

The perspective of the chemical industry on the Polish Gas Hub?

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Is there any rationale for a gas hub in Poland? With one of the lowest consumption of natural gas in the EU per capita (448 m³ per person in 2012), an energy sector based on coal/lignite and with the unexpected possibility (see fig.1.) for a shale revolution the future is bright. In addition, the cleanest source of carbon & hydrogen is generally used for the heating households (see fig.2.) and rarely as a fuel for CHPs while its main industrial use is as a hydrogen feedstock for fertilizers and the petrochemical industry(see fig.4.).

“The fertilizer industry is the largest single sectoral user of natural gas amongst the EU’s manufacturing sectors, and as such the European nitrogen fertilizer industry applauds the EU institutions’ continued drive to establish a truly world competitive EU single energy and gas market.

EU manufacturing, however, requires greater urgency and speed from the EU authorities in delivering a competitive and efficient energy market across Europe. Europe is typically up amongst the world’s highest energy cost regions and as a result must improve all sources of supply to the market including access to LNG and shale gas”. This quotation comes from www.fertilizerseurope.com with whom the Polish Chamber of Chemical Industry used to cooperate. So let’s try to understand: “D’où venons nous? Que sommes nous? Où allons nous?” (Where do we come from? What are we? and Where are we going?)

Economy

According to the International Monetary Fund Poland’s economy is doing quite well in comparison to the rest of the European Union. The

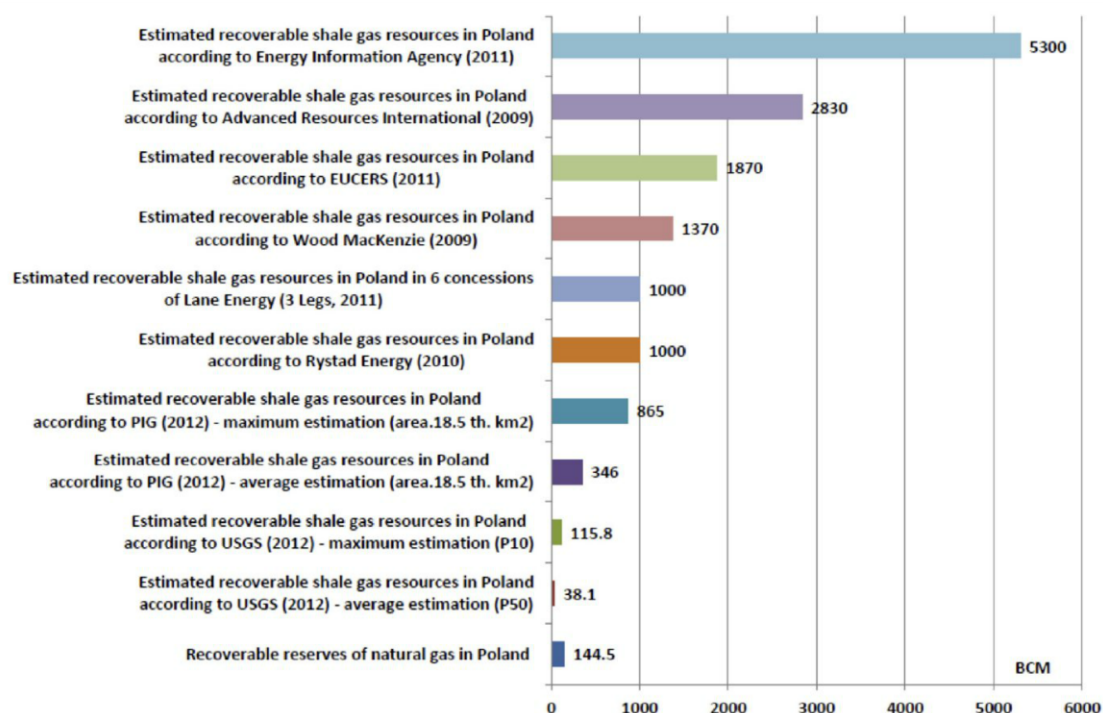


Fig. 1. Shale gas - How much do we have?

Source: Kaliski M., Krupa M., Sikora A., „Forecasts and/or scenarios, including quantification of the distance, timing and costs”. (Tytuł polski: “Prognozy i / lub ich scenariusze, w tym kwantyfikacja obszaru prognozowania, czasu i kosztów”). Arch. Min. Sci., Vol. 57 (2012), No 2, p. 423–439

1 Kaliski M., Nagy S., Siemek J., Sikora A., Szurlej A., “NATURAL GAS IN POLAND AND IN THE EUROPEAN UNION” Tytuł polski: „Gaz ziemny w Polsce I w Unii Europejskiej” Archives of Energetics. Archiwum Energetyki. TOM XLII 2012 Nr 1 PL ISSN 0066-684X. Str. 93-109. Gdańsk 2012.

2 <http://www.indexmundi.com/map/?v=137000> Accessed on 02/02/2013.

3 Siemek, J., Kaliski, M., Janusz, P., Sikora, S., Szurlej, A., 2011 – Wpływ shale gas na rynek gazu ziemnego w Polsce. Rynek Energii nr 5, ss. 118–124. (Impact of shale gas on the natural gas market in Poland. Energy Market No. 5, pp. 118-124.)

in million cubic meters	2005	2006	2007	2008	2009	2010	2011
Oil and gas upstream	24	107	102	104	125	195	215
Mining	115	42	44	50	43	68	67
Manufacturing industry for fuel purposes, including:	3971	4078	4399	4265	4256	4618	4860
Non-metallic mineral products industry	1095	1158	1141	993	1163	1209	1187
Refining industry	661	708	861	819	787	909	1134
Basic metal production industry	821	788	836	747	640	657	685
Food industry	498	517	574	558	581	596	609
Chemicals industry (fuel purposes)	198	193	255	208	258	341	410
Paper industry	49	70	115	157	147	159	144
Other branches	648	645	617	784	681	746	691
Manufacturing industry for non-fuel purposes (chemical industry)	2400	2335	2328	2340	1846	1956	2206
Construction	34	33	46	43	54	53	42
Transport (including pipelines)	349	445	435	473	422	399	354
Energy (utilities)	1512	1416	1320	1339	1344	1338	1416
Water supply	23	25	26	29	17	20	22
Agriculture	30	35	52	53	44	42	43
Commercial sector	1678	1677	1720	2057	1957	2055	2032
Households	3793	3888	3730	3695	3786	4182	3806
Natural gas industry own consumption (nitrogen removal and distribution)	189	249	201	152	115	168	55
Losses and statistical difference (storage)	261	192	172	167	171	10	-19
Total country	14380	14523	14575	14767	14181	15105	15098
Average low heating value for 1 CM in MJ	35,62	35,67	35,55	35,57	35,61	35,49	35,60

Fig.2. Natural gas consumption in Poland (source: ISE calculation based on Central Statistical Office data)

Fund predicted that in 2010 Polish GDP was to increase some 3.4% and by another 3.7% in 2011. "Poland's economy performed well throughout the crisis, due to very strong economic fundamentals and effective counter-cyclical policies. Nevertheless, Poland's strong trade and financial links to Europe continue to make it vulnerable to potential shocks from the region. Its status as a "gate-keeper" economy for Eastern Europe and its relatively deep and liquid financial markets make it susceptible to a retrenchment in global risk appetite" [...]. Poland is one of the biggest primary energy producers in the European Union (8.0% share in 2010); among other EU member states more primary energy is produced only in the United Kingdom, France, Germany and Netherlands.

Energy generation/consumption

During the last 10 years in Poland primary energy (PE) consumption was almost stable, while production systematically decreased. A relatively slow decrease in PE consumption was accelerated significantly in 2007, and in 2008 production fell below 3000 PJ, continuing to fall in 2009. In contrast, total energy consumption amounted to 4,410 PJ in 2011. The most important energy carrier is hard coal, accounting for 62% of PE in 2011. The structure of primary energy production and consumption is presented in figure 3.

According to the report "Polish Energy Policy until 2030 [PEP]" the Polish energy sector will be still dominated by coal and the role of

Primary energy production in 2011

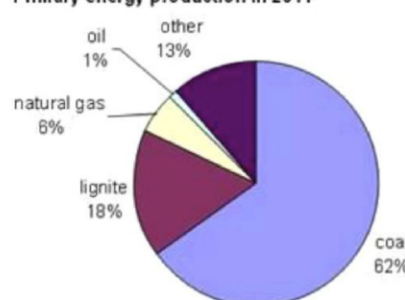


Fig.3. Primary energy production in 2011 in Poland (source: Central Statistical Office data)

natural gas in generation of electric energy is to be marginal (below 7% share in 2030, currently 3.5%) even in the future. This is mostly derived from the angle of energy security – large domestic resources of coal make it much "safer" fuel than imported natural gas. However, the discovery of large natural gas (shale) deposits should change this point of view dramatically – gas would be as safe as coal, but much more environmentally friendly. Large volume of domestic natural gas production is one of the necessary (but not sufficient) preconditions to start large scale base-load power generation.

4 World Economic Outlook Database-October 2012; International Monetary Fund. Accessed on 02/02/2013

<http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx>,

<http://www.imf.org/external/pubs/ft/scr/2013/cr1321.pdf>

5 http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_production_and_imports Accessed on 02/02/2013

6 http://www.mg.gov.pl/files/upload/8134/Polityka%20energetyczna%20ost_en.pdf Accessed on 02/02/2013

Pillar of the Polish Energy Policy

There are two pillars of the Polish Energy Policy. The first pillar is the dominant role of coal (lignite and hard coal), while the second one is an obligation arising from EU climate policy. On this basis the authors of the PEP have calculated the total amount of renewable generation required. In addition, the possibility of biomass and biofuel production was evaluated and the remaining value was allocated to wind energy and nuclear energy. Finally, the remaining energy production was allocated to natural gas, explaining why natural gas makes up only 14.5% of total primary energy, and 6.6% in electricity production in 2030. However, the authors did not mention the new possibility of domestic shale gas production.

The switch from coal to natural gas can be done in a relatively easy and "natural" way, taking into consideration the future scale of necessary investments in the energy generation sector. Poland plans to close down approx. 14.5 GW (out of 35 GW) of existing generating capacity in base load power plants by 2030. Surprisingly, natural gas is to replace only 600 MW. However, taking into consideration probable influence of a shale gas revolution and especially CO₂ emission costs gas fired energy generation should be cheaper than coal fired. Therefore we would expect significant growth of natural gas based generation, and our perception is supported by the Polish market: there are about around 10 gas-fired power plants currently discussed, and no one plans to build new hard coal- or lignite-fired power plants in Poland.

Natural gas market

Total gas consumption in Poland in 2012 amounted to about 14.9 bcm. Approx. 2/3 of natural gas is imported, and 1/3 is produced domestically. The most important portion of imported gas is of Russian origin; in 2010 Poland has signed an agreement with Gazprom, which allows for an import of approx. 10 bcm per year between 2012 and 2022.

As in most of the other natural gas market areas final customers are supplied mostly by POGC Group companies (six regional division but starting from 2013 one distributor DSO) with a market share of approx. 97%, while the remaining 3% comes from small independent companies.

Infrastructure

According to the Energy Law there is only one transmission system operator in Poland which is GAZ-SYSTEM S.A. and also an owner of the Polish natural gas transmission grid. There is also a one transit pipeline – Yamal, owned by EuroPolGaz, however Gaz-System is its operator since 2011. Approximately 97% of the total length of the distribution system belongs to POGC; while the remaining 3% is in hands of above-mentioned independent companies or other local distributors. The transmission system in Poland is primarily aimed at transport of gas from the eastern border (mostly south-east) to the western and northern parts of the country. Currently, Poland has few connection points with neighboring countries including entry points, allowing import of natural gas from: Belarus and Ukraine (four entry points with total capacity of

1.3 mcm/h); Germany (180 tcm/h); and the Czech Republic (with initial annual capacity of 0.5 bcm). Additional import capacity is provided via the Yamal pipeline, with two entry points in Poland (total capacity of 620 tcm/h). Almost all of the import capacity is booked by POGC and there is still lack of mechanisms allowing for the release of unused capacity, this being one of the major obstacles preventing other entrepreneurs from importing natural gas. At the moment Gaz System is carrying out a large investment program aiming at reducing system bottlenecks and operating costs, ensuring: security of gas transmission, connection of new entities and increase of transmission capacities. The most important investments are implemented due to a construction of the LNG regasification terminal in Świnoujście.

Tariffs

All prices in the natural gas market in Poland (both fuel itself and logistic services) are regulated in the form of tariffs accepted by the Regulator. In spite of the announcement of the first trade on the Natural Gas Exchange in Poland on Dec., 20th. 2012, a natural gas wholesale market still does not exist. In consequence there is no market liquidity and commercial transactions are carried out only within the framework of long term or open-ended bilateral contracts. The President of the Energy Regulatory Office (the Regulator) is a central body of state administration dealing with the energy market (including natural gas) as well as promoting competition. Tariffs are usually approved on the yearly basis. According to EU regulations Poland had an obligation to introduce the entry-exit tariff system in 2011. However it is not expected that the new system will significantly change the current structure of payments for transmission services. In case of gas distribution and supplies tariffs define: customers groups and group selection criteria; tariff rate and subscription fee, principles of the monthly payment calculation.

Future - forecasts

There are two basic forecasts covering majority of issues regarding the Polish energy sector, including natural gas. These are: the Energy Market Agency, (EMA) prognosis and EU one (PRIMES). While the bases for both prognoses are slightly different, results also differ, in some cases – substantially. EMA forecasts (base of the Polish Energy Policy) expect huge growth of renewable energy generation to reach 12.5% of total demand in 2030, as a result of EU climate package implementation. With regards to natural gas demand both prognoses expect an increase of consumption level, from today's 14 bcm to 16-19 bcm in 2030. But – and this is the most important factor discussing future consumption of natural gas – all existing forecasts are based on today's consumption structure and today's trends (coal as the dominant fuel). Therefore, we have to ask the key question - what volumes of natural gas can be absorbed by the Polish economy in case that gas is available domestically and its price is attractive in comparison to other energy carriers? Considering the potential of shale hydrocarbons in Poland, one raises other questions, i.e. what to do with shale gas findings in the short- and long-term?

7 POGC – Polish Oil and Gas Company – (pol. Polskie Górnictwo Naftowe i Gazownictwo S.A.) – www.pgnig.pl

8 <http://en.gaz-system.pl/> see also article : March 2013 edition ENERGY DELTA INSTITUTE

9 <http://www.bloomberg.com/news/2012-12-20/poland-exchange-traded-natural-gas-begins-at-4-9-premium-to-ttf.html>

10 URE www.ure.gov.pl

11 Kaliski M., Krupa M., Sikora A., "Entry-Exit tariff system in Poland versus analysis of the situation with the Yamal pipeline". MONOGRAFIA "Dilemmas of the contemporary economy facing global changes" Edited by Jarosław Kaczmarek, Tomasz Rojek str. 747 i dalsze ISBN 978-83-62511-51-8 Cracow University of Economics 2012.

12 Albrycht I., Boyfield K., Jankowski J.M., Kaliski M., Kolaczkowski M., Krupa M., Ndiolou Z., Lewis G., Perry K.F., Poprawa P., Rewald P., Riley A., Ruszel M., Rychlicki S., Siemek J., Sikora A., Smith T., Szlagowski P., Tarnawski M., Zawisza A., Editor: Izabela Albrycht. „Unconventional Gas – a Chance for Poland and Europe? Analysis and Recommendations.” Edition completed: June 2011 The Kosciuszko Institute 2011. ISBN: 978-83-931093-5-7

13 See chapter on tariffs.

Wholesale market regulations

Poland is significantly different from the others EU countries than other EU countries: most EU members adopted a solution preserving regulated prices for small customers (households and small companies) and abolishing regulations for medium and large customers, while some have completely abolished regulation and approval of natural gas prices by regulators.

In contrast, Poland decided to regulate prices in the wholesale gas trade as well and as a result there is no market liquidity and commercial transactions are not carried out on natural gas exchanges or in trade hubs but only within the framework of long term or open-ended bilateral contracts. Considering this, the breakdown into wholesale and retail segments of natural gas sales is rather irrelevant at the moment.

We expect that there is one necessary (but maybe not sufficient) precondition to the origination of the wholesale market in Poland the emergence of new natural gas suppliers, delivering gas with non-Russian origin. Such an event would significantly change the balance of the market (without that Poland was paying to Gazprom 526 USD per 1000 m³ in 2012 of natural gas in comparison to 379 USD paid by Germany). Particularly with the appearance of indigenous gas (having in mind that production costs of domestic gas could be 2-3 times lower than the price of imported Russian gas) we would expect the Regulator to change their policy towards the future shape of the market, which may allow for the creation of a real wholesale natural gas market in Poland.

Finally, it is worth mentioning that according to current tariff regulations companies dealing with natural gas trade are obliged to calculate the gas sales price for customers in Poland as a weighted average of purchase prices (which in the case of Poland means POGC's import prices) and the costs of producing natural gas from their own sources. Provided that POGC's natural gas production costs from domestic sources are 2-3 times lower than gas prices in import contracts, the tariff calculation methodology causes domestic gas prices to be determined at a level below the attainable prices of imported natural gas. This would make other potential market new-comers incapable of competing¹⁴. The only



Fig.4. Map of ammonia and urea plants in Poland. (source: ISE own work)

solution is either development of domestic independent gas outside of the POGC Group or deliveries to Poland of non-Russian or non-GAZPROM origin natural gas with a price lower than the current import price.

Ammonia and urea plants including existing and proposed feedstock types.

Fertilizers and intermediates for fertilizers are produced in ten plants in Poland and a number of smaller plants exist for special types of fertilizer.¹⁵ In addition, five large ammonia plants exist in Poland (Fig. 4).

Ammonia production in all Polish plants is based on natural gas steam reforming technology (ZCh. Police, Anwil, Azoty Tarnów) and natural gas partial oxidation technology (ZA Puławy, ZA Kędzierzyn)

Plant	Ammonia production capacity in th. tons/year	GJ per ton of NH ₃ (LHV)	Natural gas per ton of NH ₃ (m ³ /ton)	Theoretical gas consumption for NH ₃ in million m ³	Ammonia production in 2010 in th. tons	Ammonia production in 2009 in th. tons	Ammonia production in 2008 in th. tons	Natural gas consumption* 2011 in million m ³	Natural gas consumption* 2010 in million m ³	Natural gas consumption* 2009 in million m ³	Natural gas consumption* 2008 in million m ³
Zakłady Azotowe Puławy	1130	29,5	820	927	811	835	680	1000	1000	800	800
Zakłady Chemiczne Police	560	32,0	890	498	293	247	470	400	300	300	500
Anwil	520	31,5	875	455	373	407	502	500	400	400	600
Zakłady Azotowe Kędzierzyn	384	32,0	890	342	391	333	367	300	300	300	400
Azoty Tarnów	240	32,0	890	214	191	179	191	200	200	100	100
TOTAL	2834	31,4	873	2435	2059	2001	2210	2400	2200	1900	2400

Table.1. Ammonia plants in Poland: ammonia production capacity, production volume and gas consumption in 2008-2010. (source: Company data, ISE estimations)

¹⁴ This is one of the reasons why Poland remains a closed market, practically disconnected from the markets of other EU countries.

¹⁵ <http://grupaaazoty.com/en/>

Currently¹⁶ domestic capacity of existing ammonia plants is equal to 2.83 million tons of NH₃ per year. Capacity utilization was at the level of 91% in 2007, then dropped to 73% in 2009 and 77% in 2010. We expect that capacity utilization will remain at the same level in next years, which means 1.83-1.95 billion m³ of natural gas demand for ammonia production only and 2.1 - 2.2 billion m³ of total natural gas consumption in the five plants mentioned in Table 1.

After the construction of an air separation unit and intensification of ammonia and urea production in ZA Pulawy (at total cost of nearly half a billion PLN) we do not expect any major investments in capacity expansion for ammonia production in Polish plants.

Proposed and planned petrochemical and chemical (other than fertilizers) facilities (location, facility type, capacity, alternative fuels/feed-stock, efficiency).

Chemical and petrochemical sector

In 2011 employment in the Polish chemical industry was 245,000, 10,000 more than in 2010, while total revenues increased from PLN 102.6 billion to PLN 116.9 billion. This revenue growth has been observed in pharmaceutical products, rubber and plastic products and all chemicals and chemical products except the production of soaps and detergents.

In 2011 gross turnover profitability rate in the production of chemicals and chemical products increased to 7.8% (from 6.3%). The production of pharmaceutical substances and medications decreased to 7.8% (from 9.5%). Profitability decrease has been observed in the production of rubber and plastic products, from 5.1% to 4.6%.

The chemical industry provides raw materials for manufacturing modern products and the use of chemicals is growing. As a result, we are observing growth in demand for plastic, rubber, paints and varnishes, and in consequence, for basic petrochemical raw materials (i.e. petroleum refining products). Unfortunately, domestic production does not satisfy current demand for these chemicals, leading to an increase in the (already high) foreign trade deficit. In 2011 the negative balance¹⁷ amounted to EUR 8.3 billion (compared to EUR 7.4 billion in the previous year) and exports in chemical industry increased to EUR 18.8 billion (from EUR 15.5 billion) and imports increased to EUR 27.1 billion (from EUR 22.8 billion).

A potential natural gas consumption growth.

Now let us try to assess potential natural gas consumption growth in the area of fertilizers production – the largest non-energy application of gas. Being a source of hydrogen natural gas may account for 80-90% of total cost of fertilizers ammonia production, depending on technology applied.

		2006	2007	2008	2009	2010	2011	3Q 2012
Ammonia production	thous. t	2 434	2 417	2 417	1 958	2059	2172	1922
Installed capacities	thous. t	2 920	2 920	2 920	2 920	3100	3100	3100
Effective capacities*	thous. t	2 680	2 680	2 680	2 680	2843	2843	2843
Utilization rate	%	83%	83%	83%	67%	66%	70%	62%
Effective utilization rate	%	91%	90%	90%	73%	72%	76%	68%
Nitrogen fertilizer production in nitrogen equivalent	thous. t	1 707	1 818	1 692	1 503	1692	1785	1580
Export of nitrogen fertilizers	thous. t in N of product	536	632	547	245	410	323	287
Share of export in total production	%	31%	35%	32%	B.D.	B.D.	B.D.	B.D.
Natural gas consumption to ammonia and nitrogen fertilizers production***	mcm [bcf]	2166	2151	2151	1743	1833	1933	1711

Table.3 Ammonia and nitrogen fertilizer production in Poland in 2006-20. (source: Own calculations based on Production of main industrial products I-XII 2009 published by Central Statistical Office, Annual Report for 2009 of Polish Chamber of Chemical Industry, Polish Customs data for 2007-2008, and Best Available Techniques (BAT) Guidelines for the Chemical Industry in Poland: Large Volume Inorganic Chemicals - Ammonia, Acids and Fertilisers Industries prepared on the order from Ministry of Environment, September 2005.

* Effective capacities were calculated assuming a 30-day plant shutdown per year.

** Foreign trade turnover by commodities 2011 – Central Statistical Office

*** Own calculation assuming average gas consumption of 31 GJ per one ton of NH₃ (average value derived from capacities based on conventional steam reforming and partial oxidation).

16 After Zakłady Azotowe Pulawy expansion in April 2010 from 960 th. tons to 1130 th. tons per year

17 Data for 2009 are initial estimations by the Ministry of Economy.

The crisis in the fertilizer market was clearly visible in 2009, where a strong decline of 21% was observed in ammonia production. This has resulted in significantly lower demand for natural gas from fertilizer manufacturers from the level of 2.2 bcm to merely 1.8 bcm per year. Maximum potential demand for gas of all ammonia plants amounts to 2.66 bcm per year, however due to maintenance reasons and temporary shutdowns, a 100% effective utilization rate matches gas consumption of 2.45 bcm per year.

Mineral fertilizer (NPK¹⁸) consumption in Poland per hectare of cultivated area amounts to 132.6 kg, compared to 140 kg in Germany, 200kg in Netherlands, 115kg in the Czech Republic, 120 kg in France, 125 kg in Lithuania and only 30 kg in Romania¹⁹. Nitrogen fertilizers account for 53.3% share of all mineral fertilizers. Therefore, the growth potential on the domestic market is not impressive. Additionally installed supply capacities are bigger than domestic demand, which result in substantial export amounting to 30% of total production volume. Unfortunately, recently mispriced natural gas on the Polish market, in relation to spot prices in Europe, resulted in a significant decline of competitiveness of fertilizer manufacturers in Poland which was clearly visible in capacity utilization rates for 2009. In case that decline in production appears permanent (no release of the gas market), demand for gas from the chemical industry could be lower by 0.400 bcm per year. Indeed, it is rather unlikely that demand for gas from the chemical industry will soar, an optimistic scenario assumes comeback to 2006-2008 level of consumption. Therefore we see a potential annual consumption growth of approx. 0.4-0.50 bcm over this time horizon.

The remaining groups of customers consist mainly of small entities (considering volume of gas consumption), often dispersed, so efficient gas delivery to these customers will require active participation of gas distribution companies.²⁰ The author would like to draw readers attention to the fact that there are (articles available (in Polish)focusing on mentioned topic.²¹

Impact of LNG receiving terminal (infrastructure and pricing).

The first LNG terminal in Poland is under construction in Świnoujście, and to be more precise in Warszowa – which is the right bank area of Świnoujście, and about 40 km from the Nordstream entry point to Germany. In the first step of operation, the LNG terminal will allow for the off-take amounting to 5 bcm of natural gas annually. In the next step, provided sufficient demand for gas exists, there is a possibility to increase the dispatch capacity to 7.5 bcm.

In 2007 POGC established a company called Polskie LNG (Polish LNG) to build the LNG terminal. Then, by the Resolution of the Council of Ministers of August 19th 2008, gas transmission system operator Gaz-System became the owner of Polskie LNG. The technical project of the terminal was accomplished in 2009. The consortium of

Saipem S.p.A. (Italy) – Saipem SA (France) – Techint Compagnia Tecnica Internazionale S.p.A. (Italy) – Snamprogetti Canada Inc. (Canada) – PBG SA (Poland) – PBG Export Sp. z o.o. (Poland) was chosen as the General Contractor for the investment in a public tender. Construction started in September 2010 and according to the schedule the terminal will be ready for operation by 30th of June 2014.²²



Fig.7. LNG Terminal in Świnoujście. (source: www.Gaz-System.pl)

According to government strategy Gaz-System is supervising the construction of the LNG terminal, whereas POGC is responsible for the supply and transport of the liquefied natural gas to the terminal in Świnoujście. In June 2009 Gaz-System started an “open season” procedure for the LNG terminal. On the basis of binding order made by POGC, an agreement between Polskie LNG and POGC was signed in March 2010 concerning regasification and auxiliary services. As a result the terminal regasification capacity of 3.2 bcm per year was granted to POGC out of total capacity amounting to 5 bcm per year. This means that still approximately 200 thousand cm per hour (1.8 bcm per year) remains available.

In June 2009 POGC signed a contract with Qatargas Operating Company Ltd concerning LNG sales and delivery from Qatar to Poland. The agreement concerns the delivery of 1 million ton LNG per year (approx. 1.5 bcm) through 20 years starting from 2014). The beginning of deliveries is bound with planned start-up of LNG terminal. Deliveries are to be realized by Qatargas on an ex-ship basis, utilizing 217 thousand cu. m capacity Q-Flex type ships. According to the reliable sources of information a price formula is set in a way that makes the Qatargas contract the most expensive natural gas in Poland, with price approx. 30% higher (before regasification) than “Gazprom” gas.

¹⁸ NPK – nitrogen, phosphorus and potassium (potash).

¹⁹ Zalewski A., Supply-demand balances on the world and domestic mineral fertilizers market in 2008, Scientific Yearbook of Agrobusiness Association, Volume XI, part 3.

²⁰ It is important to notice a substantial role of oil products and LPG in Poland in the consumption structure. These energy carriers are easiest to substitute with natural gas, and their annual energy demand amounts to more than 1 bcm of high methane gas equivalent. As a result an effective potential of substitution within this group is only slightly smaller than in processing industry and may equal to 1.2 bcm of high methane gas per year (which means the rate of substitution of 30%).

²¹ Sikora A., Lubiewa – Wieleżyński W., 2009: „Surowce dla przemysłu chemicznego ich zapotrzebowanie i logistyka.” Przemysł Chemiczny czerwiec 2009 r. Krupa M., Majchrzak J., Sikora A., 2009: „Paliwo alternatywne - gaz propan-butan. Cz. 1 Przemysłowe zastosowanie propanu – butanu. LPG JAKO SUROWIEC CHEMICZNY” Chemia Przemysłowa 5/2009 Krupa M., Majchrzak J., Sikora A., 2009: „Paliwo alternatywne - gaz propan-butan. Cz. 2 Przemysłowe zastosowanie propanu – butanu. LPG JAKO SUROWIEC CHEMICZNY” Chemia Przemysłowa 6/2009

²² “Despite the reported construction delay due to the financial problems at Italy’s Saipem and Poland’s PBG, Poland expects the planned LNG terminal at Swinoujscie to be finished on time, according to Reuters. <http://www.lngworldnews.com/polish-lng-terminal-on-schedule-despite-reported-delays/> accessed on 02/02/2013.

The price formula is set as follows²³:

$$P(\text{LNG}) \text{ in USD/mbTU} = (P(\text{Brent}) \text{ in USD/bbl}) \times 0,16 + 1,00$$

That is, if a Brent crude price reaches 75 USD/bbl then LNG price will amount to: $75 \text{ USD} \times 0,16 + 1 = 13 \text{ USD/mbTU}$. In the same circumstances (i.e. the same crude price) "Gazprom" natural gas is to be priced at 10 USD/mbTU.

Taking into consideration regasification capacity and existing import contracts (Gazprom will be still dominating natural gas import) it is necessary to underline that the Świnoujście terminal will not significantly change the situation of Poland in terms of a long term contracts and diversification of gas supplies based on spot deliveries. The terminal will rather be a "peak shaving terminal", and allow for potential gas supplies in time of any "gas crisis". On a daily basis the terminal may be also utilized for supply of large gas customers in a northern Poland.

Gaz-System investment plans are tightly connected with market demands and strategic investments will be implemented in a North-Western Poland, among others: Szczecin – Gdańsk, Włocławek – Gdynia and Szczecin – Lwówek pipelines, as well as compressors station in Goleniów.

Gaz-System also intends to develop a natural gas transmission network to connect a number of new gas consumers. However, investments in a northern Poland are forced by terminal construction, as well as potential construction of interconnectors with Germany and Denmark (Baltic Pipe).

At the moment construction of the Świnoujście terminal is directly supported by following investments:

Szczecin – Gdańsk pipeline (length - 265 km, to be finalized in 2013): will allow for a direct supply of Gdańsk area from the LNG terminal, as well as second option of gas deliveries to Gdańsk, Grudziądz and Bydgoszcz.

Szczecin-Lwówek pipeline (length – 186 km, to be finalized in 2014) supported by compression station in Goleniów: will allow for supply of western and central Poland from the LNG terminal and potential Baltic Pipe.



Fig.8 Gas transmission – investments until 2015.

Source: map - Gaz System; markups – Gazoprojekt.

Conclusions

The internal profile of consumption in Poland indicate that nobody can expect a real gas hub in Poland in near future. Successful shale gas project in Poland can change such radical point of view but:

- In a very optimistic scenario, the growth potential of natural gas consumption in Poland may be more than 15 billion m³ a year. Compared with the level of current consumption, we obtain a giant increase in demand, over 100%, but in the view of production growth from 40-80 billion m³ per year, this is not a volume that would give the adequate level of comfort for potential energy investors.
- However, we should keep in mind that 100% gasification of the whole economy would be able to manage all or most of these volumes, and such a scenario is quite improbable.
- In the intermediate variant, the increase in demand for gas may be less than 5 billion m³ per year, which means that domestic market potential would constitute a significant barrier to the development of gas production from unconventional sources.
- The largest increase in demand for natural gas may come from the energy sector based today on solid fuels.
- On the basis of our knowledge regarding results of the first two boreholes (unofficial, no statements have been released) shale gas in Poland is a reality. However, its is uncertain.
- We expect the first economic assessments of the shale gas production in Poland to be determined and revealed in 2013 the earliest.
- Large scale production of shale gas in Poland would not take place before 2015-2016 and only in case that significant reserves are discovered, and all abovementioned necessary preconditions fulfilled.
- Production volumes and the economy of shale gas production – when determined – will allow assessment of the impact of domestic gas production on the Polish energy sector. Only then one will be able to foresee its influence on the future coal vs. gas energy generation.
- We do not expect any changes in Polish Energy Policy at least until 2015. After this time point shale gas may have an impact on the future energy mix. Its scale will be determined by the amount of domestic reserves and productivity of shale gas fields.
- However according to our estimations we believe that 7-10% of energy in Poland will be produced in gas-fired generators by 2020, and 15-20% by 2025.

Shale gas in the USA has dramatically changed the perception of "peak oil" and the role of hydrocarbons from unconventional resources. Technology changed the view that "conventional means cheaper". Such changes, considering predicted American self-sufficiency and "petrochemical and chemical business leakage" toward cheaper sources of hydrogen, set off warning bells for the EU, and Germany especially. "Actions at regional, national, EU and global levels are urgently required to correct any uncompetitive situation especially when it arises from unfair state fixing of energy pricing by suppliers inside or outside the EU. For natural gas in particular, and for other energy commodities, it is necessary to develop financial and physical commodity hubs that promote and encourage transparent interconnected prices. For gas, a European super-hub could supply enormous benefits to consumers²⁴."

Let the power and simplicity of natural gas raise the economy, open minds, form the base for a sustainable energy future.

²³ According to an article „Qatargas Signs HoA To Supply Polish Terminal”; www.poten.com LNG in World Market. Apr. '09 accessed on 29/04/2009 (now for subscribers only).

²⁴ A quotation comes from the www.fertilizerseurope.com