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Possibilities and selected aspects of hydrogen energy storage

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Energy storage methods may be used for covering energy demand fluctuations and for integration power generation from renewable energy sources as wind plants and solar farms. Classic form of energy storage is hydropower energy storage in top-pumped power plants. Other possibilities of energy storage as alternatives for classic solutions are compressed air or hydrogen energy storage in appropriate geological conditions. Salt caverns are the most relevant formations for hydrogen and compressed air energy storage. The possibilities of hydrogen energy storage application in Polish conditions are presented in this paper. In Poland, there are many suitable geological formations for salt caverns construction, especially in northern and north-western part of the country. Also in northern and western part of Poland, there are the most suitable wind conditions for wind farm localization. The location of large industrial plants (e.g., oil refineries in Gdansk and Plock), which need hydrogen for their technological processes, is also very important factor. In this case the salt caverns may be hydrogen storage for industrial purposes besides the energy storage. This situation requires the design of all infrastructures for transportation and utilization of hydrogen. Hydrogen may be transported in especially designed high pressure pipelines. Pipeline transport of hydrogen is quite similar to natural gas transport. Physical properties of hydrogen cause lower pressure drops along the pipeline. One of methods of hydrogen utilization is to add it to natural gas pipeline system for improvement of natural gas transportation parameters. Hydrogen transportation and storage processes causes' material challenges because of the hydrogen potential to penetrate the crystal lattice of steel leading to hydrogen corrosion. In this paper underground hydrogen storage methods and design aspects of salt caverns and infrastructure challenges are considered. It is concluded that there are possibilities for effective hydrogen energy storage in Poland.

Biography

Tomasz Wlodek is currently working as a Research Assistant in Natural Gas Engineering Department. His main research interests are related to LNG technology, pipeline transmission of natural gas, hydrogen and CO2 and natural gas composition analysis.

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