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Using underground gas storage to replace the swing capacity of the giant natural gas field of Groningen in the Netherlands. A reservoir performance feasibility study.

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In this study we probe the ultimate potential Underground Gas Storage (UGS) capacity of the Netherlands by carrying out a detailed feasibility study on inflow performances of all available onshore natural gas reservoirs. The Netherlands is one of the largest natural gas producers in Western Europe. The current decline of its national production and looming production restrictions on its largest field of Groningen -owing to its induced seismicity- have recently made necessary to upgrade the two largest UGS of Norg and Grijpskerk. The joined working volume of these two UGS is expected to replace the swing capacity of the Groningen field to continue guaranteeing the security of supply of low calorific natural gas. The question is whether the current UGS configuration will provide the expected working storage capacity unrestricted by issues on reservoir performances and/or induced seismicity. This matter will be of paramount importance in the near future when production restrictions and/or the advance state of depletion of the Groningen field will turn the Netherlands into a net importer of high calorific natural gas. By then, the question will be whether the current UGS will still be economically attractive to continue operating, or if additional/alternative types of UGS will be needed?. Hence the characterization and ranking of the best potential reservoirs available today is of paramount importance for future UGS developments.
We built an in-house automated module based on the application of the traditional inflow performance relationship analysis to screen the performances of 156 natural gas reservoirs in onshore Netherlands. Results enable identifying the 72 best candidates with an ultimate total working volume capacity of 122±30 billion Sm3. A detailed sensitivity analysis shows the impact of variations in the reservoir properties or wellbore/tubing configurations on withdrawal performances and storage capacity. We validate our predictions by comparing them to performances of the UGSs currently operating in the Netherlands. Our results show that although Norg and Grijpskerk stand midst the best candidates, their working:cushion gas volume (wv:cv) ratios appear amongst the lowest. We found many other reservoir candidates with higher wv:cv ratios (>1) and working volumes between 3 and 10 billion Sm3 geographically distributed across the Netherlands. Any of the current and future UGSs will have to compete with economically more attractive means of gas import via pipelines and liquefied natural gas. We suggest that only the strategic development of a network of efficient underground gas storages with wv:cv ratios >1, could increase its economical attractiveness. This can reduce future dependence on foreign gas supply for cases of import disruption or shortages during peak demand in winter periods. Future political and economic decisions and societal acceptance will determine the role that UGS will play in the security of supply of natural gas in the Netherlands and Western Europe.