Report for DG JRC in the Context of Contract JRC/PTT/2015/F.3/0027/NC "Development of shale gas and shale oil in Europe"

European Unconventional Oil and Gas Assessment (EUOGA)

Resource estimation of shale gas and shale oil in Europe

Deliverable T7b
Appendix A

Appendix A

This Appendix shows all used parameters for the Monte Carlo calculations as well as all individual calculation results and sensitivities per Screening Index. For the first basin, the results are discussed in detail and can serve as an example on how to read the figures and tables for the other basins. In total 49 formations are evaluated for which some cases hold only gas, some only oil and some both shale oil and gas. In total 15 formations have both oil and gas, 26 formations have assessments for only gas and 8 for oil.

T01 – Norwegian-Danish-S. Sweden – Alum Shale

Index	Basin	Country	Shale(s)	Age	Screening-Index
T1	Norwegian-Danish-S. Sweden (Caledonian foreland)	S	Alum Shale	M. Cambrian-L. Ordovician	1015
		S	Alum Shale	M. Cambrian-L. Ordovician	1016
		DK	Alum Shale	M. Cambrian-L. Ordovician	1019

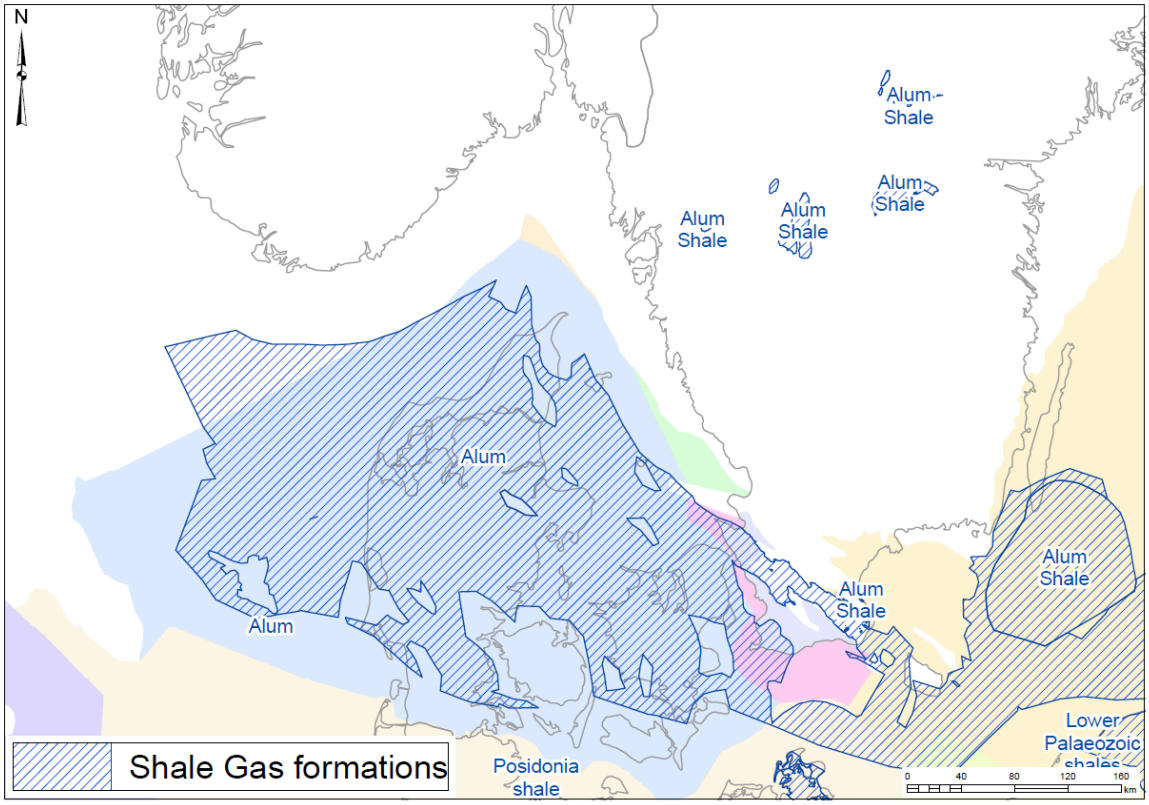

Figure A1 Overview map of the location of assessed formations

The first basin is the Norwegian-Danish-Southern Sweden basin with the Alum Shale of Lower Paleozoic age. The Alum Shale itself is also present in the Fennoscandian shield basin which will be calculated separately as a biogenic shale basin as well as an

occurrence of the Alum Shale formation within the Baltic Basin, where it is present as oil mature shale.

Table A1 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1015, 1016, 1019	*Success factors*
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	High
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Shallow, average to deep
Mineral composition	Unknown

Three separate shale occurrences have been received for this basin (Screening Index SI 1015, 1016, 1017, 1019), each will be calculated separately.

Sweden 1015

After passing the shale gas system ranking, the formation reaches a class 2 uncertainty and will be calculated with the following parameter values:

Table A2 Summary of the classification according to assessment step 3 for the Alum shale of Sweden (CP 1015) for the individual assessment units.

1015	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	108	2	1	1	1	Gas	2
Offshore	107	2	1	1	1	Gas	2

A number of parameters needed for the calculation of the adsorbed gas are not provided by the NGS. For these parameters (Bg and Langmuir's Parameters) analogues or references are needed. These are present within the delivered characteristics of the Alum Shale of Denmark (SI 1019) so these are used. Because no value for pressure was given, the pressure has to be calculated by using hydrostatic pressure.

Table A3 Overview of the input data used for the assessment of the OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

1015	***Min***	***Max***	***Mean***	***Distribution curve***	***Source***
Area (km2)	*SD = 5%*		*2234*	*Normal*	*NGS, Class 2a, GIS data*
Thickness (m)	*48.8*	*78.8*	*64*	*Triangular*	*NGS*
Depth (m)	*0*	*1000*	*800*	*Triangular*	*NGS*
Porosity (%)	*1*	*10.2*	*6.1*	*Triangular*	*NGS*
Saturation gas (%)	*0.075*	*0.532*	*0.206*	*Triangular*	*NGS*
Saturation oil (%)	*0*	*0.279*	*0.0356*	*Triangular*	*NGS*
Bg (gas)	*62*	*109*	*85*	*Triangular*	*TNO, Calculated using depth and temp*
Bo (oil)	*-*	*-*	*-*	*-*	*-*
Pressure (psi)	*14.5*	*1479*	*1171*	*Triangular*	*TNO, Calculated, hydrostatic*
Langmuir Pressure (psi)	*432*	*700*	*435*	*Triangular*	*NGS, Denmark_1019*
Langmuir Volume (scf/ton)	*20*	*63*	*36*	*Triangular*	*NGS, Denmark_1019*
Density (g/cm3)	*2.33*	*2.81*	*2.54*	*Triangular*	*NGS*
Temperature (^{o}C)	*10*	*33*	*28*	*Triangular*	*NGS*

The results of the Monte Carlo simulation of the GIIP of the Alum Shale are shown in Figure 2. Mean values of the calculated gas in place are 122 and 237 bcm totalling in 358.6 bcm for this part of the Norwegian Danish S-Sweden Basin.

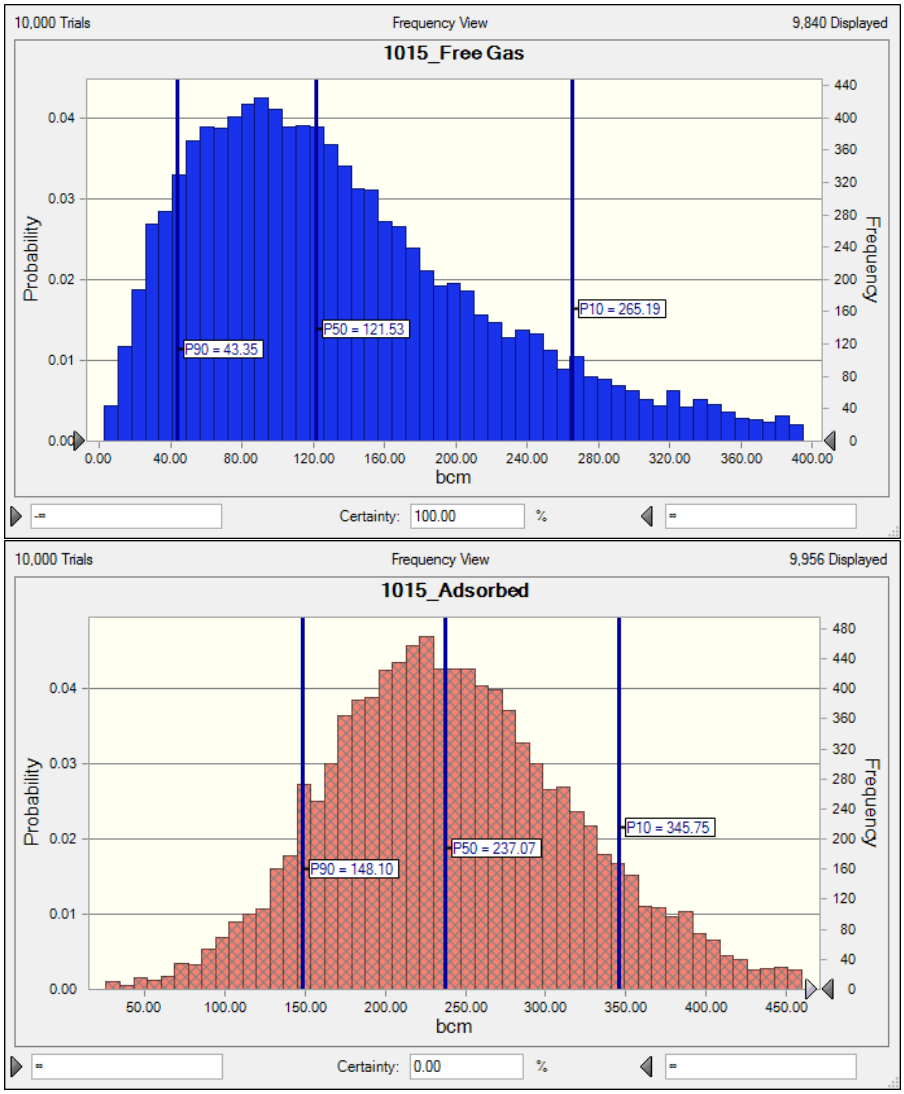

Figure A2 Results from GIIP calculations of Free Gas and Adsorbed Gas for the CP_1015, the Alum Shale of Sweden showing a mean of 122 bcm Free Gas and 237 bcm of adsorbed gas.

Sensitivity analyses on the calculation of the free and adsorbed gas shows the following result:

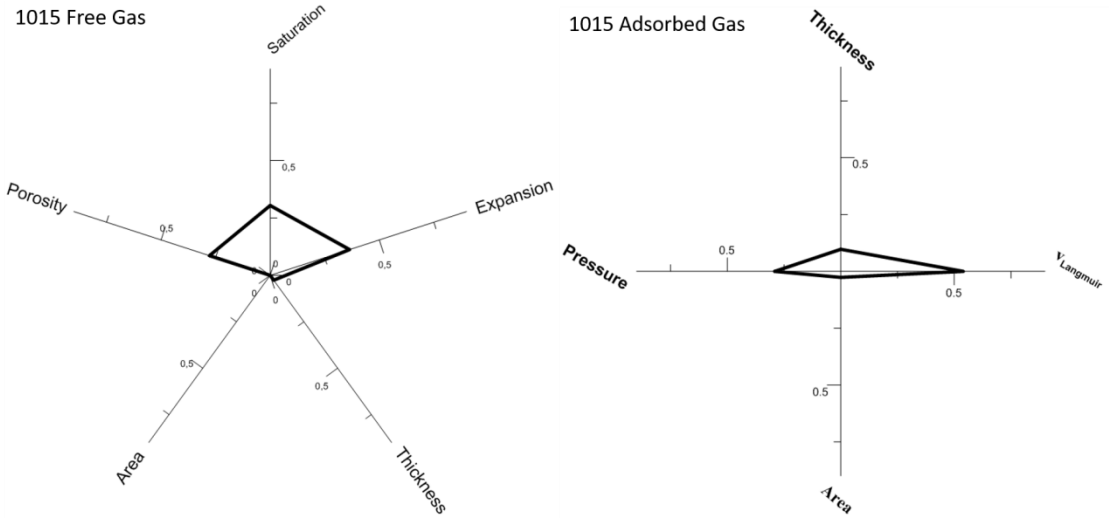

Figure A1 Sensitivity analyses results of the free gas and adsorbed calculations of the CP_1015 part of the Alum Shale.

Figure 3 shows the sensitivity analysis of the GIIP calculation. Gas saturation, expansion and porosity have the largest influence on the free gas simulation, with respectably each being responsible for some 30% of the total uncertainty of the free gas in place. For the adsorbed gas the assumed Langmuir volume has the biggest influence on the range of calculated adsorbed gas in place. About 54% of the total uncertainty are related to this parameter. Another important parameter in this case is the pressure, being responsible for another 29% of the total uncertainty. All of these parameters with the exception of the Langmuir volume and pressure come from direct measurements of the formation itself thus should have a small degree of uncertainty.

This formation was given a class 2 classification for its relatively shallow depth in this assessment unit of on average 800m. It is furthermore located in a structurally complex system, decreasing the chance of success further. One of the main questions therefore is related to the amount of gas either in free or adsorbed form in the formation. This is also reflected in the wide range of measured gas saturation in this formation.

Sweden 1016

The second SI of the Alum Shale is the deeper part of the formation, still in Sweden. The formation is run through the Ranking workflow, resulting in a Class 3 Gas formation which will be calculated in this assessment.

Table A4 Summary of the classification according to assessment step 3 (see x) for the individual assessment units.

1016	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	110	1	1	3	1	Gas	3
Offshore	109	1	1	3	1	Gas	3

For the SI_1016 a number of parameters are missing i.e. porosity, gas saturation, pressure, density, temperature and Langmuir parameters. Most of the parameters

have been obtained from the analogue formations are the Swedish and Danish Alum Shale which gives us most of the parameters. The pressure of the formation is calculated hydrostatically by using the given depth occurrence of the unit.

Table A5 Overview of the input data used for the assessment of the OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

1016	***Min***	***Max***	***Mean***	***Distribution curve***	***Source***
Area (km2)	*SD = 5%*		427.5	Normal	NGS, Class 2a, GIS data
Thickness (m)	*35*	*44*	*40*	*Triangular*	*NGS*
Depth (m)	*1370*	*2500*	*2300*	*Triangular*	*NGS*
Porosity (%)	*1*	*12*	*6.55*	*Triangular*	*NGS, Ranges from Sweden_1015 and Denmark_1019*
Saturation gas (%)	*0.075*	*0.8*	*0.353*	*Triangular*	*NGS, Ranges from Sweden_1015 and Denmark_1019*
Saturation oil (%)	-	-	-	-	-
Bg (gas)	*169*	*199*	*227*	*Triangular*	*TNO, Calculated, depth and given temp*
Bo (oil)	-	-	-	-	-
Pressure (psi)	*2047*	*4092*	*3477*	*Triangular*	*TNO, Calculated, hydrostatic*
Langmuir Pressure (psi)	*432*	*700*	*435*	*Triangular*	*NGS, Denmark_1019*
Langmuir Volume (scf/ton)	*20*	*63*	*36*	*Triangular*	*NGS, Denmark_1019*
Density (g/cm3)	*2.3*	*2.81*	*2.54*	*Triangular*	*NGS, Ranges from Sweden_1015 and Denmark_1019*
Temperature (^{o}C)	*55.21*	*92.5*	*85.9*	*Triangular*	*TNO, Calculated using loc gradient of 3.3 deg/100 m (CP)*

In Figure 4 the results of the Monte Carlo simulation are shown, which results in 78 bcm of free gas and 46 bcm of adsorbed gas, totalling 124 bcm GIIP.

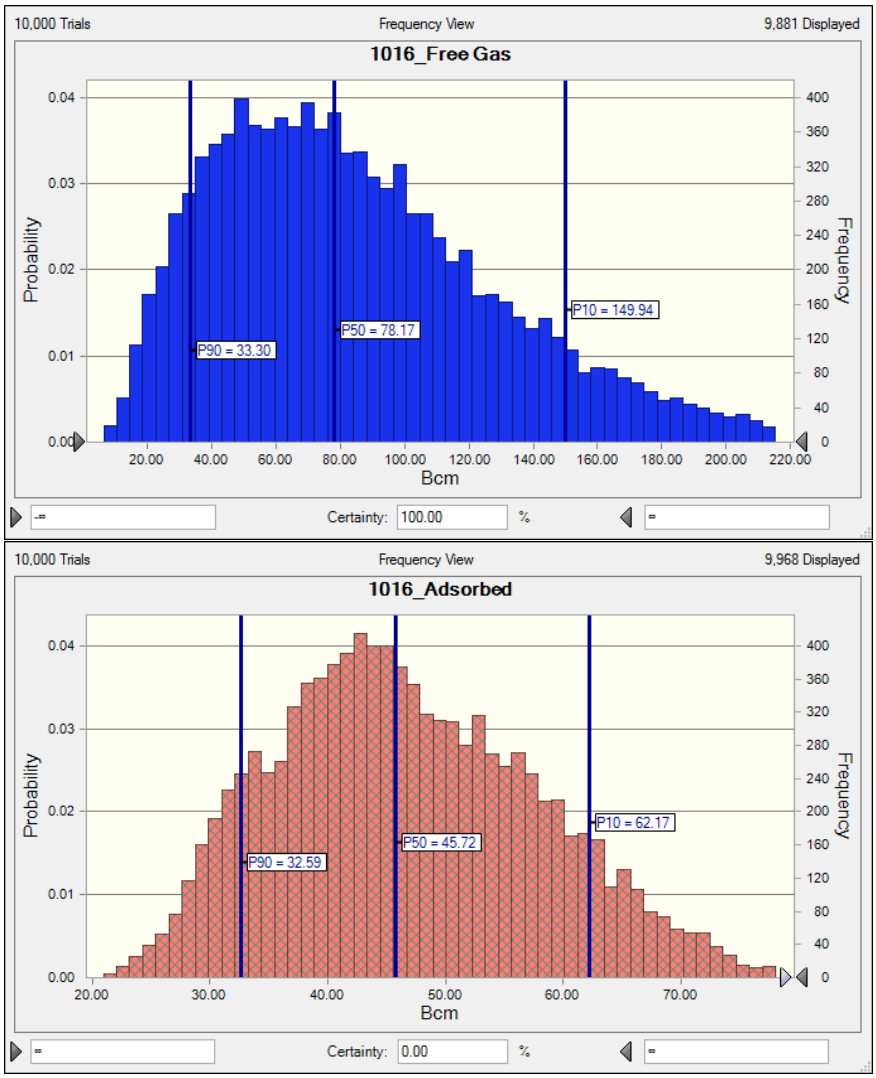

Figure A2 Results from GIIP calculations of Free Gas and Adsorbed Gas for the CP_1016, the Alum Shale of Sweden showing a mean of 78 bcm Free Gas and 46 bcm of adsorbed gas.

Figure 5 shows the sensitivity analysis of the GIIP calculation. Gas saturation and porosity have the largest influence on the free gas, each being responsible for more than 45% of the total uncertainty of the free gas in place value. For the adsorbed gas the assumed Langmuir volume has the biggest influence on the range of calculated adsorbed gas in place. About 90% of the total uncertainty is related to this parameter which is quite big. All of these parameters were from local analogues of the unit itself, increasing the uncertainty.

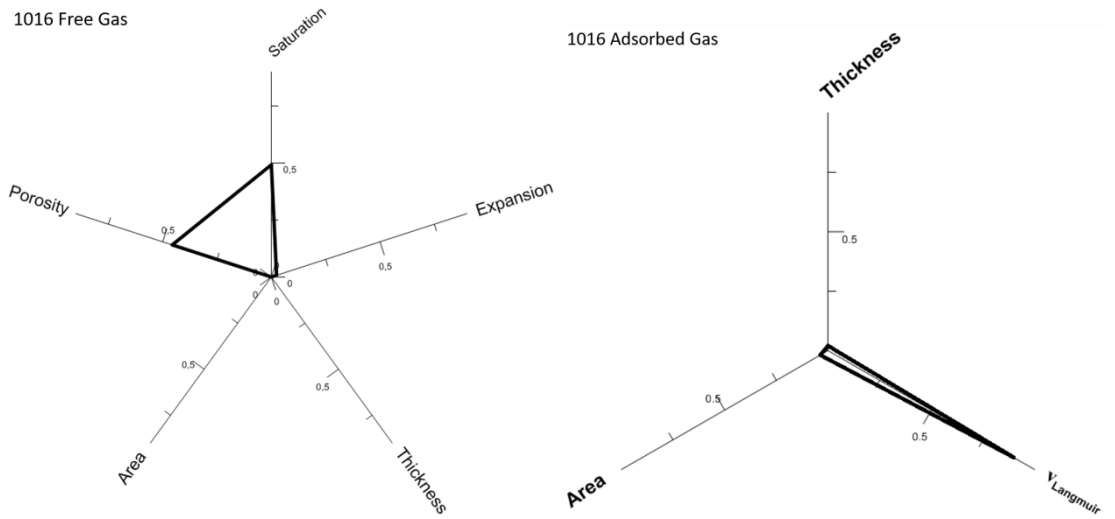

Figure A3 Sensitivity analyses of the Free Gas and Adsorbed gas calculations of the Alum Shale of Sweden (CP 1016)

This formation was given a class 3 classification for its unknown TOC content. It is furthermore located in a structurally complex system, decreasing the chance of success further. Several of the parameters needed for the calculation of the GIIP were taken from local analogues, including relatively easily obtainable parameters such as porosity, density and TOC. Better studies on the basin history, temperature and pressure could also decrease the uncertainty of this formation significantly.

Denmark 1019

Third formation within the basin is the Alum Shale occurrence in Denmark. In comparison to the Swedish occurrences of the Alum Shale the Denmark part is substantially larger, with over three times as big a distribution area next to being thicker as well. This will of course results in higher GIIP results.

The formation is run through the ranking workflow, showing the formation is ranked as a Class 1 Gas formation, and GIIP calculations will commence. The Denmark Alum shale is a shale with a distribution depth going beyond 5 km depth. As discussed in report T2 all shale distribution deeper than 5 km will receive separate calculations as the risk for this depth is higher. Because of this the first resource assessment will cover depth 0-5000 (1019_1), the second 5000-7000 (1019_2) m depth.

Table A6 Summary of the classification according to assessment step 3 for the individual assessment units.

1019	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	32, 34	1	1	1	1	Gas	1
Onshore	36	1	1	1	2	Gas	2
Onshore	20, 22, 40, 42	2	1	1	1	Gas	2
Onshore	44	2	1	1	2	Gas	2
Onshore	29	1	1	1	No	Gas	No
Onshore	38	2	1	1	No	Gas	No
Onshore	47	No	No	1	No	Overmature	No
Onshore	49, 51	No	No	1	1	Overmature	No
Onshore	53	No	No	1	2	Overmature	No
Offshore	25, 26, 31, 33	1	1	1	1	Gas	1
Offshore	35	1	1	1	2	Gas	2
Offshore	28	1	1	1	No	Gas	No
Offshore	19, 21, 39, 41	2	1	1	1	Gas	2
Offshore	23, 43	2	1	1	2	Gas	2
Offshore	37	2	1	1	No	Gas	No
Offshore	17, 45	No	1	1	1	Gas	No
Offshore	48, 50	No	No	1	1	Overmature	No
Offshore	52	No	No	1	2	Overmature	No
Offshore	46	No	No	1	No	Overmature	No

Table A7 Overview of the input data used for the assessment of the GIIP of CP 1019

1019	Min	Max	Mean	Distribution curve	Source
Area (km2)	*SD = 2.5%*		11739	Normal	NGS, Class 2a, GIS data
Thickness (m)	*30*	*80*	*50*	*Triangular*	*NGS*
Depth (m)	*1500*	*7000*	*4250*	*Triangular*	*NGS*
Porosity (%)	*3*	*12*	*6*	*Triangular*	*NGS*
Saturation gas (%)	*0.03*	*0.28*	*0.67*	*Triangular*	*EU*
Saturation oil (%)	-	-	-	-	-
Bg (gas)	*169*	*292*	*270*	*Triangular*	*TNO, NGS temp, hydro press*
Bo (oil)	-	-	-	-	-
Pressure (psi)	*2945*	*8300*	*7106*	*Triangular*	*NGS*
Langmuir Pressure (psi)	*432*	*700*	*435*	*Triangular*	*NGS*
Langmuir Volume (scf/ton)	*20*	*63*	*36*	*Triangular*	*NGS*
Density (g/cm3)	*2.3*	*2.5*	*2.45*	*Triangular*	*NGS*
Temperature (°C)	*64*	*202*	*135*	*Triangular*	*NGS*

Results of GIIP Calculations (Figure 6) show a mean of 1796 bcm of free gas and 736 bcm of adsorbed gas totalling in bcm for the first part of SI 1019, the second part of SI 1019 (**Error! Reference source not found.**) showing 1920 bcm of free gas and 655 bcm of adsorbed gas. These combined are a staggering volume of gas in place.

After the calculations a sensitivity analyses is performed on the gas calculations, shown in **Error! Reference source not found.** and

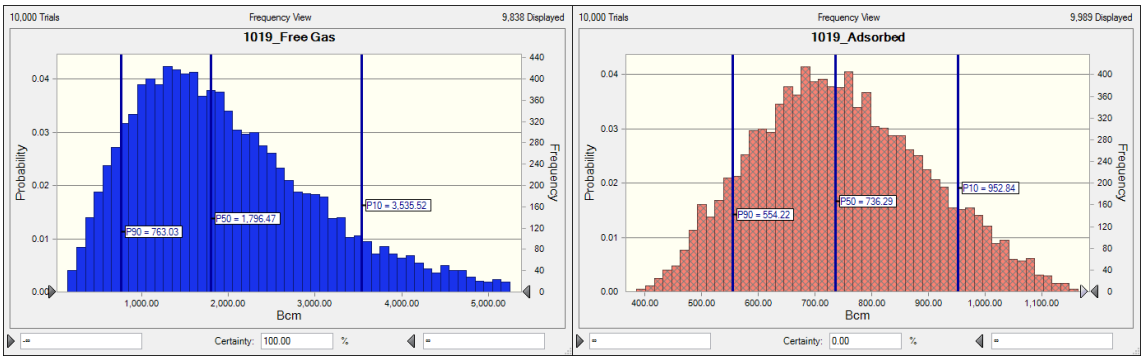

Figure A4 Results from GIIP calculations of Free Gas and Adsorbed Gas for depth up to 5km of CP_1019, the Alum Shale of Denmark showing a mean of 1796 bcm Free Gas and 736 bcm of adsorbed gas.

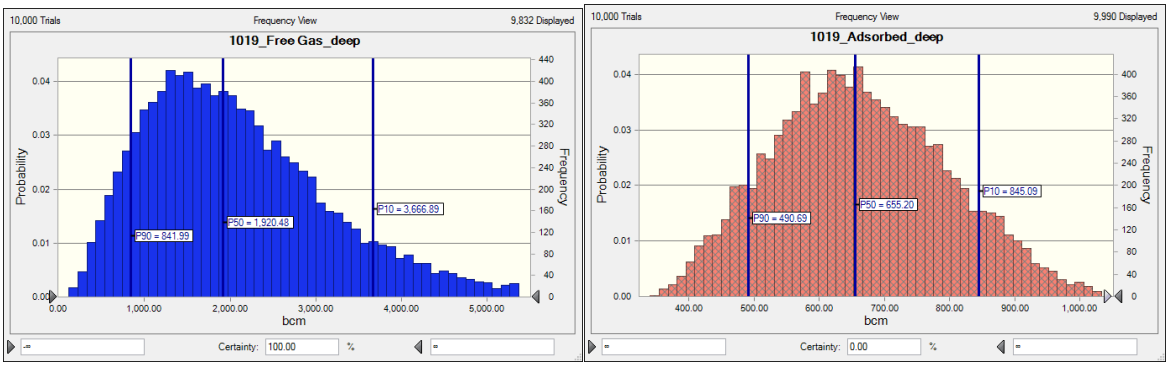

Figure A5 Results from GIIP calculations of Free Gas and Adsorbed Gas for depths deeper than 5 km of CP_1019, the Alum Shale of Denmark. This shows a mean of 1920 bcm Free Gas and 655 bcm of adsorbed gas.

Figure 8 shows the sensitivity analysis of the GIIP calculations of the Alum shale of Denmark. Gas saturation has the largest influence on the free gas in place, being responsible for about 60% of the total uncertainty of the free gas in place value for both cases. Another important parameter in this case is the porosity, being responsible for another 22% of the uncertainty of the free gas in place. For the adsorbed gas the thickness has the biggest influence on the range of calculated gas in place. More than 90% of the total uncertainty is related to this parameter, for both depth ranges. The thickness and porosity values were reported by the NGS for this formation, for the gas saturation the EU average value was selected.

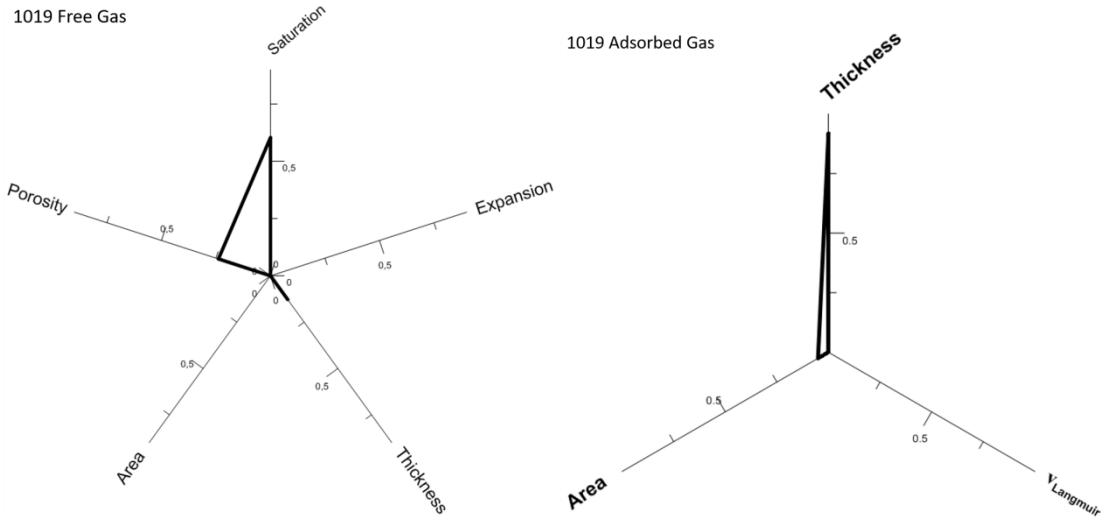

Figure A6 Sensitivity analyses of the Free Gas and Adsorbed gas calculations of the Alum Shale of Denmark up to 5 km depth (CP 1019)

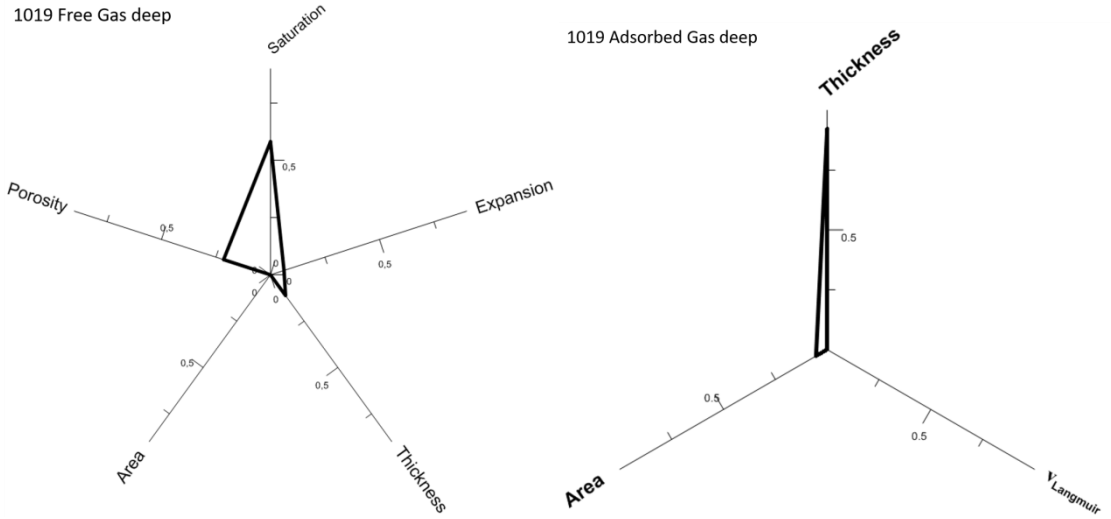

Figure A7 Sensitivity analyses of the Free Gas and Adsorbed gas calculations of the Alum Shale of Denmark deeper than 5 km depth (CP 1019)

This formation was given a class 1 classification. It is located in a structurally complex system influencing the overall chance of success. One of the main parameters influencing the uncertainty for the calculation of the GIIP were taken from the EU average.

Results

The mean value of gas in place for the entire basin for depth class <5 km is 3015 bcm. Subdivided into P10-P50-P90 this looks as follows:

Table A8 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Alum Shale-1015, Adsorbed	S	148.10	**237.07**	345.75
Alum Shale-1015, Free Gas	S	43.35	**121.53**	265.19
Alum Shale-1016, Adsorbed	S	32.59	**45.72**	62.17
Alum Shale-1016, Free Gas	S	33.30	**78.17**	149.94
Alum Shale-1019_1, Adsorbed	DK	554.22	**736.29**	952.84
Alum Shale-1019_1, Free Gas	DK	763.03	**1796.47**	3535.52
Total GIIP for Basin T1			**3015.26**	

For the deeper (>5 km) gas is place estimations the results are:

Table A9 Overview of the results of the GIIP calculation for the deep formations

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Alum Shale-1019_deep, Adsorbed	DK	490.69	**655.20**	845.09
Alum Shale-1019_deep, Free Gas	DK	841.99	**1920.48**	3666.89
Total GIIP Deep for Basin T1			**2575.68**	

T02 - Baltic Basin – Cambrian-Silurian Shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
T2	Baltic Palaeobasin	LV	Zebrus	Lower Ordovician	1001
	Baltic Basin	S	Alum Shale Formation	M. Cambrian - E. Ordovician	1014
	Sorgenfrei Tornquist Zone	S	Alum Shale Formation	M. Cambrian - E. Ordovician	1015
	Norwegian-Danish-Scania	DK	Alum shale	M. Cambrian - E. Ordovician	1019
	Baltic Sedimentary Basin	LT	Upper Ordovician-Llandovery Shales	Middle-Late Llandovery (Late Ordovician)	1061
	Baltic Basin	PL	Lower Palaeozoic shales	Upper Cambrian to Llandovery	1051
	Płock-Warsaw zone	PL	Lower Palaeozoic shales	Upper Cambrian to Llandovery	1052
	Podlasie basin and North Lublin	PL	Lower Palaeozoic shales	Silurian (Llandovery to Wenlock)	1053

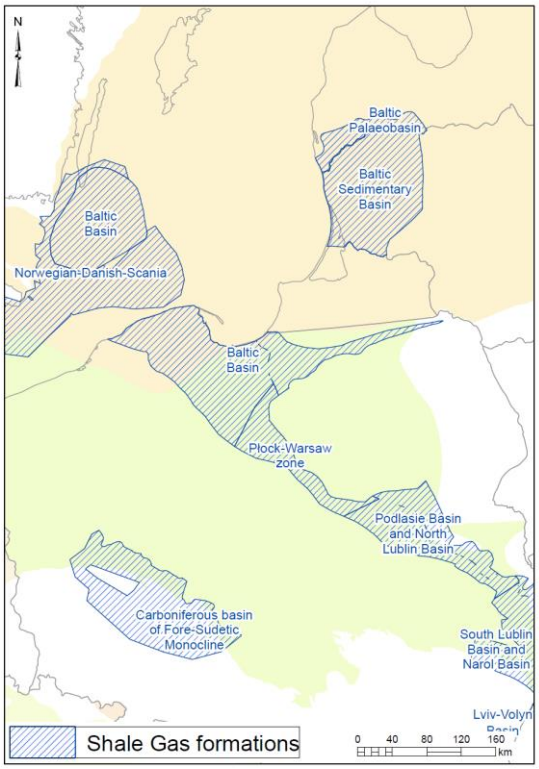

Figure A10 Overview map of the location of assessed formations

From this point onwards there will no longer be figures for each results of the stochastic volumetric calculations as well as each sensitivity study results, this are instead aggregated in Appendix A.

For the Baltic Basin a first calculation is done on the Upper Ordovician and Llandovery shales (1061) and a part of the Alum Shale (1014) of Sweden shales.

Table A10 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1001	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Low
Data availability	Poor
HC system	Possible
Maturity variability	Unknown
Depth	Average
Mineral composition	No data

1014	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Moderate
HC system	Possible
Maturity variability	High
Depth	Shallow
Mineral composition	No data

1015	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	High
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Shallow to average to deep
Mineral composition	Unknown

1019	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	High
Data availability	Moderate
HC system	Possible
Maturity variability	High

Depth	Shallow
Mineral composition	Unknown

1051	***Success factors***
Mapping status	Unknown
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown

1052	***Success factors***
Mapping status	Unknown
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	No data

1053	***Success factors***
Mapping status	Unknown
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	No data

1061	***Success factors***
Mapping status	Good
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown

Zebrus 1001

The first formation in the Baltic Basin is the Zebrus formation of Latvia, a very large formation which is present over 3000 square kilometres. The formation is run through the shale ranking system, showing:

Table A11 Summary of the classification according to assessment step 3 for the individual assessment units.

1001	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	92	1	no	1	1	Immature	No

Which means that the formation will not be assessed as it is immature.

Raikiula-Adavere and Fjäcka-Mossen Formations 1061

The second Baltic formation is the Upper Ordovician – Llandovery shales of Lithuania. This large shale formation combination (stacked almost directly on top of each other) covers some 7222 square kilometres. When running the formation through the ranking system, this gives the following result:

Table A12 Summary of the classification according to assessment step 3 for the individual assessment units.

1061	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	88, 89, 90,	1	1	1	1	Oil/Gas	1
Onshore	91	1	No	No	1	Total Basin	No

Table A13 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T2a	LT_1061	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		5825	Normal	NGS, Class 4a, GIS data
	Thickness (m)	16.5	35	20	Log normal	NGS
	Depth (m)	1500	2130	1800	Log normal	NGS
	Porosity (%)	0.35	14.1	5.7	Log normal	NGS
	Saturation gas	0.5	0.75	0.67	Triangular	NGS Poland as analogue
	Saturation oil	0.01	0.15	0.06	Triangular	NGS Poland as analogue
	Expansion Factor (Bg)	164	182	173	Triangular	TNO
	Bo (oil)	0.8	1.1	1.01	Triangular	NGS, Poland_1052
	Pressure (psi)	2243	3180	2690	Triangular	TNO with gradient NGS
	Langmuir Pressure (psi)	432	700	435	Triangular	NGS
	Langmuir Volume (scf/ton)	20	63	36	Triangular	NGS
	Density (g/cm3)	2.11	2.85	2.49	Log normal	NGS
	Temperature (°C)	32	91.7	71.4	Triangular	NGS

This means the shale is identified as a Class 1 oil and gas shale and will have a resource assessment. For the calculations the saturation (both gas and oil) as well as the compressibility factor are taken from the Polish Lower Paleozoic shales (SI 1052) as this is the best analogue for the Lithuania formations, indicated by the Lithuanian Geological Survey. The expansion is calculated by TNO based on hydrostatic pressure and local temperature gradient.

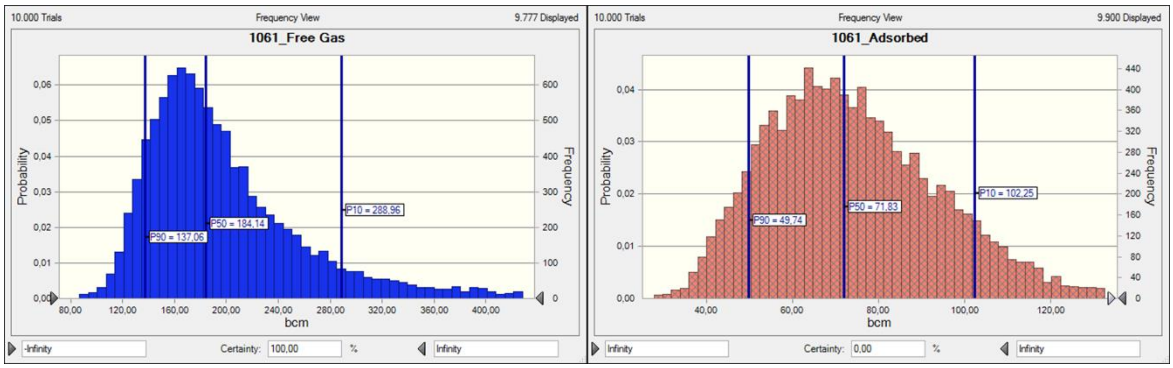

Figure A11 Results from GIIP calculations of Free Gas and Adsorbed Gas

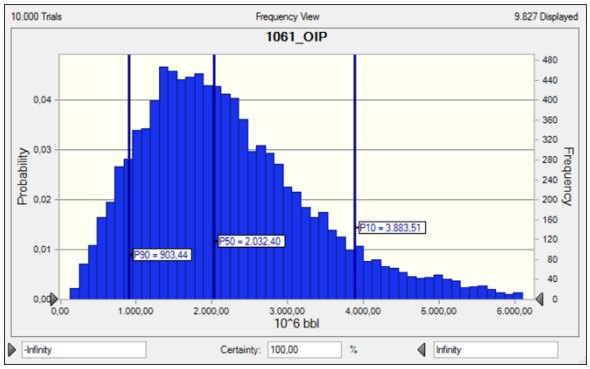

Figure A12 Results from the OIIP calculation

The resource assessment for this unit shows a total of 255.97 bcm of GIP and 2.03 billion million barrels of OIP, which is a very high amount of hydrocarbons in place. The Monte Carlo results as well as the sensitivities can be found in Appendix A.

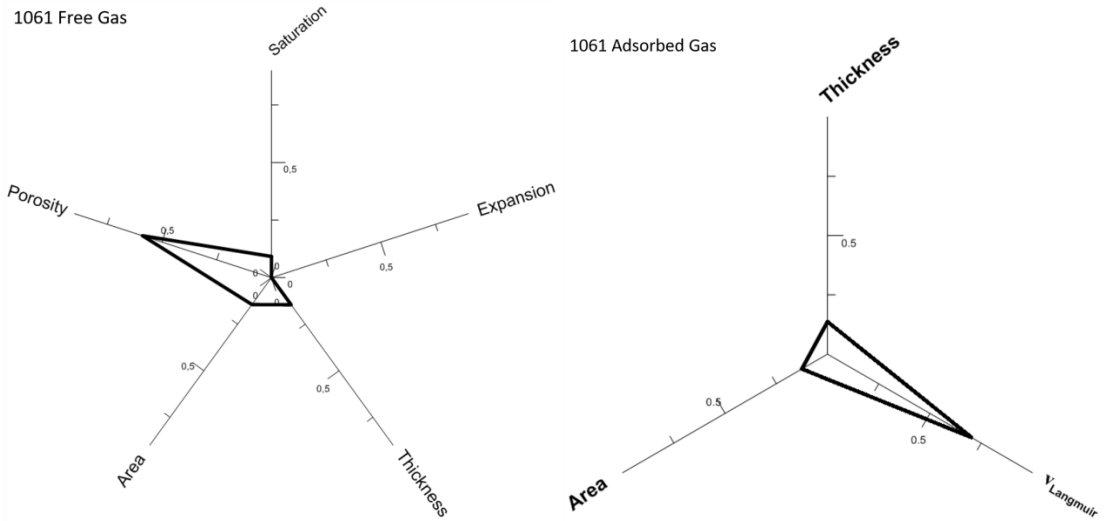

Figure A13 Sensitivity analyses results of the free gas and adsorbed calculations.

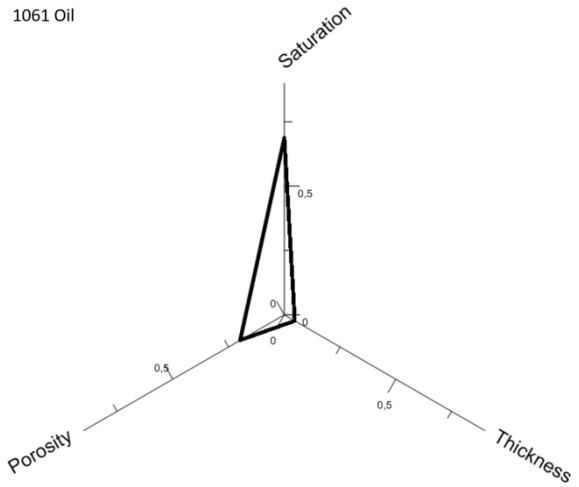

Figure A14 Sensitivity analyses results of the oil in place calculation

Alum Shale Formation 1014

Fourth formation of the Baltic Basin is the Alum Shale of Sweden, which we've also seen in basin T1, although its characteristics are somewhat different that before. The formation is quite small with a distribution are of 106 square kilometres. To see in which Class the formation falls it is run through the ranking workflow:

Table A14 Summary of the classification according to assessment step 3 for the individual assessment units.

1014	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	104	2	2	1	1	gas	2
Offshore	103	2	2	1	1	gas	2

Table A15 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T1	S_1014	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD = 10%		99.78	Normal	NGS, Class 4a, GIS data
	Thickness (m)	15	25	20	Triangular	NGS
	Depth (m)	0	800	300	Triangular	NGS
	Porosity (%)	1	10.2	6.1	Triangular	NGS, Sweden_1015
	Saturation gas	-	-	-	-	-
	Saturation oil	0	0.279	0.0356	Triangular	NGS, Sweden_1015
	Expansion Factor (Bg)	-	-	-	-	-
	Bo (oil)	0.76	1.1	1.01	Triangular	NGS, Summary_1061
	Pressure (psi)	145	1160	432	Triangular	NGS
	Langmuir Pressure (psi)	-	-	-	-	-
	Langmuir Volume (scf/ton)	-	-	-	-	-
	Density (g/cm3)	2.33	2.81	2.54	Triangular	NGS, Sweden_1015
	Temperature (°C)	8	35	15	Triangular	NGS

This shows that the formation is a Class 2 oil shale, and resources will be calculated. When doing the calculation the formation did not have values for the porosity, saturation, density and compressibility factor. Analogue formation Alum Shale SI 1015 is used, which is a continuation of the same formation.

Figure shows the results of the OIL Monte Carlo simulation, with a mean value of 66 million barrels of oil. As expected not a lot of oil in place, as it is a rather small formation.

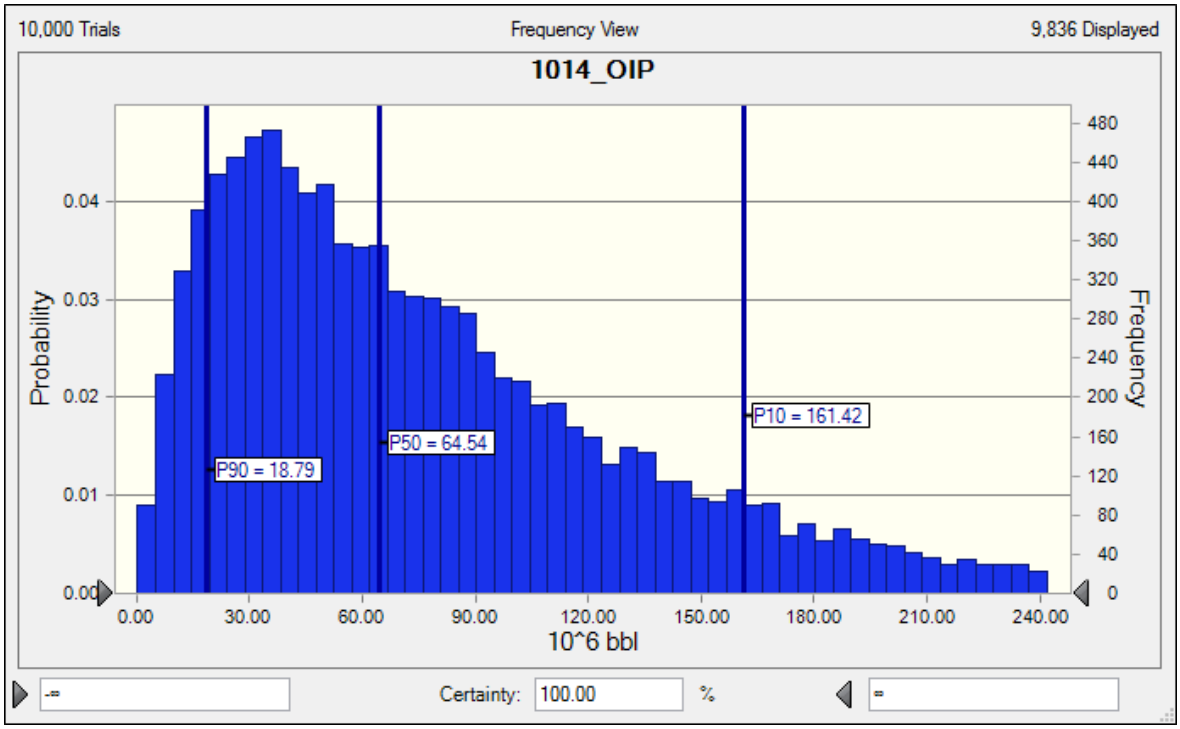

Figure A15: OIP Monte Carlo results of the Alum shale showing 65 million barrels of oil in place as a P50.

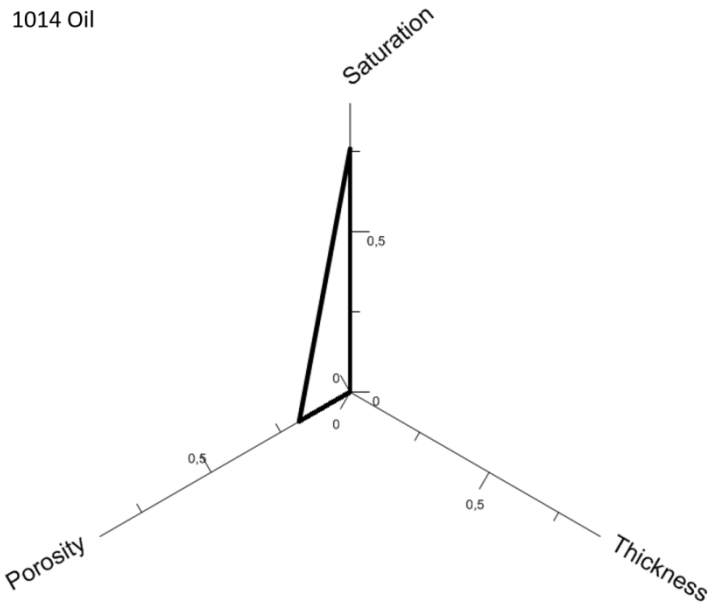

Figure A16 Sensitivity analyses results of the oil in place calculation

Alum Shale Formation of the Sorgenfrei Tornquist Zone 1015

Table A16 Summary of the classification according to assessment step 3 for the individual assessment units.

1015	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	106	2	1	1	1	Gas	2
Offshore	105	2	1	1	1	Gas	2

Alum Shale of the Norwegian-Danish-Scania 1019

Table A17 Summary of the classification according to assessment step 3 for the individual assessment units.

1019	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Offshore	24, 26, 27, 30	1	1	1	1	Gas	1
Offshore	15, 16, 18	No	1	1	1	Gas	No
Offshore	14	No	3	1	1	Gas	No

Lower Paleozoic shale Baltic basin 1051

Table A18 Summary of the classification according to assessment step 3 for the individual assessment units.

1051	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	95	1	1	1	1	oil	1

Onshore	96	1	1	1	1	gas	1

Table A19 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T2b	PL_1051	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		17820	Normal	NGS, Class 4a, GIS data
	Thickness (m)	12	73	40	Triangular	NGS
	Depth (m)	1500	4500	2800	Triangular	NGS
	Porosity (%)	4	5	4.5	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	0.005	0.15	0.06	Triangular	NGS
	Expansion Factor (Bg)	172	299	250	Triangular	NGS
	Bo (oil)	0.8	1.1	1	Triangular	NGS
	Pressure (psi)	2200	6600	4100	Triangular	NGS
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.5	2.7	2.6	Triangular	NGS
	Temperature (°C)	40	120	70	Triangular	NGS

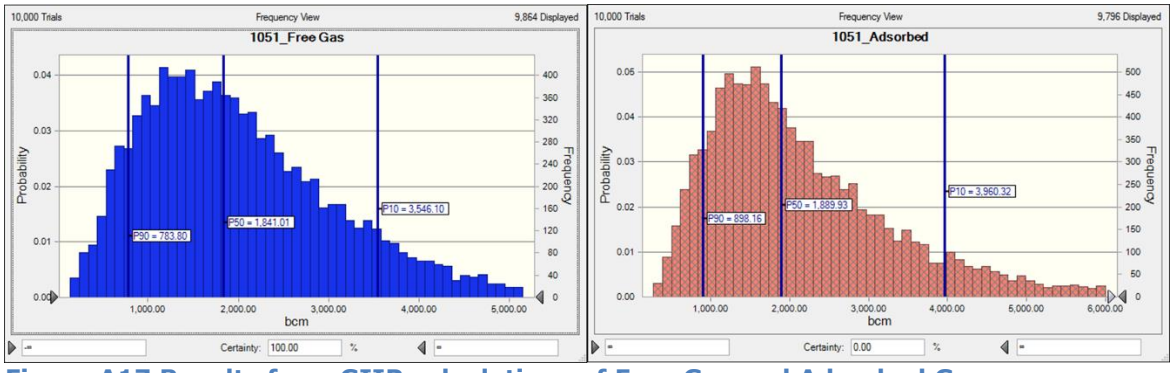

Figure A17 Results from GIIP calculations of Free Gas and Adsorbed Gas

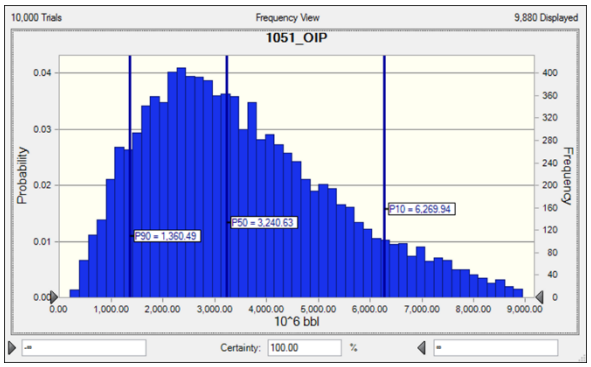

Figure A18 Results from the OIIP calculation

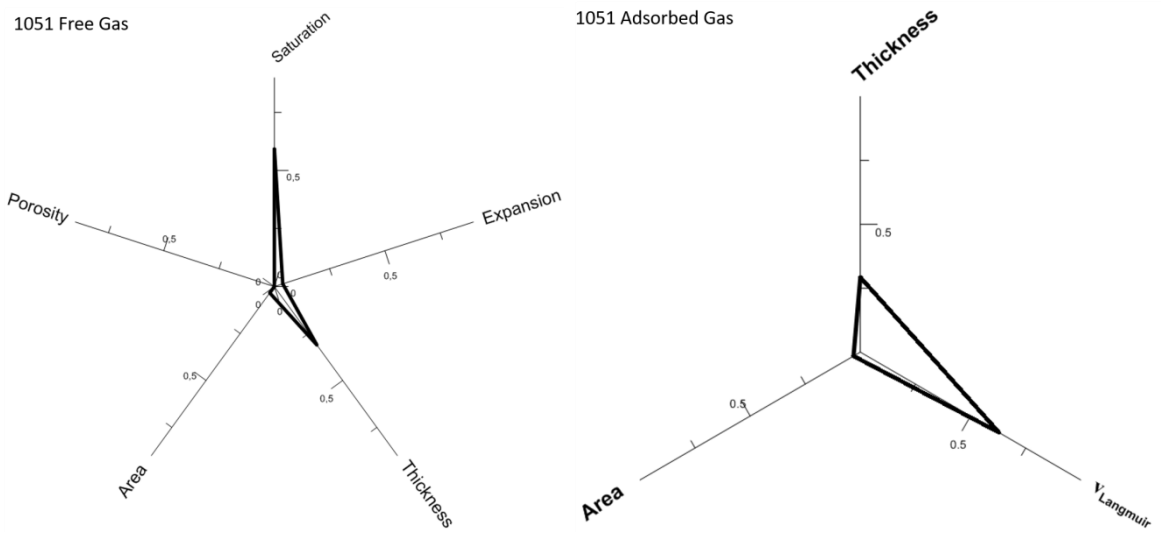

Figure A19 Sensitivity analyses results of the free gas and adsorbed calculations.

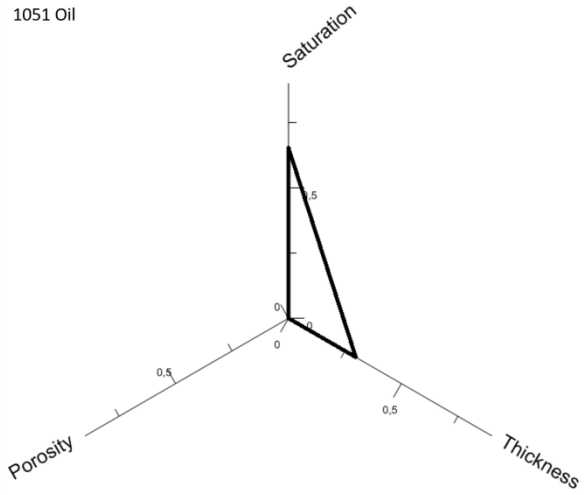

Figure A20 Sensitivity analyses results of the oil in place calculation

Lower Paleozoic shale Płock-Warsaw zone 1052

Table A20 Summary of the classification according to assessment step 3 for the individual assessment units.

1052	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	97	1	1	1	1	gas	1

Table A21 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T2c	PL_1052	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		4599	Normal	NGS, Class 4a, GIS data
	Thickness (m)	30	80	50	Triangular	NGS
	Depth (m)	3500	5000	4430	Triangular	NGS
	Porosity (%)	4	5	4.5	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	0.005	0.15	0.06	Triangular	NGS
	Expansion Factor (Bg)	315	333	317	Triangular	NGS
	Bo (oil)	-	-	-	-	-
	Pressure (psi)	5200	7300	6500	Triangular	NGS
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.5	2.7	2.6	Triangular	NGS
	Temperature (°C)	110	140	129	Triangular	NGS

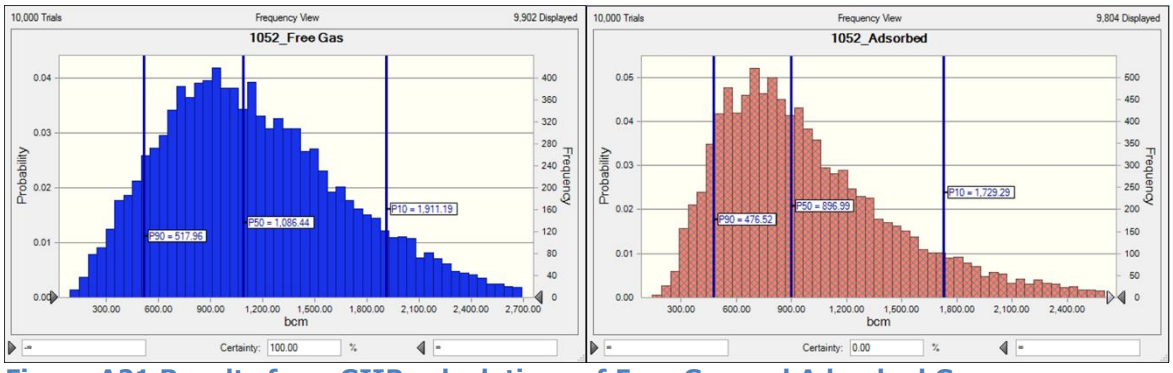

Figure A21 Results from GIIP calculations of Free Gas and Adsorbed Gas

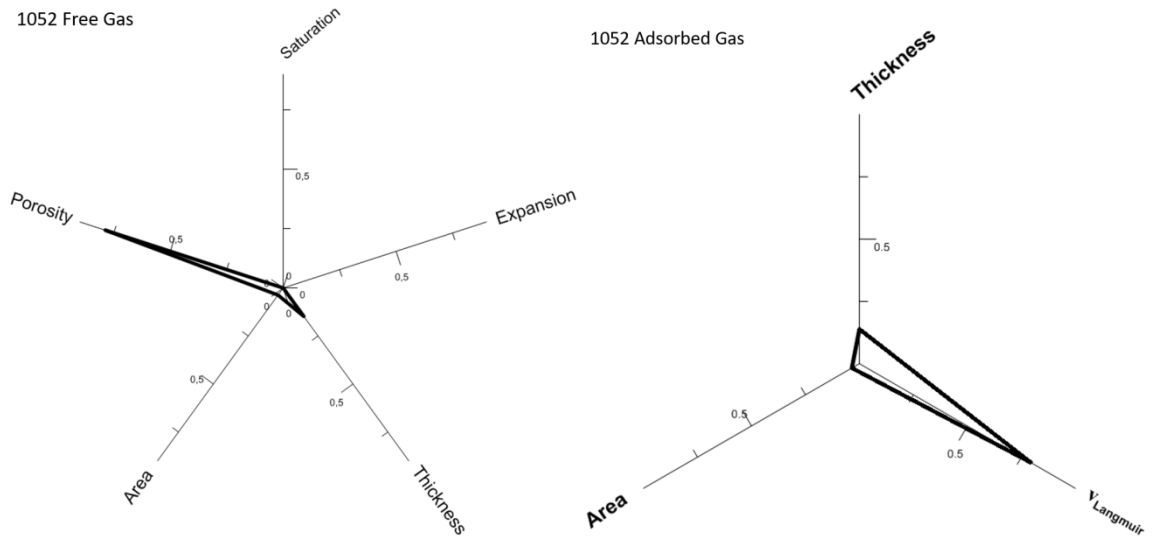

Figure A22 Sensitivity analyses results of the free gas and adsorbed calculations.

Lower Paleozoic shales Podlasie and North Lublin Basin 1053

Table A22 Summary of the classification according to assessment step 3 for the individual assessment units.

1053	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	98	1	1	1	1	oil	1
Onshore	99	1	1	1	1	gas	1

Table A23 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T2d	PL_1053	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		3670	Normal	NGS, Class 4a, GIS data
	Thickness (m)	24	60	40	Triangular	NGS
	Depth (m)	1500	4000	2025	Triangular	NGS
	Porosity (%)	4	5	4.5	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	0.005	0.15	0.06	Triangular	NGS
	Expansion Factor (Bg)	164	277	172	Triangular	NGS
	Bo (oil)	0.8	1.1	1	Triangular	NGS
	Pressure (psi)	2200	3000	5900	Triangular	NGS
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.5	2.7	2.6	Triangular	NGS
	Temperature (°C)	57	107	68	Triangular	NGS

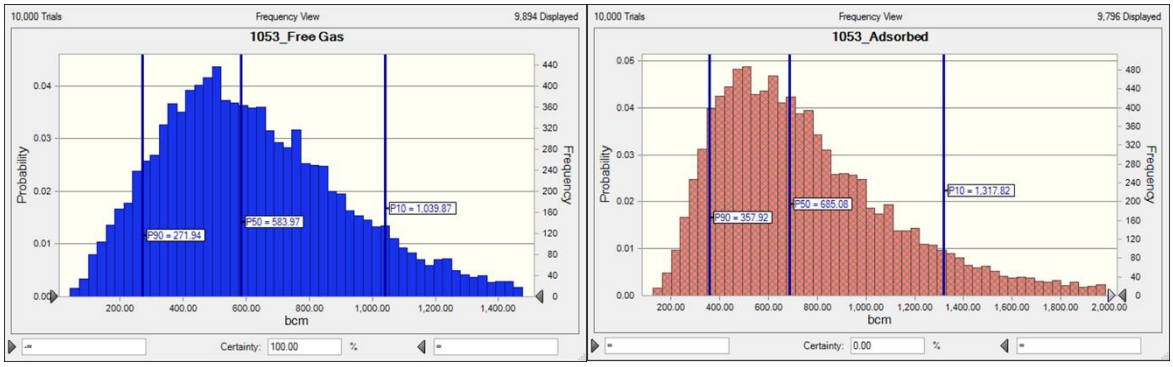

Figure A23 Results from GIIP calculations of Free Gas and Adsorbed Gas

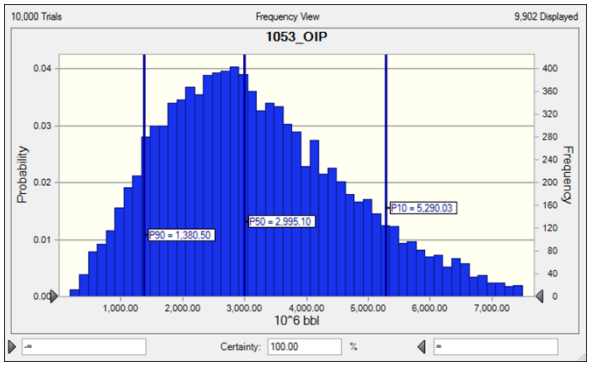

Figure A24 Results from the OIIP calculation

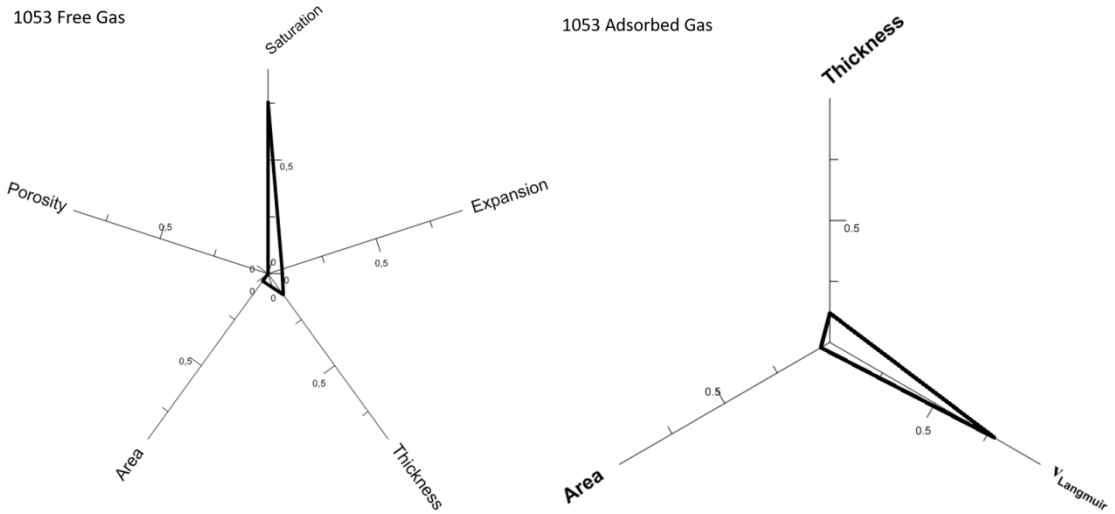

Figure A25 Sensitivity analyses results of the free gas and adsorbed calculations.

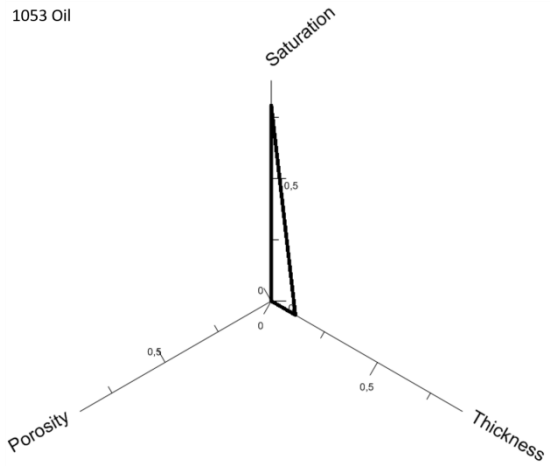

Figure A26 Sensitivity analyses results of the oil in place calculation

Results

Table A24 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Lower Palaeozoic shales-1051, Adsorbed	PL	898.16	**1889.93**	3960.32
Lower Palaeozoic shales-1051, Free Gas	PL	783.80	**1841.01**	3546.10
Lower Palaeozoic shales-1052, Adsorbed	PL	476.52	**896.99**	1729.29
Lower Palaeozoic shales-1052, Free Gas	PL	517.96	**1086.44**	1911.19
Lower Palaeozoic shales-1053, Adsorbed	PL	357.92	**685.08**	1317.82
Lower Palaeozoic shales-1053, Free Gas	PL	271.94	**583.97**	1039.87
Llandovery-1061, Adsorbed	LT	49.74	**71.83**	102.25
Llandovery-1061, Free Gas	LT	137.06	**184.14**	288.96
Total GIIP for Basin T2			**7239.40**	

Basin T2 only holds one formation which is expected to hold shale oil, this is the Alum shale of Sweden. The results for the oil in place estimations are:

Table A25 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Alum Shale-1014, Oil	S	18.79	**64.54**	161.42
Total OIIP for Basin T1			**64.54**	

T03 - Podlasis Lublin Basin – Various shales 1054, 1062

Index	Basin	Country	Shale(s)	Age	Screening-Index
T03	Lviv-Volyn	UA	Black shale	Lower Silurian	1062
	South Lublin Basin and Narol Basin	P	Lower Palaeozoic shales	Silurian (Llandovery to Wenlock)	1054

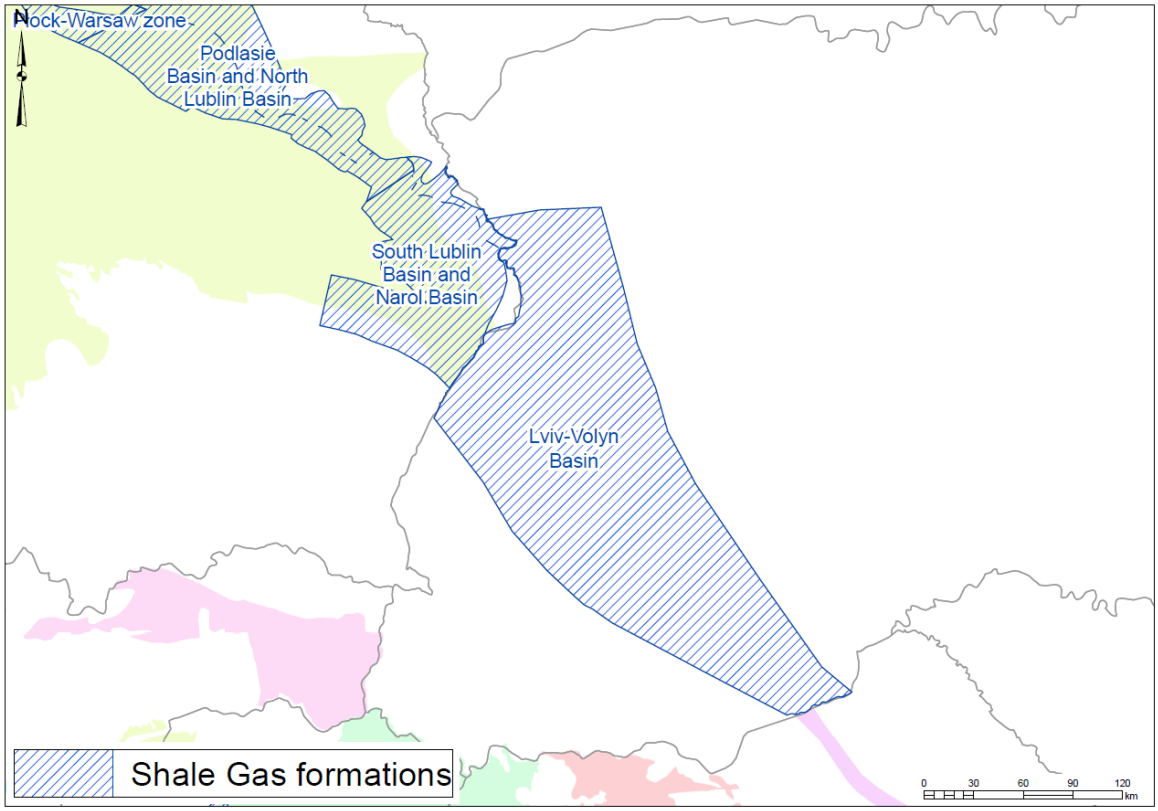

Figure A27 Overview map of the location of assessed formations

Table A26 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1054	***Success factors***
Mapping status	Unknown
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Unknown
Maturity variability	Unknown
Depth	Average
Mineral composition	No data

1062	***Success factors***

Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Unknown
Maturity variability	Unknown
Depth	Average
Mineral composition	No data

Lower Paleozoic shales South Lublin and Narol Basin 1054

Table A27 Summary of the classification according to assessment step 3 for the individual assessment units.

1054	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	100	1	1	1	1	oil	1
Offshore	101	1	1	1	1	gas	1

Table A28 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T3	PL_1054	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		7759	Normal	NGS, Class 4a, GIS data
	Thickness (m)	21	34	30	Triangular	NGS
	Depth (m)	2000	4300	2995	Triangular	NGS
	Porosity (%)	4	5	4.5	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	0.05	0.15	0.06	Triangular	NGS
	Expansion Factor (Bg)	212	294	243	Triangular	NGS
	Bo (oil)	0.8	1.1	1	Triangular	NGS
	Pressure (psi)	2900	6300	4400	Triangular	NGS
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.4	2.79	2.67	Triangular	NGS
	Temperature (°C)	60	110	80	Triangular	NGS

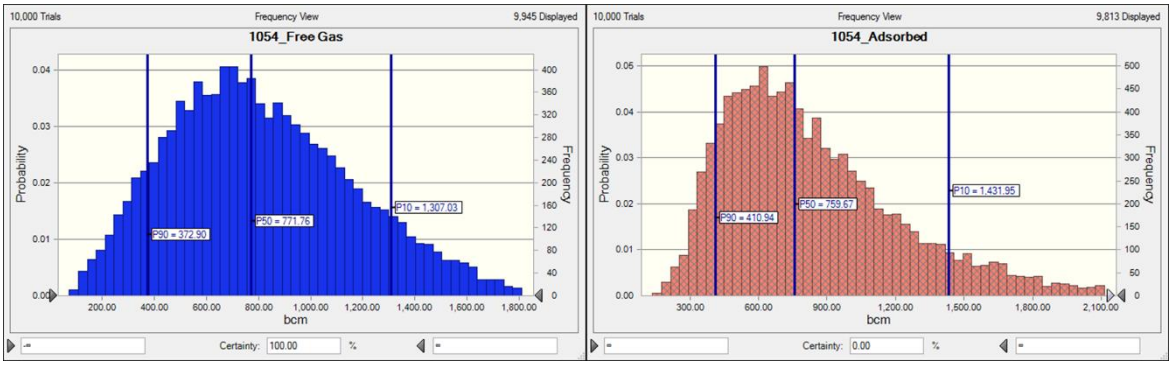

Figure A28 Results from GIIP calculations of Free Gas and Adsorbed Gas

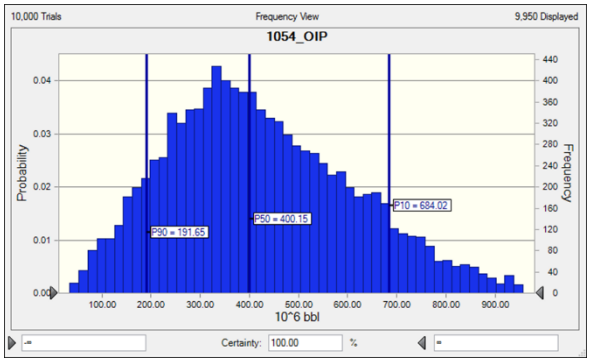

Figure A29 Results from the OIIP calculation

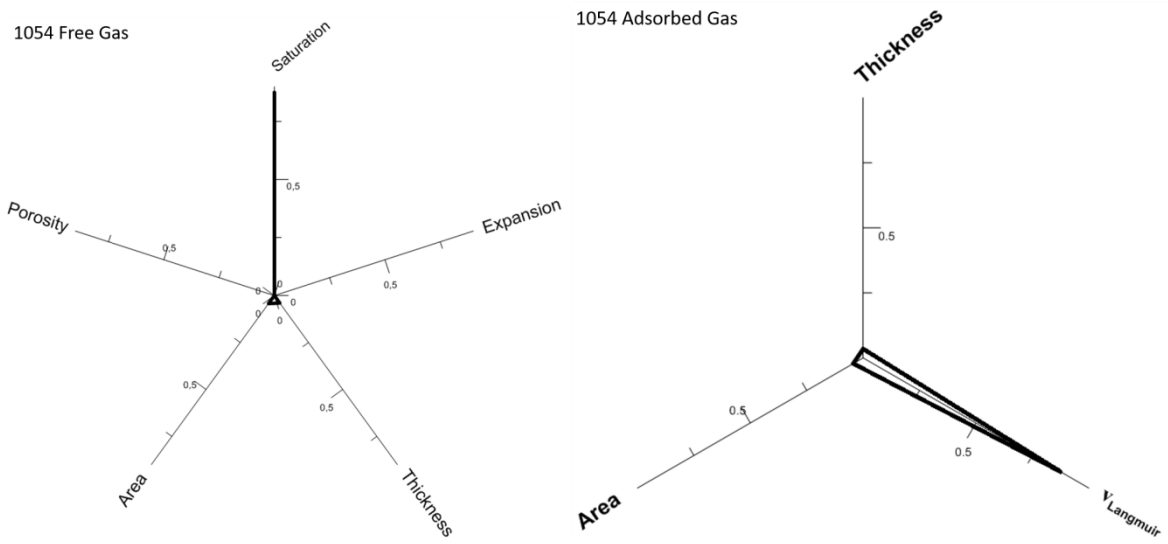

Figure A30 Sensitivity analyses results of the free gas and adsorbed calculations.

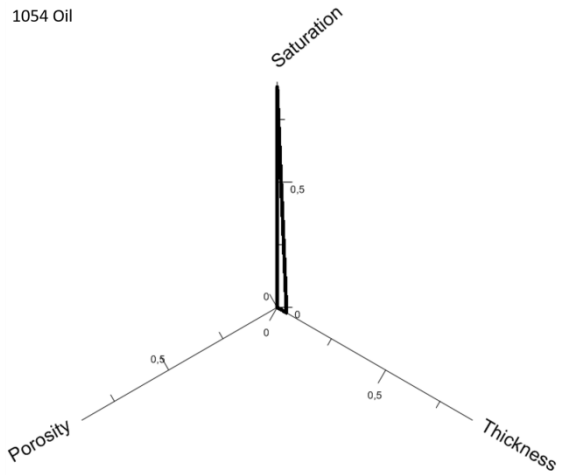

Figure A31 Sensitivity analyses results of the oil in place calculation

Black Shales of the Lviv-Volyn Basin 1062

Table A29 Summary of the classification according to assessment step 3 for the individual assessment units.

1062	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	120	1	1	3	2	gas	3

Table A30 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T3	UA_1062	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=25%		30611	Normal	NGS, Class 5a, GIS data
	Thickness (m)	17.5	63.925	40.725	Triangular	NGS, with N/G 2.5%
	Depth (m)	261.4	5120	2821.4	Triangular	NGS
	Porosity	0.013	0.061	0.0435	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	SD=0.083		0.044	Log normal	EU
	Expansion Factor	27	291	230	Triangular	EU
	Bo (oil)	0.85	1.01	0.98	Triangular	EU
	Pressure (psi)	372	4010	7277	Triangular	TNO
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.6	2.8	2.7	Triangular	NGS
	Temperature (°C)	87	8.1	159	Triangular	TNO, gradient 31

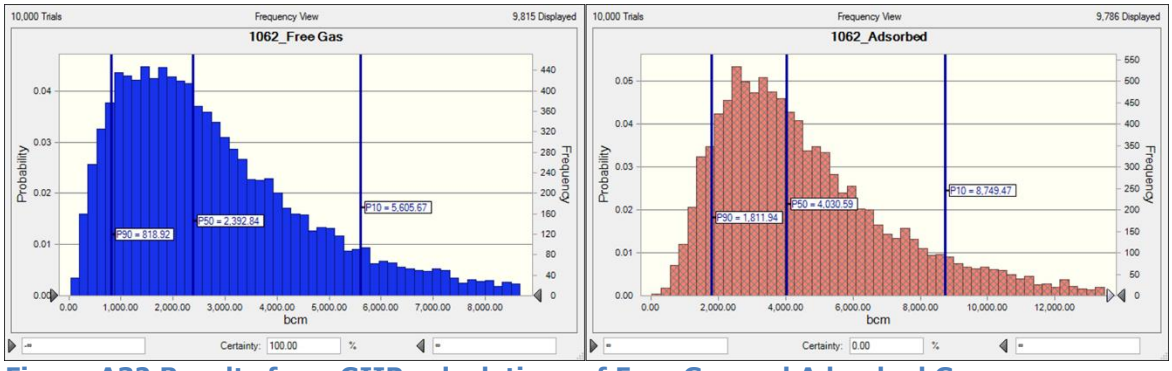

Figure A32 Results from GIIP calculations of Free Gas and Adsorbed Gas

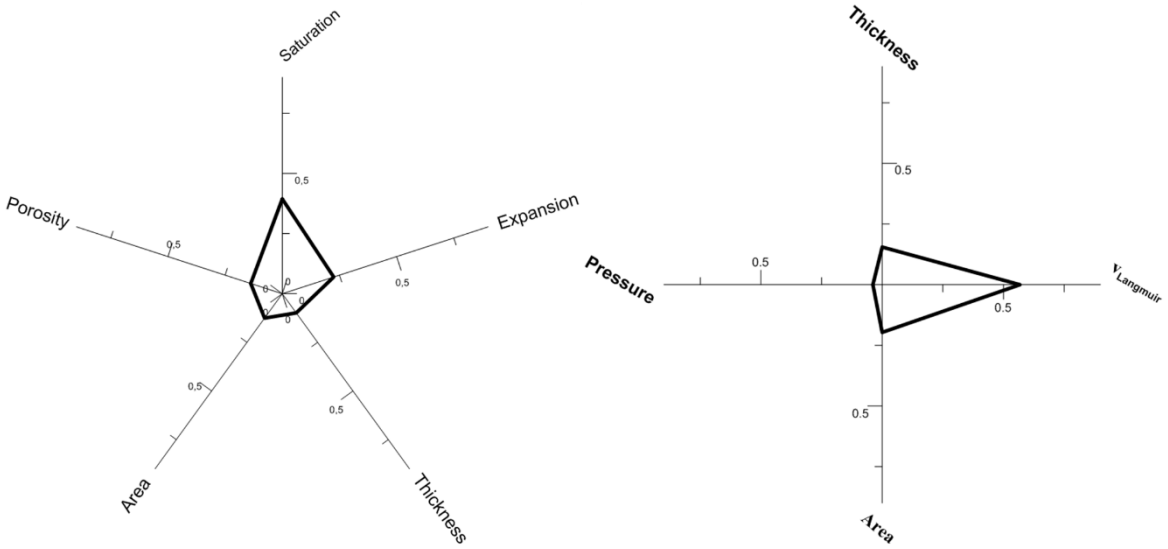

Figure A33 Sensitivity analyses results of the free gas and adsorbed calculations.

Results

Table A31 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Lower Palaeozoic shales-1054, Adsorbed	PL	410.94	**759.67**	1431.95
Lower Palaeozoic shales-1054, Free Gas	PL	372.90	**771.76**	1307.03
Black shale-1062, Adsorbed	UA	1811.94	**4030.59**	8749.47
Black shale-1062, Free Gas	UA	818.92	**2392.84**	5605.67
Total GIIP for Basin T03			**7954.86**	

T04 - Moesian Platform – Lower and Upper Paleozoic Shales

Index	Basin	Country	Shale(s)	Age	Screening-Index (summarized in 2001)
T4	Moesian Platform	BG	Lower Paleozoic Shales	Silurian to Lower Devonian	1056
		RO	Tandarei Graptolitic Black Shales	U Ordovician U Silurian L Devonian	1038
		BG	Upper Paleozoic shale & coal succession Trigorska & Konarska Fms	Lower carboniferous (Middle Mississippian, Upper Visean)	1057
		RO	Calarasi bituminous limestones	U Devonian L Carboniferous	1039
		RO	Vlasin black shale Formation	U Carboniferous	1040
		BG	J1 shale & clay limestonesOzirovo Fm (Bucorovo & Dolnilucovt Mbs)	Jurassic (Sinemurian - Toarcian)	1058
		BG	J2 shale Etropole Fm (Stefanets Mb)	Aalenian Lower Bajocian	1059
	Kamchia Basin	BG	Ruslar Fm	Oligocene	1060

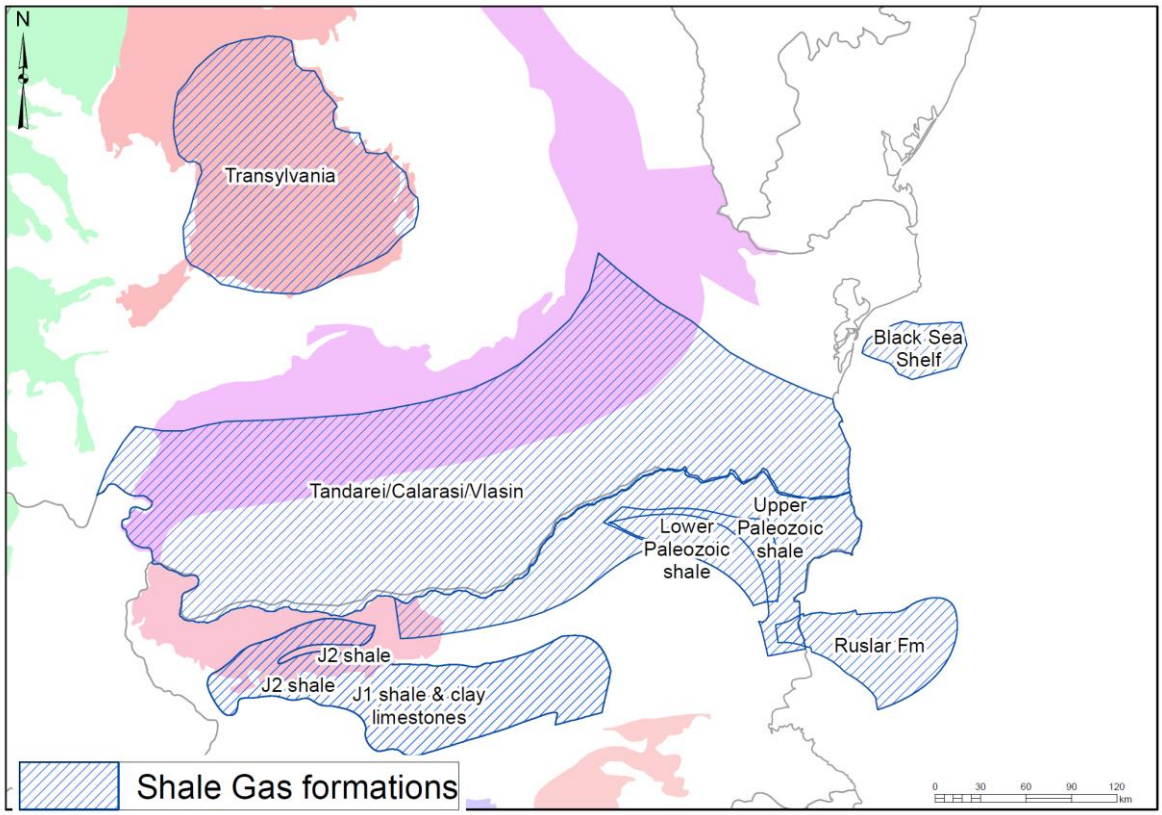

Figure A34 Overview map of the location of assessed formations

Table A32 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1038	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	High
Data availability	Moderate
HC system	Unknown
Maturity variability	High
Depth	Average
Mineral composition	No data

1039	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	High
Data availability	Moderate
HC system	Unknown
Maturity variability	Unknown
Depth	Unknown
Mineral composition	No data

1040	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Unknown
Maturity variability	Unknown
Depth	Unknown
Mineral composition	No data

1056	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	High
Data availability	Moderate
HC system	Unknown
Maturity variability	High
Depth	Average
Mineral composition	No data

1057	***Success factors***

Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate to High
Data availability	Good
HC system	Unknown
Maturity variability	High
Depth	Average
Mineral composition	No data

1058	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Proven
Maturity variability	Moderate
Depth	Average
Mineral composition	No data

1059	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	Favourable

1060	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Low
Data availability	Good
HC system	Proven
Maturity variability	Moderate
Depth	Shallow to deep
Mineral composition	No data

Lower Paleozoic Shales 1056

Table A33 Summary of the classification according to assessment step 3 for the individual assessment units.

1056	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	8	1	1	1	2	gas	2

Table A34 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BG_1056	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		3652	Normal	NGS, Class 5a, GIS
Thickness (m)	60	170	108	Normal	NGS
Depth (m)	800	>3500	2200	Triangular	NGS
Porosity	0.005	0.04	0.02	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	95	246	210	Triangular	TNO with NGS gradient
Bo (oil)	-	-	-	-	-
Pressure (psi)	1300	6400	4200	Triangular	NGS
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.3	2.5	2.4	Triangular	NGS
Temperature (°C)	40	150	100	Triangular	NGS

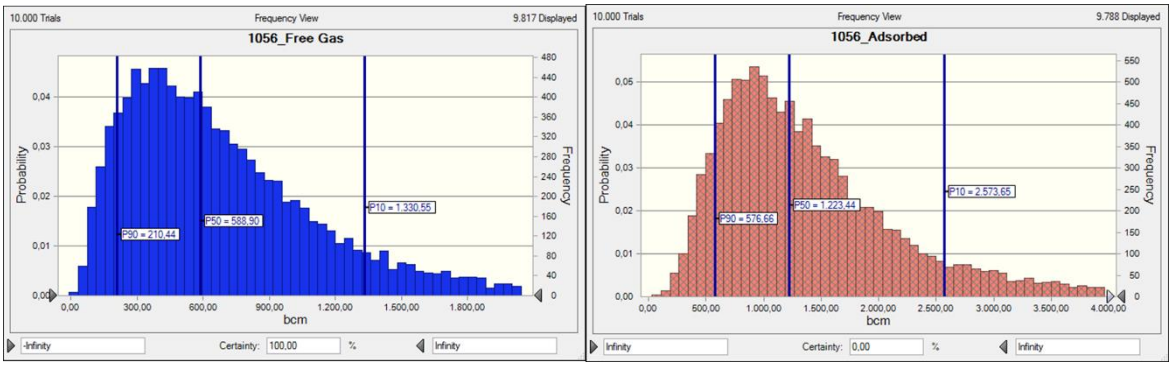

Figure A35 Results from GIIP calculations of Free Gas and Adsorbed Gas

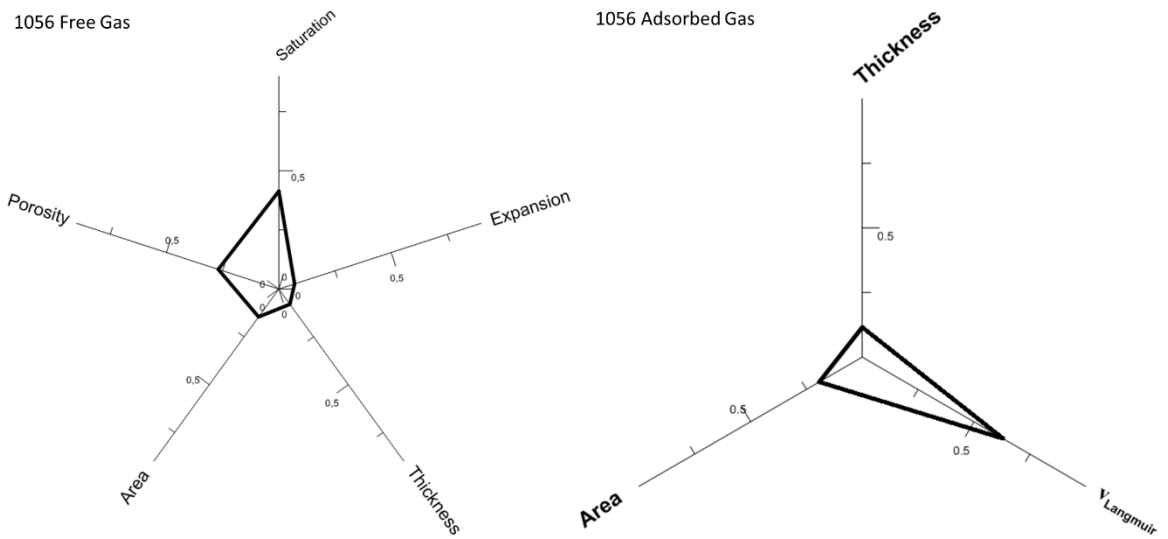

Figure A36 Sensitivity analyses results of the free gas and adsorbed calculations.

Tandarei Graptolitic Black Shales 1038

Table A35 Summary of the classification according to assessment step 3 for the individual assessment units.

1038	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	137	1	1	3	1		3

Table A36 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T4a	RO_1038	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=25%		30000	Normal	NGS, Class 5a
	Thickness (m)	4.8	37.75	20.1	Triangular	TNO & NGS with N/G 5%
	Depth (m)	2000	4250	3350	Triangular	NGS
	Porosity (%)	1.5	11.8	4.88	Triangular	EU
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	-	-	-	-	-
	Expansion Factor (Bg)	167	245	208	Triangular	TNO
	Bo (oil)	-	-	-	-	-
	Pressure (psi)	2842	6041	4762	Triangular	TNO, hydrostatic
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.1	2.71	2.45	Triangular	NGS
	Temperature (°C)	72	142	114	Triangular	TNO with gradient 31 degc/km

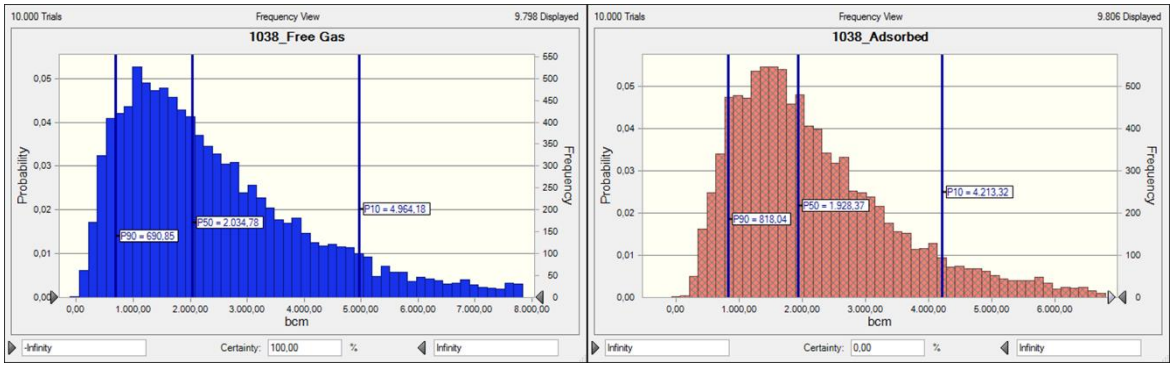

Figure A37 Results from GIIP calculations of Free Gas and Adsorbed Gas

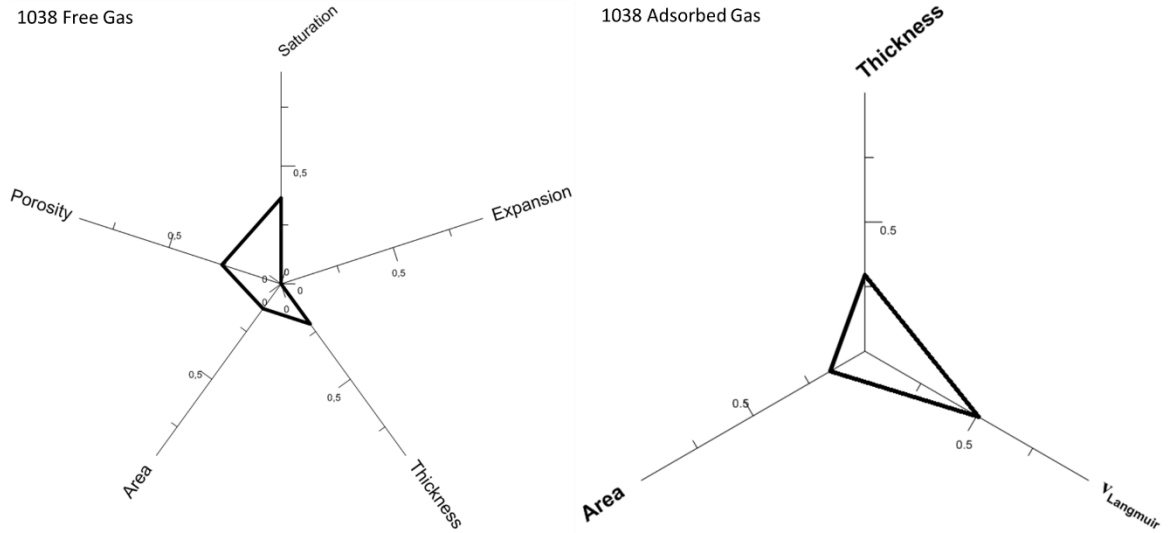

Figure A38 Sensitivity analyses results of the free gas and adsorbed calculations.

Upper Paleozoic Shale 1057

Table A37 Summary of the classification according to assessment step 3 for the individual assessment units.

1057	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	9	1	1	1	2	gas	2

Table A38 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BG_1057	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		10082	Normal	NGS, Class 4a, GIS, 80% gas 20% oil
Thickness (m)	0	250	90	Triangular	NGS
Depth (m)	850	3400	2000	Triangular	NGS
Porosity	0.005	0.05	0.025	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	85	228	199	Triangular	TNO
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	1300	6800	4500	Triangular	NGS
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.3	2.45	2.35	Triangular	NGS
Temperature (°C)	42	170	110	Triangular	NGS

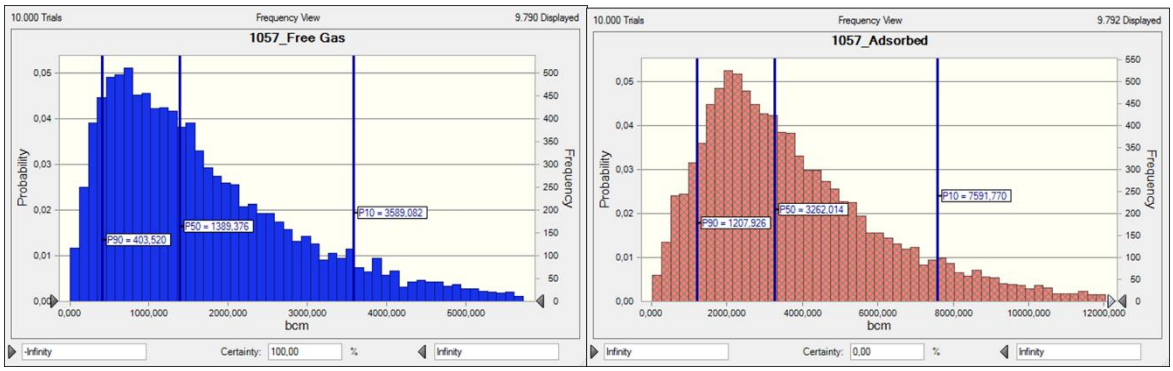

Figure A39 Results from GIIP calculations of Free Gas and Adsorbed Gas

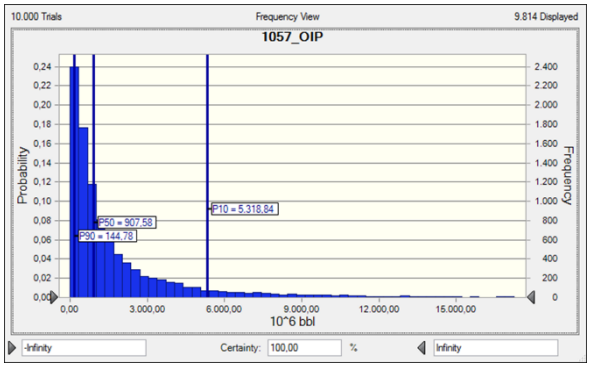

Figure A40 Results from the OIIP calculation

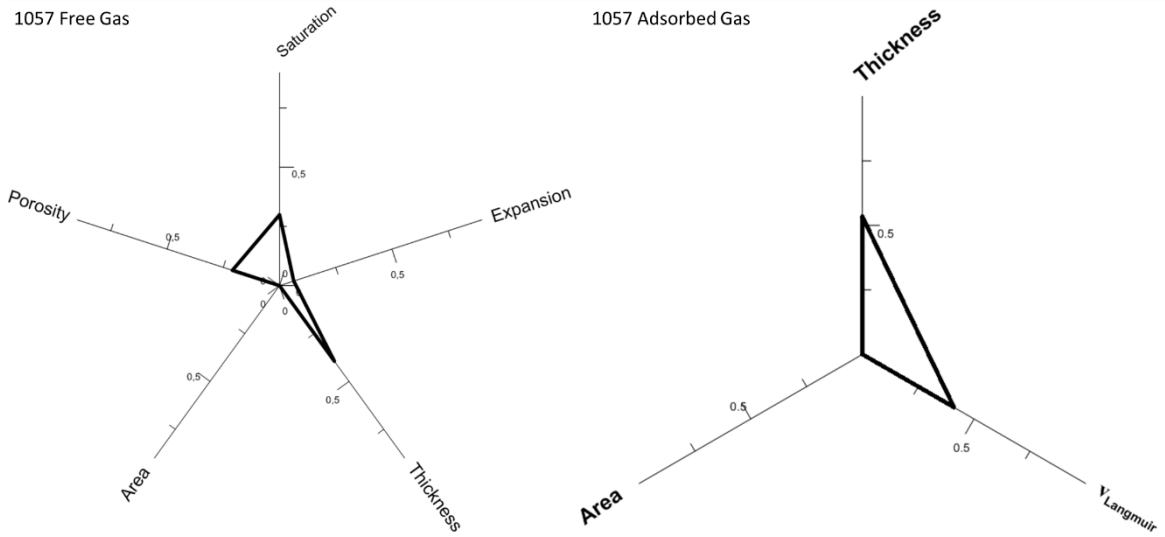

Figure A41 Sensitivity analyses results of the free gas and adsorbed calculations.

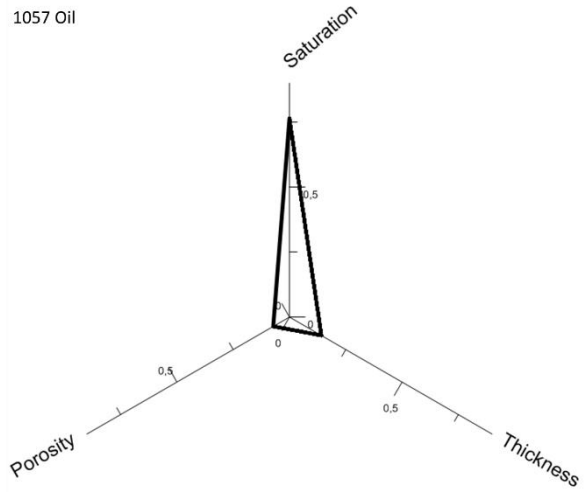

Figure A42 Sensitivity analyses results of the oil in place calculation

Calarasi bituminous limestones 1039

Table A39 Summary of the classification according to assessment step 3 for the individual assessment units.

1039	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	126	No data	3	3	2		No

As the amount of data proved to be to scarce no calculations will be performed.

Vlasin Black Shale Formation 1040

Table A40 Summary of the classification according to assessment step 3 for the individual assessment units.

1040	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	136	No data	3	1	1		No

As no depth indication is given no calculations will be performed.

J1 Shale 1058

Table A41 Summary of the classification according to assessment step 3 for the individual assessment units.

1058	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	10	1	1	3	1	gas	3

Table A42 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BG_1058	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		12582	Normal	NGS, Class 4a, GIS
Thickness (m)	0	200	55	Triangular	NGS with N/G 10%
Depth (m)	2600	4400	3500	Triangular	NGS
Porosity (%)	0.002	0.055	0.03	Triangular	NGS
Saturation gas	0.02	0.1	0.05	Triangular	NGS
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	198	295	241	Triangular	TNO
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	3700	6800	5200	Triangular	EU
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.25	2.5	2.4	Triangular	NGS
Temperature (°C)	95	150	120	Triangular	NGS

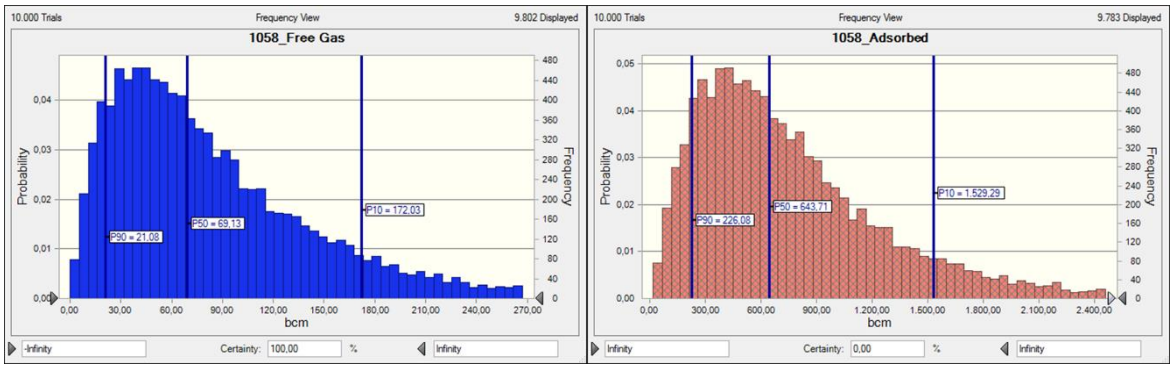

Figure A43 Results from GIIP calculations of Free Gas and Adsorbed Gas

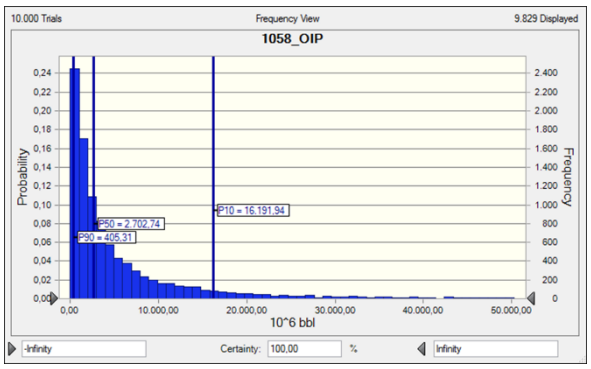

Figure A44 Results from GIIP calculations of Free Gas and Adsorbed Gas

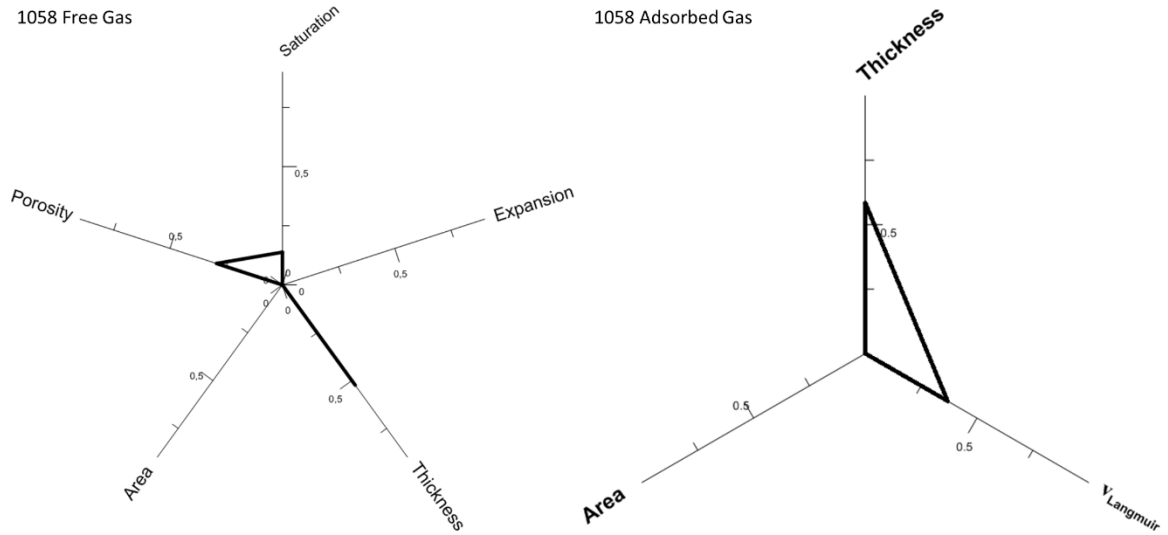

Figure A45 Sensitivity analyses results of the free gas and adsorbed calculations.

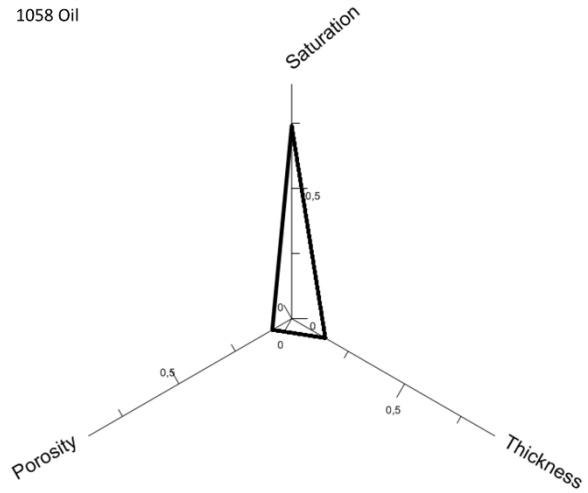

Figure A46 Sensitivity analyses results of the oil in place calculation

J2 Shale 1059

Table A43 Summary of the classification according to assessment step 3 for the individual assessment units.

1059	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	11	1	1	3	1	gas	3

Table A44 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BG_1059	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		12582	Normal	NGS, Class 4a, GIS data
Thickness (m)	0	200	50	Triangular	NGS with N/G 10%
Depth (m)	2500	4400	3350	Triangular	NGS
Porosity (%)	0.2	4.5	0.0275	Triangular	NGS
Saturation gas	-	-	-	-	-
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	-	-	-	-	-
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	3550	6000	4800	Triangular	NGS
Langmuir Pressure (psi)	-	-	-	-	-
Langmuir Volume (scf/ton)	-	-	-	-	-
Density (g/cm3)	2.25	2.4	2.3	Triangular	NGS
Temperature (°C)	90	130	110	Triangular	NGS

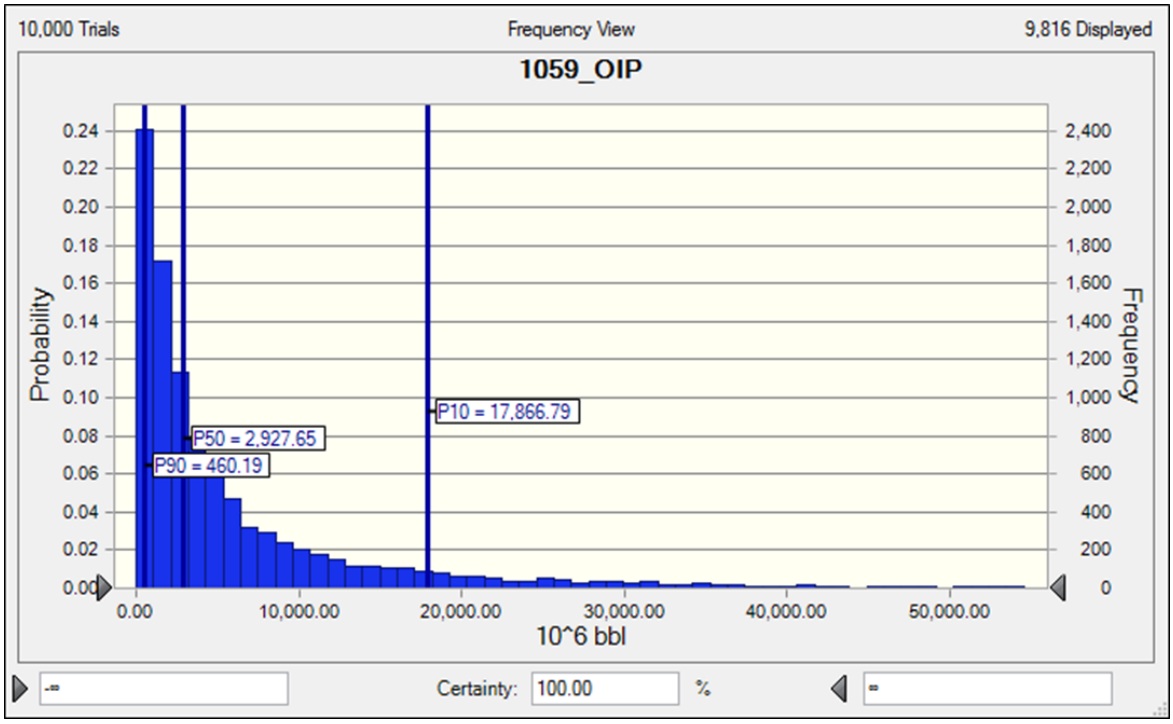

Figure A47 Results from the OIIP calculation

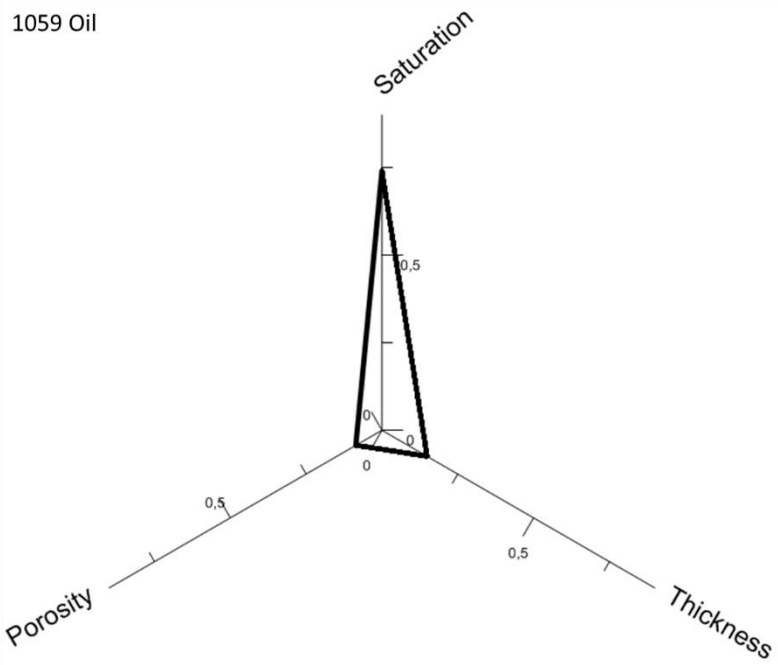

Figure A48 Sensitivity analyses results of the oil in place calculation

Ruslar Formation of the Kamchia Basin 1060

Table A45 Summary of the classification according to assessment step 3 for the individual assessment units.

1060	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	12	2	No	1	2	gas	No
Offshore	13	1	2	1	2	gas	2

As the formation is immature this formation is not calculated.

Results

Table A46 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Tandarei graptolitic black shales-1038, Adsorbed	RO	818.04	**1928.37**	4213.32
Tandarei graptolitic black shales-1038, Free Gas	RO	690.85	**2034.78**	4964.18
Total GIIP for Basin T4a			**3963.16**	

Table A47 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Lower Paleozoic shales-1056, Adsorbed	BG	576.66	**1223.44**	2573.65
Lower Paleozoic shales-1056, Free Gas	BG	210.44	**588.90**	1330.55
Trigorska & Konarska Fms-1057, Adsorbed	BG	1207.92	**3262.01**	7591.77
Trigorska & Konarska Fms-1057, Free Gas	BG	403.52	**1389.38**	3589.08
J1 shale-1058, Adsorbed	BG	226.08	**643.71**	1529.29
J1 shale-1058, Free Gas	BG	21.08	**69.13**	172.03
Total GIIP for Basin T4b			**7176.57**	

Table A48 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Trigorska & Konarska Fms-1057, Oil	BG	144.78	**907.58**	5318.84
J1 shale-1058, Oil	BG	405.31	**2702.74**	16191.94
J2 shale-1059, Oil	BG	460.19	**2927.65**	17866.79
Total OIIP for Basin T4b			**6537.98**	

T05 - Ukraine – Dnieper-Donets Basin Lower Carboniferous Black Shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
T5	Dnieper-Donets Basin	UA	Rudov Beds *(Upper Visean Shales)* *(Lower Serpukhovian)*	Upper Visean *(Upper Visean)* *(Serpukhovian)*	1043

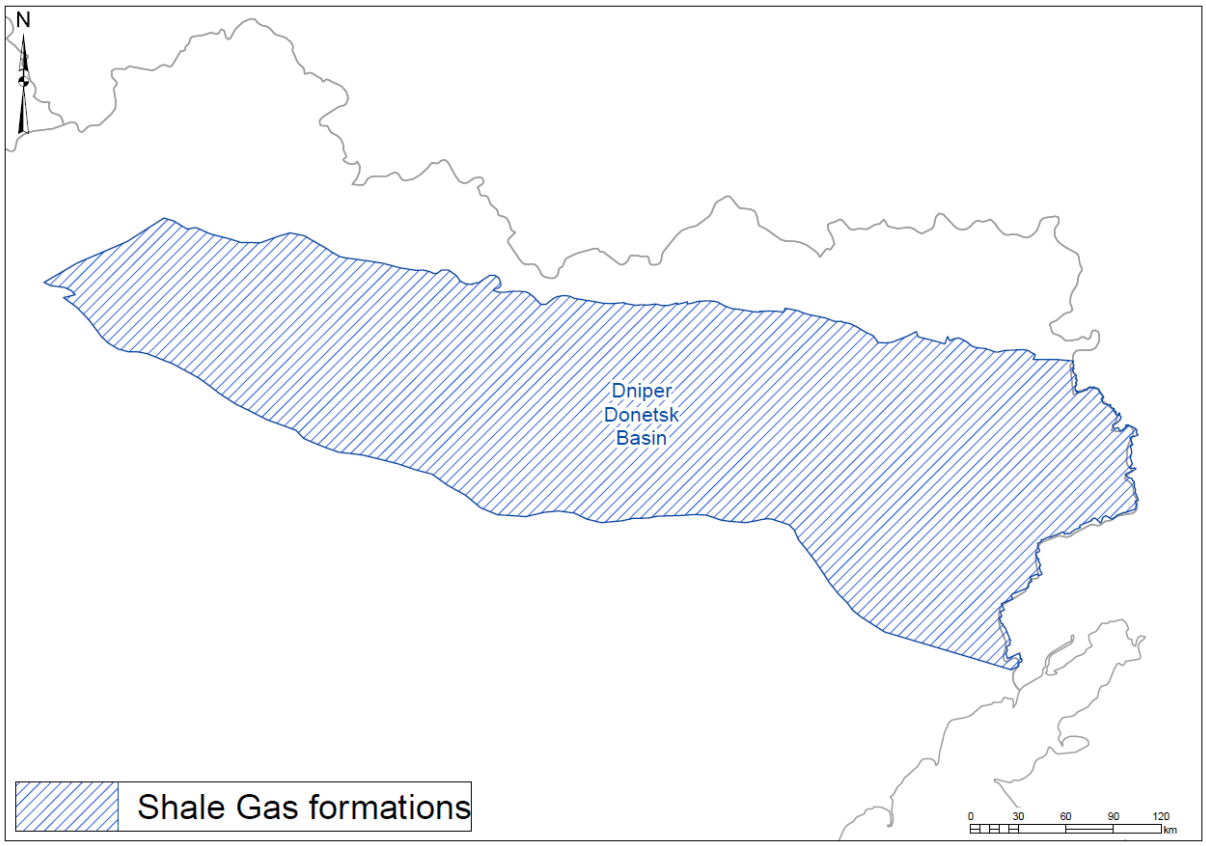

Figure A49 Overview map of the location of assessed formations

Table A49 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1043	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low to Moderate
Structural complexity	Low to Moderate
Data availability	Good
HC system	Proven
Maturity variability	Moderate
Depth	Average
Mineral composition	Poor

Rudov Beds Ukraine 1043

Table A50 Summary of the classification according to assessment step 3 for the individual assessment units.

1043	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	119	2	1	1	2	gas	2

Table A51 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T5	UA_1043	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=25%		10500	Normal	NGS, Class 5a, no GIS, 50% oil 50% gas
	Thickness (m)	5	140	285	Triangular	NGS, with N/G 5%
	Depth (m)	100	8000	4500	Triangular	NGS
	Porosity	0.02	0.07	0.03	Triangular	NGS
	Saturation gas	0.18	0.23	0.2	Triangular	NGS
	Saturation oil	SD=0.083		0.044	Log normal	EU
	Expansion Factor (Bg)	9	385	282	Triangular	TNO
	Bo (oil)	0.85	1.01	0.98	Triangular	EU
	Pressure (psi)	142	15919	6396	Triangular	TNO with NGS gradient
	Langmuir Pressure (psi)	320	630	395	Log normal	EU
	Langmuir Volume (scf/ton)	15	55	30	Log normal	EU
	Density (g/cm3)	2.4	2.79	2.67	Triangular	NGS
	Temperature (°C)	28	212	119	Triangular	NGS

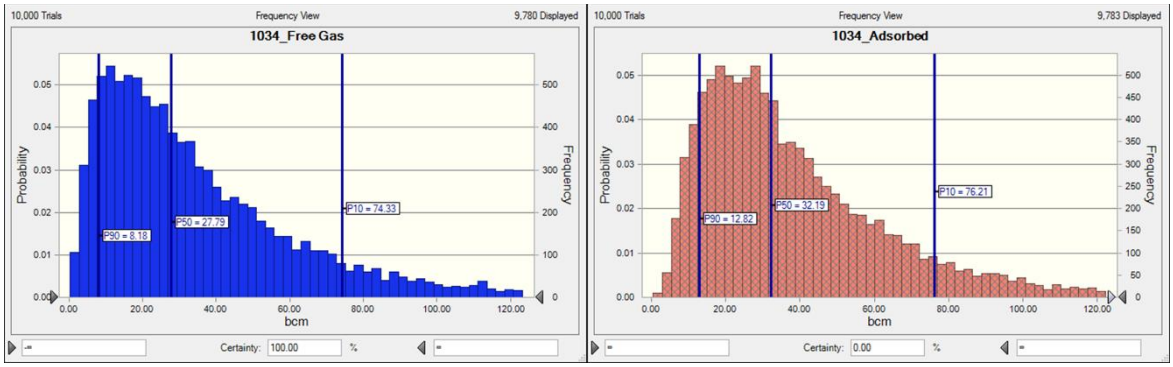

Figure A50 Results from GIIP calculations of Free Gas and Adsorbed Gas

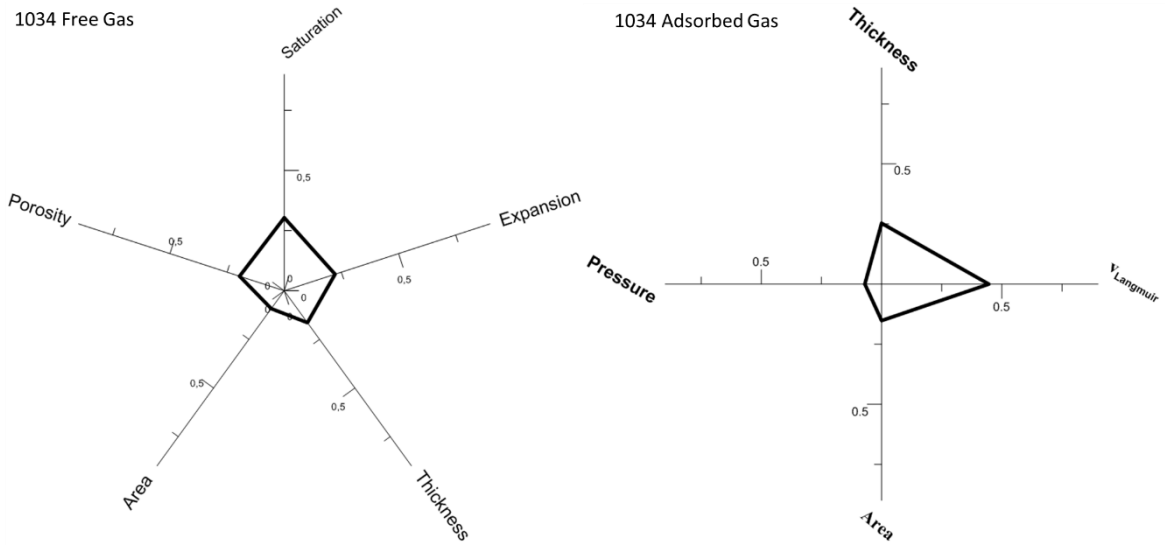

Figure A51 Sensitivity analyses results of the free gas and adsorbed calculations.

Results

Table A52 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
East Ukraine shales-1043, Adsorbed	UA	957.36	**2592.47**	6314.52
East Ukraine shales-1043, Free Gas	UA	257.33	**933.23**	2410.66
Total GIIP for Basin T03			**3525.70**	

Table A53 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
East Ukraine shales-1043, Oil	UA	411.50	**2781.81**	17168.89
Total OIIP for Basin T03			**2781.81**	

T06 - Poland – Lower Carboniferous shales of the Fore-Sudetic Monocline Basin

Index	Basin	Country	Shale(s)	Age	Screening-Index
T6	Fore-Sudetic Monocline Basin	PL	Lower Carboniferous shales and siltstones	Lower Carboniferous	1055

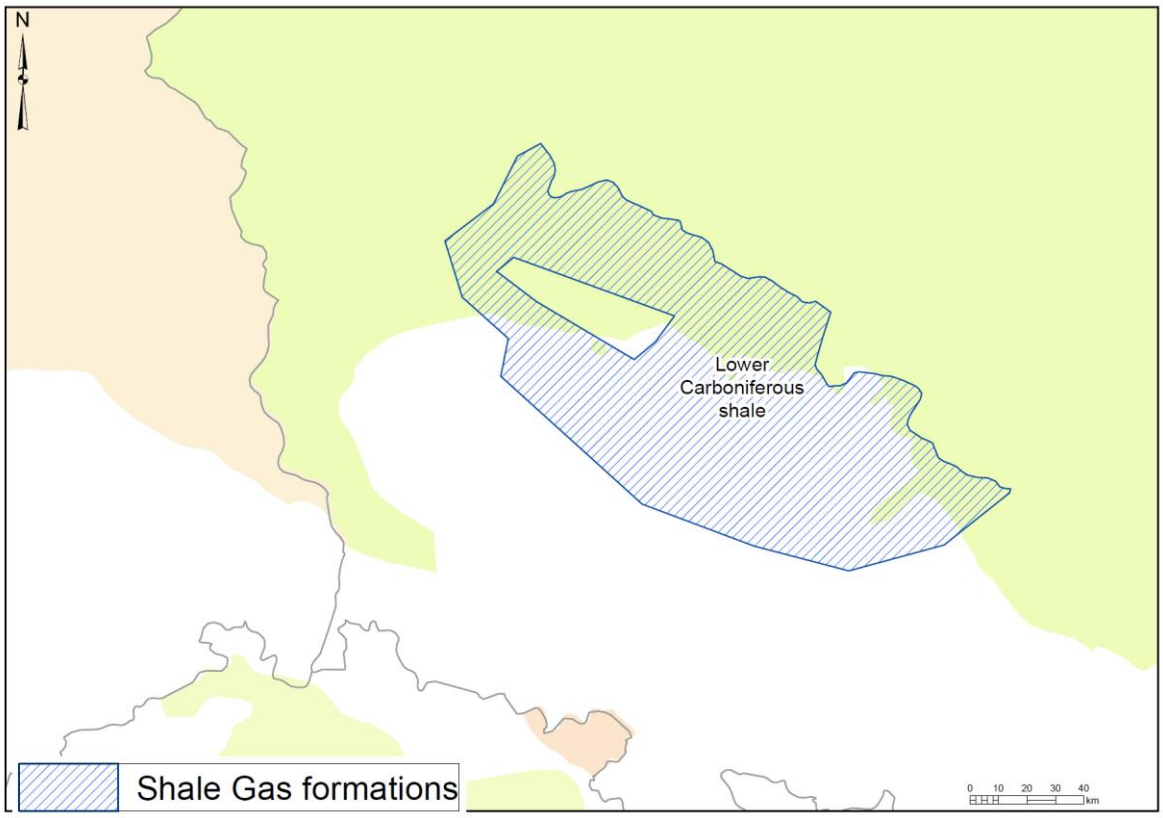

Figure A52 Overview map of the location of assessed formations

Table A54 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1055	***Success factors***
Mapping status	Poor
Sedimentary variability	Unknown
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Proven
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown

Lower Carboniferous shales 1055

Table A55 Summary of the classification according to assessment step 3 for the individual assessment units.

1055	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	102	1	1	1	1	gas	1

Table A56 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T6	PL_1055	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		13179	Normal	NGS, Class 4a, GIS data
	Thickness (m)	20	100	55	Triangular	NGS
	Depth (m)	1700	3500	2500	Triangular	NGS
	Porosity (%)	1.4	8.5	3.6	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	NGS
	Saturation oil	-	-	-	-	-
	Expansion Factor (Bg)	217	263	204	Triangular	NGS
	Bo (oil)	-	-	-	-	-
	Pressure (psi)	2800	5700	4000	Triangular	NGS
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.5	2.7	2.6	Triangular	NGS
	Temperature (°C)	65	115	85	Triangular	NGS

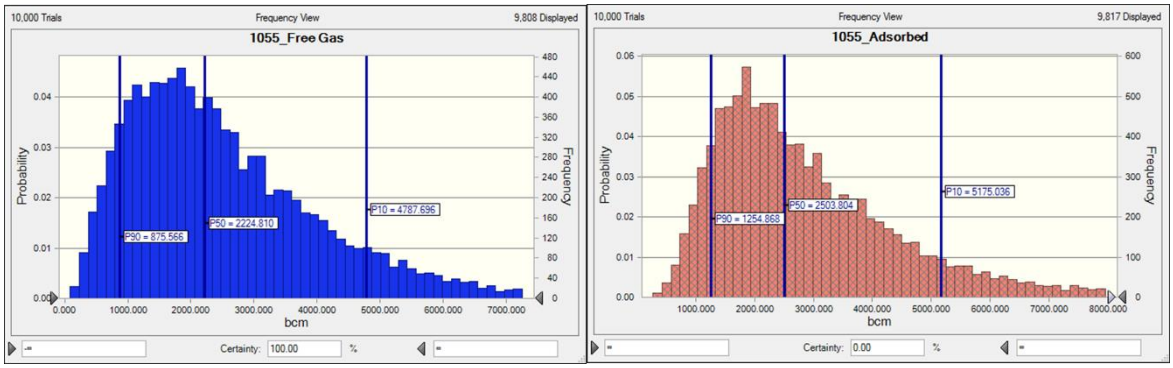

Figure A53 Results from GIIP calculations of Free Gas and Adsorbed Gas

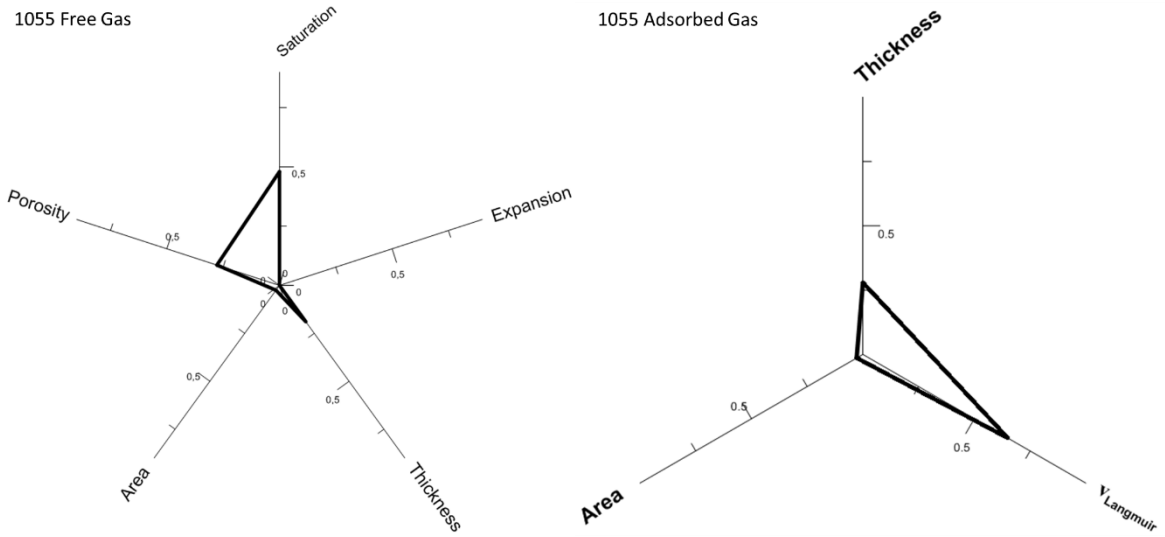

Figure A54 Sensitivity analyses results of the free gas and adsorbed calculations.

Results

Table A57 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Upper Palaeozoic shales-1055, Adsorbed	PL	1254.87	**2503.80**	5175.04
Upper Palaeozoic shales-1055, Free Gas	PL	875.57	**2224.81**	4787.70
Total GIIP for Basin T6			**4728.61**	

T07 – Pannonian Basin – Hungary and Slovenia

Index	Basin	Country	Shale(s)	Age	Screening-Index
T7a	Pannonia	HU	Kössen Marl	Norian, Late Triassic	1049
T7b	Pannonia	HU	Tard Clay	Oligocene	1050
T7c	Pannonia, Mura-Zala	SLO	Haloze-Špilje Fm. Shale	Neogene	1066&1068 (gas), 1067&1069 (oil)

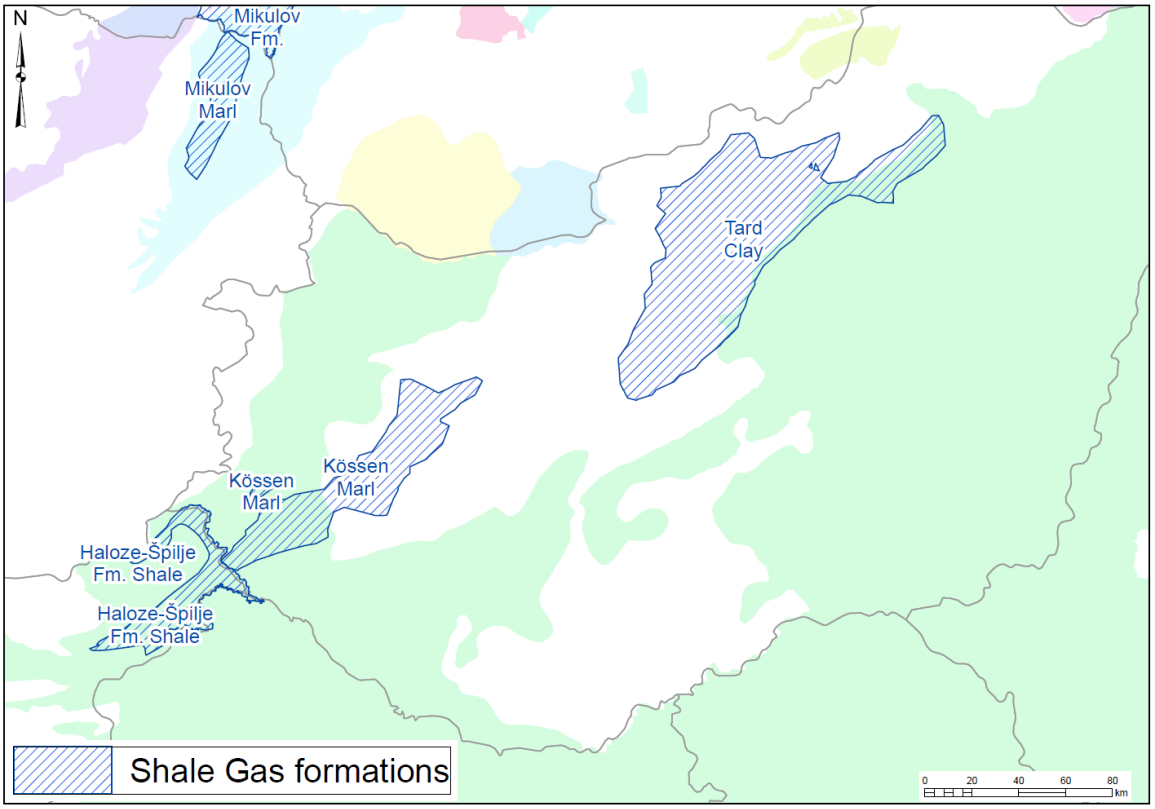

Figure A55 Overview map of the location of assessed formations

Table A58 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1049	***Success factors***
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Moderate
HC system	Proven
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown to Favourable

1050	Success factors
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Low
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown

1066, 1067, 1068, 1069	Success factors
Mapping status	Good
Sedimentary variability	Moderate to High
Structural complexity	Moderate
Data availability	Good
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown

Kössen Marl Hungary 1049

Table A59 Summary of the classification according to assessment step 3 for the individual assessment units.

1049	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	72	1	1	1	2	oil	2
Onshore	127	1	1	1	2	gas	2

Table A60 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T7a	HU_1049	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=7.5%		720	Normal	NGS, Class 3a, GIS data
	Thickness (m)	17	575	200	Triangular	NGS
	Depth (m)	2100	5000	3250	Triangular	NGS
	Porosity (%)	1.2	2.2	2	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	SD=0.083		0.044	Log normal	EU
	Expansion Factor (Bg)	211	217	212	Triangular	TNO, NGS temp, hydro
	Bo (oil)	1.055	1.06	1.05	Triangular	NGS
	Pressure (psi)	4264	7107	5686	Triangular	TNO, hydrostatic
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.4	2.5	2.7	Triangular	NGS
	Temperature (°C)	100	250	165	Triangular	NGS

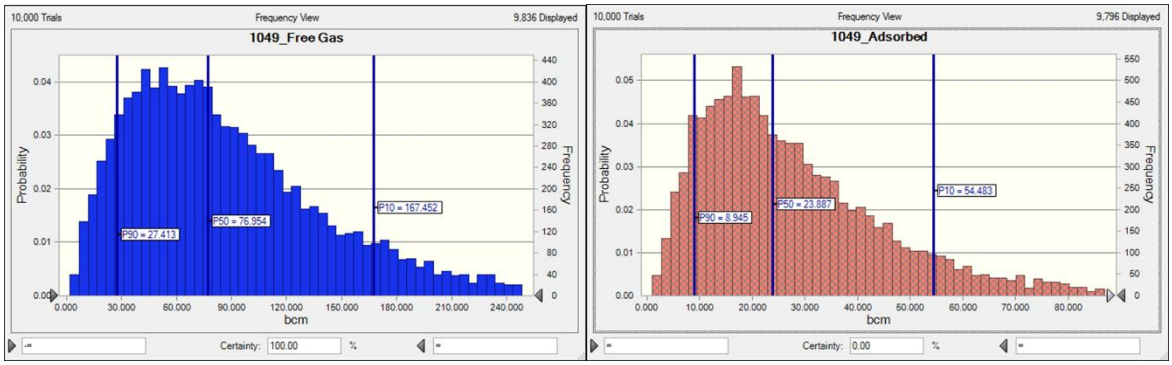

Figure A56 Results from GIIP calculations of Free Gas and Adsorbed Gas

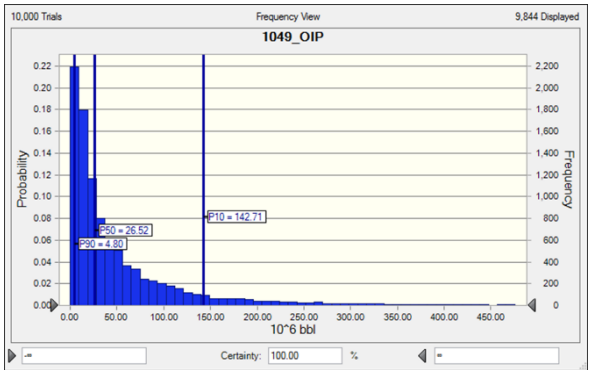

Figure A57 Results from the OIIP calculation

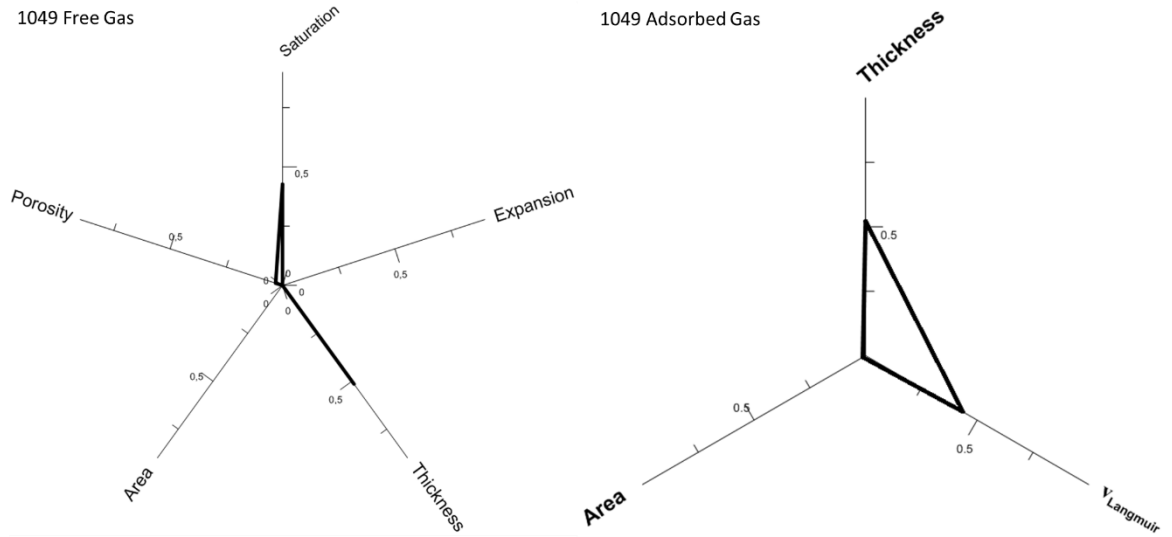

Figure A58 Sensitivity analyses results of the free gas and adsorbed calculations.

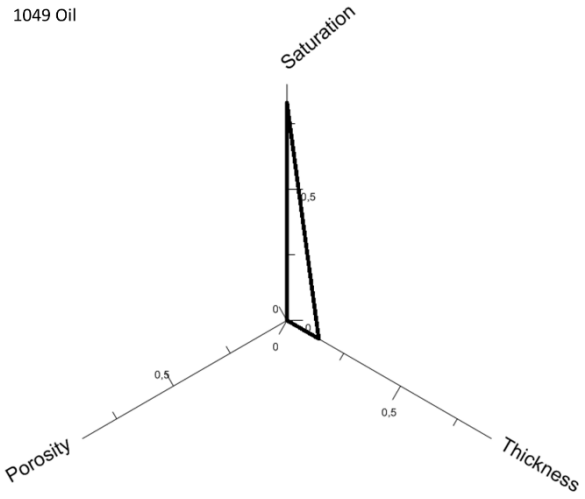

Figure A59 Sensitivity analyses results of the oil in place calculation

Tard Clay Hungary 1050

Table A61 Summary of the classification according to assessment step 3 for the individual assessment units.

1050	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	73	1	1	1	1	oil	1
Onshore	128	1	1	1	1	gas	2

Table A62 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T7b	HU_1050	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=7.5%		1900	Normal	NGS, Class 3a, GIS data
	Thickness (m)	3.2	80	27	Triangular	NGS
	Depth (m)	3000	4500	3750	Triangular	NGS
	Porosity (%)	5.6	24.3	10	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	SD=0.083		0.044	Log normal	EU
	Expansion Factor (Bg)	183	204	193	Triangular	TNO, NGS temp, hydro
	Bo (oil)				Triangular	NGS
	Pressure (psi)	3045	3916	3480	Triangular	TNO
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.4	2.7	2.5	Triangular	NGS
	Temperature (°C)	70	200	130	Triangular	NGS

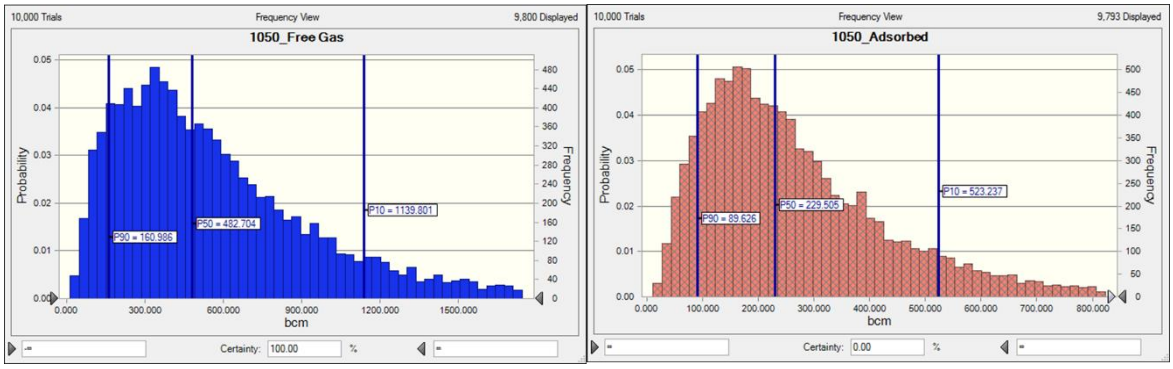

Figure A60 Results from GIIP calculations of Free Gas and Adsorbed Gas

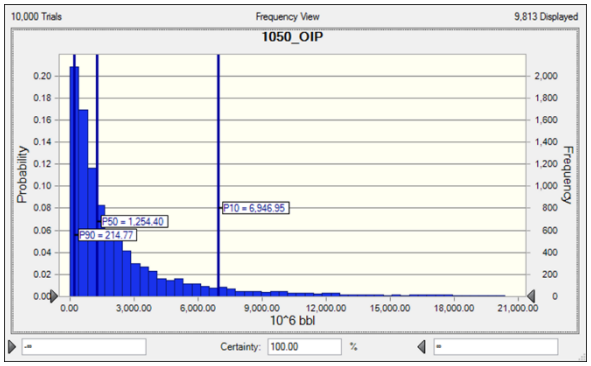

Figure A61 Results from the OIIP calculation

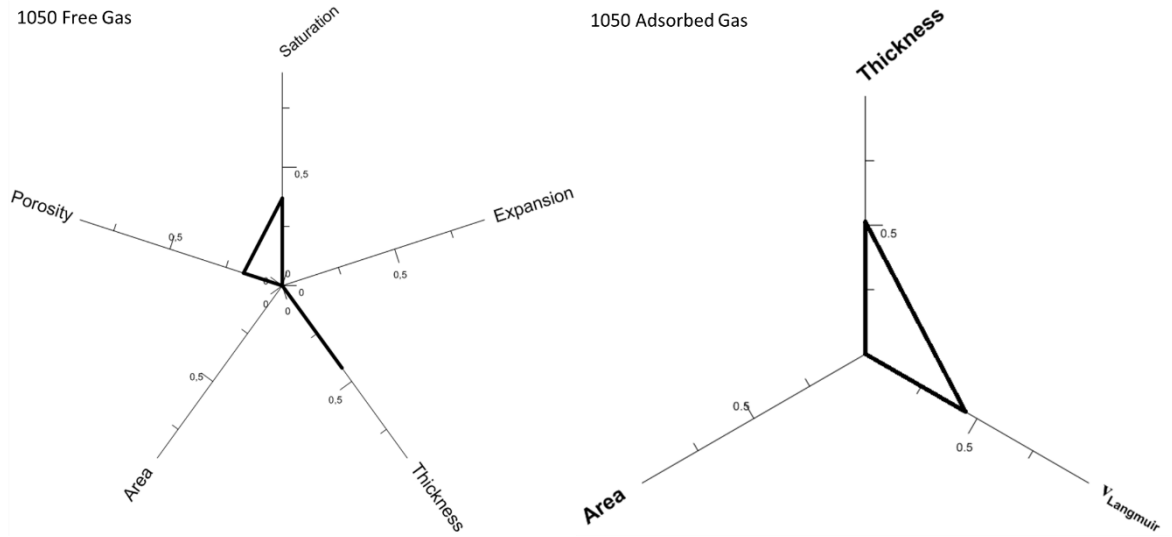

Figure A62 Sensitivity analyses results of the free gas and adsorbed calculations.

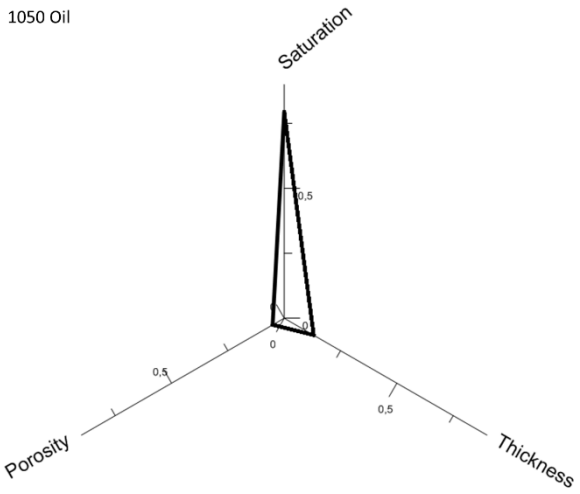

Figure A63 Sensitivity analyses results of the oil in place calculation

Haloze-Špilje Formation Slovenia 1066 and 1067

1068 and 1069 classified as sandstones and will therefore not be calculated as they not fall under the scope of this research.

Table A63 Summary of the classification according to assessment step 3 for the individual assessment units.

1066	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	114	1	1	3	1	gas	3
Onshore	115	1	1	3	2	gas	3

Table A64 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T7c	SI_1066	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=7.5%		857	Normal	NGS, Class 3a, GIS data
	Thickness (m)	8	75	68.5	Triangular	NGS, with N/G 10%
	Depth (m)	1500	4300	2900	Triangular	NGS
	Porosity (%)	1	5	2	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	-	-	-	-	-
	Expansion Factor (Bg)	127	288	186	Triangular	TNO, NGS temp, hydro
	Bo (oil)	-	-	-	-	-
	Pressure (psi)	3000	6000	4500	Triangular	TNO, hydrostatic
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.1	2.5	2.3	Triangular	NGS
	Temperature (°C)	70	190	130	Triangular	NGS

Table A65 Summary of the classification according to assessment step 3 for the individual assessment units.

1067	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	116, 117, 118	1	1	3	2	oil	3

Table A66 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T7c	SI_1067	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		1153	Normal	NGS, Class 3a, GIS data
	Thickness (m)	13	78	66	Triangular	NGS, with N/G 10%
	Depth (m)	1500	4000	2800	Triangular	NGS
	Porosity (%)	1	5	2	Triangular	NGS
	Saturation gas	-	-	-	-	-
	Saturation oil	SD=0.083		0.044	Log normal	EU
	Expansion Factor (Bg)	-	-	-	-	-
	Bo (oil)	0.85	1.01	0.98	Triangular	EU
	Pressure (psi)	3000	6000	4500	Triangular	NGS
	Langmuir Pressure (psi)	-	-	-	-	-
	Langmuir Volume (scf/ton)	-	-	-	-	-
	Density (g/cm3)	2.1	2.5	2.3	Triangular	NGS
	Temperature (°C)	70	190	130	Triangular	NGS

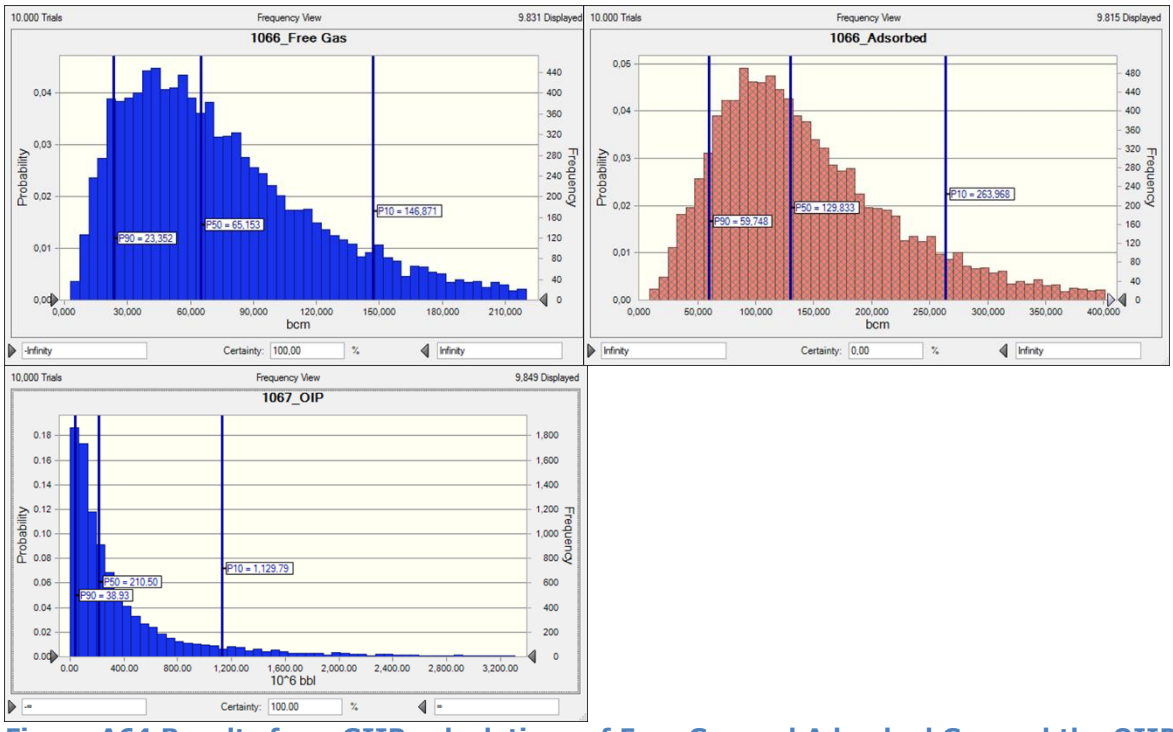

Figure A64 Results from GIIP calculations of Free Gas and Adsorbed Gas and the OIIP calculation

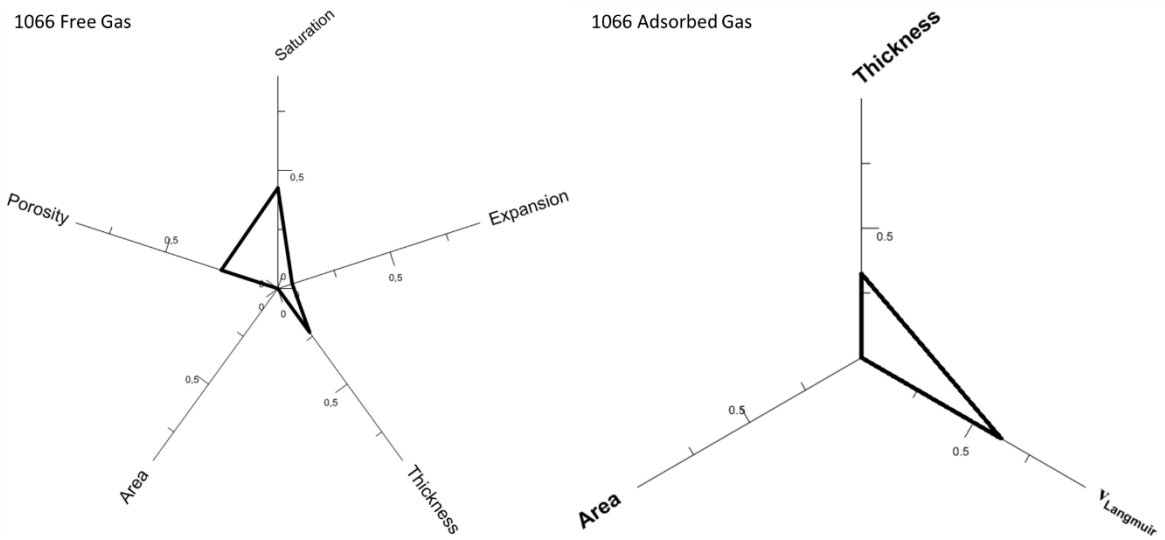

Figure A65 Sensitivity analyses results of the free gas and adsorbed calculations.

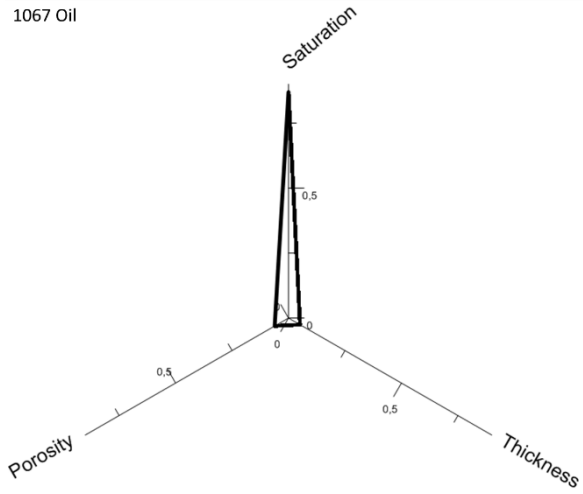

Figure A66 Sensitivity analyses results of the oil in place calculation

Results

Table A67 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Kössen Marl-1049, Adsorbed	HU	8.94	**23.89**	54.48
Kössen Marl-1049, Free Gas	HU	27.41	**76.95**	167.45
Tard Clay-1050, Adsorbed	HU	89.63	**229.50**	523.24
Tard Clay-1050, Free Gas	HU	160.99	**482.70**	1139.80
Haloze-Špilje Fm. Shale-1066, Adsorbed	SL	59.75	**129.83**	263.97
Haloze-Špilje Fm. Shale-1066, Free Gas	SL	23.35	**65.15**	146.87
Total GIIP for Basin T7			**1008.03**	

Table A68 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Kössen Marl-1049, Oil	HU	4.80	**26.52**	142.71
Tard Clay-1050, Oil	HU	214.77	**1254.40**	6946.95
Haloze-Špilje Fm. Shale-1067, Oil	SL	38.93	**210.50**	1129.79
Total OIIP for Basin T7			**1491.42**	

T08 - Vienna Basin – Mikulov Marl

Index	Basin	Country	Shale(s)	Age	Screening-Index
T8	Vienna Basin	A	Mikulov Marl Fm. (Mergelsteinserie)	U. Jurassic (Oxfordian – Kimmeridgean)	1018
	SE Bohemian Massif	CZ	Mikulov Fm.	U. Jurassic - Oxfordian	1063

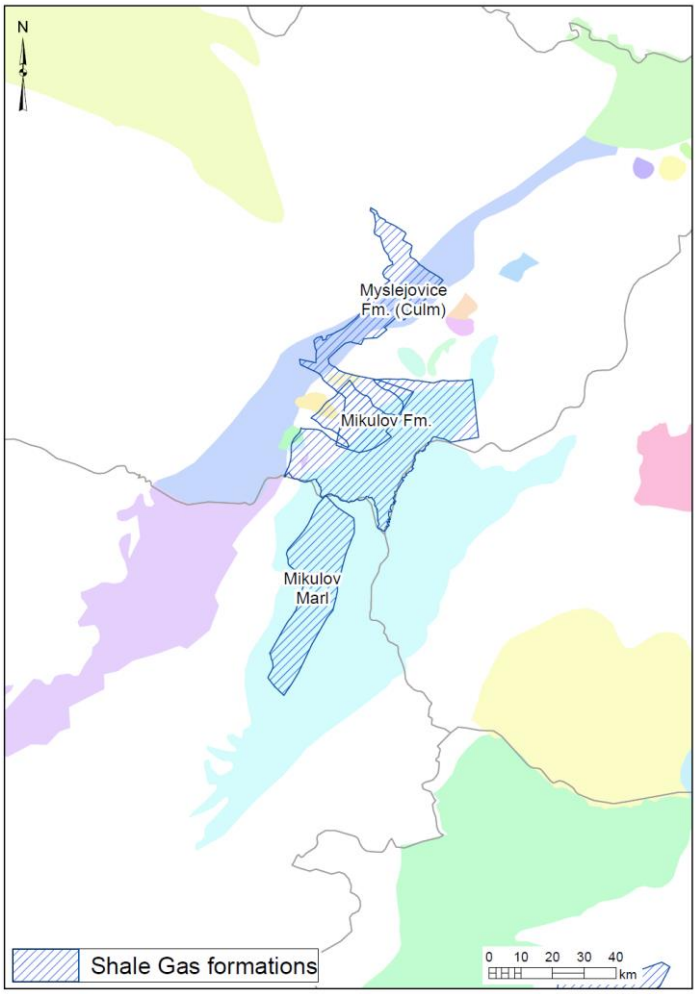

Figure A67 Overview map of the location of assessed formations

Table A69 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1018	*Success factors*
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Proven
Maturity variability	Moderate
Depth	Average to deep
Mineral composition	Unknown

1063	*Success factors*
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Proven
Maturity variability	Moderate
Depth	Average to deep
Mineral composition	Unknown

Mikulov Marl Formation Austria 1018

Table A70 Summary of the classification according to assessment step 3 for the individual assessment units.

1018	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	1	1	1	1	2	oil	2
Onshore	2, 3	2	1	1	2	gas	2

Table A71 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T8	AT_1018	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=10%		726	Normal	NGS, Class 4a, GIS
	Thickness (m)	150	900	525	Triangular	NGS
	Depth (m)	4000	7000	5500	Triangular	NGS
	Porosity (%)	0	9	5	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	SD=0.083		0.0444	Log normal	EU
	Expansion Factor (Bg)	255	300	283	Triangular	TNO
	Bo (oil)	0.85	1.01	0.98	Triangular	EU
	Pressure (psi)	5700	9964	7832	Triangular	TNO, hydrostatic
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.15	2.7	2.24	Triangular	EU
	Temperature (°C)	126	213	170	Triangular	TNO with NGS gradient

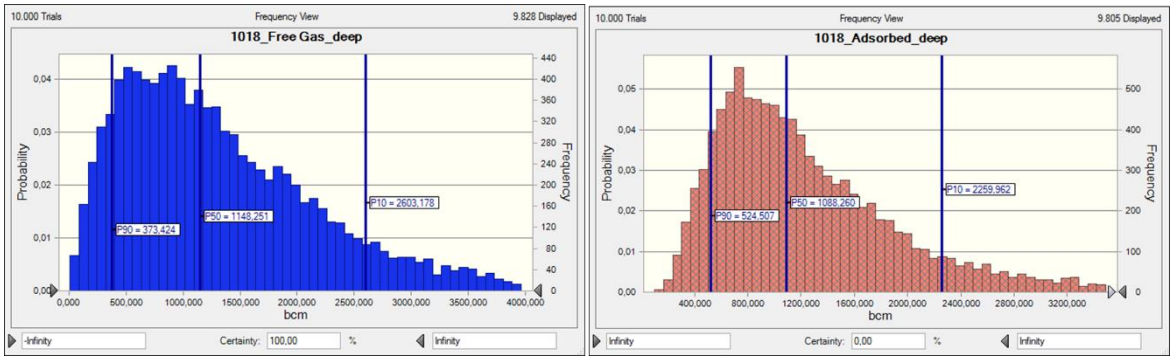

Figure A68 Results from GIIP calculations of Free Gas and Adsorbed Gas

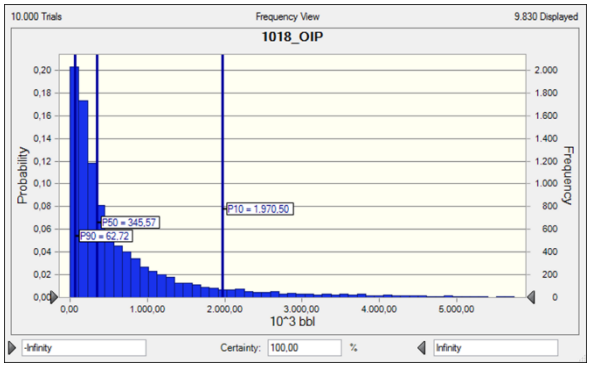

Figure A69 Results from the OIIP calculation

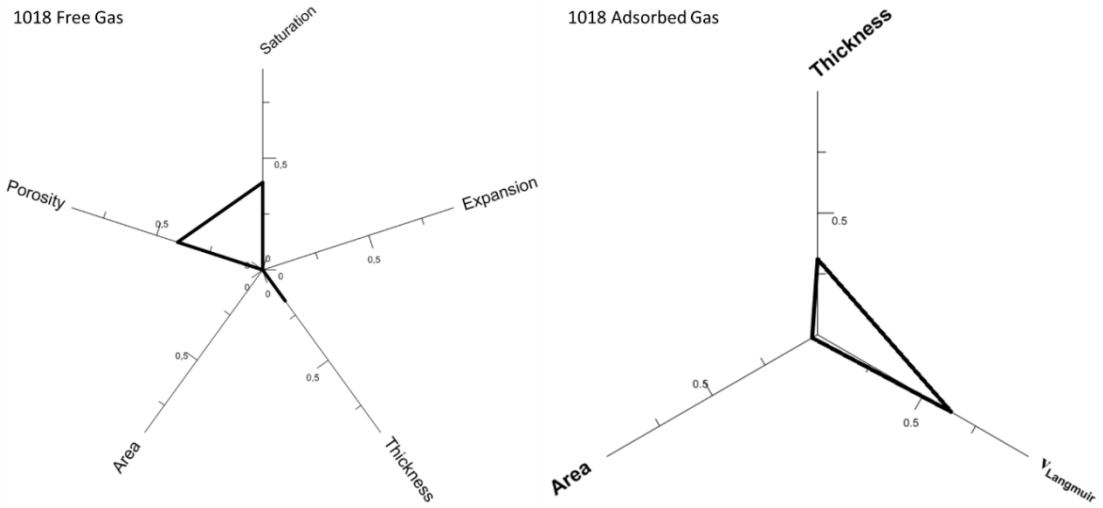

Figure A70 Sensitivity analyses results of the free gas and adsorbed calculations.

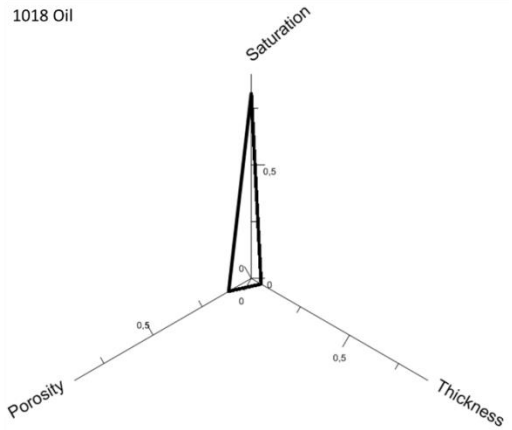

Figure A71 Sensitivity analyses results of the oil in place calculation

Mikulov Marl Formation Czech Republic 1063

Table A72 Summary of the classification according to assessment step 3 for the individual assessment units.

1063	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	129	1	1	1	2	Oil/gas	2

Table A73 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T8	CZ_1063	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=25%		1483	Triangular	NGS, GIS, Class 5a
	Thickness (m)	3	150	65	Triangular	NGS, with N/G 10%
	Depth (m)	3000	8000	5500	Triangular	NGS
	Porosity (%)	0.5	8.2	4.35	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	SD=0.083		0.0444	Log normal	EU
	Expansion Factor (Bg)	188	323	299	Triangular	TNO, NGS temp hydro
	Bo (oil)	0.85	1.01	0.98	Triangular	EU
	Pressure (psi)	4786	12763	8775	Triangular	TNO with NGS gradient
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.41	2.63	2.52	Triangular	NGS
	Temperature (°C)	75	185	130	Triangular	NGS

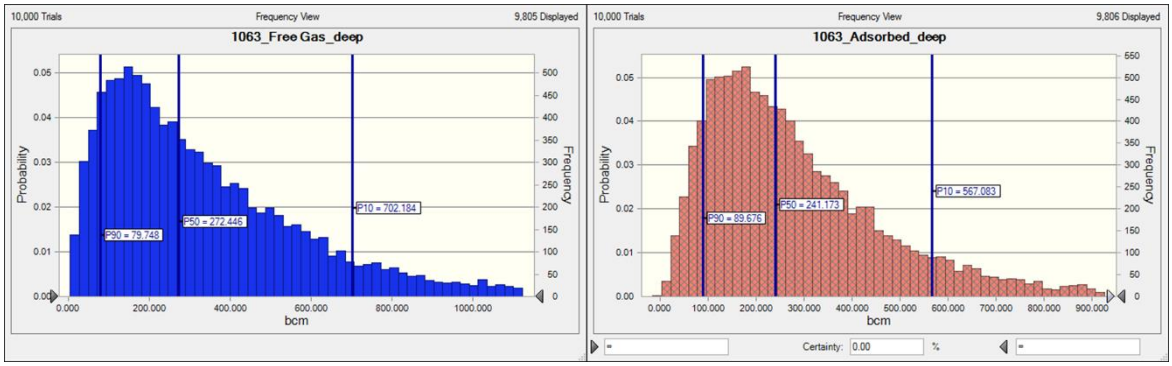

Figure A72 Results from GIIP calculations of Free Gas and Adsorbed Gas

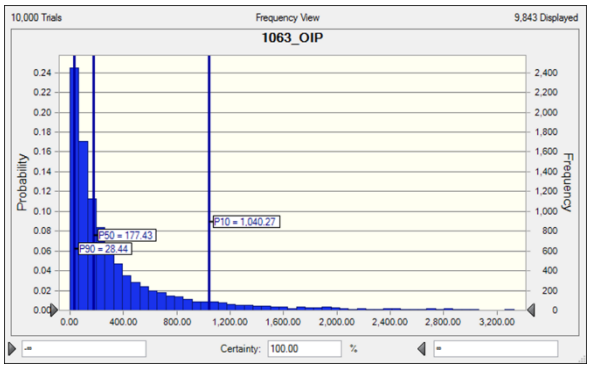

Figure A73 Results from the OIIP calculation

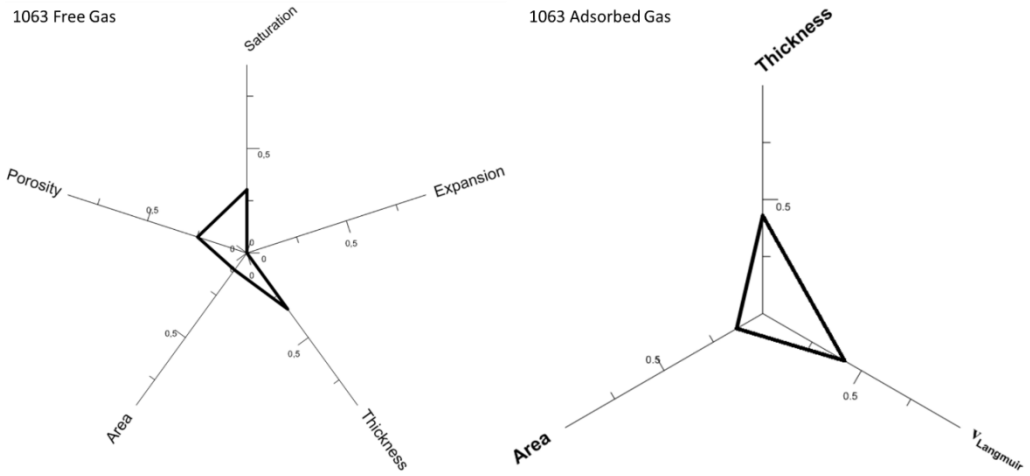

Figure A74 Sensitivity analyses results of the free gas and adsorbed calculations.

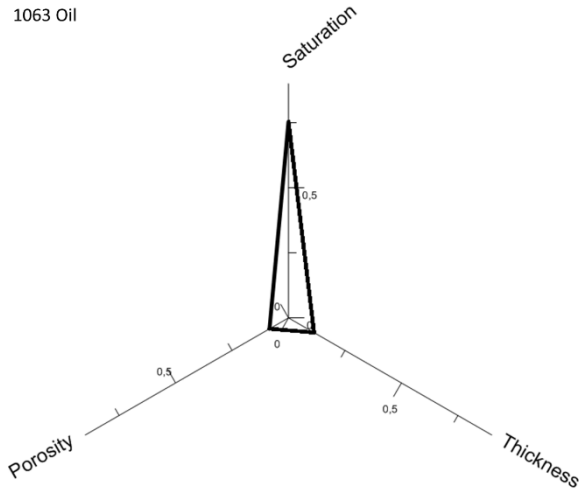

Figure A75 Sensitivity analyses results of the oil in place calculation

Results

Table A74 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Mikulov Marl-1063, Adsorbed	CZ	89.68	**241.17**	567.08
Mikulov Marl-1063, Free Gas	CZ	79.75	**272.45**	702.18
Total GIIP for Basin T8			**513.62**	

Table A75 Overview of the results of the GIIP calculation for the deep formations

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Mikulov Marl-1018, Adsorbed-deep	A, CZ	524.51	**1088.26**	2259.96
Mikulov Marl-1018, Free Gas-deep	A, CZ	373.42	**1148.25**	2603.18
Total deep GIIP for Basin T8			**2236.51**	

Table A76 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Mikulov Marl-1018, Oil	A	62.72	**345.57**	1970.50
Mikulov Marl-1063, Oil	CZ	28.44	**177.43**	1040.27
Total OIIP for Basin T8			**523.00**	

T09 - Lombardy Basin Italy – Triassic – Early Cretaceous shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
T9	Lombardy Basin	It	Various Ladinian shales	Ladinian	1005
		It	Argillite di Riva di Solto Fm	Norian	1006
		It	Marne di Bruntino formation	Early Cretaceous	1007

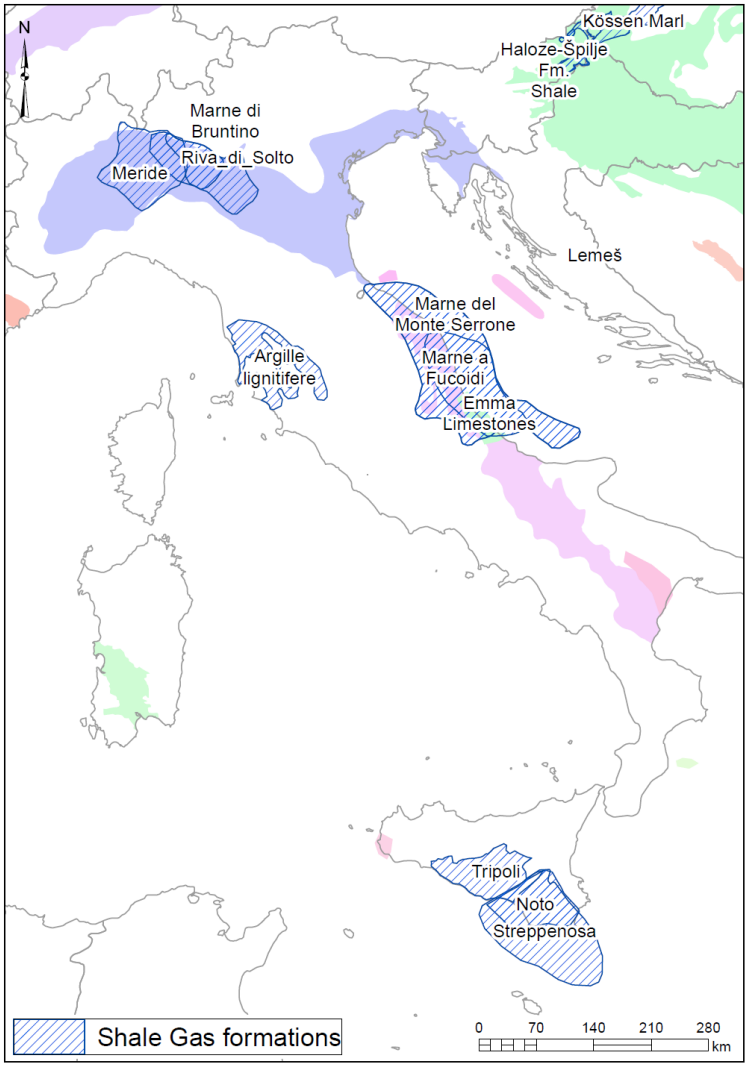

Figure A76: Overview map of the location of assessed formations

Table A77: Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1005, 1006, 1007	*Success factors*
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Proven
Maturity variability	High
Depth	Average to deep
Mineral composition	No data

Ladinian shales 1005

Table A78 Summary of the classification according to assessment step 3 for the individual assessment units.

1005	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	74	2	1	No	1	oil	No

No calculations are performed as the TOC content of the formation is too low.

Argillite di Riva di Solto Formation 1006

Table A79 Summary of the classification according to assessment step 3 for the individual assessment units.

1006	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	75	2	3	No	2	oil	No

No calculations are performed as the TOC content of the formation is too low.

Marne di Bruntino Formation 1007

Table A80 Summary of the classification according to assessment step 3 for the individual assessment units.

1007	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	76	1	3	No	1	oil	No

No calculations are performed as the TOC content of the formation is too low.

T10, T22, T23, T24, T33 - Northwest European Carboniferous Basin

Index	Basin	Country	Shale(s)	Age	Screening-Index
T10a	Northwest European Carboniferous Basin	NL	Geverik	Namurian A	1064
T10b	UK Carboniferous	UK	Bowland, Hodder	Carboniferous	1077
T22	Campine	B	Westphalian, Chokier	Carboniferous	1045, 1048
T23	Mons	B	Chokier	Carboniferous	1046
T24	Liege	B	Chokier	Carboniferous	1047
T33	Northern Germany	D	Westphalian, Choiker	Carboniferous	2013

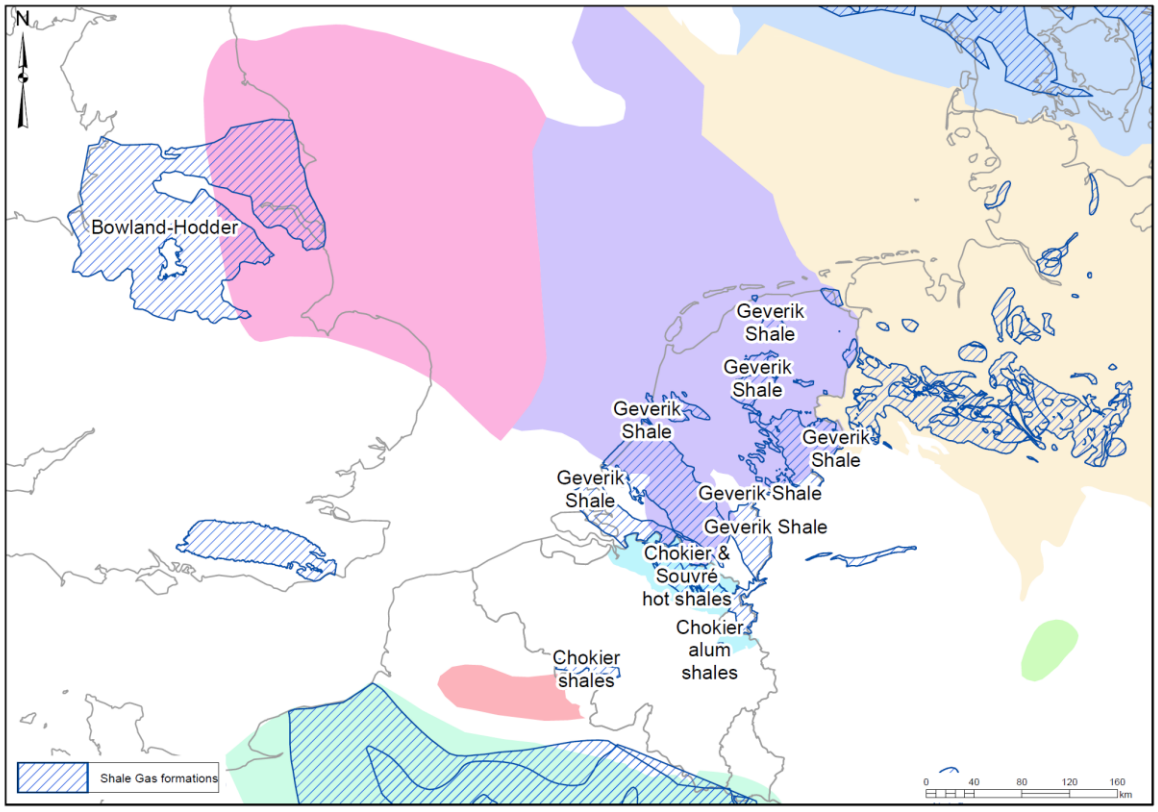

Figure A77 Overview map of the location of assessed formations

Table A81 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1064	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate to High
Structural complexity	Moderate
Data availability	Moderate

HC system	Possible
Maturity variability	Moderate to High
Depth	Average to deep
Mineral composition	Favourable

1045	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Moderate
HC system	Unknown
Maturity variability	Moderate
Depth	Average
Mineral composition	Poor

1046	***Success factors***
Mapping status	Moderate
Sedimentary variability	High
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Unknown
Maturity variability	Moderate
Depth	Average
Mineral composition	No data

1047	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	High
Data availability	Moderate
HC system	Unknown
Maturity variability	Moderate
Depth	Average
Mineral composition	No data

1048	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Moderate
HC system	Unknown
Maturity variability	Moderate
Depth	Average

Mineral composition	Unknown

1077	*Success factors*
Mapping status	Good
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Good
HC system	Proven
Maturity variability	Moderate
Depth	Shallow to Average
Mineral composition	No data

Geverik Shale Formation 1064

Table A82 Summary of the classification according to assessment step 3 for the individual assessment units.

1064	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	93	2	1	1	1	gas	2

Table A83 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

T10a	NL_1064	Min	Max	Mean	Dist. Curve	Source
	Area (km2)	SD=7.5%		8672	Normal	NGS, Class 3a
	Thickness (m)	40	80	50	Triangular	NGS
	Depth (m)	444	7000	3700	Triangular	NGS
	Porosity (%)	1	9	1.5	Triangular	NGS
	Saturation gas	0.03	0.67	0.28	Triangular	EU
	Saturation oil	-	-	-	-	-
	Expansion Factor (Bg)	12	335	212	Triangular	NGS
	Bo (oil)	-	-	-	-	-
	Pressure (psi)	646	9964	5273	Triangular	NGS
	Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
	Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
	Density (g/cm3)	2.63	2.77	2.71	Triangular	NGS
	Temperature (°C)	24	227	124	Triangular	NGS

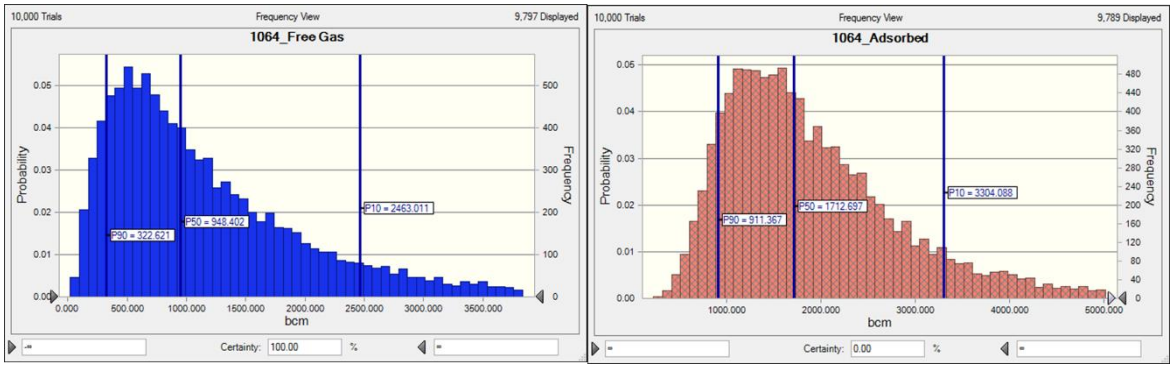

Figure A78 Results from GIIP calculations of Free Gas and Adsorbed Gas

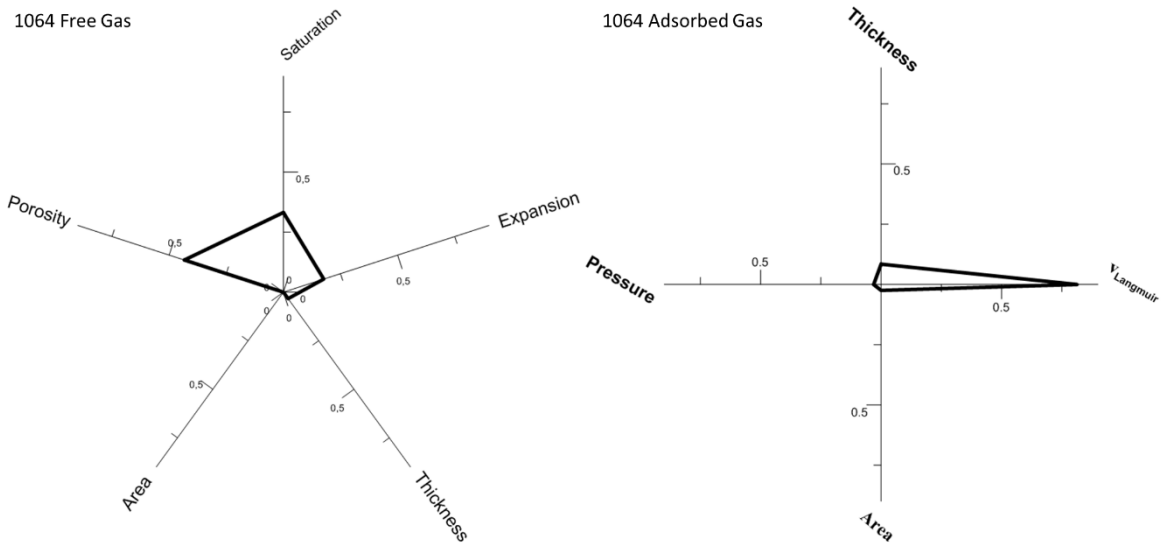

Figure A79 Sensitivity analyses results of the free gas and adsorbed calculations.

Alaunschiefer Germany 2013

German shale formations are not calculated in this study as Germany is not part of the EUOGA project. The results presented in Ladage 2016 (Schieferöl und schiefergas in Deutschland) were examined and the GIIP resource estimations turn out to be calculated in similar method as this report does as well as give similar results. The OIIP calculated are done by a different method. Because of this the GIIP estimations of the BGR are used and presented together with the EUOGA results in our reports.

Bowland Hodder 1077

Table A84 Summary of the classification according to assessment step 3 for the individual assessment units.

1077	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	122	1	1	1	2	gas	2

Table A85 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

UK_1077	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=7.5%		21611	Normal	NGS, Class 3a, GIS
Thickness (m)	0,2	355,5	86,35	Triangular	NGS, GIS, with N/G 10%
Depth (m)	0	4866	1635	Triangular	NGS, GIS
Porosity (%)	0,5	10	3	Triangular	NGS
Saturation gas	-	-	1	-	NGS, 'gas filled porosity'
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	168	253	211	Triangular	NGS min max, TNO mean
Bo (oil)	-	-	-	-	-
Pressure (psi)	2610	3915	3263	Triangular	NGS
Langmuir Pressure (psi)	2,5	10	6,25	Triangular	NGS
Langmuir Volume (scf/ton)	18	71	44,5	Triangular	NGS
Density (g/cm3)	2,55	2,65	2,6	Triangular	NGS
Temperature (°C)	10	161	61	Triangular	TNO, temp gradient 31c/km

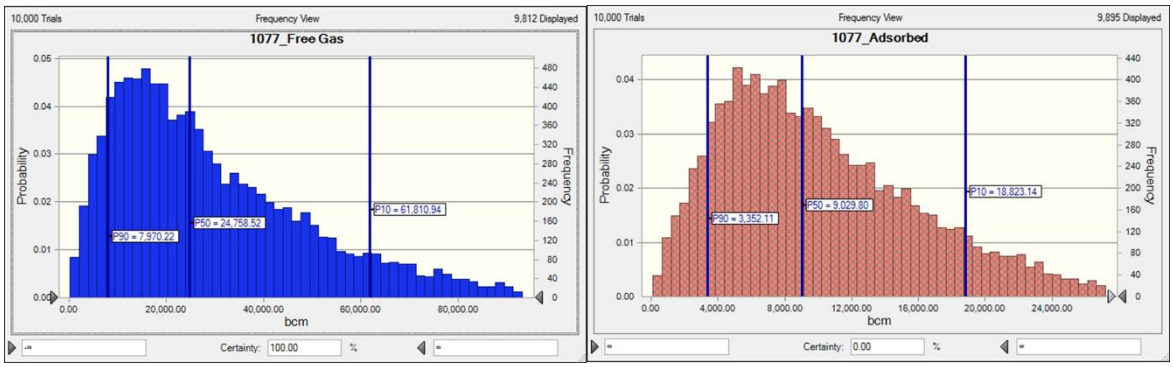

Figure A80 Results from GIIP calculations of Free Gas and Adsorbed Gas

Special case; both porosity and saturation is taken from US analogues. Because of this the resources estimates gives very high results. When using EUOGA means for the porosity and saturation total volumes reduces by 60%, a thing to keep in mind.

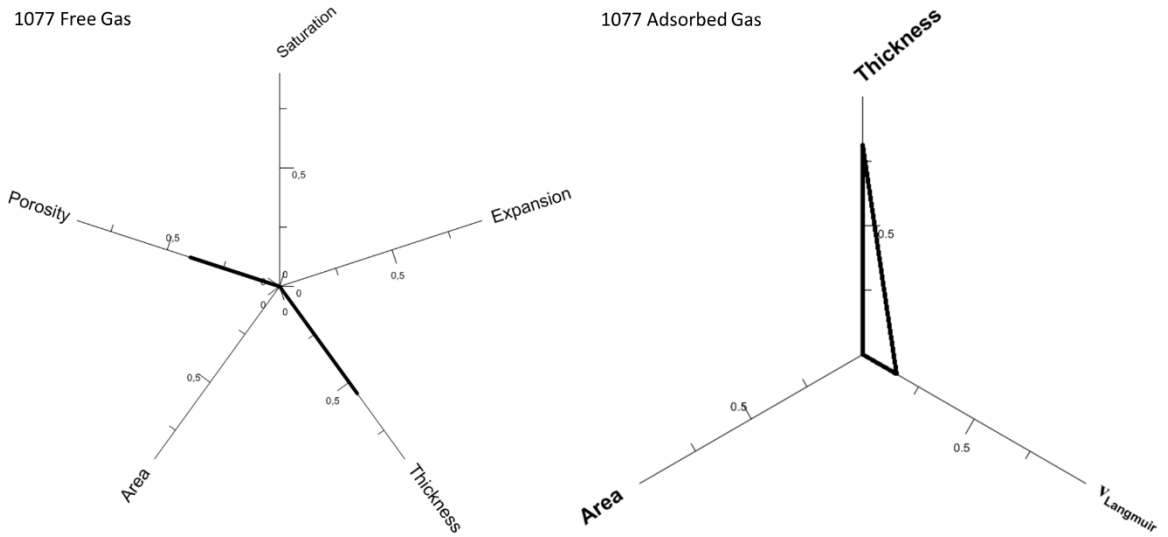

Figure A81 Sensitivity analyses results of the free gas and adsorbed calculations.

Westphalian Chokier 1045 and 1048

Table A86 Summary of the classification according to assessment step 3 for the individual assessment units.

1045	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	4	1	1	1	1	gas	1

Table A87 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BE_1045	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		708	Normal	NGS, Class 4a, GIS data
Thickness (m)	15	45	30	Triangular	NGS
Depth (m)	1500	2237	1869	Triangular	NGS
Porosity (%)	2	6	4	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	127	199	170	Triangular	TNO, NGS temp, hydro press
Bo (oil)	-	-	-	-	-
Pressure (psi)	2219	3353	2786	Triangular	NGS
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	1.95	2.8	2.48	Triangular	NGS
Temperature (°C)	52.5	71	61.75	Triangular	NGS

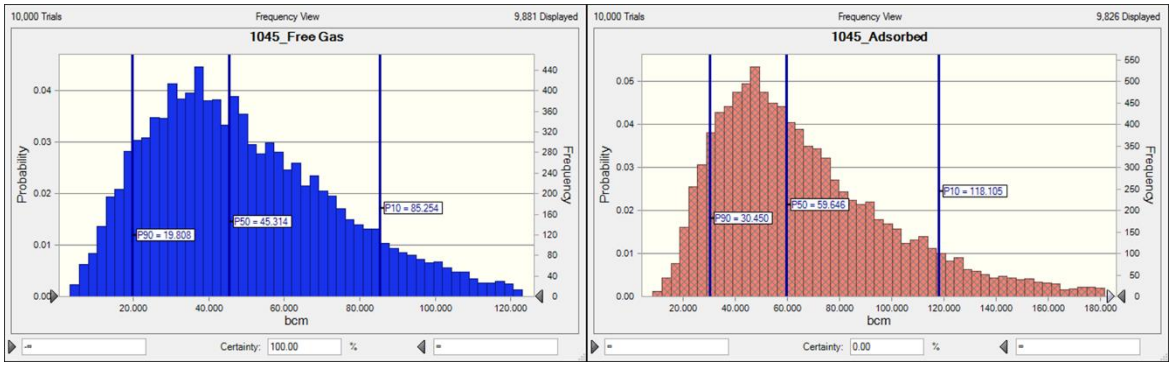

Figure A82 Results from GIIP calculations of Free Gas and Adsorbed Gas

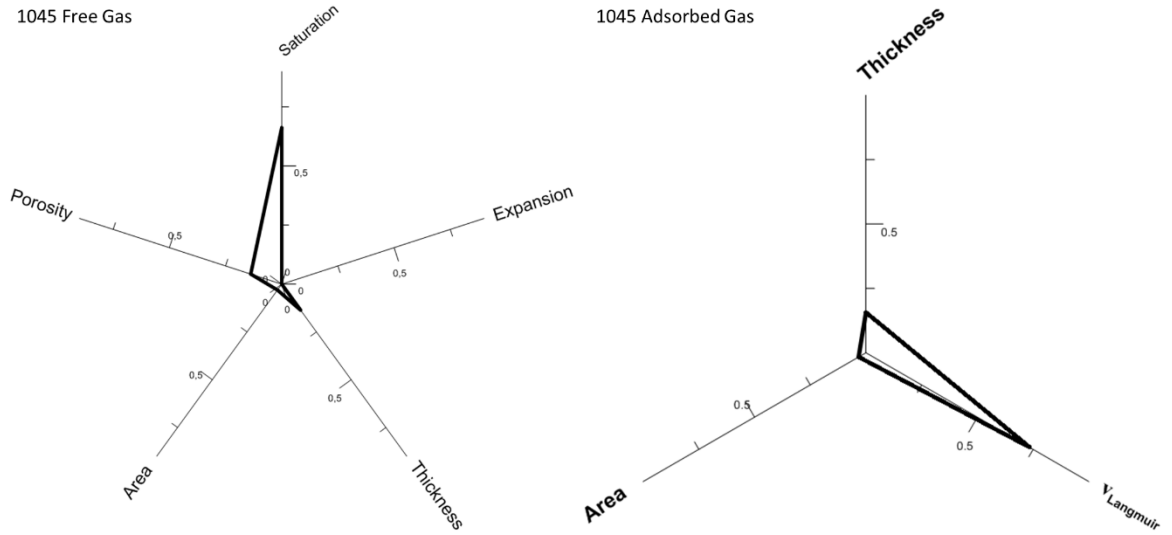

Figure A83 Sensitivity analyses results of the free gas and adsorbed calculations.

Table A88 Summary of the classification according to assessment step 3 for the individual assessment units.

1048	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	133	1	1	1	2	gas	2

Table A89 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BE_1048	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		1713	Normal	NGS, Class 4a, GIS data
Thickness (m)	70	120	120	Triangular	NGS
Depth (m)	1500	5286	1838	Triangular	NGS
Porosity (%)	0.1	7.6	1.59	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)				Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	1140	1700	1420	Triangular	NGS
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	SD=0.12		2.61	Normal	NGS
Temperature (°C)	67	100	83.5	Triangular	NGS

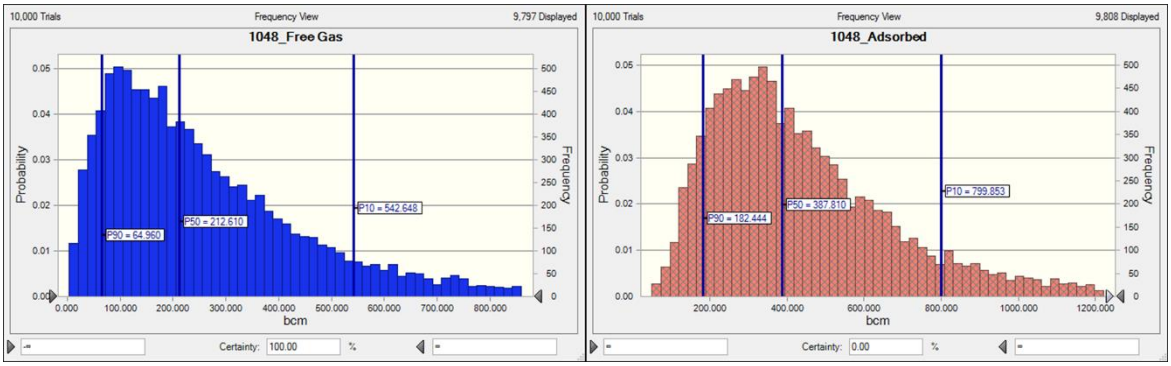

Figure A84 Results from GIIP calculations of Free Gas and Adsorbed Gas

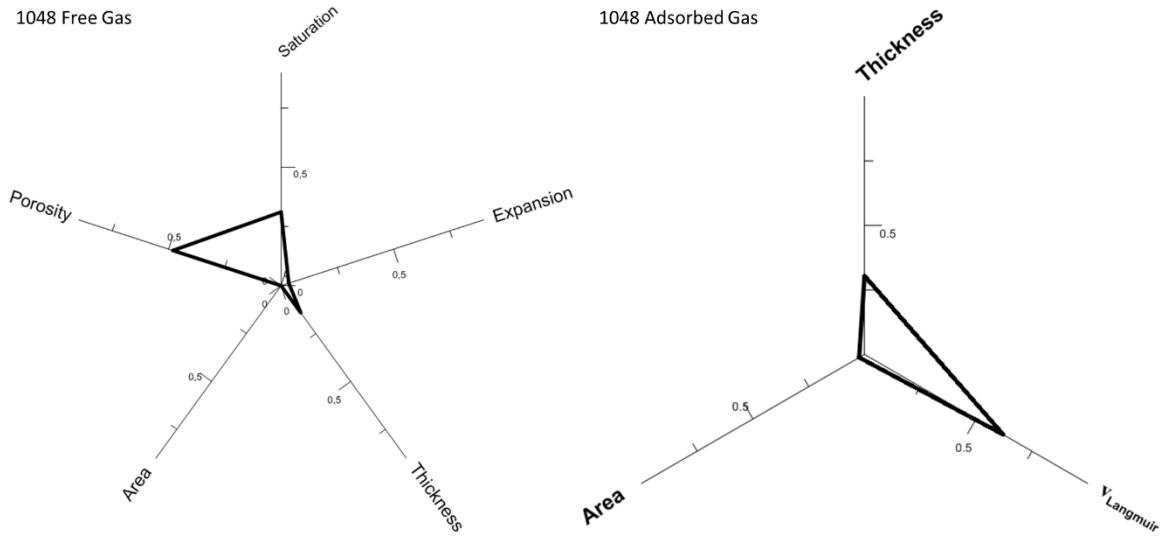

Figure A85 Sensitivity analyses results of the free gas and adsorbed calculations.

Mons Chokier 1046

Table A90 Summary of the classification according to assessment step 3 for the individual assessment units.

1046	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	5	1	3	3	1	gas	3

Table A91 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BE_1046	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		466	Normal	NGS, Class 4a, GIS
Thickness (m)	55	80	75	Triangular	NGS
Depth (m)	1500	2000	1750	Triangular	NGS
Porosity (%)	0.1	7.6	1.95	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	127	167	147	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	2147	2857	2502	Triangular	TNO, hydrostatic gradient
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	SD=0.12		2.61	Normal	NGS
Temperature (°C)	46.5	63	54.25	Triangular	NGS and TNO

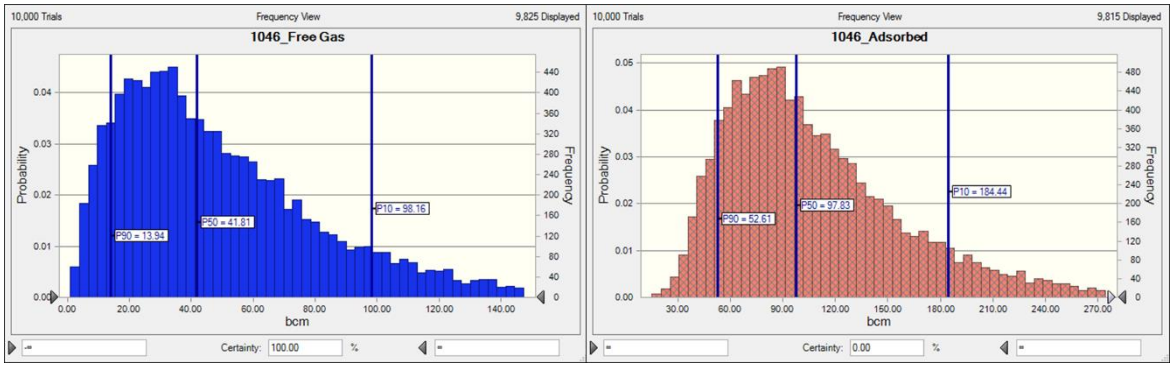

Figure A86 Results from GIIP calculations of Free Gas and Adsorbed Gas

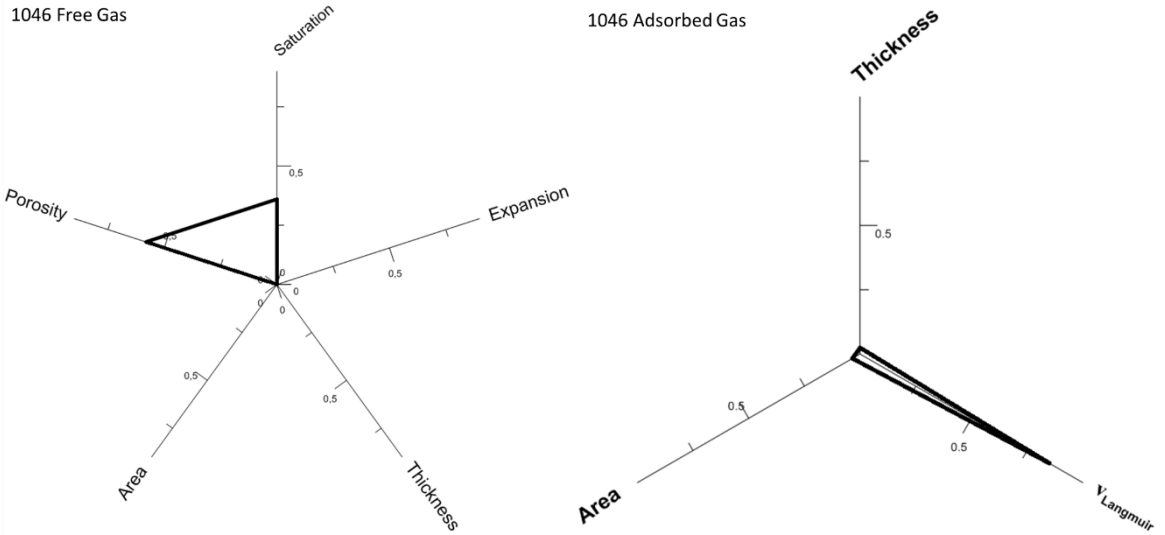

Figure A87 Sensitivity analyses results of the free gas and adsorbed calculations.

Liege Chokier 1047

Table A92 Summary of the classification according to assessment step 3 for the individual assessment units.

1047	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	6	1	3	3	2	gas	3

Table A93 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

BE_1047	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		15.7	Normal	NGS, Class 4a, GIS data
Thickness (m)	100	110	105	Triangular	NGS
Depth (m)	1500	1800	1650	Triangular	NGS
Porosity (%)	0.1	7.6	1.95	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	130	159	141	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	2147	2573	2360	Triangular	NGS
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	SD=0.12		2.61	Normal	NGS
Temperature (°C)	65	76	70	Triangular	TNO, NGS gradient

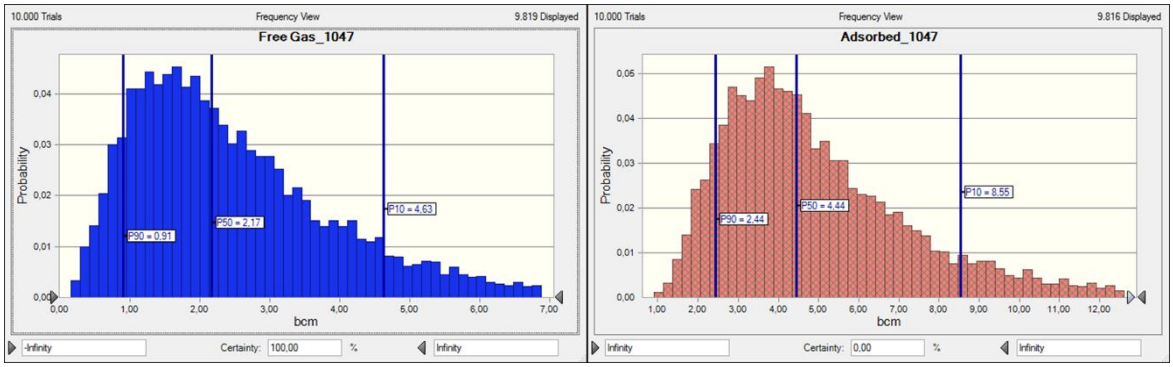

Figure A88 Results from GIIP calculations of Free Gas and Adsorbed Gas

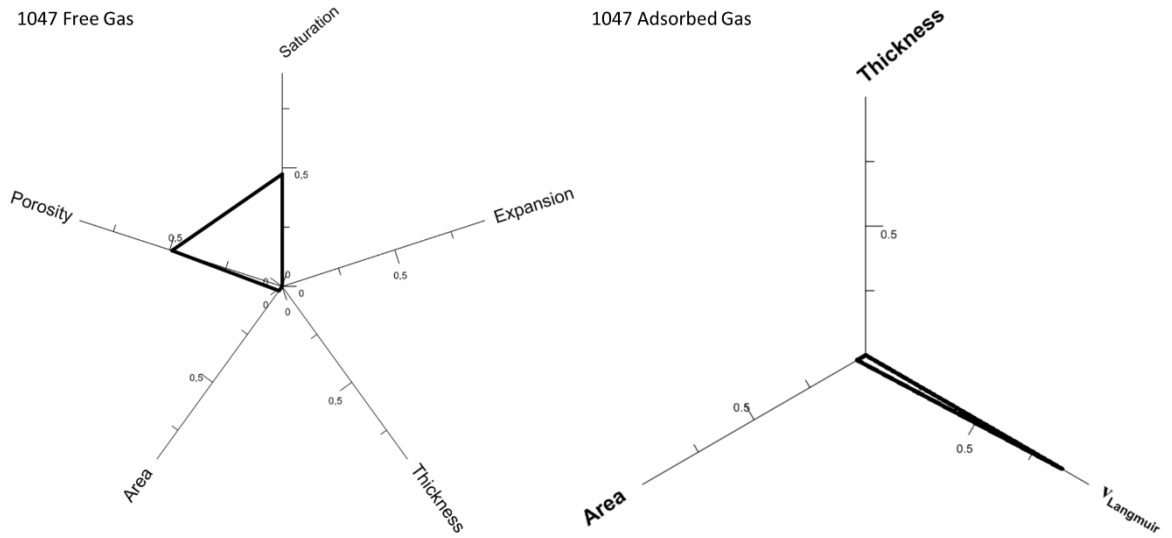

Figure A89 Sensitivity analyses results of the free gas and adsorbed calculations.

Results

Table A94 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Geverik Shale Member-1064, Adsorbed	NL	911.37	**1712.70**	3304.09
Geverik Shale Member-1064, Free Gas	NL	322.62	**948.40**	2463.01
Bowland -Hodder unit-1077, Adsorbed	UK	3352.11	**9029.80**	18823.14
Bowland -Hodder unit-1077, Free Gas	UK	7970.22	**24758.52**	61810.94
Total GIIP for Basin T10			**36449.42**	

Table A95 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Westphalian A and B-1045, Adsorbed	BE	30.45	**59.65**	118.10
Westphalian A and B-1045, Free Gas	BE	19.81	**45.31**	85.25
Chokier & Souvré hot shales-1048, Adsorbed	BE	182.44	**387.81**	799.85
Chokier & Souvré hot shales-1048, Free Gas	BE	64.96	**212.61**	542.65
Chokier shales-1046, Adsorbed	BE	52.61	**97.83**	184.44
Chokier shales-1046, Free Gas	BE	13.94	**41.81**	98.16
Chokier alum shales-1047, Adsorbed	BE	2.44	**4.44**	8.55
Chokier alum shales-1047, Free Gas	BE	0.91	**2.17**	4.63
Total GIIP for Basins T22, T23, T24			**851.62**	

T11, T12, T13 – Italian basins – Various shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
T11b	Emma	I	Emma Formation	L. Triassic – E. Jurassic	1008
T11a	Umbria-Marche	I	Marne del Monte Serrone Formation	E. Jurassic (Toarcian)	1009
T11a	Umbria-Marche	I	Marne a Fucoidi Formation	E. Cretaceous (Aptian-Albian)	1010
T12	Ribolla	I	Argille Lignitifere	Miocene (Tortonian-Messinian)	1011
T13	Ragusa	I	Noto & Streppenosa Shales	Triassic	1012, 1013

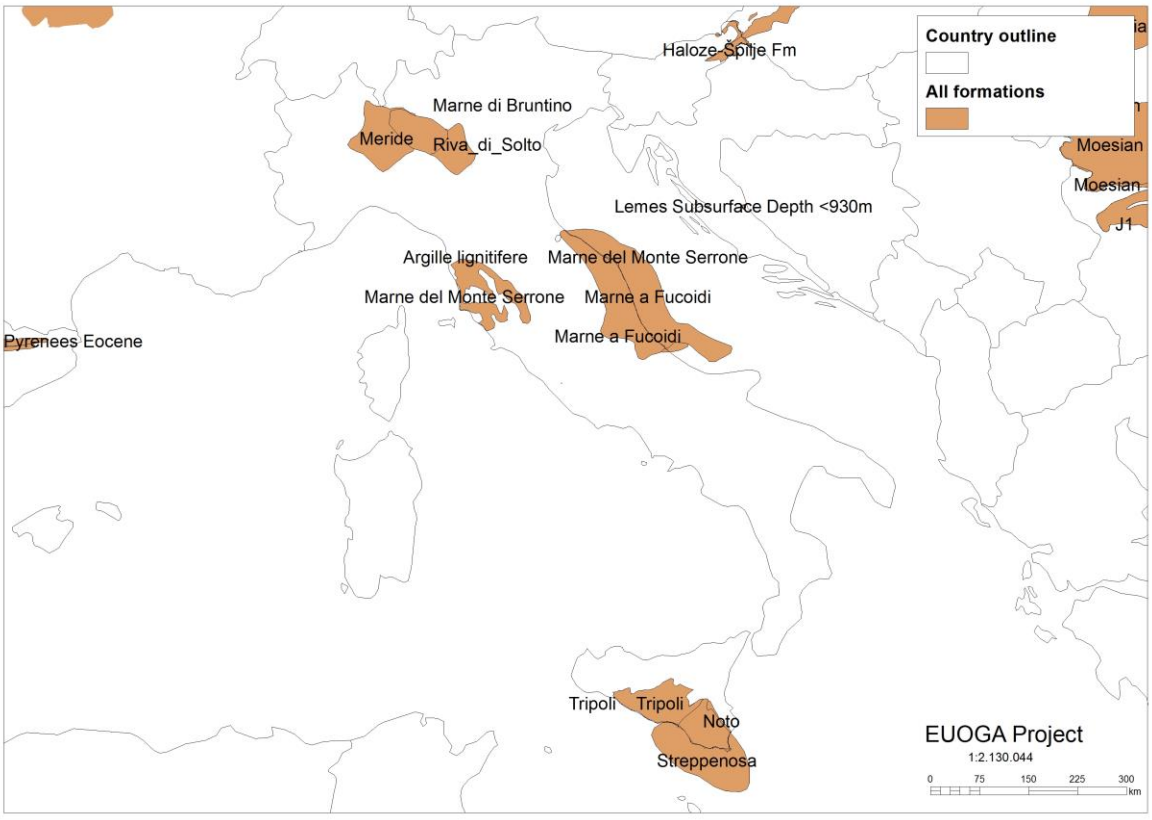

Figure A90 Overview map of the location of assessed formations

Table A96 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1008	***Success factors***
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Moderate
HC system	Proven
Maturity variability	High
Depth	Average to deep
Mineral composition	No data

1009	***Success factors***
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Possible
Maturity variability	High
Depth	Average
Mineral composition	No data

1010	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	High
Data availability	Moderate
HC system	Proven
Maturity variability	High
Depth	Average
Mineral composition	No data

1011	***Success factors***
Mapping status	Good
Sedimentary variability	Moderate
Structural complexity	Low
Data availability	Moderate
HC system	Proven
Maturity variability	Low
Depth	Average
Mineral composition	Favourable

1012	Success factors
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Low
HC system	Unknown
Maturity variability	High
Depth	Average
Mineral composition	Poor

1013	Success factors
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Low
HC system	Unknown
Maturity variability	High
Depth	Average
Mineral composition	No data

Emma Formation 1008

Table A97 Summary of the classification according to assessment step 3 for the individual assessment units.

1008	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	78	2	3	1	no	oil	No
Offshore	77	2	3	1	no	oil	No

As the thickness does not meet the EUOGA requirements this formation will not be calculated.

Marne del Monte Serrone Formation 1009

Table A98 Summary of the classification according to assessment step 3 for the individual assessment units.

1009	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	80	1	3	No	no	oil	No
Offshore	79	1	3	No	no	oil	No

As the thickness does not meet the EUOGA requirements this formation will not be calculated.

Marne a Fucoidi Formation 1010

Table A99 Summary of the classification according to assessment step 3 for the individual assessment units.

1010	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	82	1	3	1	1	oil	3
Offshore	81	1	3	1	1	oil	3

Table A100 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

IT_1010	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		8981	Normal	NGS, Class 5a, GIS
Thickness (m)	8	42	20	Triangular	NGS
Depth (m)	2000	5000	4500	Triangular	NGS
Porosity (%)	1,5	11,8	4,88	Triangular	EU
Saturation gas	-	-	-	-	-
Saturation oil	SD=0.083		0,044	Log normal	EU
Expansion Factor (Bg)	-	-	-	-	-
Bo (oil)	0,85	1,01	0,98	Triangular	EU
Pressure (psi)					
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2,1	2,71	2,45	Triangular	EU
Temperature (°C)	58	130	118	Triangular	C/km

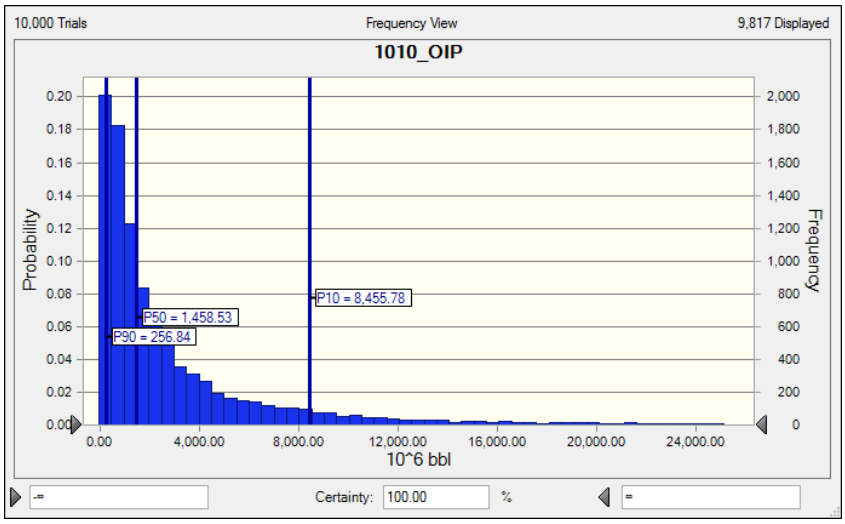

Figure A91 Results from the OIIP calculation

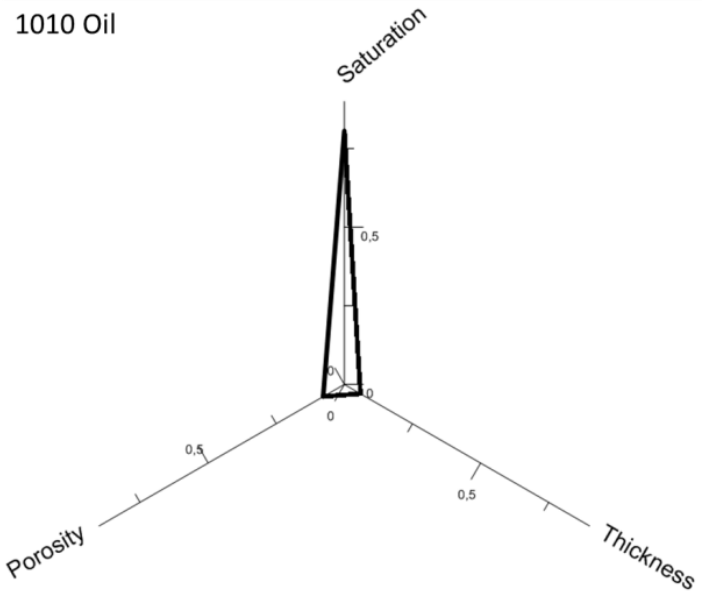

Figure A92 Sensitivity analyses results of the oil in place calculation

Results

Table A101 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Marne a Fucoidi-1010, Oil	IT	256.84	**1458.53**	8455.78
Total OIIP for Basin T11			**1458.53**	

Argille Lignitifere 1011

Table A102 Summary of the classification according to assessment step 3 for the individual assessment units.

1011	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	83	2	1	1	No	gas	No

No calculation will be performed as the formation is too thin.

Noto Shale 1012

Table A103 Summary of the classification according to assessment step 3 for the individual assessment units.

1012	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	85	1	3	1	no	oil	no
Offshore	84	1	3	1	no	oil	3

No calculation will be performed as the formation is too thin.

Streppenosa Shale 1013

Table A104 Summary of the classification according to assessment step 3 for the individual assessment units.

1013	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	87	1	3	No	no	oil	No
Offshore	86	1	3	No	no	oil	No

No calculation will be performed as the formation is too thin.

T14 - Lemeš shale 1004

Index	Basin	Country	Shale(s)	Age	Screening-Index
T14	Dinarides	HR	Lemeš	Jurassic	1004

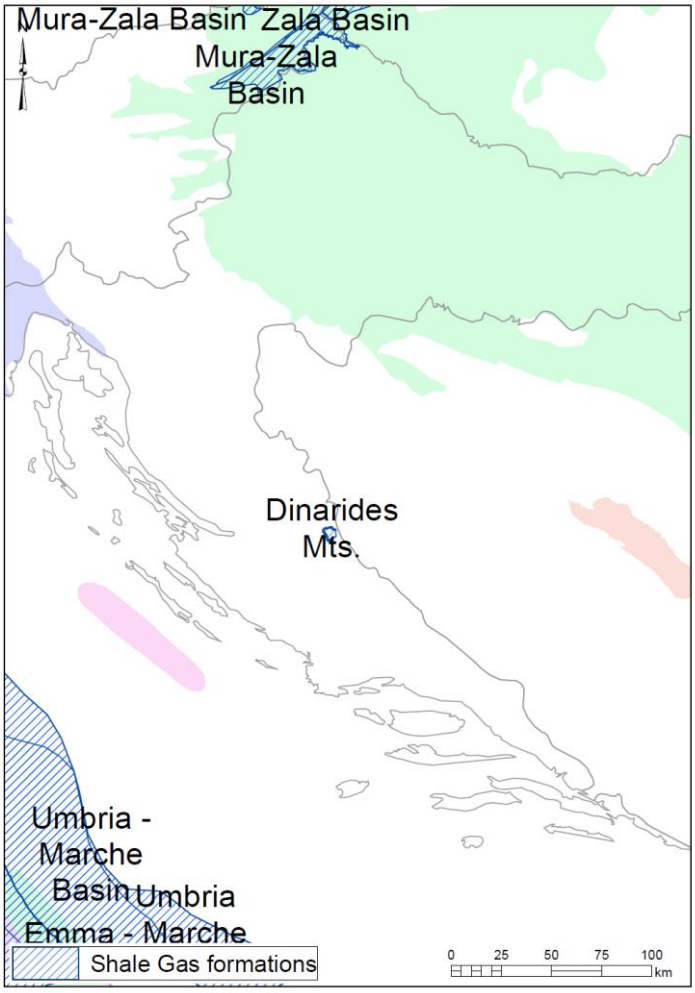

Figure A93 Overview map of the location of assessed formations

Table A105 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1004	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	High
Data availability	Moderate
HC system	Unknown
Maturity variability	Low
Depth	Average
Mineral composition	Favourable

Table A106 Summary of the classification according to assessment step 3 for the individual assessment units.

1004	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	70	2	1	1	1		2
Onshore	71	No	1	1	1		No

Table A107 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

HR_1004	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		34,2	Normal	NGS, Class 5a, GIS
Thickness (m)	3	70	36,5	Triangular	NGS
Depth (m)	0	930	465	Triangular	NGS
Porosity (%)	1	5,4	4,2	Triangular	NGS
Saturation gas	0,03	0,67	0,28	Triangular	EU
Expansion Factor (Bg)	1	94	48	Triangular	TNO
Pressure (psi)	14,5	1336	676	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2,6	2,7	2,65	Triangular	NGS
Temperature (°C)	10	38,8	24,4	-	TNO

Results

Table A108 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Lemeš shale-1004, Adsorbed	HR	0.41	**1.27**	3.34
Lemeš shale-1004, Free Gas	HR	0.13	**0.46**	1.22
Total GIIP for Basin T14			**1.74**	

T15, T16, T17, T18, T19, T20, T21 – Spanish Basins

Index	Basin	Country	Shale(s)	Age	Screening-Index
T15	Cantabria	E	Cantabia shales	Silurian-Jurassic	1027, 1028, 1029, 1030, 1031, 1032
T16	Guadalquivir	E	Guadalquivir Carboniferous shales	Carboniferous	1026
T17	Ebro	E	Ebro shales	Eocene, Carboniferous	1024, 1025
T18	Duero	E	Duero shales	Carboniferous	1023
T19	Iberian	E	Iberian shales	Cretaceous, Carboniferous	1021, 1022
T20	Catalonia	E	Catalonia shales	Carboniferous	1020
T21	Pyrenees	E	Pyrenees shale	Jurassic-Eocene	1033, 1034, 1035

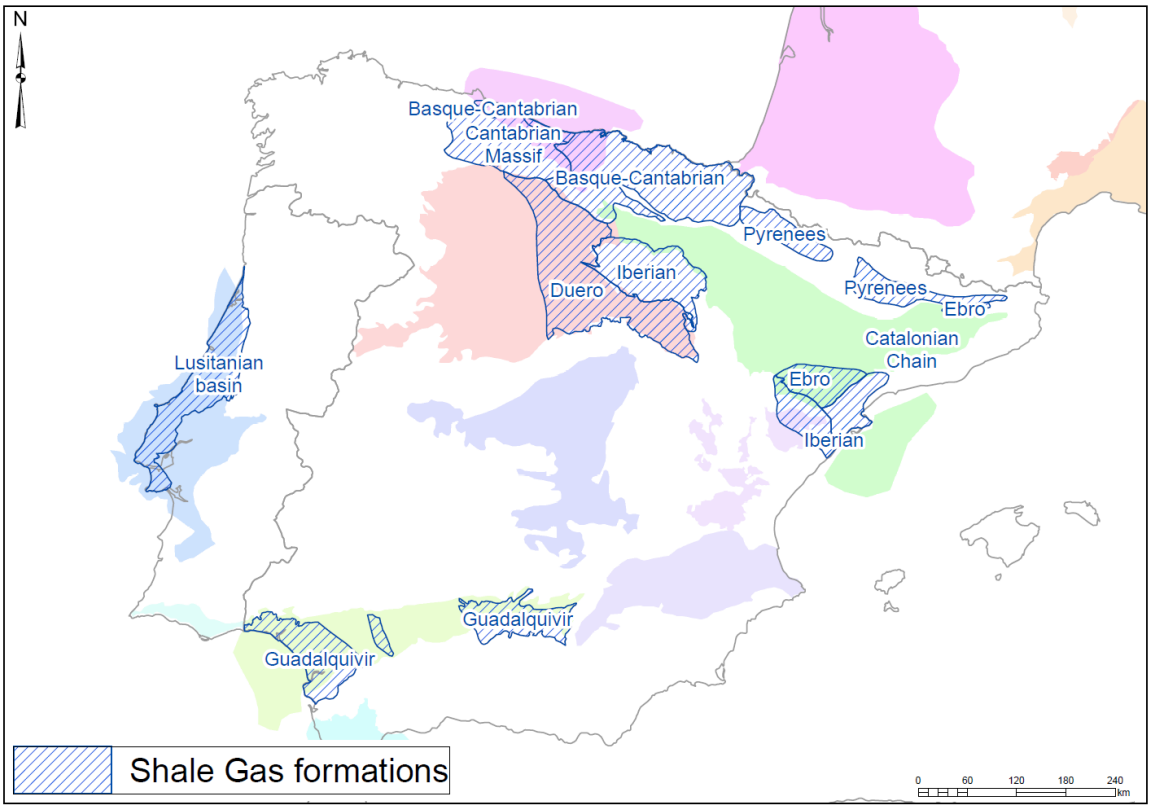

Figure A94 Overview map of the location of assessed formations

Table A109 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1020	Success factors
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Shallow to Average
Mineral composition	No data

1021	Success factors
Mapping status	Poor
Sedimentary variability	High
Structural complexity	Moderate
Data availability	Moderate
HC system	Unknown
Maturity variability	High
Depth	Shallow
Mineral composition	No data

1022	Success factors
Mapping status	Poor
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Shallow to Average
Mineral composition	No data

1023	Success factors
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Moderate
HC system	Unknown
Maturity variability	Unknown
Depth	Average
Mineral composition	No data

1024	Success factors

Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Average
Mineral composition	No data

1025	**Success factors**
Mapping status	Poor
Sedimentary variability	High
Structural complexity	Low
Data availability	Moderate
HC system	Unknown
Maturity variability	Unknown
Depth	Shallow to Average
Mineral composition	No data

1026	**Success factors**
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Possible
Maturity variability	Unknown
Depth	Shallow to Average
Mineral composition	No data

1027	**Success factors**
Mapping status	Poor
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Moderate
HC system	Possible
Maturity variability	Unknown
Depth	Shallow to deep
Mineral composition	No data

1028	**Success factors**
Mapping status	Poor
Sedimentary variability	High
Structural complexity	Moderate

Data availability	Moderate
HC system	Possible
Maturity variability	Unknown
Depth	Shallow to deep
Mineral composition	No data

1029	**Success factors**
Mapping status	Poor
Sedimentary variability	High
Structural complexity	Moderate
Data availability	Moderate
HC system	Possible
Maturity variability	Unknown
Depth	Shallow to deep
Mineral composition	No data

1030	**Success factors**
Mapping status	Poor
Sedimentary variability	Moderate to High
Structural complexity	High
Data availability	Moderate
HC system	Proven
Maturity variability	Unknown
Depth	Shallow to Average
Mineral composition	No data

1031	**Success factors**
Mapping status	Poor
Sedimentary variability	Moderate to High
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Possible
Maturity variability	Unknown
Depth	Shallow to deep
Mineral composition	No data

1032	**Success factors**
Mapping status	Poor
Sedimentary variability	Moderate to High
Structural complexity	Moderate to High
Data availability	Moderate
HC system	Possible
Maturity variability	Unknown

Depth	Shallow to deep
Mineral composition	No data

1033	**Success factors**
Mapping status	Poor
Sedimentary variability	Moderate
Structural complexity	High
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Average
Mineral composition	No data

1034	**Success factors**
Mapping status	Poor
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Shallow to Average
Mineral composition	Favourable

1035	**Success factors**
Mapping status	Poor
Sedimentary variability	Moderate
Structural complexity	Low
Data availability	Moderate
HC system	Unknown
Maturity variability	Low
Depth	Shallow to Average
Mineral composition	No data

Basque-Cantabrian Liassic-1027

Table A110 Summary of the classification according to assessment step 3 for the individual assessment units.

1027	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	61	1	3	1	1	gas	3

Table A111 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

ES_1027	Min	Max	Mean	Dist. Curve	Source
Area (km2)	1200	3500	2350	Triangular	NGS, Class 5a
Thickness (m)	25	100	62,5	Triangular	NGS
Depth (m)	0	7000	2200	Triangular	NGS
Porosity	1,5	11,8	4,88	Triangular	EU
Saturation gas	0,03	0,67	0,28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	1	248	162	Triangular	TNO, NGS temp, hydro press
Bo (oil)	-	-	-	-	-
Pressure (psi)	14,5	9964	3142	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	1,9	2,4	2,15	Triangular	NGS
Temperature (°C)	10	293,5	99,1	Triangular	TNO with gradient NGS

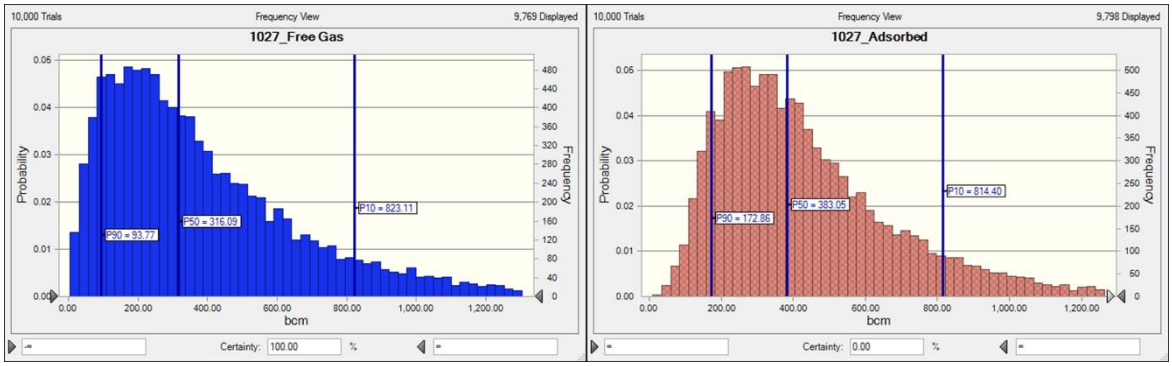

Figure A95 Results from GIIP calculations of Free Gas and Adsorbed Gas

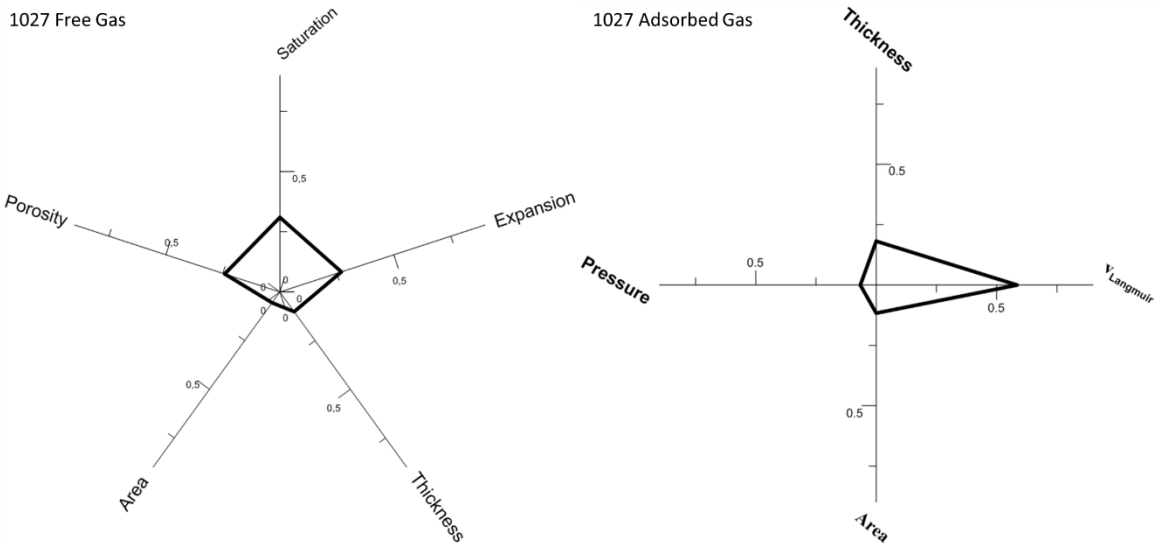

Figure A96 Sensitivity analyses results of the free gas and adsorbed calculations.

Basque-Cantabrian Lower Cretaceous 1028

Table A112 Summary of the classification according to assessment step 3 for the individual assessment units.

1028	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	62	1	3	No	2	gas	No

No calculation will be performed as the TOC is too low.

Basque-Cantabrian Upper Cretaceous 1029

Table A113 Summary of the classification according to assessment step 3 for the individual assessment units.

1029	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	63	1	3	3	2	gas	No

No calculation will be performed as too little data is available.

Basque-Cantabrian Carboniferous-1030

Table A114 Summary of the classification according to assessment step 3 for the individual assessment units.

1030	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	64	1	3	3	1	gas	3

Table A115 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

ES_1030	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		379	Normal	NGS, Class 5a
Thickness (m)	26	50	38	Triangular	NGS
Depth (m)	0	2500	1200	Triangular	NGS
Porosity (%)	1,5	11,8	4,88	Triangular	EU
Saturation gas	0,03	0,67	0,28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	1	232	130	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	14,5	3568	1720	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2,1	2,6	2,35	Triangular	NGS
Temperature (°C)	10	56,25	32,2	Triangular	TNO, NGS gradient

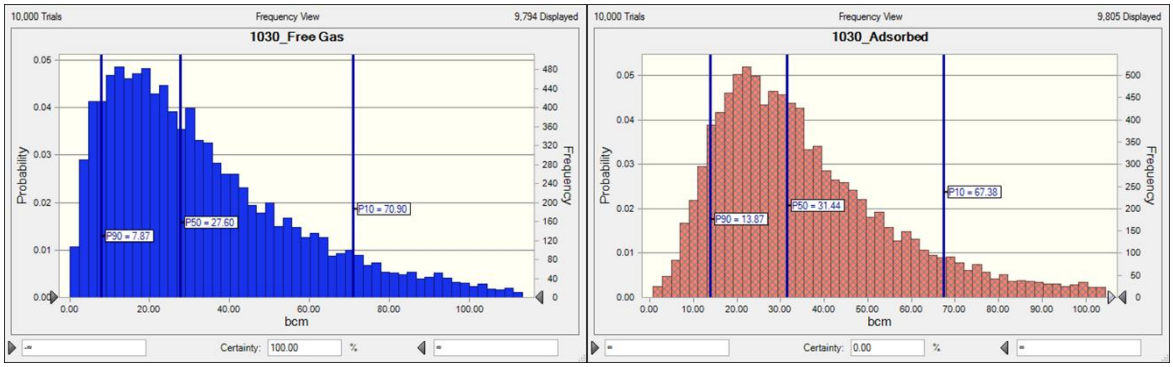

Figure A97 Results from GIIP calculations of Free Gas and Adsorbed Gas

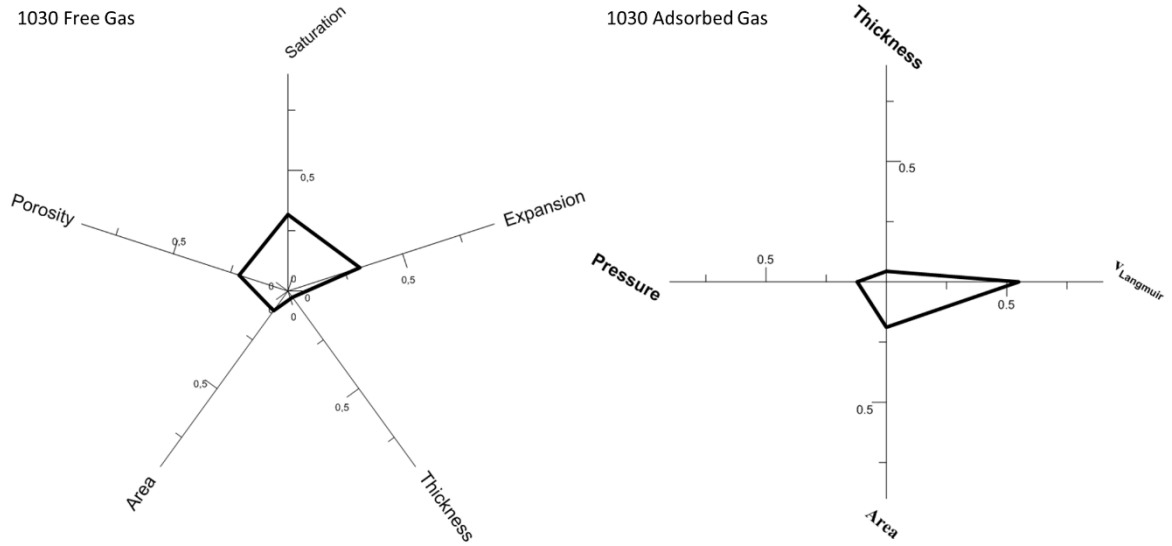

Figure A98 Sensitivity analyses results of the free gas and adsorbed calculations.

Cantabrian Massif Carboniferous 1031

Table A116 Summary of the classification according to assessment step 3 for the individual assessment units.

1031	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	65	1	1	No	2	gas	No

No calculation will be performed as the TOC values of the formations are too low.

Cantabrian Massif Silurian 1032

Table A117 Summary of the classification according to assessment step 3 for the individual assessment units.

1032	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	66	1	1	No	2	gas	No

No calculation will be performed as the TOC values of the formations are too low.

Guadalquivir Carboniferous-1026

Table A118 Summary of the classification according to assessment step 3 for the individual assessment units.

1026	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	60	1	3	3	1	gas	3

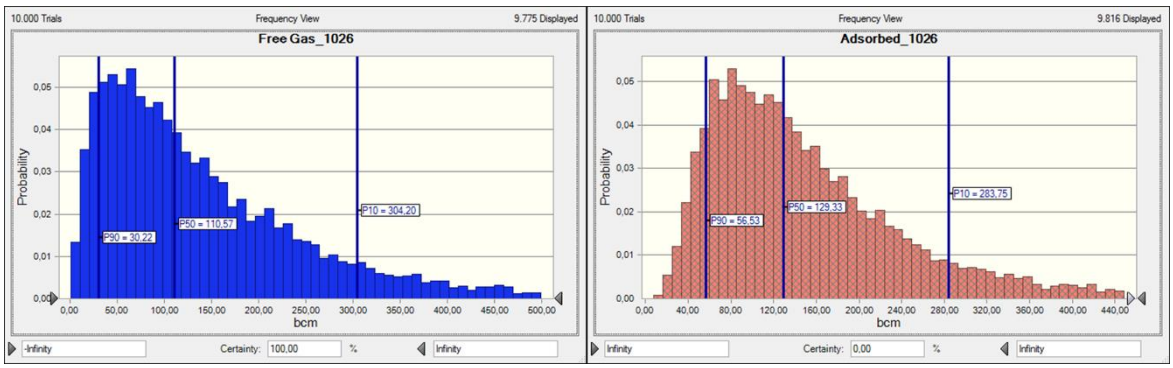

Figure A99 Results from GIIP calculations of Free Gas and Adsorbed Gas

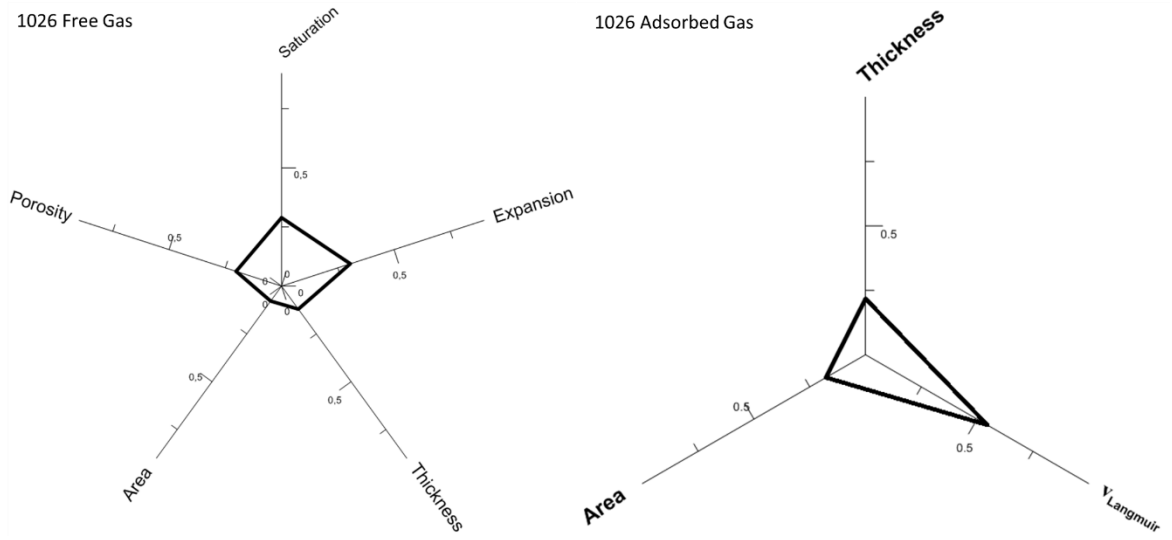

Figure A100 Sensitivity analyses results of the free gas and adsorbed calculations.

Ebro Carboniferous-1024

Table A119 Summary of the classification according to assessment step 3 for the individual assessment units.

1024	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	58	1	1	No	1	gas	No

No calculation will be performed as the TOC values of the formations are too low.

Ebro Eocene 1025

Table A120 Summary of the classification according to assessment step 3 for the individual assessment units.

1025	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	59	1	3	3	1	gas	No

No calculation will be performed as too little data is available.

Duero Carboniferous-1023

Table A121 Summary of the classification according to assessment step 3 for the individual assessment units.

1023	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	57	1	3	3	1	gas	3

Table A122 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

ES_1023	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		900	Normal	NGS, Class 5a
Thickness (m)	50	100	75	Triangular	NGS
Depth (m)	1000	2500	1700	Triangular	NGS
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	104	204	149	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	1436	3568	2431	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.1	2.6	2.35	Triangular	NGS
Temperature (°C)	40	85	61	Triangular	TNO, NGS gradient

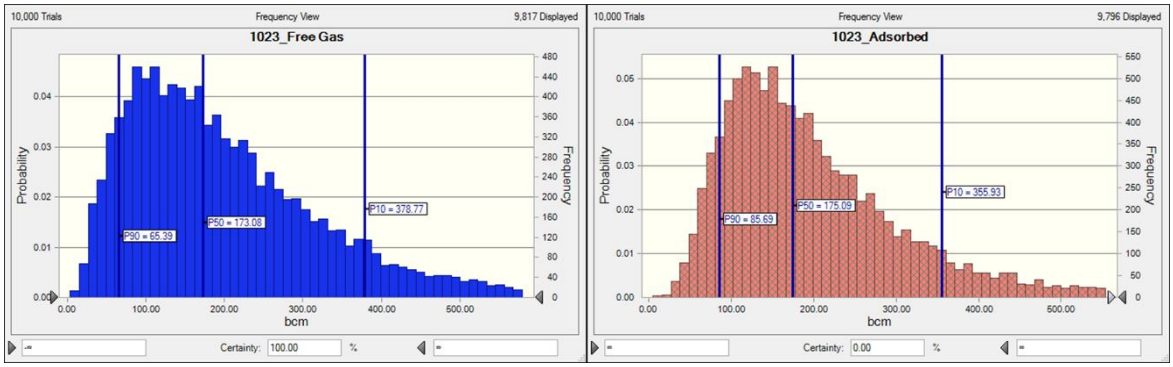

Figure A101 Results from GIIP calculations of Free Gas and Adsorbed Gas

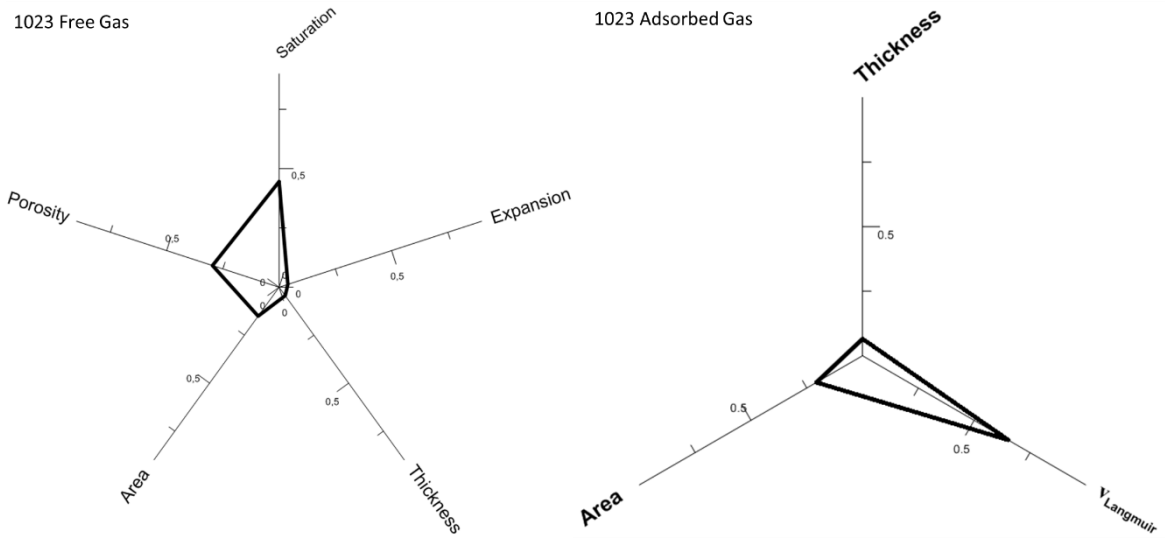

Figure A102 Sensitivity analyses results of the free gas and adsorbed calculations.

Iberian Lower Cretaceous 1021

Table A123 Summary of the classification according to assessment step 3 for the individual assessment units.

1021	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	55	2	1	No	2	gas	No

No calculation will be performed as the TOC values of the formations are too low.

Iberian Carboniferous-1022

Table A124 Summary of the classification according to assessment step 3 for the individual assessment units.

1022	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	56	1	3	3	1	gas	3

Table A125 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

ES_1022	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		850	Normal	NGS, Class 5a
Thickness (m)	50	100	75	Triangular	NGS
Depth (m)	0	2500	1500	Triangular	NGS
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	1	220	153	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	15	3568	2147	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.1	2.6	2.35	Triangular	NGS
Temperature (°C)	10	67.5	44.5	Triangular	TNO, NGS gradient

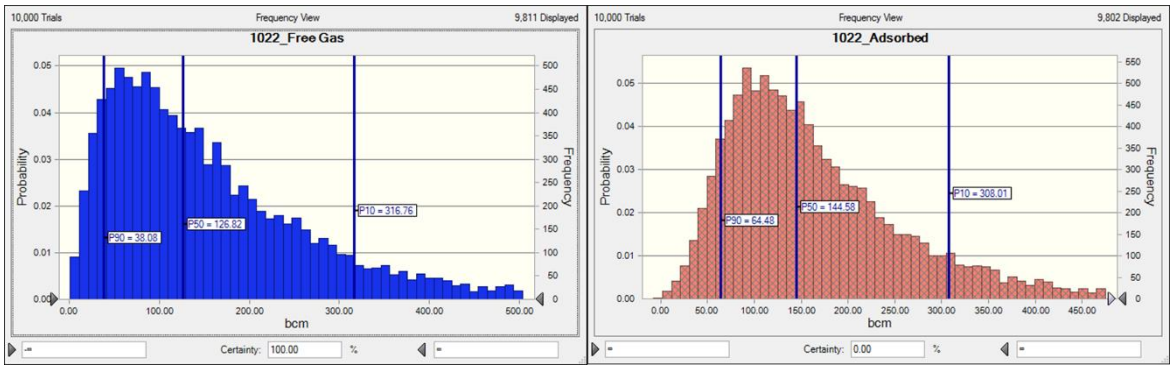

Figure A103 Results from GIIP calculations of Free Gas and Adsorbed Gas

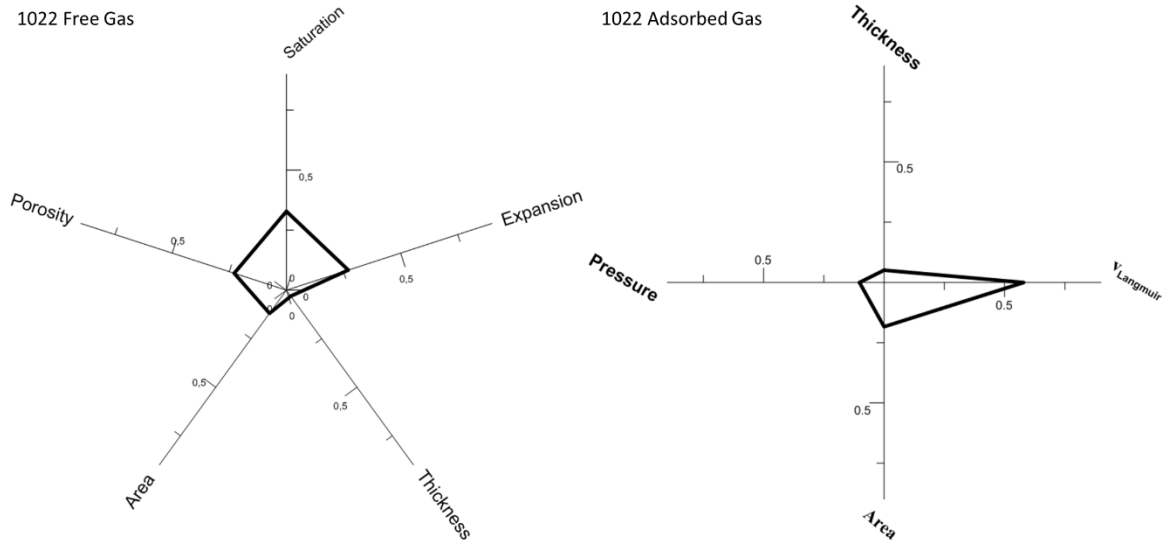

Figure A103 Sensitivity analyses results of the free gas and adsorbed calculations.

Catalonian Chain Carboniferous-1020

Table A126 Summary of the classification according to assessment step 3 for the individual assessment units.

1020	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	54	1	3	1	1	gas	3

Table A127 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

ES_1020	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=25%		500	Normal	NGS, Class 5a, GIS data
Thickness (m)	50	100	75	Triangular	NGS
Depth (m)	0	2000	1500	Triangular	NGS
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	1	167	149	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	15	2857	2147	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.1	2.6	2.35	Triangular	NGS
Temperature (°C)	10	72	53	Triangular	TNO, NGS gradient

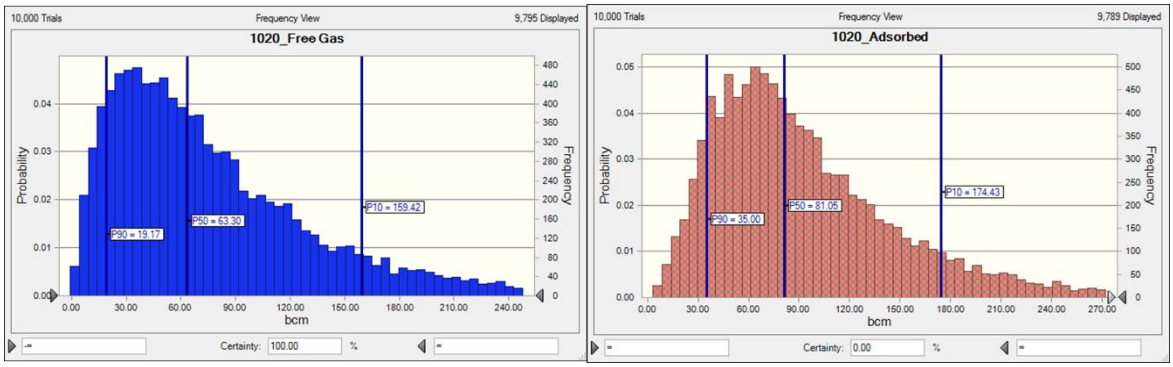

Figure A104 Results from GIIP calculations of Free Gas and Adsorbed Gas

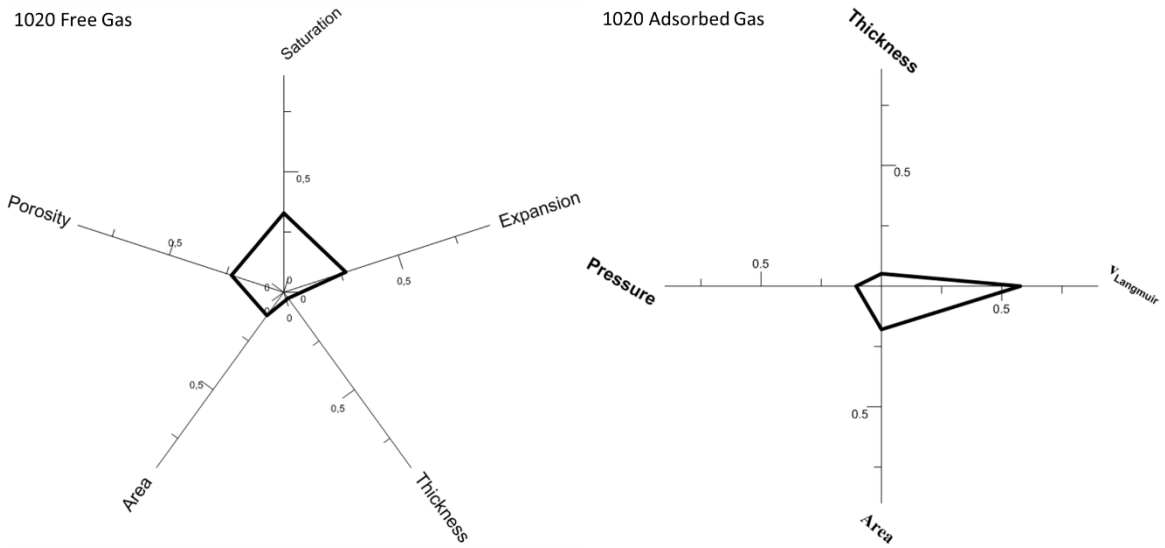

Figure A105 Sensitivity analyses results of the free gas and adsorbed calculations.

Cantabrian Massif Silurian-1033

Table A128 Summary of the classification according to assessment step 3 for the individual assessment units.

1033	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	67	1	3	3	1	gas	3

Pyrenees Lower Cretaceous-1034

Table A129 Summary of the classification according to assessment step 3 for the individual assessment units.

1034	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	68	1	3	3	1	gas	3

Pyrenees Eocene 1035

Table A130 Summary of the classification according to assessment step 3 for the individual assessment units.

1035	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	69	1	3	No	1	gas	No

No calculations will be performed as the TOC is too low.

Results

Table A131 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Basque-Cantabrian Liassic-1027, Adsorbed	ES	172.86	**383.05**	814.40
Basque-Cantabrian Liassic-1027, Free Gas	ES	93.77	**316.09**	823.11
Basque-Cantabrian Carboniferous-1030, Adsorbed	ES	13.87	**31.44**	67.38
Basque-Cantabrian Carboniferous-1030, Free Gas	ES	7.87	**27.60**	70.90
Guadalquivir Carboniferous-1026, Adsorbed	ES	56.53	**129.33**	283.75
Guadalquivir Carboniferous-1026, Free Gas	ES	30.22	**110.57**	304.20
Ebro Carboniferous-1024, Adsorbed	ES	299.58	**706.62**	1236.44
Ebro Carboniferous-1024, Free Gas	ES	223.97	**718.27**	1362.75
Duero Carboniferous-1023, Adsorbed	ES	85.69	**175.09**	355.93
Duero Carboniferous-1023, Free Gas	ES	65.39	**173.08**	378.77
Iberian Carboniferous-1022, Adsorbed	ES	64.48	**144.58**	308.01
Iberian Carboniferous-1022, Free Gas	ES	38.08	**126.82**	316.76
Catalonian Chain Carboniferous-1020, Adsorbed	ES	35.00	**81.05**	174.43
Catalonian Chain Carboniferous-1020, Free Gas	ES	19.17	**63.30**	159.42
Cantabrian Massif Silurian-1033, Adsorbed	ES	45.68	**95.77**	200.32
Cantabrian Massif Silurian-1033, Free Gas	ES	48.29	**131.09**	292.40
Pyrenees Lower Cretaceous-1034, Adsorbed	ES	12.82	**32.19**	76.21
Pyrenees Lower Cretaceous-1034, Free Gas	ES	8.18	**27.79**	74.33
Total GIIP for the Spanish basins			**3473.72**	

Table A132 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Ebro Carboniferous-1024, Oil	ES	0.31	**1.71**	3.72
Total OIIP for the Spanish basins			**1.71**	

T25, T31, T32 - Northwest European Lower Jurassic Basin - Central Europe

Index	Basin	Country	Shale(s)	Age	Screening-Index
T25a	Northwest European L. Jurassic	NL	Posidonia Shale	Toarcian	1065
T25c	Northwest German Basin	D	Posidonien Schiefer	Toarcian	2012
			Wealden	Tithonian-Berriasian	2012
			Blättertone/Fish Shale	Barremian/Aptian	n/a
			Mid Rhaetian shale	Rhaetian	n/a
T25d	Weald Basin SE England	UK	Kimmeridge Clay	Kimmeridgian-Tithonian (Late Jurassic)	1070
			Mid Lias Clay	Pliensbachian	1074
			Oxford Clay	Oxfordian	1075
			Upper Lias Clay	Early Toarcian	1076
			Corallian Clay	Oxfordian	1078
T31	Molasse Basin	D	Fish shale	Oligocene	n/a
T32	Upper Rhine Graben	D	Posidonien Schiefer	Toarcian (Jurassic)	2012
			Fish shale	Oligocene	n/a

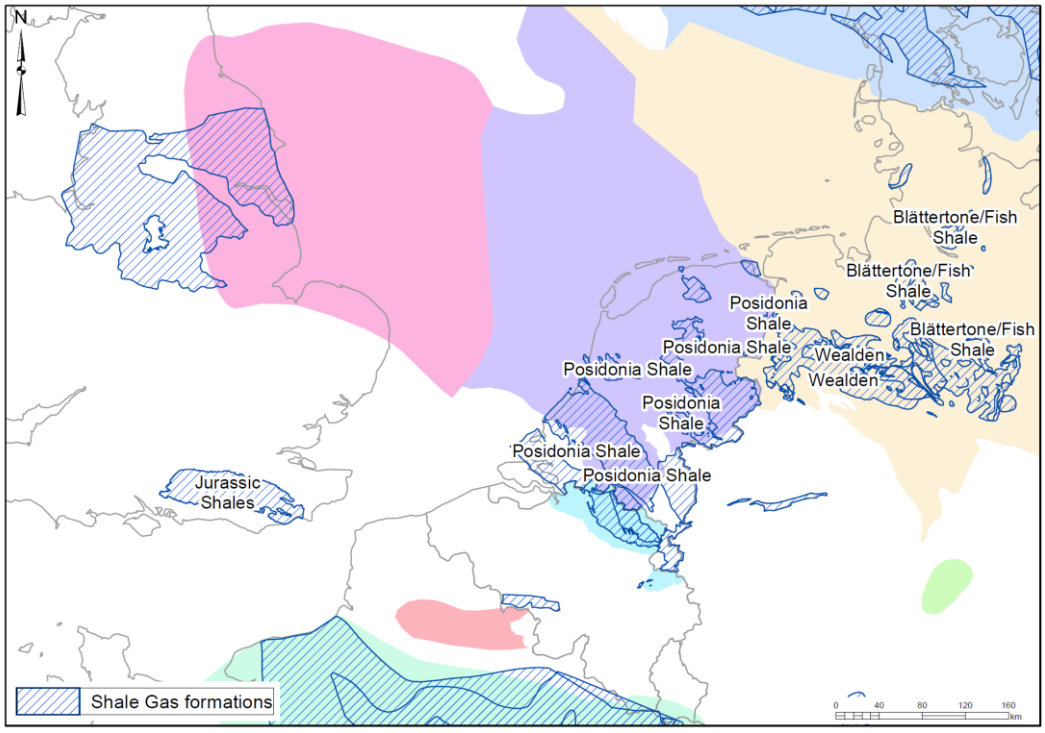

Figure A106 Overview map of the location of assessed formations

Table A133 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1065	Success factors
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Proven
Maturity variability	Moderate to High
Depth	Average
Mineral composition	Poor

1070	Success factors
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Possible
Maturity variability	Moderate
Depth	Shallow
Mineral composition	Unknown to Poor

1074	Success factors
Mapping status	Good
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Good
HC system	Possible
Maturity variability	Moderate
Depth	Shallow to average
Mineral composition	No data

1075	Success factors
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Good
HC system	Unknown
Maturity variability	Moderate
Depth	Shallow to Average
Mineral composition	Unknown

1076	Success factors
Mapping status	Good
Sedimentary variability	Unknown

Structural complexity	Moderate
Data availability	Good
HC system	Possible
Maturity variability	Moderate
Depth	Shallow to average
Mineral composition	Unknown

1078	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Good
HC system	Unknown
Maturity variability	Moderate
Depth	Shallow to Average
Mineral composition	Unknown

Posidonia Shale Formation 1065

Table A134 Summary of the classification according to assessment step 3 for the individual assessment units.

1065	***Object ID***	***Depth***	***Maturity***	***TOC***	***Thickness***	***Gas/Oil***	***Class***
Onshore	94	1	1	1	1	gas	1

Table A135 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

NL_1065	Min	Max	Mean	Dist. Curve	Source
Area (km2)			5798	Normal	NGS, Class 1a, GIS
Thickness (m)	8	60	30	Triangular	NGS
Depth (m)	90	3960	2000	Triangular	NGS
Porosity (%)	5	13	7	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	85	259	195	Triangular	NGS
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	127	5628	2842	Triangular	NGS
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.4	2.7	2.6	Triangular	NGS
Temperature (°C)	12.8	133	72	Triangular	NGS

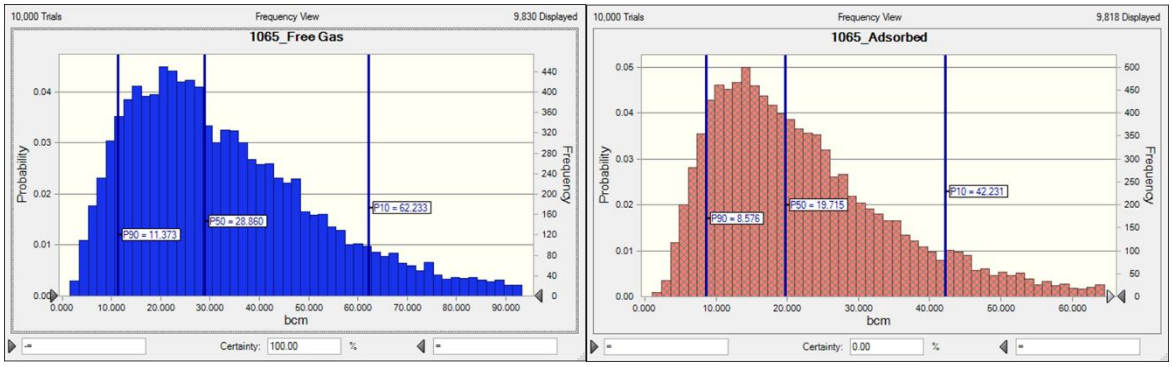

Figure A107 Results from GIIP calculations of Free Gas and Adsorbed Gas

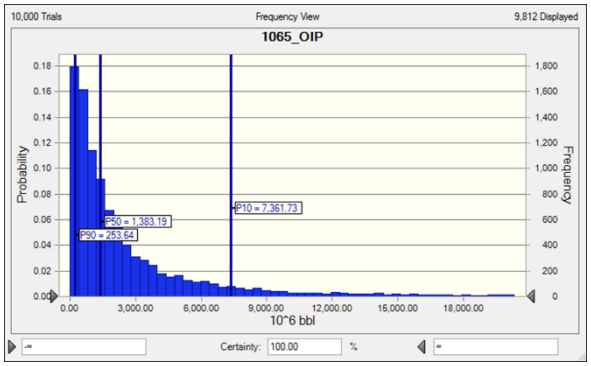

Figure A108 Results from the OIIP calculation

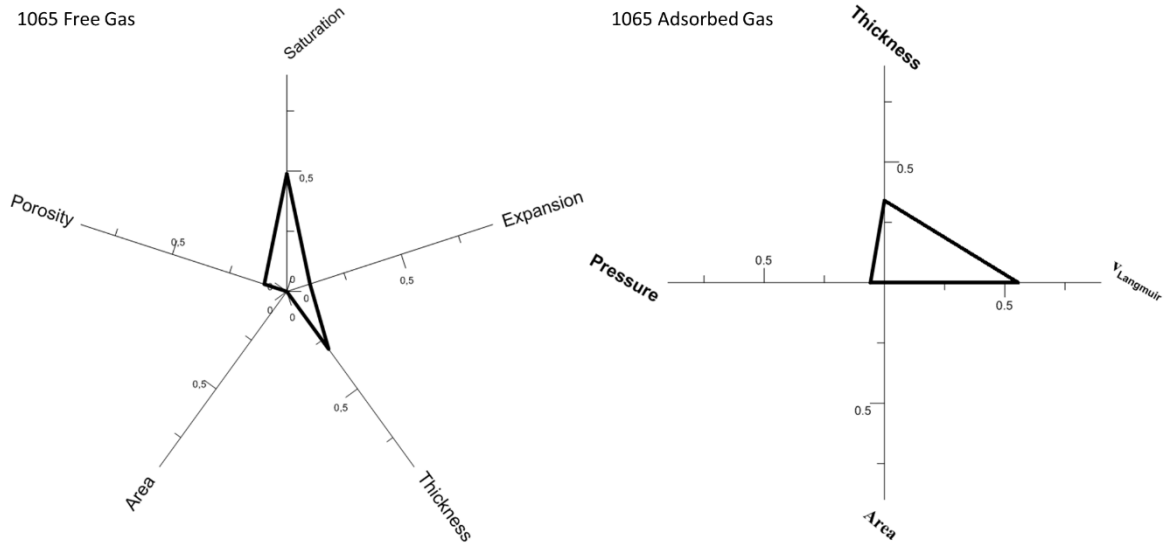

Figure A109 Sensitivity analyses results of the free gas and adsorbed calculations.

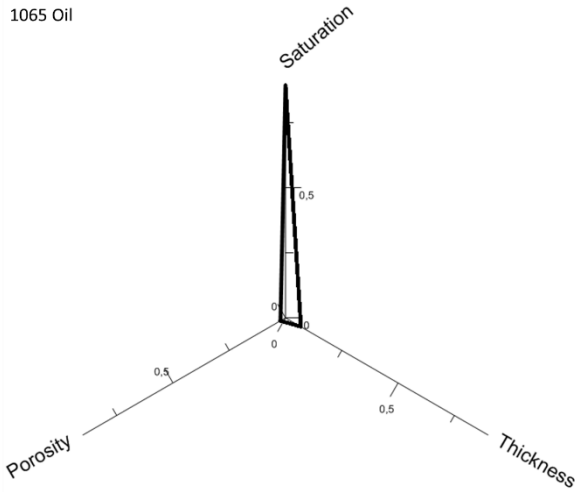

Figure A110 Sensitivity analyses results of the oil in place calculation

Kimmeridge Clay 1070

Table A136 Summary of the classification according to assessment step 3 for the individual assessment units.

1070	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	121	1	1	1	2	oil	1

Table A137 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

UK_1070	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=7.5%		3506	Normal	NGS, GIS, Class 3a
Thickness (m)	4,2	147,7	80,6	Triangular	NGS, GIS, N/G 10%
Depth (m)	0	1326	586	Triangular	NGS, GIS
Porosity (%)	1,5	11,8	4,88	Triangular	EU
Saturation gas	-	-	-	-	-
Saturation oil	SD=0.083		0,044	Log normal	EU
Expansion Factor (Bg)	-	-	-	-	-
Bo (oil)	0,85	1,01	0,98	Triangular	EU
Pressure (psi)	-	-	-	-	-
Langmuir Pressure (psi)	-	-	-	-	-
Langmuir Volume (scf/ton)	-	-	-	-	-
Density (g/cm3)	2,6	2,7	2,6	Triangular	NGS
Temperature (°C)	-	-	-	-	-

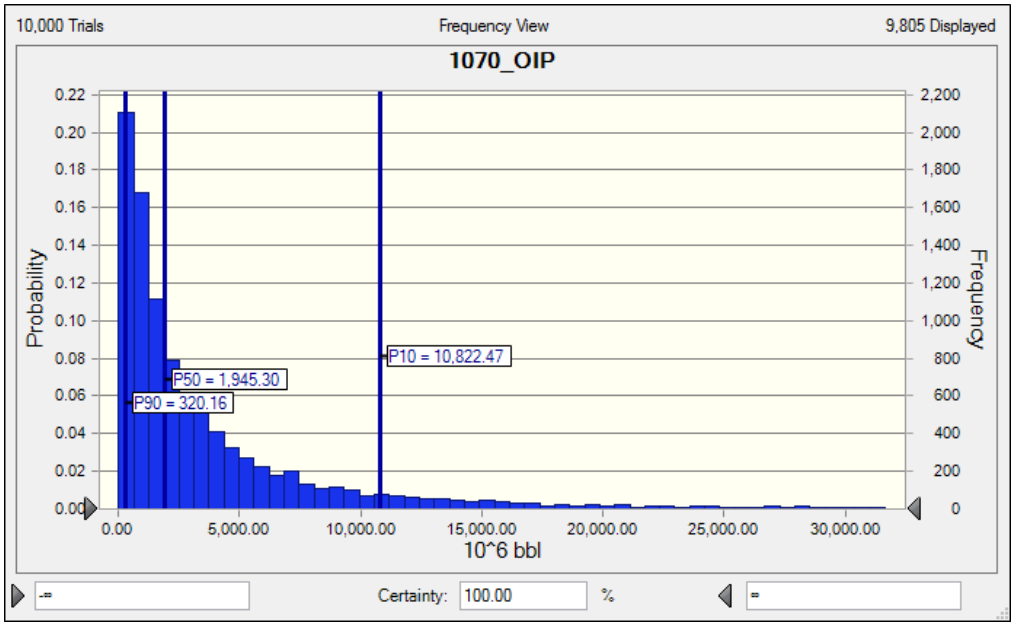

Figure A111 Results from the OIIP calculation

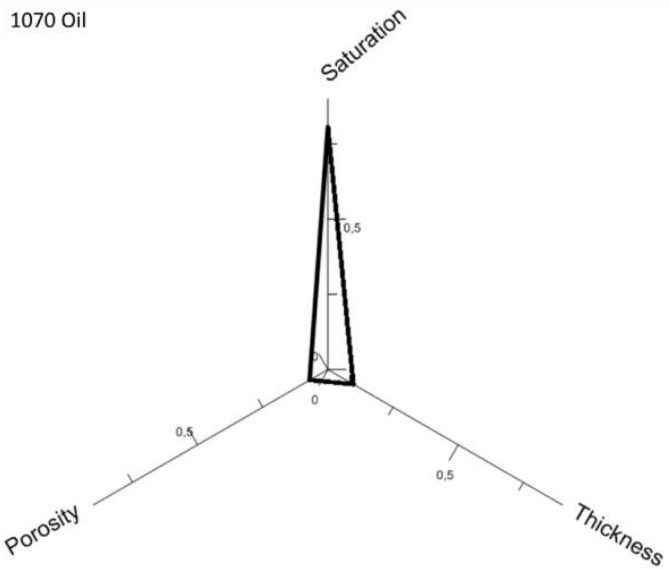

Figure A112 Sensitivity analyses results of the oil in place calculation

Mid Lias Clay 1074

Table A138 Summary of the classification according to assessment step 3 for the individual assessment units.

1074	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore		3	1	No	1	-	No

No calculations will be performed as the average TOC is too low.

Oxford Clay 1075

Table A139 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	3	1	1	No	-	No

No calculations will be performed as no thickness information is available.

Upper Lias Clay 1076

Table A140 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	3	1	1	No	-	No

No calculations will be performed as no thickness information is available.

Corallian Clay 1078

Table A141 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	3	1	No	1	-	No

No calculations will be performed as the average TOC is too low.

German Lower Jurassic shales; Posidonien Schiefer 2012, Fish Shale Germany, Wealden Germany 2012, Blättertone/Fish Shale, Mid Rhaetian Shale

The German shale formations are not calculated in this study as Germany is not part of the EUOGA project. The results presented in Ladage 2016 (Schieferöl und schiefergas in Deutschland) were examined and the GIIP resource estimations turn out to be calculated in similar method as this report does as well as give similar results. The OIIP calculated are done by a different method. Because of this the GIIP estimations of the BGR are used and presented together with the EUOGA results in our reports.

Results

Table A142 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Posidonia Shale Fm-1065, Adsorbed	NL	8.58	**19.71**	42.23
Posidonia Shale Fm-1065, Free Gas	NL	11.37	**28.86**	62.23
Total GIIP for Basin T25			**48.57**	

Table A143 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Posidonia Shale Fm-1065, Oil	NL	253.64	**1383.19**	7361.73
Kimmeridge Clay-1070, Oil	UK	320.16	**1945.30**	10822.47
Total OIIP for Basin T25			**3328.49**	

T26, T27, T28, T29 – French Basins

Index	Basin	Country	Shale(s)	Age	Screening-Index
T26	Paris Basin	F	Promicroceras	Late Pliensbachian	1082
			Amaltheus	Sinemurian	1083
			Schistes Carton	Toarcian	1084
T27	Aquitaine	F	Sainte Suzanne Marls	Aptian (Cretaceous)	1085
T28a	South Eastern basin	F	Schistes Cartons Fm	Jurassic	1084
T28b	South Eastern basin	F	Permo Carboniferous	Permian-Carboniferous	1080
T29	Jura Mountains	F	Jurassic shales	Toarcian (Jurassic)	1080, 1082 1083, 1084
Txx		F	Autunian		1081

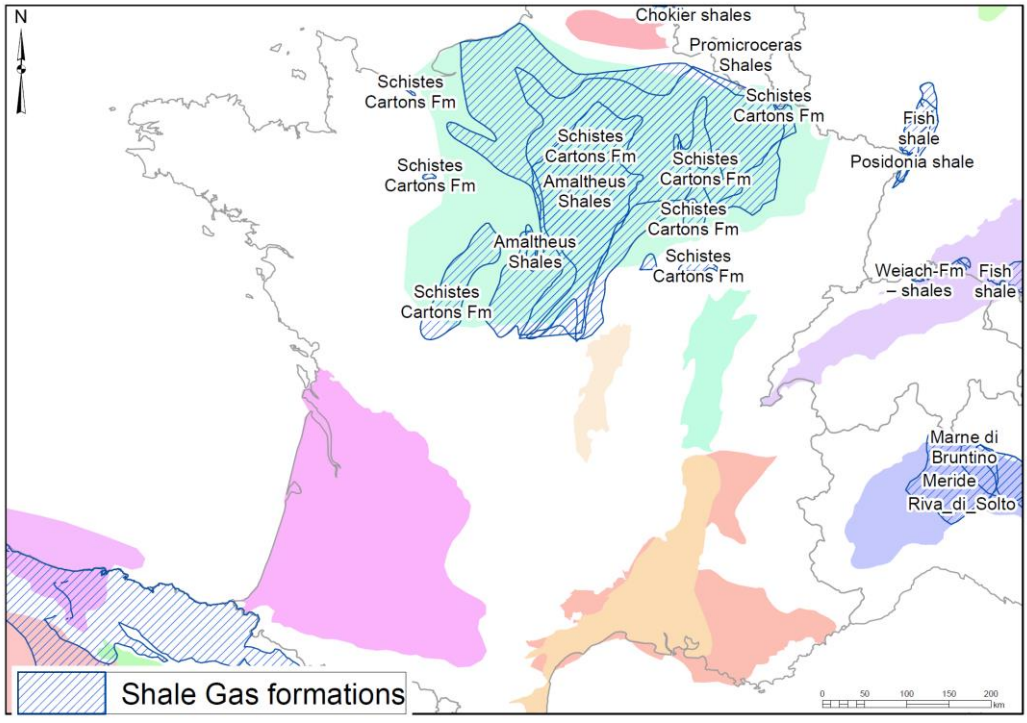

Figure A113 Overview map of the location of assessed formations

Table A144 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1080	*Success factors*
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Unknown
Maturity variability	High
Depth	Unknown
Mineral composition	No data

1081	*Success factors*
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Shallow
Mineral composition	No data

1082	*Success factors*
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Moderate
HC system	Unknown
Maturity variability	Moderate
Depth	Shallow to Average
Mineral composition	No data

1083	*Success factors*
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	Moderate
Data availability	Moderate
HC system	Unknown
Maturity variability	Moderate
Depth	Shallow to Average
Mineral composition	No data

1084	Success factors
Mapping status	Poor
Sedimentary variability	High
Structural complexity	High
Data availability	Poor
HC system	Possible
Maturity variability	High
Depth	Unknown
Mineral composition	No data

1085	Success factors
Mapping status	Poor
Sedimentary variability	Low
Structural complexity	Low and High
Data availability	Poor
HC system	Unknown
Maturity variability	Unknown
Depth	Unknown
Mineral composition	No data

Autunian 1081

Table A145 Summary of the classification according to assessment step 3 for the individual assessment units.

1081	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	2	3	3	2	-	3

No calculations will be performed as too little data is available for the formation.

Promicroceras 1082

Table A4146 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	3	1	No	1	-	No

No calculations will be performed as the TOC values of the formation are too low.

Amaltheus 1083

Table A147 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	3	1	1	1	Oil	3

Table A148 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

FR_1083	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		2104	Normal	NGS, GIS, Class 4a
Thickness (m)	0	40	20	Triangular	NGS,
Depth (m)	2100	2500	2300	Triangular	TNO, literature
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	-	-	-	-	-
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	-	-	-	-	-
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	-	-	-	-	-
Langmuir Pressure (psi)	-	-	-	-	-
Langmuir Volume (scf/ton)	-	-	-	-	-
Density (g/cm3)	2.1	2.71	2.45	Triangular	EU
Temperature (°C)	-	-	-	-	-

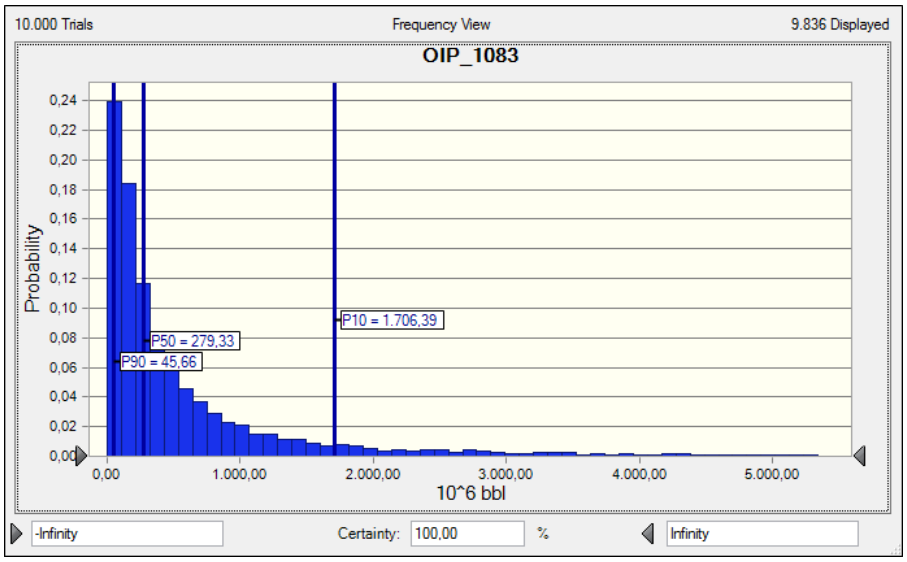

Figure A114 Results from the OIIP calculation

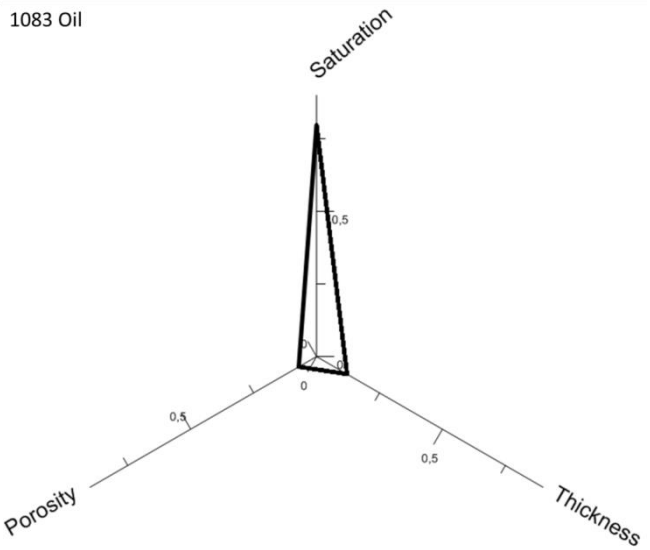

Figure A115 Sensitivity analyses results of the oil in place calculation

Schistes Carton 1084

Table A149 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	-	2	1	1	2	Oil	No

Table A150 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

FR_1084	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		20280	Normal	NGS, GIS, Class 4a
Thickness (m)	1	32	13	Triangular	NGS
Depth (m)	0	1180	800	Triangular	NGS
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	-	-	-	-	-
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	-	-	-	-	-
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	-	-	-	-	-
Langmuir Pressure (psi)	-	-	-	-	-
Langmuir Volume (scf/ton)	-	-	-	-	-
Density (g/cm3)	2.1	2.71	2.45	Triangular	EU
Temperature (°C)	-	-	-	-	-

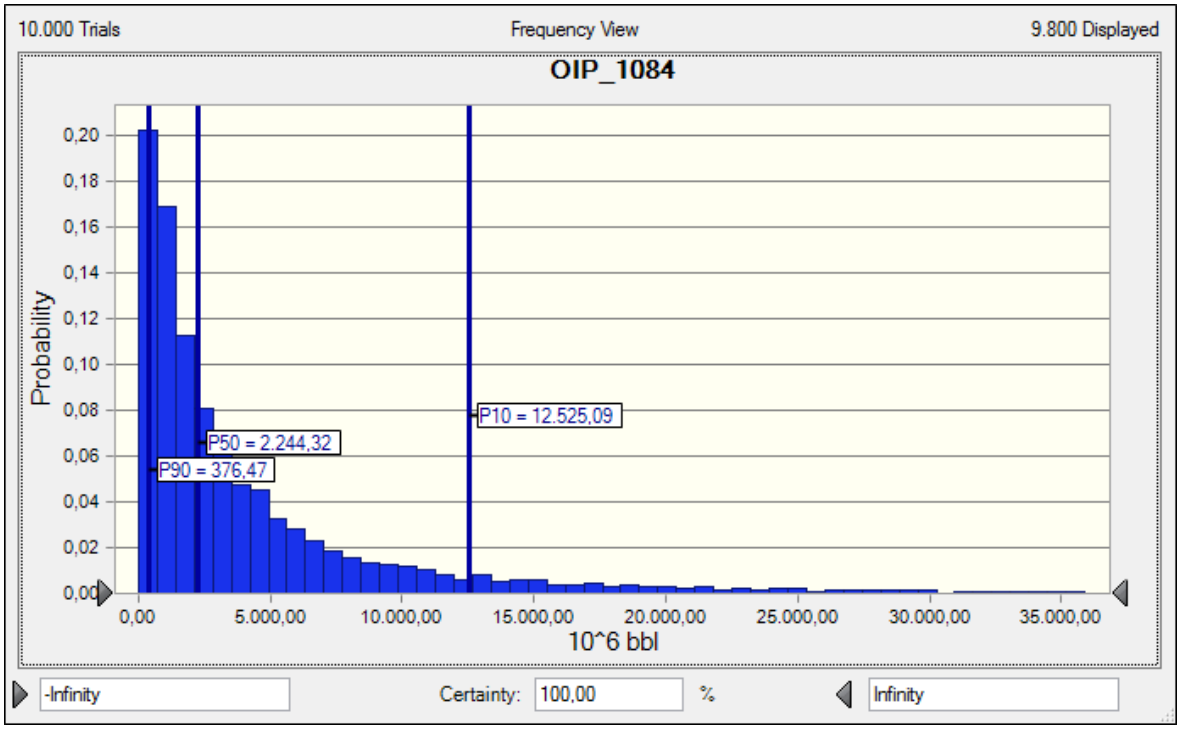

Figure A116 Results from the OIIP calculation

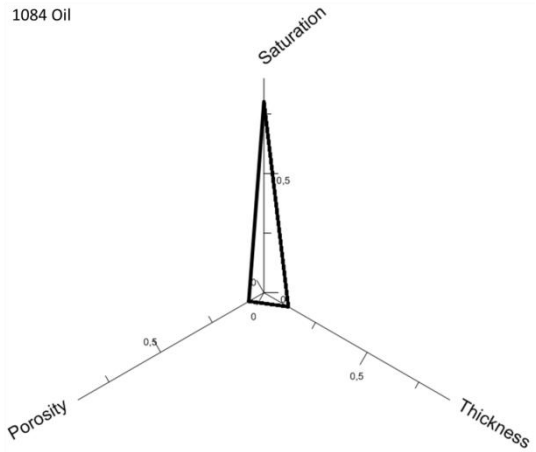

Figure A117 Sensitivity analyses results of the oil in place calculation

Results

Table A151 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Amaltheus Shales-1083, Oil	FR	45.66	**279.33**	1706.39
Schistes Cartons Fm-1084, Oil	FR	376.47	**2244.32**	12525.09
Total OIIP for Basin T26			**2523.65**	

T30 – Lusitanian basin Portugal – Jurassic Shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
T30	Lusitanian	PT	Jurassic	Jurassic	1087

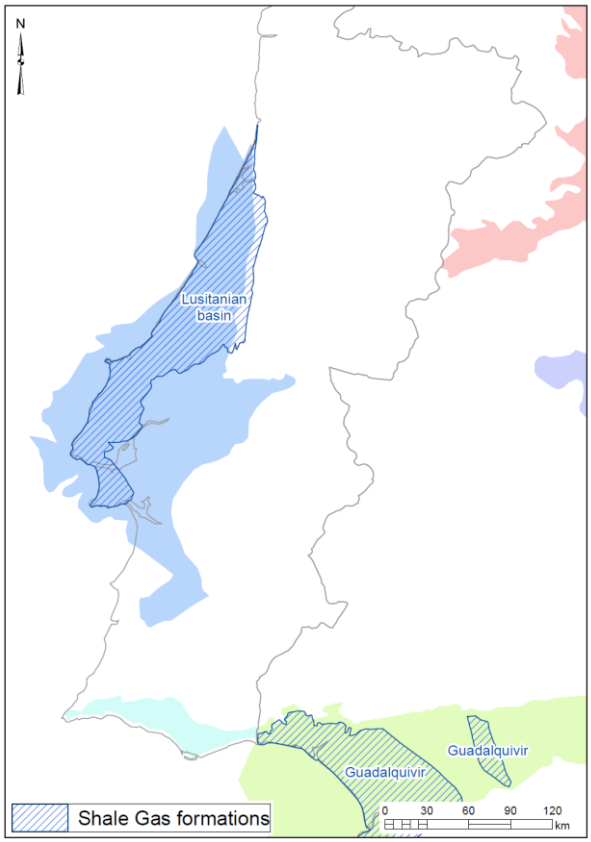

Figure A118 Overview map of the location of assessed formations

Table A152 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1087	***Success factors***
Mapping status	Poor
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Average
Mineral composition	Unknown to Favourable

Table A153 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	134	1	1	1	2	both	2

Table A154 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

PT_1087	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		9515	Normal	NGS, GIS, Class 4a
Thickness (m)	50	400	200	Triangular	Literature, N/G 20%
Depth (m)	1000	3500	2250	Triangular	NGS
Porosity (%)	0.2	19.8	10	Triangular	NGS
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	101	237	190	Triangular	TNO
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	1436	4989	3213	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.1	2.71	2.45	Triangular	EU
Temperature (°C)	41	119	80	Triangular	TNO

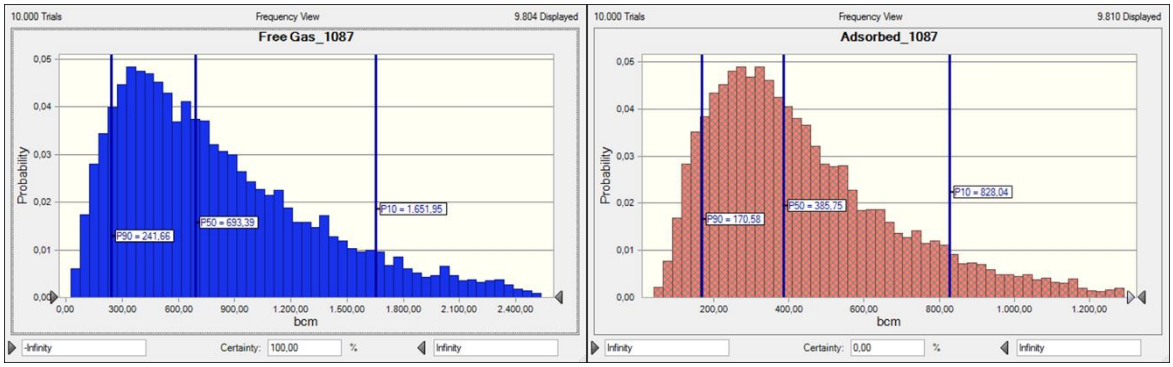

Figure A119 Results from GIIP calculations of Free Gas and Adsorbed Gas

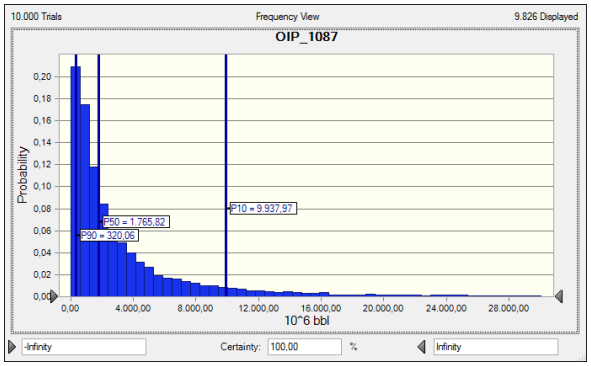

Figure A120 Results from the OIIP calculation

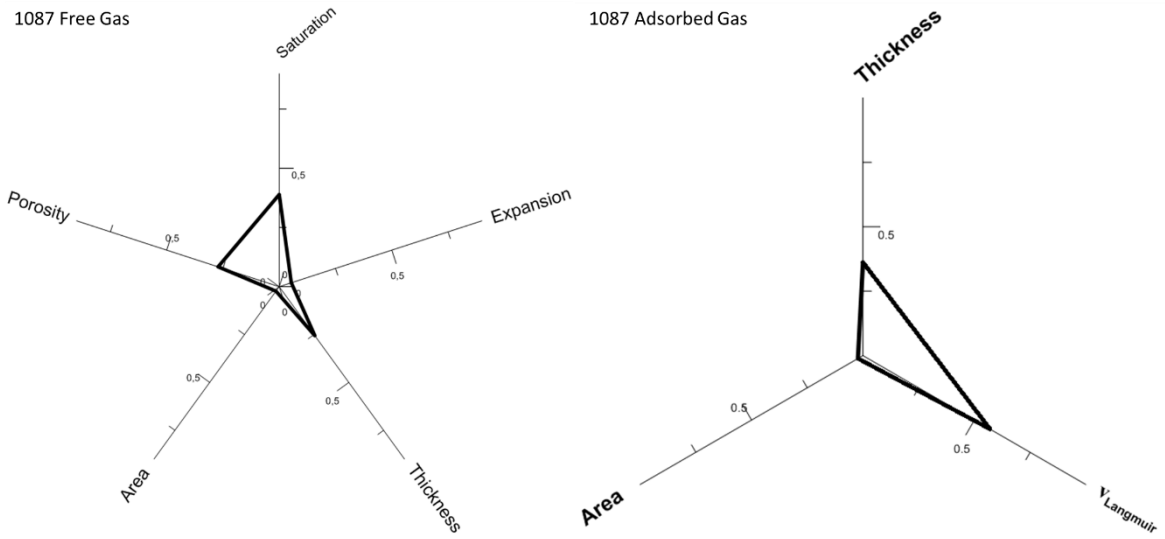

Figure A121 Sensitivity analyses results of the free gas and adsorbed calculations.

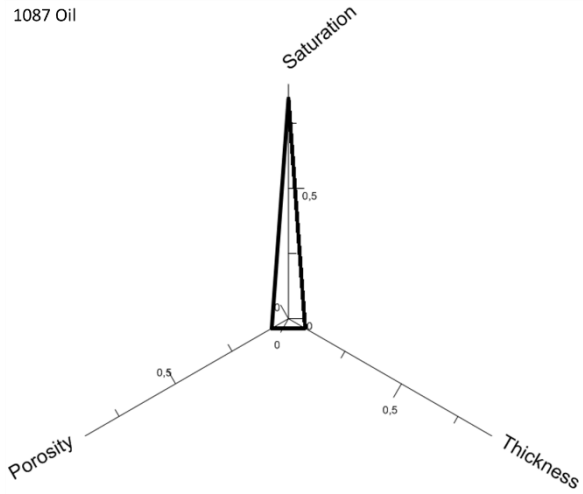

Figure A122 Sensitivity analyses results of the oil in place calculation

Results

Table A155 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Lias shales-1087, Adsorbed	PT	170.58	**385.75**	828.04
Lias shales-1087, Free Gas	PT	241.66	**693.39**	1651.95
Total GIIP for Basin T30			**1079.14**	

Table A156 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
Lias shales-1087, Oil	PT	320.06	**1765.82**	9937.97
Total OIIP for Basin T30			**1765.82**	

T34 – Midland Valley of Scotland – Carboniferous shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
T34	Midland Valley of Scotland	UK	Limestone Coal Formation	Carboniferous	1071
		UK	West Lothian Oil Shale unit	Carboniferous	1072
		UK	Lower Limestone Formation	Carboniferous	1073
		UK	Gullane Unit	Carboniferous	1079

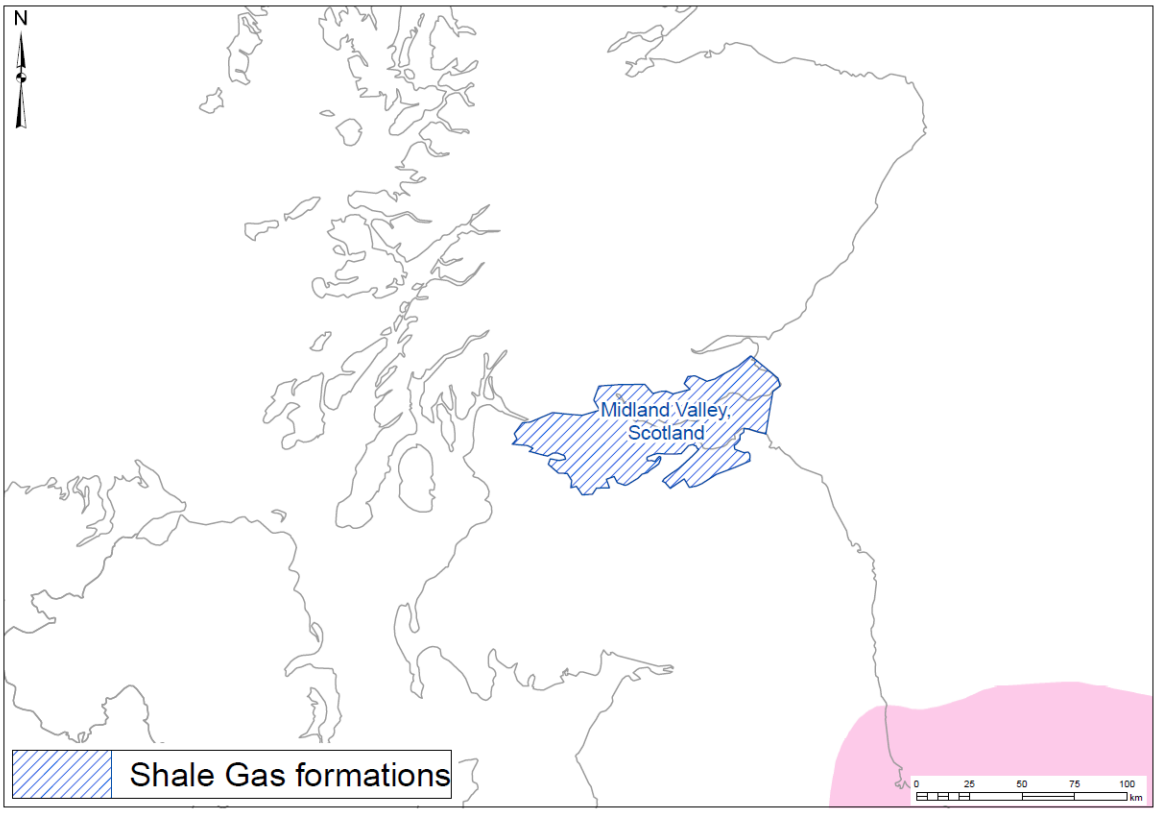

Figure A123 Overview map of the location of assessed formations

Table A157 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1071	***Success factors***
Mapping status	Good
Sedimentary variability	High
Structural complexity	High
Data availability	Good
HC system	Possible
Maturity variability	High
Depth	Shallow to Average
Mineral composition	Unknown to Poor

1072	***Success factors***
Mapping status	Good
Sedimentary variability	High
Structural complexity	High
Data availability	Good
HC system	Possible
Maturity variability	High
Depth	Shallow to Average
Mineral composition	Unknown to Poor

1073	***Success factors***
Mapping status	Good
Sedimentary variability	High
Structural complexity	High
Data availability	Good
HC system	Possible
Maturity variability	High
Depth	Shallow to Average
Mineral composition	Unknown to Poor

1079	***Success factors***
Mapping status	Good
Sedimentary variability	High
Structural complexity	High
Data availability	Good
HC system	Possible
Maturity variability	High
Depth	Shallow to Average
Mineral composition	Unknown to Poor

Limestone Coal Formation – 1071

Table A158 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	1	1	1	No	-	NO

No calculations will be performed as too little data is available.

West Lothian Oil Shale unit – 1072

Table A159 Summary of the classification according to assessment step 3 for the individual assessment units.

	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	1	1	1	2	Gas and oil	2

Table A160 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

UK_1072	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=7.5%		2943	Normal	NGS, Class 3a, GIS
Thickness (m)	0	1915	451	Triangular	NGS, GIS, N/G 10% gas 30% oil
Depth (m)	804	4505	1050	Triangular	NGS, GIS
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	84	302	103	Triangular	TNO
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	1157	6418	1507	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.55	2.65	2.6	Triangular	NGS
Temperature (°C)				Triangular	TNO, temp gradient 31c/km

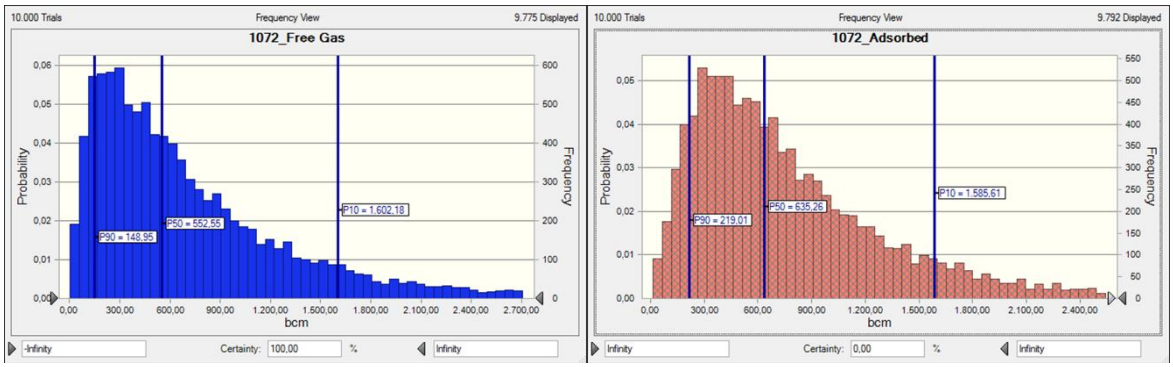

Figure A124 Results from GIIP calculations of Free Gas and Adsorbed Gas

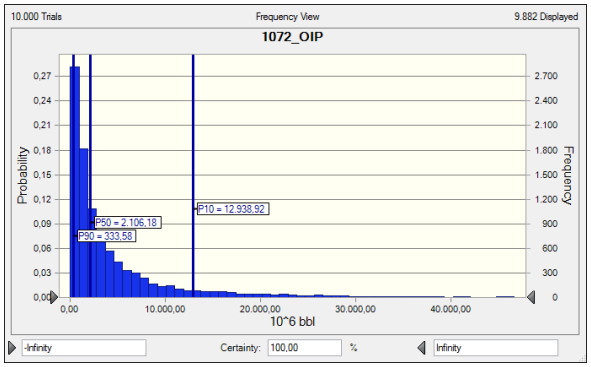

Figure A125 Results from the OIIP calculation

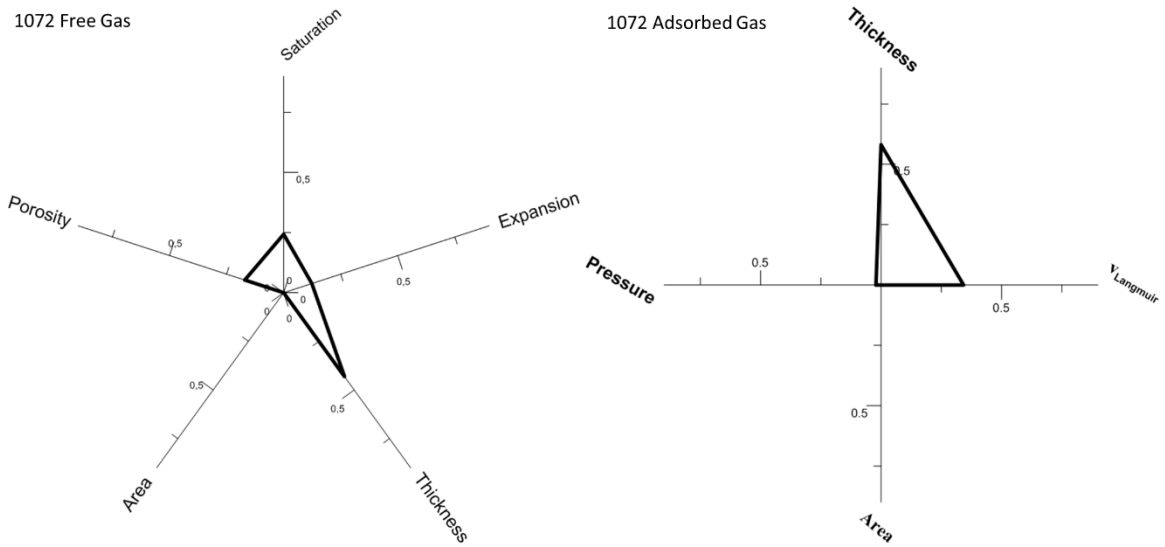

Figure A126 Sensitivity analyses results of the free gas and adsorbed calculations.

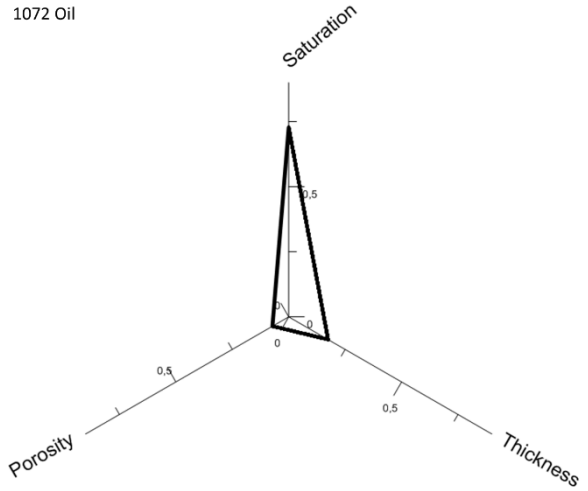

Figure A127 Sensitivity analyses results of the oil in place calculation

Lower Limestone Formation – 1073

Table A161 Summary of the classification according to assessment step 3 for the individual assessment units.

1079	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	-	1	1	1	No	-	No

No calculations will be performed as too little data is available.

Gullane Unit – 1079

Table A162 Summary of the classification according to assessment step 3 for the individual assessment units.

1079	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	123	1	1	1	1	oil	1

Table A163 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

UK_1079	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=7.5%		4378	Normal	NGS, Class 3a, GIS
Thickness (m)	0	191	54	Triangular	NGS, GIS, N/G 10%
Depth (m)	809	5469	1570	Triangular	NGS, GIS
Porosity (%)	1.5	11.8	4.88	Triangular	EU
Saturation gas	0.03	0.67	0.28	Triangular	EU
Saturation oil	SD=0.083		0.044	Log normal	EU
Expansion Factor (Bg)	80	275	149	Triangular	TNO
Bo (oil)	0.85	1.01	0.98	Triangular	EU
Pressure (psi)	1164	7788	2246	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2.55	2.65	2.6	Triangular	NGS
Temperature (°C)	35	59	180	Triangular	TNO, temp gradient 31c/km

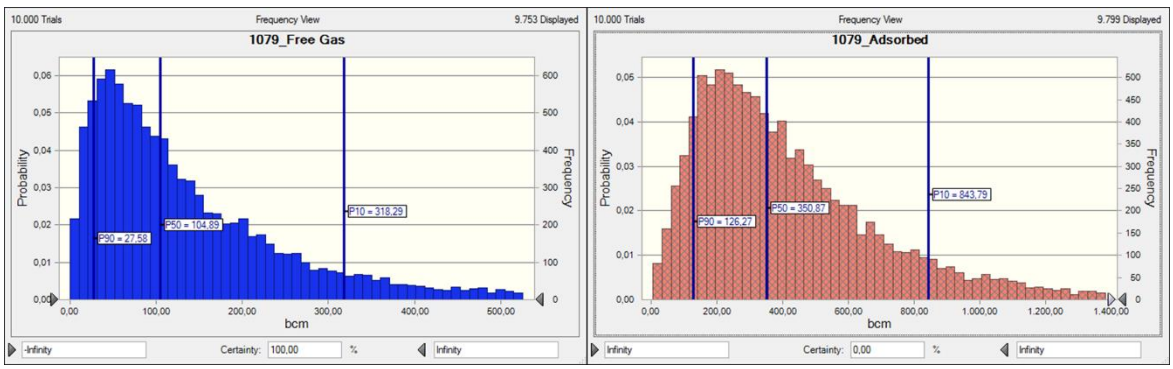

Figure A128 Results from GIIP calculations of Free Gas and Adsorbed Gas

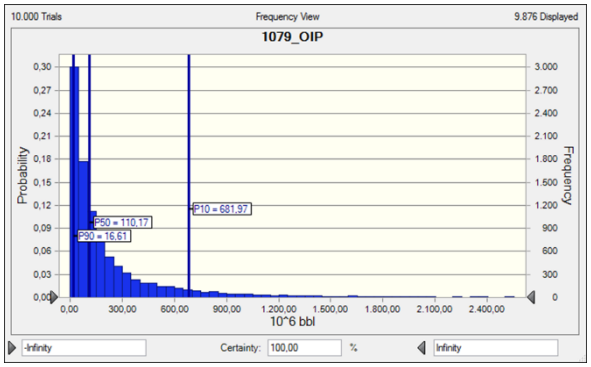

Figure A129 Results from the OIIP calculation

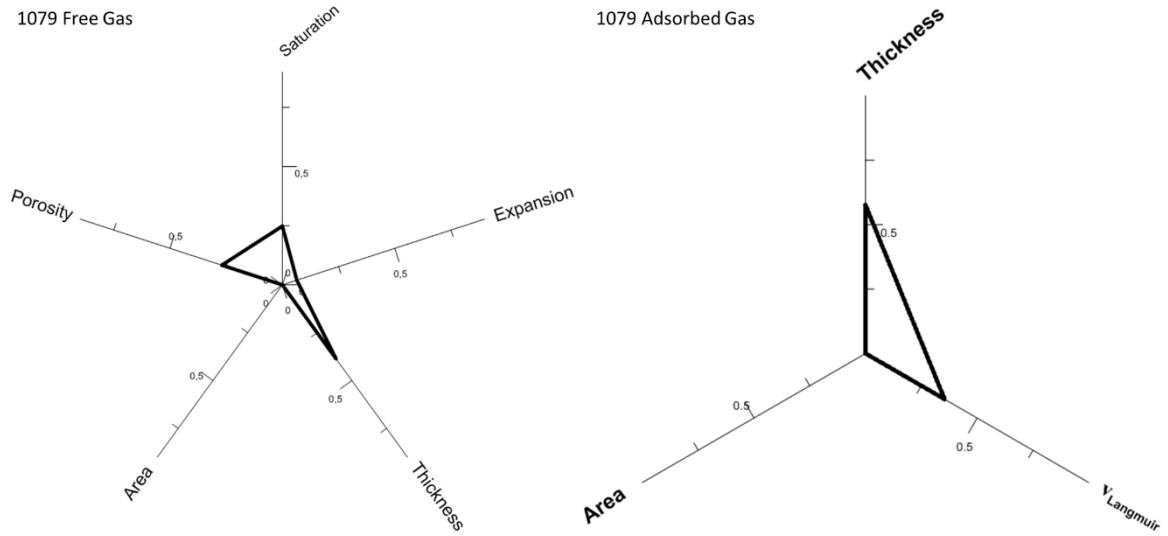

Figure A130 Sensitivity analyses results of the free gas and adsorbed calculations.

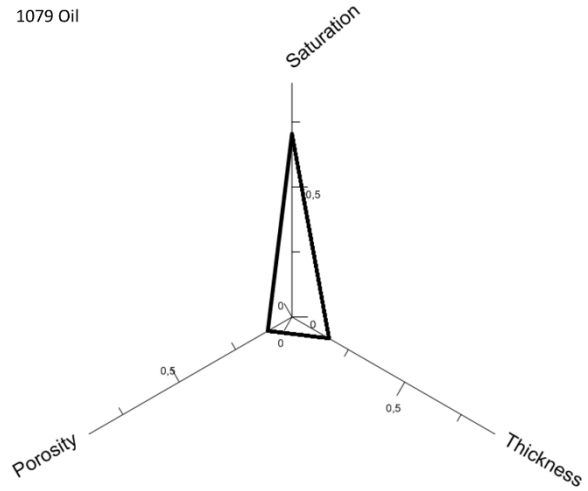

Figure A131 Sensitivity analyses results of the oil in place calculation

Results

Table A164 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
West Lothian Oil Shale unit-1072, Adsorbed	UK	219.01	**635.26**	1585.61
West Lothian Oil Shale unit-1072, Free Gas	UK	148.95	**552.55**	1602.18
Gullane Unit-1079, Adsorbed	UK	126.27	**350.87**	843.79
Gullane Unit-1079, Free Gas	UK	27.58	**104.89**	318.29
Total GIIP for Basin T10			**1643.57**	

Table A165 Overview of the results of the OIIP calculation

Shale	*Country*	*P90*	*P50 (10^6 bbl)*	*P10*
West Lothian Oil Shale unit-1072, Oil	UK	333.58	**2106.18**	12938.92
Gullane Unit-1079, Oil	UK	16.61	**110.17**	681.97
Total OIIP for Basin T10			**2216.35**	

B01 - Transilvanian Basins – Neogene Shales

Index	Basin	Country	Shale(s)	Age	Screening-Index
B1	Transilvanian Basins	RO		Neogene	1041
		RO		Neogene	1042

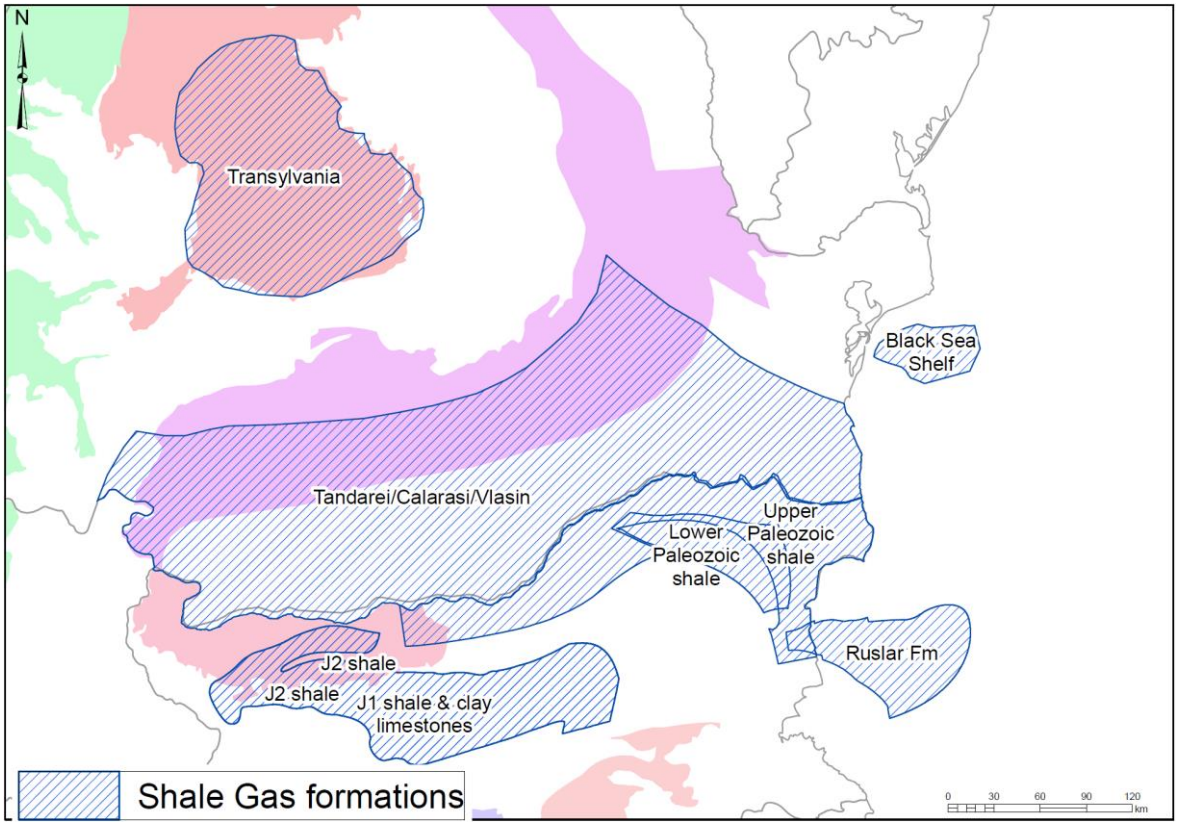

Figure A132 Overview map of the location of assessed formations

Table A166 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1041	***Success factors***
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Poor
HC system	Possible
Maturity variability	Biogenic
Depth	Average to deep
Mineral composition	No data

1042	Success factors
Mapping status	Moderate
Sedimentary variability	Moderate
Structural complexity	Moderate
Data availability	Poor
HC system	Possible
Maturity variability	Biogenic
Depth	Average to deep
Mineral composition	No data

Biogenic shale Romania 1041

Table A167 Summary of the classification according to assessment step 3 for the individual assessment units.

1041	Object ID	Depth	Maturity	TOC	Thickness	Gas/Oil	Class
Onshore	135	1	2	2	1	biogenic	2

Table A168 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

RO_1041	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		18649	Normal	NGS, GIS, Class 4a
Thickness (m)	SD=35		50	Log normal	TNO, NGS maps with N/G 1(
Depth (m)	550	4400	1400	Triangular	TNO, literature
Porosity (%)	1,5	11,8	4,88	Triangular	EU
Saturation gas	0,03	0,67	0,28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	47	305	137	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	796	6269	2004	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2,1	2,71	2,45	Triangular	EU
Temperature (°C)	26,5	142	52	Triangular	TNO, NGS gradient

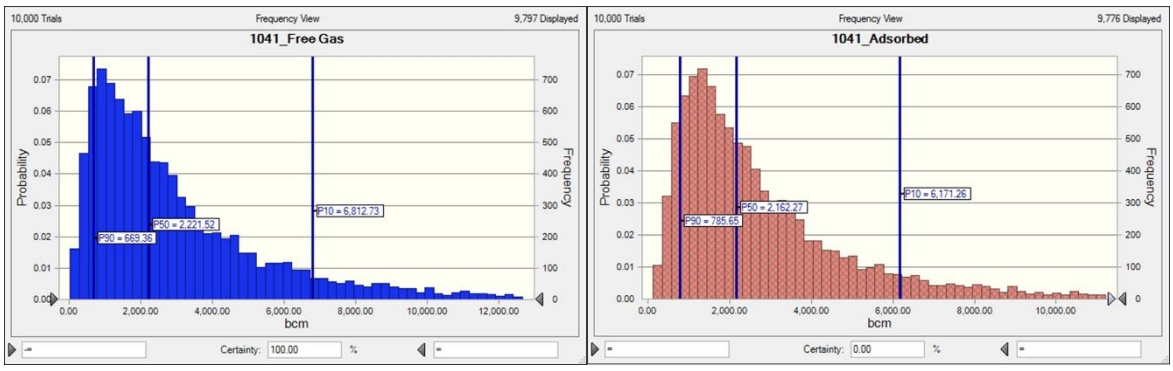

Figure A133 Results from GIIP calculations of Free Gas and Adsorbed Gas

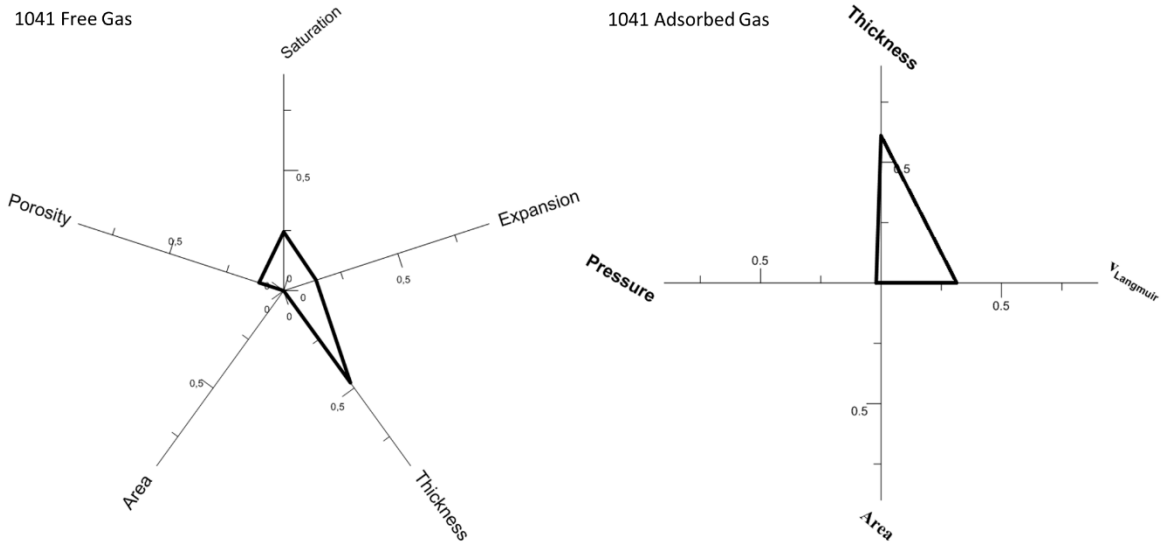

Figure A134 Sensitivity analyses results of the free gas and adsorbed calculations.

Biogenic shale Hungary 1042

Table A169 Summary of the classification according to assessment step 3 for the individual assessment units.

1042	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	124	1	2	2	1	biogenic	2

Table A170 Overview of the input data used for the assessment of the GIIP/OIIP and the source of that data (NGS, TNO, EU analogue - EU, US analogue - US)

RO_1042	Min	Max	Mean	Dist. Curve	Source
Area (km2)	SD=10%		18649	Normal	NGS, GIS, Class 4a
Thickness (m)	SD=25		30	Triangular	TNO, NGS maps with N/G 1(
Depth (m)	0	2200	500	Triangular	TNO, literature
Porosity (%)	1,5	11,8	4,88	Triangular	EU
Saturation gas	0,03	0,67	0,28	Triangular	EU
Saturation oil	-	-	-	-	-
Expansion Factor (Bg)	1	205	44	Triangular	TNO
Bo (oil)	-	-	-	-	-
Pressure (psi)	14,5	3142	725	Triangular	TNO, hydrostatic
Langmuir Pressure (psi)	SD=450		1230	Log normal	EU
Langmuir Volume (scf/ton)	SD=34		69	Log normal	EU
Density (g/cm3)	2,1	2,71	2,45	Triangular	EU
Temperature (°C)	10	76	25	Triangular	TNO, NGS gradient

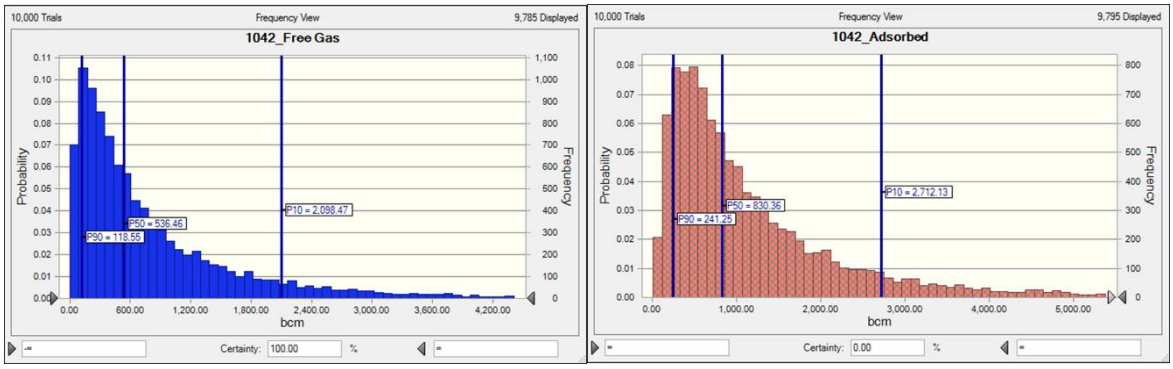

Figure A135 Results from GIIP calculations of Free Gas and Adsorbed Gas

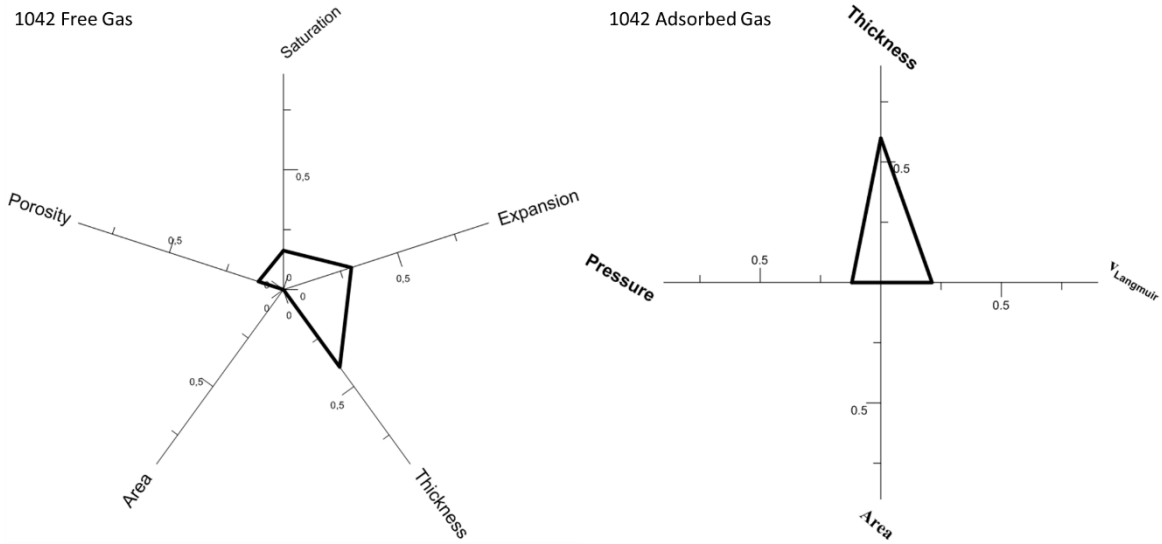

Figure A136 Sensitivity analyses results of the free gas and adsorbed calculations.

Results

Table A171 Overview of the results of the GIIP calculation

Shale	*Country*	*P90 (bcm)*	*P50 (bcm)*	*P10 (bcm)*
Biogenic shale-1041_Adsorbed	RO	785.65	2162.27	6171.26
Biogenic shale-1041_Free Gas	RO	669.36	2221.52	6812.73
Biogenic shale-1042_Adsorbed	RO	241.25	830.36	2712.13
Biogenic shale-1042_Free Gas	RO	118.55	536.46	2098.47
Total Biogenic GIIP for Basin B1			**5750.62**	

B02 – Fennoscandian shield – Alum Shale

Index	Basin	Country	Shale(s)	Age	Screening-Index
B2	Fennoscandian shield	S	Alum shale	Cambrian-Ordovician	1017

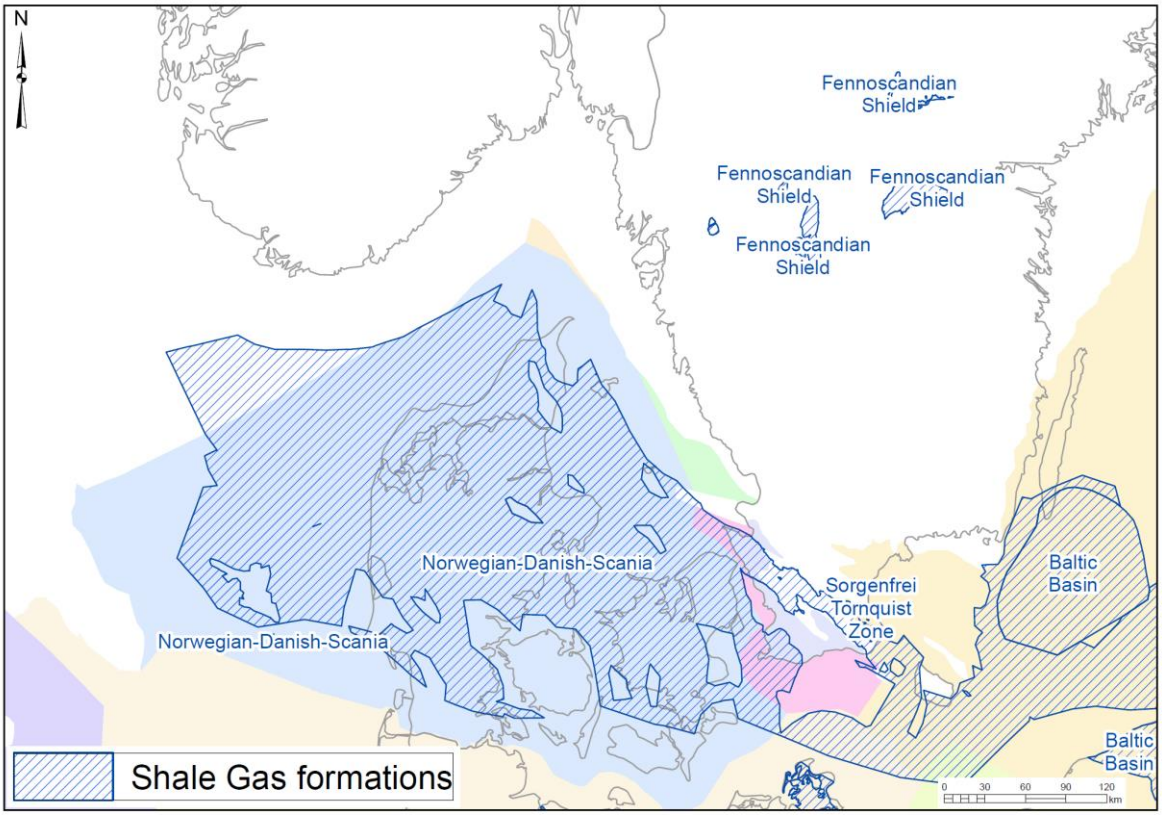

Figure A137 Overview map of the location of assessed formations

Table A172 Summary table of the general chance of success factors as extracted from the geological description of the formation (Assessment step 1, see T4b).

1017	***Success factors***
Mapping status	Moderate
Sedimentary variability	Low
Structural complexity	High
Data availability	Moderate
HC system	Possible
Maturity variability	Moderate
Depth	Shallow
Mineral composition	Unknown

The second biogenic basin and its formation, the Alum shale of the Fennoscandian shield, is so small that it is not calculated at this point. The formation does show some potential with TOC of 11% on average, but a too small area.

Table A173 Summary of the classification according to assessment step 3 for the individual assessment units.

1017	*Object ID*	*Depth*	*Maturity*	*TOC*	*Thickness*	*Gas/Oil*	*Class*
Onshore	111, 112, 1113	2	2	1	no	biogenic	No

No calculations will be performed as the formation is too thin.