

# Energy Relations between Russia and EU with Emphasis on Natural Gas

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# Abstract

- Energy issues in general and in particular with respect to Russian gas exports play today a crucial role in political discussions covering a substantial amount of space in the press.
- This paper argues that the European strive for energy diversification at present is economically inefficient given the nearby resources and existing or committed transport network to Russia. Furthermore, this present diversification strategy will put Europe into competition with other consuming regions in the future, when the sources available for diversification turn dry.
- Hence, the current policy pursued by the EU faces a serious trade off of risking future supplies for present energy security (after all its questionable whether some of these sources are secure).
- We use the methodology based on the dynamics of gas reserves and path dependency in trade flows based on investment in pipeline infrastructure.



# Introduction 1: Russian gas

- Energy issues in general and in particular with respect to Russian gas exports play today a crucial role in political discussions. Being an economic issue, gas trade policy became increasingly politicised in 2006, following temporal interruption of gas supply to EU in January 2006.
- Almost simultaneously other events happened:
  - a) forced sales of Shell's assets in Sakhalin II to Gazprom, b) the threat of raising gas prices to international levels for former Soviet republics (now possibly including Belarus), c) new EU member Poland blocking negotiations about new agreement between EU and Russia by forcing Russia to sign Energy charter.
- These primarily energy related economic-political issues are related in the press, but possibly mixed up with Russian internal politics.



## Introduction 2: EU Energy Policy

- In March 2007, EU Council has adopted new energy policy for Europe. The document focuses on the necessity to ensure security in energy supply. If energy trends remain, Europe will be much more dependent on energy imports: by the year 2030, 84% of gas and 91% of oil will be imported. It has an ambitious objective that Europe to lead new industrial revolution that will reduce greenhouse emissions by 30%, improve energy efficiency by 20%, raise the share of renewable energy to 20% by the year 2020 [10]. The document also states EU energy solidarity in helping its members to diversify energy supply when they are highly dependent on a single supplier.



# Introduction 3: Focus of Study

- Europe's declared strategy for energy (and gas) diversification is understandable. However, it should take into account the evolving temporal pattern of gas suppliers. Here we have to distinguish between middle and long term horizon.
- In the middle term (by the year 2020) it is important to consider existing infrastructure projects (since construction of gas infrastructure is expensive and usually takes from 5 to 10 years to complete) as well as the points of geopolitical instabilities (like Iraq, Afghanistan) that may push away investors in the nearest future even if in longer term the situation there would stabilize. This approach has been taken by Jonathan Stern (2006).
- We focus on the long run horizon (2030). The decline in production and rising import dependence of EU is obvious: indigenous gas production will not increase beyond 2010, and the debate is only whether by 2030 EU gas import dependence will increase to 65% or 80%. The spatial structure of world gas reserves remaining in 2030 will play crucial role in the long run.



# Introduction 4: Features of Study

- First, the long term perspective, in particular taking the resource limits of gas suppliers into account.
- Second, to view the market also from Russian perspective by considering corresponding Russian sources and announcements.
- Third, although also a policy paper, it tries to de-personalize the issues by characterizing the European natural gas market and its future options, the economic implications from such a situations and the political consequences (or temptations for national politicians, here Russia).
- Fourth, peculiarities of the gas market, with the oligopolistic supply and the oligopsonistic demand (first characterized in Golombek et al. (1987)), when the spatial aspects and the sunk investment into infrastructure (pipelines) are explicitly taken into account.

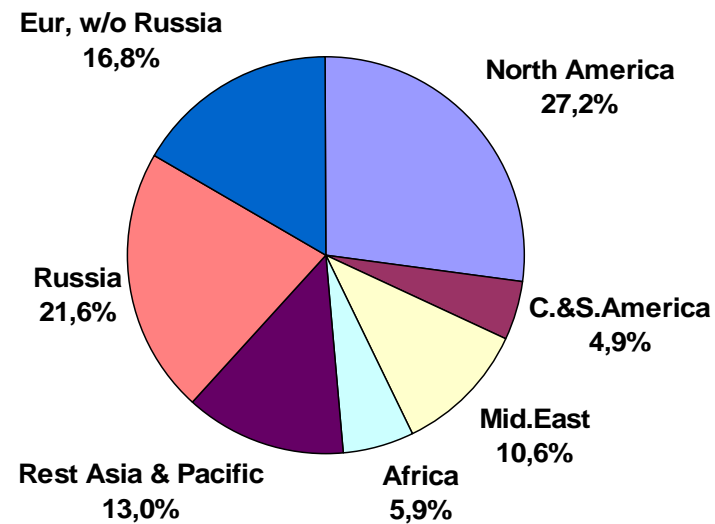


# Gas: Demand, Supply, Reserves

- World production and consumption of gas is growing at the rate 2-3% per year
- Next graphs show that the shares of production, consumption and reserves are distributed asymmetrically across regions.
- Europe has the highest gas import dependency across world regions (its consumption to production ratio is about 1.65). Other import depending regions (Northern America and South-East Asia have this ratio close to 1.1, i.e. less import dependent. Gas demand in Western Europe will grow at 2.7%, but in 2020 it will demand much larger share of imports than today.

# Gas Production: Regional Shares

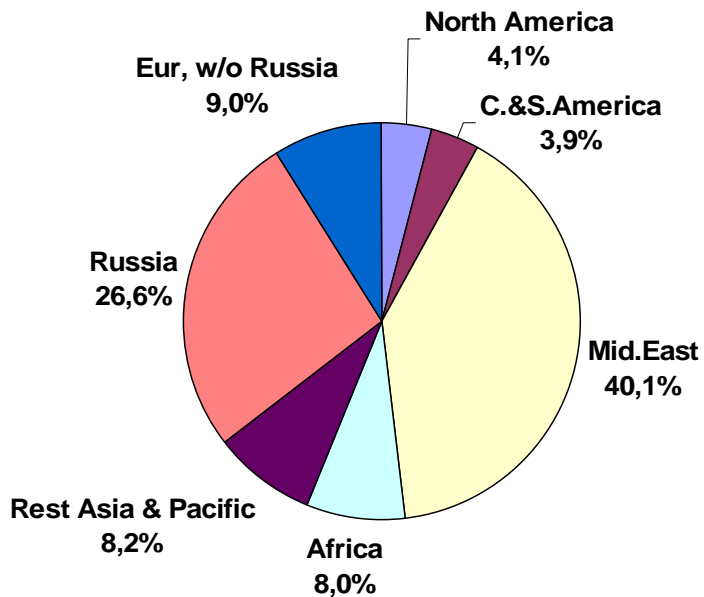
Production of gas. Regional shares in 2005.  
Source: BP.





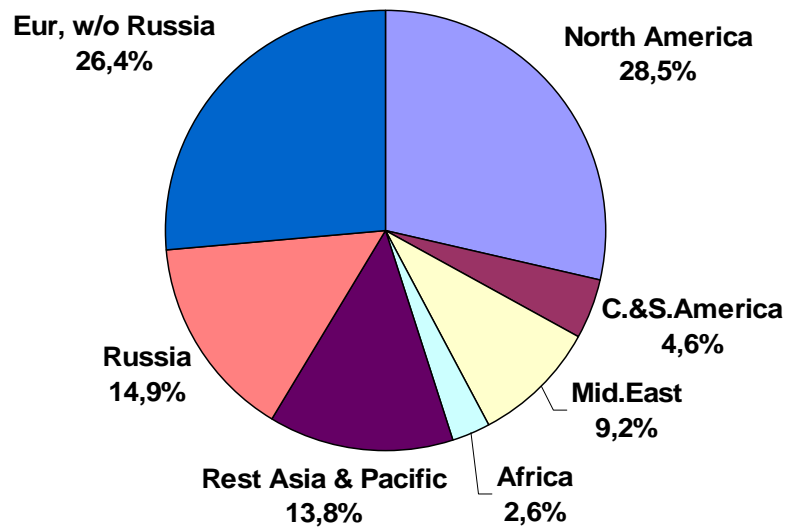
# Regional Shares in Gas Reserves

Regional shares of gas reserves in 2005.  
Source: BP



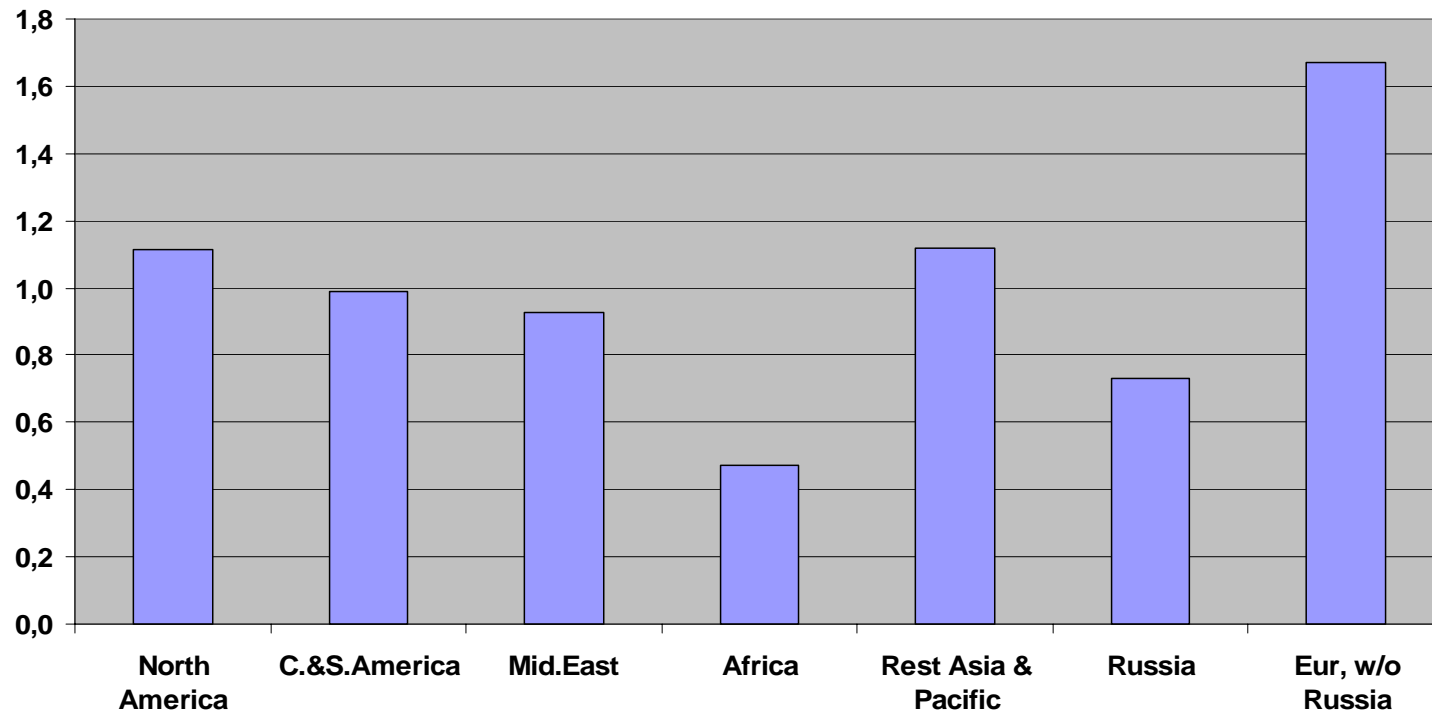
# Gas Consumption by Regions

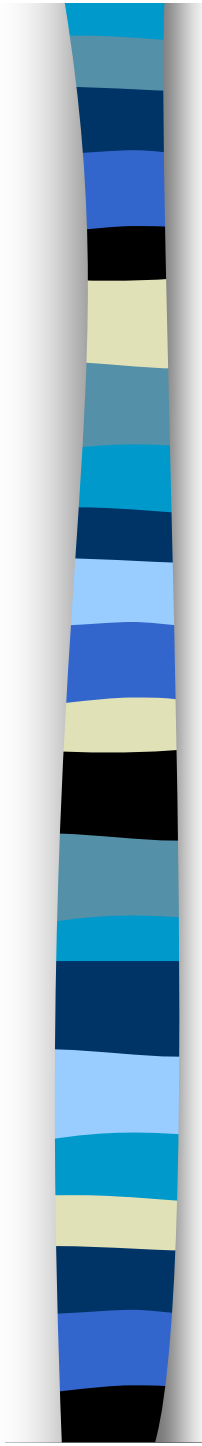
Gas consumption regional shares in 2005. Source: BP



# Consumption-Production Ratios

Gas Consumption-Production Ratio for Different Regions (2005)





N	Country	Reserve	%	R/P years	Production mtoe	YUS	Cons. 2005	Export mtoe	Export%
1	Russia	47,82	26,6	80	538,2	75,52	364,6	173,6	32,3
2	Iran	26,74	14,9	>100	78,3	42,23	79,6	-1,3	-1,7
3	Qatar	25,78	14,3	>100	39,2	40,72	14,3	24,9	63,5
4	Saudi Arabia	6,9	3,8	99	62,6	10,87	62,6	0	0,0
5	OAE	6,04	3,4	>100	41,9	9,54	36,4	5,5	13,1
6	USA	5,45	3	10,4	473	8,63	570,1	-97,1	-20,5
7	Nigeria	5,23	2,9	>100	19,6	8,26	n/a	n/a	n/a
8	Algeria	4,58	2,5	52,2	79	7,23	21,7	57,3	72,5
9	Venezuela	4,32	2,4	>100	26,1	6,82	26,1	0	0,0
10	Iraq	3,17	1,8	>100	n/a	5,01	n/a	n/a	n/a
11	Kazakhstan	3	1,7	>100	21,1	4,74	16	5,1	24,2
12	Indonesia	2,76	1,5	36,3	68,4	4,36	35,5	32,9	48,1
13	Australia	2,52	1,4	67,9	33,4	3,98	23,1	10,3	30,8
14	Malaysia	2,48	1,4	41,4	54	3,92	31,4	22,6	41,9
15	Norway	2,41	1,3	28,3	76,5	3,80	4	72,5	94,8
16	China	2,35	1,3	47	45	3,71	42,3	2,7	6,0

**Table 1.** The main world gas reserves holders, their production and consumption.

*Source: BP data [1] and calculations by authors.*



# Comments to Table 1

- The Table 1 shows the main 16 gas reserve holders in the world (Russia is the largest with 26.6% of reserves, or even 33% by other sources), together with their R/P and production levels in 2005 (in Mtoe). The exploitation of gas reserves is quite heterogeneous across the countries and regions with P/R ratios ranging from 10 years in North America to 240 years in the Middle East.
- However, the rate of exploitation is likely to change over time. According to forecast of ExxonMobil, the intensity of exploitation in Africa would grow dramatically in 2010-2020, exceeding the present export of Russia and still above the level of Middle East. At such speed African reserves are sufficient only for 10-15 years.



# R-P Ratio and Discoveries

- Natural gas is less scarce than oil having R/P of 65 years (oil - 40, coal -160)
- New discoveries are also important. USGS estimates the expected value of undiscovered gas to be equal to reserves. Thus gas resources can double and be sufficient for 130 years at the present level of exploitation. However, this forecast is probabilistic, so that gas resources may be sufficient for 100 to 200 years (optimistic and pessimistic scenarios)
- The modest reserves of the USA (3% of the world) may grow since it has higher expected share of undiscovered gas (10%)
- Russian share can increase if Arctic resources will be added
- All arguments of the paper are still valid, but regional resource extinction may occur 1-2 decades later



# Gas Supply to EU: Spatial Aspects

- Spatial aspects are very important for natural gas since costs and transportation modes depend significantly on distance and geography (land or sea)
- Both delivery by pipelines and as LNG requires huge sunk costs, but LNG has more flexibility
- European Union has three main sources of gas:
  - ⑩ *From Russia – by transcontinental pipelines with length about 4000 km,*
  - ⑩ *From Northern Sea (developed by Norway, Netherlands and UK) – by sea pipelines,*
  - ⑩ *From Northern Africa (mostly Algeria, Tunisia and Libya) – delivery by LNG to Mediterranean ports.*



# Future Gas Demand from USA

- The USA is the largest world gas consumer and still the second largest producer (see Table 1) although its reserves are only modest (3%). Therefore any change in the US demand for imports will have a substantial influence on world imports.
- Given the US demand for gas and its P/R ratio of 10 years, it will have to increase its future import substantially. Where will these imports come from? The American continent is less rich in gas reserves than Eurasia. According to BP Statistics 2006, North America has only 4.1% of gas reserves, South America has 3.9%. As a consequence the expansion of imports via pipelines is limited, the USA has to rely on substantial increase of LNG imports. While Qatar has substantial gas reserves and currently supplies LNG to Japan, it is located far away. Nigerian LNG exports are preferable, but they can only serve the US for the medium term. Political reasons may prevent the development of LNG supplies from Iran and Venezuela.





# Future Gas Demand from Asia

- At present, main Asian gas consumers (LNG) are Japan and S. Korea. The role of China is growing: in 2005 it consumed 47 bln.cub.m of gas, contrary to only 23.8 in 2000. The demand for gas imports from South-East Asia is likely to grow faster than from EU. Who will supply this increases amount to Asia in the future? There is a technical possibility of Russian gas supply (pipeline) from Eastern Siberia and Sakhalin (LNG) to Japan, Korea and China.
- Summarizing, by the middle of the 21<sup>st</sup> century most of the gas reserves on American and African continents will be depleted. Russia and Middle East would become the main gas suppliers. There will be oligopoly-oligopsony relationship, with 3 main producers (Russia, Iran, Qatar) and 3 large consumers (USA, EU, Pacific Asia). As a consequence, Europe will have to compete in the future in meeting its natural gas demand with Asia and the USA.



# EU Supply Security. Future Scenarios

- By 2030, global gas trade will grow from current 22% of production to 40% [Weisser, Energy policy 35, 2007].
- EU directive 2004/67/BC about multinational solutions in gas supply to embrace security is a correct step in medium term.
- But the long run moderate European reserves (Netherlands 0.8% w.res.; Norway 1.3% w.res.) will dry, while supply from Northern Africa is also limited (the largest is Algeria with 2.5%) and will dry sooner if EU will diversify more. Nigeria and Venezuela are located at larger distance, and EU will compete with the USA, Asia and other regions for future gas exports from them.
- In the long run, the main gas reserve holders (Russia, Iran, Qatar) will dominate in gas export market, and if EU wants to have less gas dependence on Russia, it should either invest in pipelines from Iran or LNG from Qatar.



# Russia: Economy

- Russia is the largest gas producer, but it is also the second largest gas consumer (after the USA). Still it is leading exporter.
- In the recent years it managed to cure most of macroeconomic problems of 1990ies, and now it has stable currency, budget surplus and positive trade saldo.
- Still, Russia has substantial inflation (close to 10%), that may also prevent investment in highly depreciated infrastructure. Another problem slowing investment is lack of incentives due to substantial price gap between domestic and world gas prices.
- At a result, in 2006, the growth of gas production was only 1.2%, and Russian economic growth was based more on the change in prices, rather than increase in the volume of output.



# Russia: Domestic Gas Demand

- At present, there exists a substantial difference between domestic (\$ 60-70/cum) and world (above 300 \$) prices for gas in Russia. Only 30% of gas is exported, because domestic demand is high and growing. Gas is used mostly for heating, but gas share in electricity production is also high (51%).
- While few years ago this price gap was justified by social reasons (low wages close to \$100 were not sufficient to cover basic heat expenditures at world prices), the gap is likely to narrow in future (in 2007, the average wage in Russia reached \$500, and domestic price will reach \$100 by 2010).
- However, internal gas prices should not grow fast (otherwise pushing inflation and causing disutility of population). Hence, in the next years Russian government has to use taxes on gas export to combine political objectives with market equilibrium.



# Russian Gas and Geography

- Due to Russia's geographical structure, it relies much more on land than on sea delivery of its goods.
- The major gas production area in Russia is concentrated in the North-West Siberia. Among perspective gas regions in Russia, there is Arctic shelf and Eastern Siberia (Lena-Baikal region).
- Gas pipeline to Western Europe is a costly investment: it should pass 3-4 thousands km of Russian territory before reaching importers. That is why investors (as well as producers) prefer security in supply.
- Shelf locations can be linked either with old EU customers, or with newly build LNG infrastructure. The gas from Far East (Sakhalin) can be easier linked to Asian consumers.
- All these considerations show the substantial increase of Russian bargaining power in future gas supplies, and EU should take them into account.



# Russian Scenarios (1)

- Russia has several options in its long term gas strategy. The scenarios 1 and 2 occur for high time discount, 3 and 4 - for low.
- The 1<sup>st</sup> scenario is in **fast development of gas production and pipeline capacity**. It might be the best for EU in the long run. Russia would increase its pipeline capacity and this will guarantee future supplies to EU. Under-utilization of capacities would be not favourable for network investors. To reduce games with transit countries, more pipelines can be built to connect Russia and EU directly (Baltic pipeline and its expansions).
- At present, EU seems to push Russia away from this scenario. Additional investment in gas infrastructure is costly and given even moderate risk aversion can be provided only after guarantees of Europe on long term and stable gas imports from Russia. But that is exactly opposite to what Europe is offering Russia by signing Energy charter.



## Russian Scenarios (2)

- The 2nd scenario assumes also the **development of LNG**.
- The critical length of gas pipeline on land is around 3800 km. If it is longer, LNG might become cheaper. The distance from Yamal (main gas reserve) to EU countries is about 3500-4000 km, and thus Russia might be indifferent between expansion of pipeline network or investment in LNG facilities. This scenario also corresponds to high time discounting. Contrary to scenario 1, Russia can choose this scenario if threatened by lack of access, long term contracts by EU and transit games by some European countries. Under this scenario, Russia makes less commitments and strategically decides to have a fraction of gas that can be sold to any buyer in the world. The main consumers of Russian LNG are then likely to be USA and Japan, while Europe is likely to have less Russian gas in its future portfolio.



## Russian Scenarios (3)

- 3<sup>rd</sup> scenario takes place for low time discount (that requires fall of inflation and interest rate in Russia). There is slow expansion of production, and growth of export comes from re-export of Central Asian gas or decline in domestic consumption of gas.
- Central Asian gas (mainly from Turkmenistan) requires pipeline transit, and Russia so far was the only option. Before this gas was sold to Ukraine at \$70-100 / th.cum, but with the growth of Central Asian bargaining power part of this gas is likely to be redirected for export to EU.
- This option allows Russia to increase its export to EU without substantial expansion of its own gas production (saving gas for future). But it may be not sustainable in the long run, since alternative pipelines may reach Central Asia. So the long run increase in export of Russian gas without increase in production requires reduction of domestic consumption.





# Russian Scenarios (4)

- Scenario 4: Keeping present steady state in gas production and export to preserve gas reserves until they become more scarce.
- This scenario can occur when the Russian discount rate declines substantially. The necessary pre-condition is putting inflation and interest rate to 3-5%, like in EU and the USA. The price of gas will definitely increase after 2030, because of extinction of a significant part of oil and gas reserves. At present, Russian growth is at the edge of its limits if it will still rely on export of raw materials. Russia already has enough money for domestic investment in other industries, and the only stopping factor is the high interest rate that makes many projects unprofitable.



# Economic Implications

- In the case that economics rules the world and everyone acts in his own interests, there is no serious threat of supply interruption since that would harm the interest of the producers.
- Which of scenarios is economically optimal for Russia? It depends. Scenario 4 is the best from the perspectives of Russian future generations, while scenario 2 maximizes Russian bargaining power if time discount remains high.
- From a European perspective, it seems that scenario 1 is the best and convincing Russia will require something: EU should punish the countries that invent gas games, adapt its energy charter to accommodate Russian interests and step back in its gas liberalization policy.
- Still, 2 problems exist: quasi-monopoly power of Gazprom and temptation for ex-post opportunism after commitments from both sides.



# Political Implications

- Economics not always rules the world; economic laws can be violated for quite some time as proved by Communism.
- What are potential rewards to Russian and EU politicians for uneconomic behavior? Nationalistic sentiments may become crucial. Few politicians around the world could resist the temptation to distribute the profits of the foreigners among the domestic population. Although such a policy of not honoring contracts has severe and devastating long term economic consequences (the next time the foreigners will not come if needed), the population and in particular most voters care little. And this can happen not only in Latin America or Russia, but also took place in UK (Conservatives broke price-cap contract with privatized utilities).
- Governments with their monopoly of coercion and possibility to make laws cannot commit themselves to anything (Kydland and Prescott critique).



# Conclusions

- Long term trends show that the demand for gas imports will grow very fast in the USA and Pacific Asia, and this will put Europe into fierce competition for gas supplies.
- The diversification of EU gas imports to mitigate its dependence on Russia looks favourable only for the next 1-2 decades. Later Russia will face only competitors from the Middle East.
- Political weakness of the Europeans in anything concerned its security in energy supply, attaches to the economically efficient linkage of Russian gas resources a significant political risk.
- If EU chooses to diversify gas supply in the middle run, it can choose only among not fully reliable countries from Africa and Middle East, and still has to return to Russia in the long run, probably at higher cost.
- (+) Allowing Gazprom to go downstream may increase its incentives to become a reliable supplier. (-) But if stakes are high for Russia, it may take decisions opposite to EU interests.