

## ASSESSMENT OF UNDISCOVERED GAS RESOURCES IN SELECTED TIGHT RESERVOIRS OF POLAND

### SUMMARY

The report<sup>1</sup>, completed in the framework of a project of Polish Geological Survey (PGS), concerns the assessment of undiscovered, tight gas resources in selected tight reservoirs of Poland. Tight gas, considered as one of unconventional sources of natural gas, is produced using similar technologies as used in case of shale gas (e.g., hydraulic fracking), but present in other types of reservoir rocks (mainly in tight, impermeable sandstones). This is the first, preliminary report on the assessment of tight gas resources in Poland. This work will continue in the framework of the tasks of PGS.

This report does not cover tight gas fields discovered recently in reservoir traps in Poland (e.g., Siekierki-Trzek and Pniewy gas fields), but concerns yet unexplored tight gas reservoirs in hydrocarbon basin centers, of likely far higher potential.

### RESULTS



Picture 1 Areas prospective for the occurrence of tight gas reservoirs in Poland after the present report

The most probable value of the undiscovered (risked) GIP in the selected tight reservoirs of Poland (Picture 1) is within the range **53.94+70.42 Tcf (1528+1995 Bcm)** (Tab. 1). The estimations of technically recoverable resources can be given hypothetically, assuming the recovery ratio is 5-15% of the GIP in case of each area, giving an average value of hypothetical TRR (**10%**) slightly larger than the proven resources of conventional gas deposits.

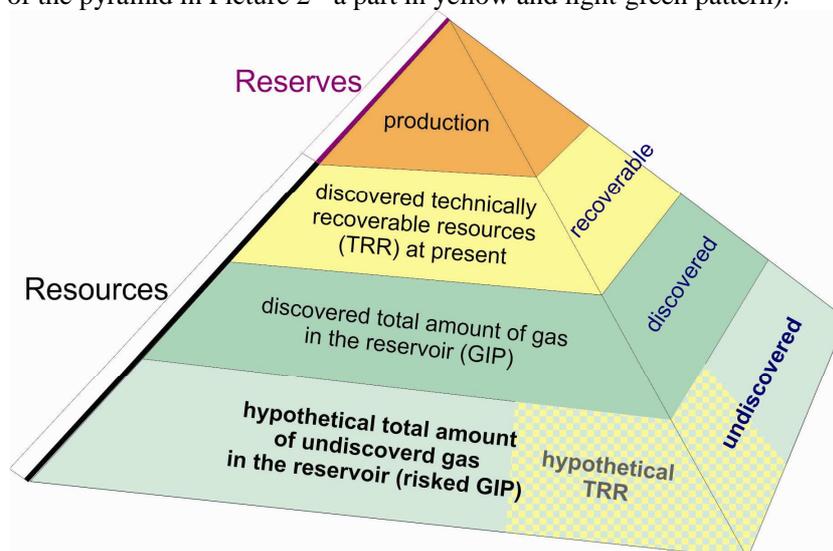
<sup>1</sup> Wójcicki A., Kiersnowski H., Dyrka I., Adamczak-Biały T., Becker A., Głuszyński A., Janas M., Kozłowska A., Krzemiński L., Kuberska M., Paczeńska J., Podhalańska T., Roman M., Skowroński L., Waksmundzka M.I., 2014: Assessment of undiscovered gas resources in selected tight gas reservoirs of Poland. PGI-NRI, Warsaw, Poland.

Tab. 1 Undiscovered (risked) GIP values for the reservoir formations of Rotliegend, Carboniferous and Cambrian; given in Tcf.

Reservoir formation	Depth [m] b.s.l.	Minimum [Tcf]	Best estimate [Tcf]	Maximum [Tcf]
I – Permian (Rotliegend) sandstones	5500-6000 or 5100-6000	3.57 or 7.62	<b>12.18</b> <b>or 28.66</b>	31.21 or 81.47
II – Carboniferous sandstones	1800-3500	15.99	<b>40.22</b>	99.62
III – Cambrian sandstones	2800-3100	0.60	<b>1.34</b>	2.82
TOTAL	-	20.16+24.22	<b>53.94+70.42</b>	133.65+183.91

### THE SCOPE

The report concerns the assessment of undiscovered (risked) Gas In Place (GIP) tight gas resources, or **hypothetical total amount of gas in undiscovered gas fields** (Picture 2). Assuming the gas recovery ratio as a fraction of risked GIP, hypothetical technically recoverable resources (TRR) can be given (the lowermost level of the pyramid in Picture 2 - a part in yellow and light-green pattern).



Picture 2 A simplified classification framework for tight gas resources

Three reservoir formations from the most prospective and/or relatively well explored areas have been analyzed (Picture 2). The following formations have been assessed: I – Permian (Rotliegend) sandstones of Poznań-Kalisz zone, II – Carboniferous sandstones of Greater Poland-Silesia zone and III – Cambrian sandstones of western part of Baltic Basin.

### DATA AND METHODOLOGY

The developed report is based on geological information from over 500 wells, including analyses of available archive geological-reservoir data from about 30 wells, taking into consideration new data acquired by exploration companies in Poland. For each reservoir formation the areas prospective for tight gas occurrence, the percentage of proper rocks and the (net-to-gross) ratio of potential gas horizons were estimated. Tight gas criteria presented in the former, archive study of PGI-NRI (Kiersnowski & Poprawa, 2010) have been adopted, then verified by the newest data from recently completed wells in Poland, results of research accomplished in Germany and other such studies worldwide. In order to perform the calculations the volumetric method has been used, and for the particular reservoir formation the volume of pore space likely filled with gas has been estimated.

In case of the first area (I) two scenarios for the unconventional reservoir in the basin center (BCGS) of two different depth ranges have been adopted. For all three prospective areas statistical analyzes (Monte Carlo method) have been carried out, based on the possible ranges of uncertainties of input parameter values, providing the most likely ranges of the values of gas in place resources (minimum, best estimate, maximum; Tab. 1).