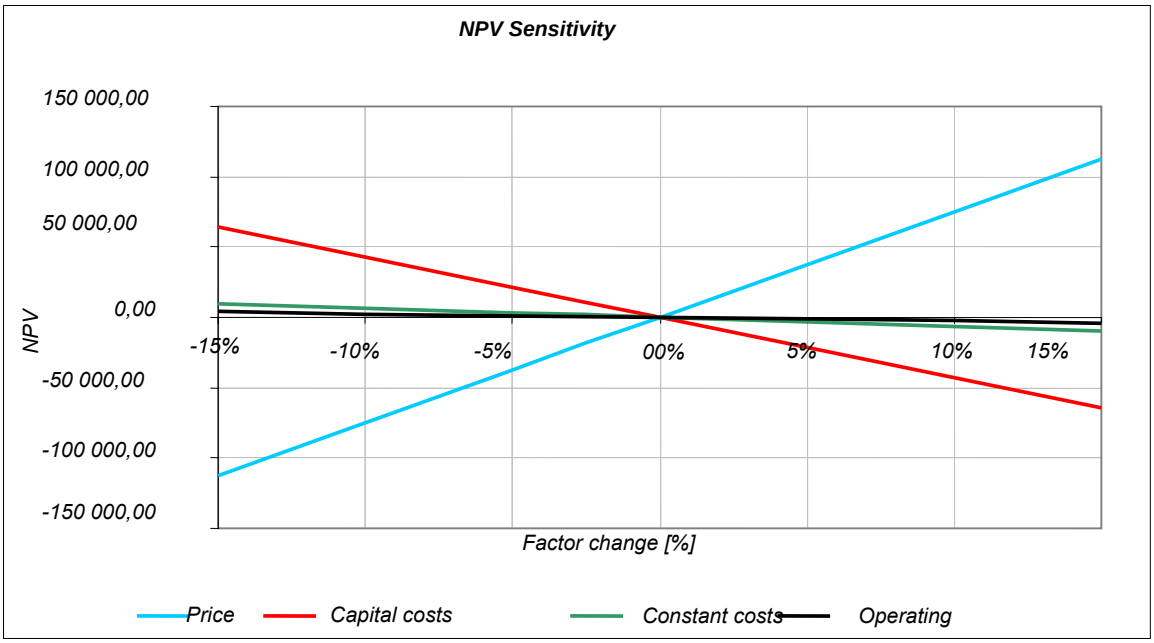

Fig 3. Sensitivity of NPV on the change of investment parameters.

The influence of the degree of the storing capacity use on the minimal price providing the assumed efficiency of investment was analysed for the same gas storage. The minimal storing price as well as its constant and floatable parts are presented in view of the capacity used (Fig. 4). In this case, the storing price has a character of a power function; its decrease with the increasing active capacity use also lowers.

A very big difference in the prices level, depending on the storage use can be clearly observed. The minimal price for the 50 % use of active storing capacity in the assumed variant is 373.45 zł/ thousand m^3, whereas for the 100 % use it reaches a level of 190.17 PLN/ thousand m^3. Having divided the sum into the constant and the floatable parts, it is evident that with the increase of the storage use the constant part rapidly decreases and the floatable one remains on a constant level. A typical scale effect occurs here, when the constant costs and the capital costs are related with an increasing active capacity, therefore their influence on the unit prices is lower.

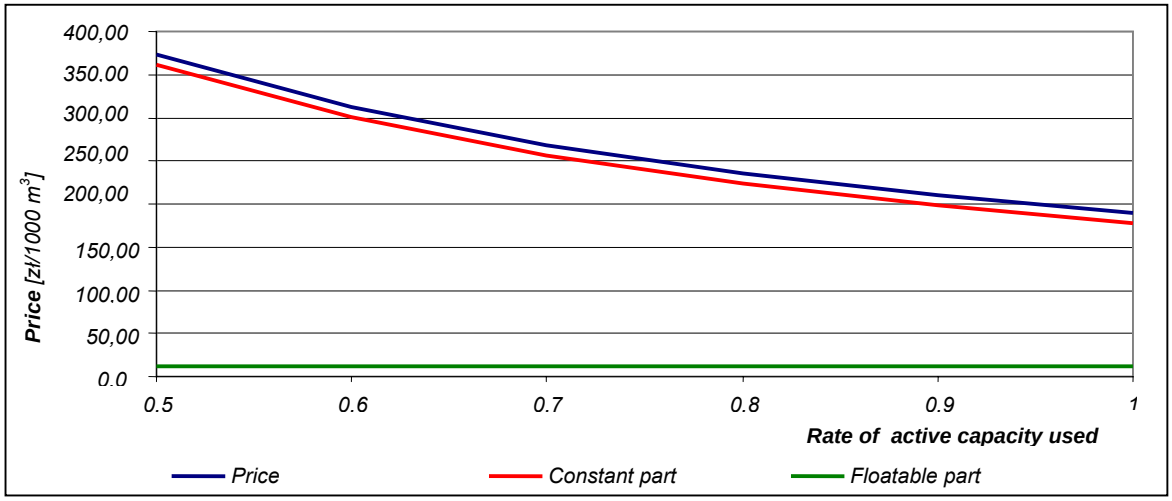

Fig. 4. Storing price depending on the active capacity used.

Conclusions

The economic results of a gas storing process are dominated by the capital costs, the degree of the active capacity used and the storing price. In competitive market conditions, the radical changes of prices can be difficult. Therefore, the remaining elements should be optimized, i.e. a minimization of the unit capital costs and a maximization of the degree of the active capacity used.

If possible, a share of the floatable costs, depending on the active capacity used should be increased in the total cost. This should enable lowering the influence of the active capacity use on the economic efficiency of gas storages. Most of the constant costs can be also reduced by increasing the automation of storages, thus reducing the costs related with wages (the most prominent component).

The role of underground gas storages as a warranty of safe deliveries keeps on increasing. This is caused by the increasing dependence of nearly all EU countries on the gas import and cases when natural gas was used as a political means. The services market also changes in the coming liberalization, as strongly stresses by the EU [2].

Therefore, it is so important that the main factors affecting the economic efficiency of the underground gas storages are identified. An optimization of the storing services can be an important argument in the free market competition conditions.

References

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