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THE US NATURAL GAS EXPORTS

New rules on the European gas landscape

Sylvie CORNOT-GANDOLPHE

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Center for Energy

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Abstract

The shale gas revolution has profoundly changed the US gas scene and the competitiveness of gas on the US market. The abundant resources and sharp rise in production have resulted in surplus production and have driven the US gas prices down. The price spread between regional markets (United States, Europe, and Asia) has led US producers to look for new export opportunities. After a lively debate between advocates of exports, mainly gas producers, and their critics, mainly the major industrial users who were worried about a price increase, US LNG exports started in late February 2016 with the first cargo from the Sabine Pass (Cheniere) liquefaction plant exported to Brazil. Four other liquefaction plants are currently under construction. In 2020, the United States could become the third largest exporter in the world after Australia and Qatar.

The US LNG exports will revolutionise international trade in LNG. Their contract structure (linked to the US gas spot price, no destination clauses, and *tolling* agreements) and the projected volumes will enable greater flexibility in the international LNG market and facilitate price convergence between regional markets.

However, the US exports are starting in a market very different from that envisioned at the start of the 2010s when the export projects were launched. The drop in oil prices, the entry into production of new liquefaction capacities since 2014, and the slowdown in demand growth in Asia have driven LNG prices down on import markets. After four years of tight supply, the market is now in a surplus situation which should continue until the turn of the decade. These new conditions are profoundly changing the economics of US LNG export projects, which is questioned in the short term: the current prices are insufficient to cover the full cost of the projects. Existing projects are secured by long-term contracts for periods of 20 years. However, it will be difficult for new projects to obtain financing in the current conditions.

Due to the flexibility of US contracts, LNG cargoes will be exported to the most profitable markets. While the projects initially targeted the Asian market, the disappearance of the premium paid by Asian buyers and the slowdown in their demand make other import markets, including Europe, more attractive for US LNG exporters. At the current level of gas prices on the European market, which is particularly low, LNG is not however guaranteed to arrive in large quantities, as higher margins can be made in

other markets (Latin America, the Middle East, and India). The European market is a "last resort" market for LNG surpluses which are likely to increase from 2018.

Traditional exporters to Europe, particularly Russia, are preparing for this new competition in a market where demand has fallen by a fifth since 2010, although it increased in 2015. The fall in Russian gas prices, which are correlated to fluctuations in the crude oil price with a six- to nine-month lag, removes on the short term the threat of this new competition. The increase in Gazprom's exports to Europe (+8 % in 2015 and +18 % in the 1st quarter of 2016) is limiting additional LNG import requirements in Europe. LNG imports have decreased slightly in the 1st quarter of 2016 after their increase in 2015.

However, the rise (even modest) in oil prices will change the situation. The price of Russian gas will increase as Russian contracts are partly linked to the oil price. This situation is likely to trigger a price war between Gazprom, the main supplier to the European gas market, and US exporters. Gazprom has stated that it intended to maintain its share of at least 30 % of the European market. It has significant assets for this: surplus production and transmission capacities and a low production/transmission cost. Gazprom could adjust its prices downwards to defend its market share, depending on the cost of US gas delivered to Europe, making this uncompetitive for European buyers.

However, a price war is not an end in itself and could not last too long; neither Gazprom nor Russia can afford it. Gazprom could therefore adopt a medium-term strategy of exploiting sufficient price volatility to discourage investment in new LNG terminals. It should have surplus volumes for this ready to be delivered in the short term to deter substantial LNG imports. Price volatility (and hence periods of higher prices) would allow the Russian company to maintain its profit margin.

This strategy requires an adaptation of Gazprom's commercial policy which appears to be being implemented. After having tested a new form of marketing its gas via the auction mechanism, organised from Saint Petersburg, Gazprom stated its intention to sell 10 % of its gas sales in Europe in this form, in addition to its sales *via* long-term contracts. Furthermore, Gazprom recently renegotiated its long-term contracts with two major buyers (Uniper, a subsidiary of the German company Eon, and the French company Engie). In both cases, the new contract terms include a price adjustment to market conditions in the countries concerned. Gazprom's strategy also includes increasing its export capacities to Europe (Nord Stream II project) and a more targeted integration into the European downstream sector (asset swap with BASF enabling Gazprom to enhance its role in European trading and in the gas storage segment, an essential tool for volume/price optimisation of gas sales in a liberalised market).

So, in the medium term, Gazprom's excess production capacities and its goal of increasing its export capacities give it the necessary means to affect prices, as its surplus capacities can be sold via the auction system, or directly on the spot market.

The US LNG has many advantages for European buyers in terms of security of supply and competitiveness, and this whether the LNG arrives in Europe or not. It puts further pressure on Gazprom to adapt its contracts and creates a price ceiling for export prices. Security of supply and competitiveness are enhanced by the existence of capacity ready to be exported if European prices rise or if the market is faced with an interruption of gas supply. The European Commission's Strategy for LNG reinforces the role of LNG in Europe by putting emphasis on the construction of missing infrastructure, the completion of the internal market, and dialogue with LNG exporters.

The United States, due to its abundant reserves and the low cost of its LNG projects, will become a major LNG exporter and is well placed to meet Europe's growing import needs, provided that Europe remains an attractive market for LNG imports. On the international market, Europe is competing with buyers worldwide. For US LNG exporters, the Latin American and Middle Eastern markets, and after the opening of the Panama Canal, the new Asian importing countries could thus be more profitable than the European market.

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Introduction

Whereas at the start of the last decade, the North American gas industry had embarked on a vast programme to build infrastructure to import liquefied natural gas (LNG) in anticipation of a fall in its gas production, the country is set to become one of the three largest LNG exporters in the world. In late February 2016, the country exported its first LNG cargo[1], paving the way for a new flow of trade between the United States and gas-importing countries, including Europe. The shale oil and gas revolution is enabling these exports by changing the US energy situation.

This change is occurring at a time when the oil and LNG prices are at the lowest for nearly ten years. Under these conditions, the resilience of US shale gas production and the economics of LNG exports can be questioned. These are the questions which are addressed in the first and second parts of this report.

The US LNG represents an opportunity for Europe as the region is looking for ways to diversify its supply and to use its regasification capacities which are largely underutilised. Although US exports are still at their beginning, they have significant implications in terms of price and security of supply for the European market. The third and fourth sections of this report examine the impact of US LNG exports on the European market. The fourth section is focused on the competition between US LNG and pipeline gas imports from Russia.

1. This excludes Alaskan LNG exports from the Kenai liquefaction plant since 1969.

2. *Dry gas* production, defined as the marketed gas production excluding losses due to extraction of gas liquids.

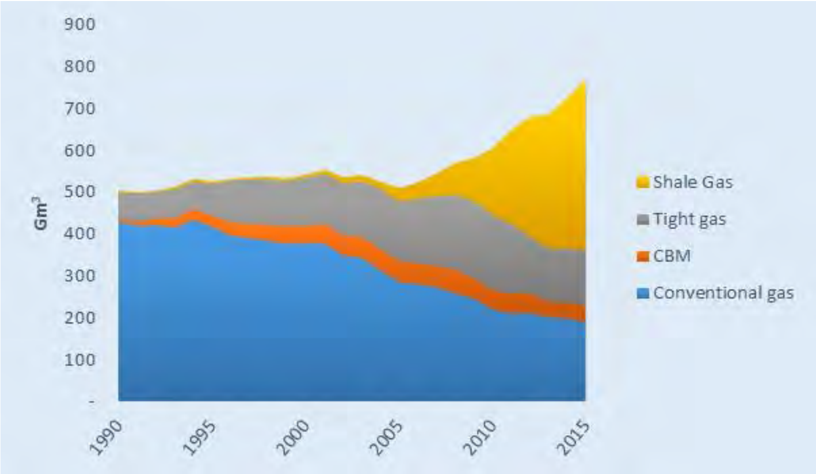
3. EIA, "The Growth of U.S. Natural Gas: An Uncertain Outlook for U.S. and World Supply",

Shale gas subject to falling prices

Shale gas represents half of US production

The use of horizontal drilling and hydraulic fracturing *(fracking)*, as well as the industrialisation of these technologies, have helped to **considerably increase shale gas production in the United States, which now accounts for 53% of marketed**[2] **gas production**, **with more than 400 billion cubic metres (bcm) produced in 2015,** as opposed to only 10% in 2007[3]. Despite the fall in conventional gas production, total marketed natural gas production in the United States has increased by 50% since 2005. In 2015, it reached 767 bcm, an increase of 5.3% compared to 2014, despite falling gas prices in the US market[4].

Graph 1: Marketed gas production in the United States



Source: Energy Information Administration (EIA).

Due to this huge increase, the United States has become the world's largest gas producer, overtaking Russia from 2009. Whereas at the start of

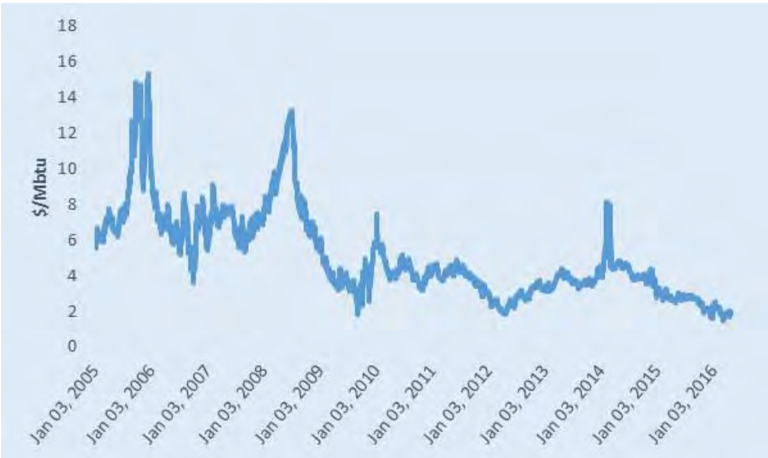
2. *Dry gas* production, defined as the marketed gas production excluding losses due to extraction of gas liquids.
3. EIA, "The Growth of U.S. Natural Gas: An Uncertain Outlook for U.S. and World Supply", 15 June 2015, www.eia.gov.
4. EIA, www.eia.gov.

the last decade, the North American gas industry had embarked on a vast programme to build infrastructure to import LNG in anticipation of a fall in production, the country is set to become one of the three largest LNG exporters in the world.

The fall in US spot prices

This extraordinary development has resulted in excess production capacity and has driven gas prices down on the US market. The natural gas spot price at Henry Hub in Louisiana, the national benchmark price, dropped to $2.63 per million British Thermal Unit (MBtu) on average in 2015, its lowest level since 1999. The daily price fell to below $2/MBtu in late 2015 for the first time since 2012; whereas production and gas storage levels reached record levels and the temperatures of the fourth quarter in 2015 were much higher than normal. In April 2016, the price was only $1.90/MBtu[5].

Graph 2: Changes in the US spot price (Henry Hub)



Source: EIA.

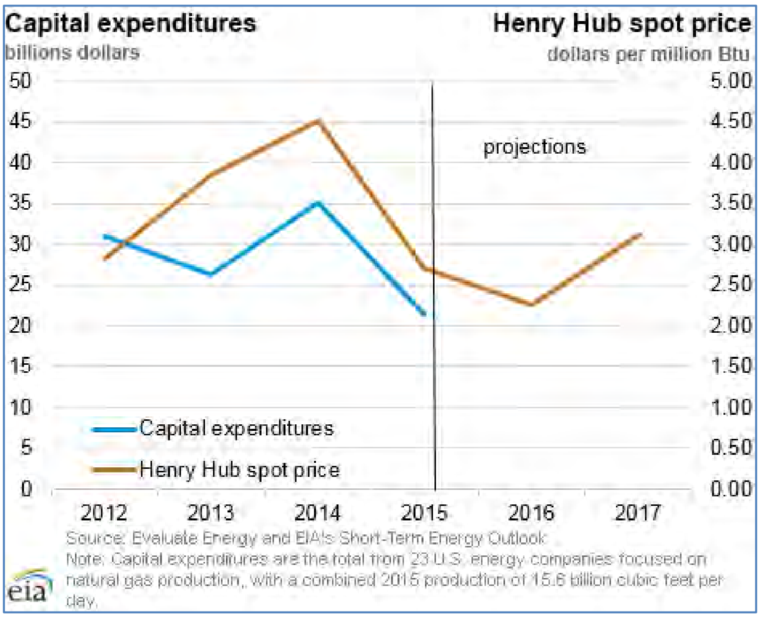
Initially, the fall in gas prices resulted in refocusing of activities to oil or wet gas basins, providing better returns. In energy equivalency, between 2010 and 2014, the WTI price was in fact 4 - 5 times higher than that of the natural gas spot price and nearly 2.5 times that of natural gas liquids. With the fall in oil price and in natural gas liquids (NGL), operators have refocused on the most prolific gas basins: Marcellus and Utica.

5. EIA, www.eia.gov.

A drastic reduction in exploration and production (E&P) capital expenditures

The fall in the gas price has affected E&P capital expenditures by operators and has resulted in a collapse in drilling activity. E&P capital expenditures by gas operators fell by 44% in 2015: from $37 billion in 2014 to $21 billion in 2015 for a sample of 23 companies representing 20% of gas production in the United States.[6].

Graph 3: E&P capital expenditures by US gas operators and gas prices



Source: EIA.

Drilling activity is in free fall and has reached its lowest level since 1949 when Baker Hughes began the census. In late April 2016, the number of gas wells being drilled was no more than 87, as opposed to about 900 at the beginning of 2011 before the fall in prices[7].

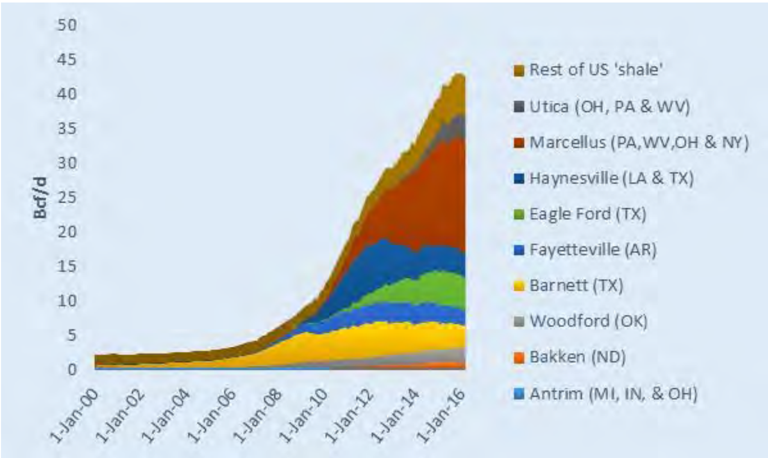
6. EIA, www.eia.gov, March 2016.
7. H. Baker, *North America Rig Count* (Jan 2000-Current), http://phx.corporate-ir.net.

Graph 4: Changes in gas drilling activity

Source: Baker Hughes.

Despite this drop, shale gas production continued to increase in 2015. Production from the Marcellus and Utica basins has helped to offset the fall in production from the other basins. The two basins are responsible for 85% of the increase in shale gas production since 2012[8].

Graph 5: Shale gas production per basin



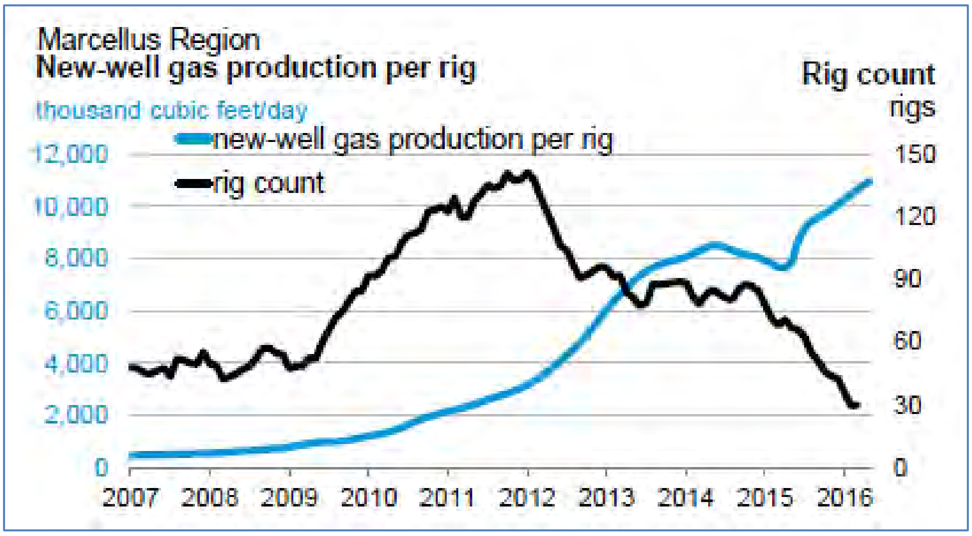
Source: EIA[9].

8. EIA, Marcellus, "Utica provide 85% of U.S. Shale Gas Production Growth since Start of 2012", 28 July 2015, *Today in Energy*, www.eia.gov.
9. EIA, Shale in the United States, 18 April 2016, www.eia.gov.

The improved productivity has helped to offset the decline in drilling activity and that of production from historical wells. Over the past five years, the industry has indeed achieved considerable technological progress, both in initial well production (due to *multi-stage fracking* and extending the horizontal drain lengths) and speed in drilling[10]. The decline in costs, which was particularly pronounced in 2015, has allowed maintaining the activity, refocused on the *sweet spots* of the most prolific basins. So, although the number of wells drilled remains a key indicator, it is not the only one to explain the level of production.

For example, graph 6 shows the productivity gains made in the Marcellus basin. Between 2011 and 2016, the production of new wells increased nearly sixfold.

Graph 6: Increased production per new well drilled in the Marcellus basin



Source: EIA, April 2016[11].

Production is resilient and will increase substantially in the medium/long term

However, it should be emphasised that shale gas production has started to decline since March 2016. In the short term, this fall is expected to continue and result in stagnation in total gas production in the United

10. See S. Cornot-Gandolphe, "The US Shale Oil Revolution: The Test of the Business Model is Underway", *Note de l'Ifri*, March 2015, www.ifri.org.
11. EIA, Drilling Productivity Report (DPR), April 206, www.eia.gov.

States. The EIA (STEO, May 2016[12]) forecasts virtually stable total production in 2016 (+0.9% only in relation to 2015).

In 2017, however, the EIA projects an increase of 2.2% in production in response to higher prices (at $3/MBtu), due to a tighter supply situation with rising domestic demand and LNG exports.

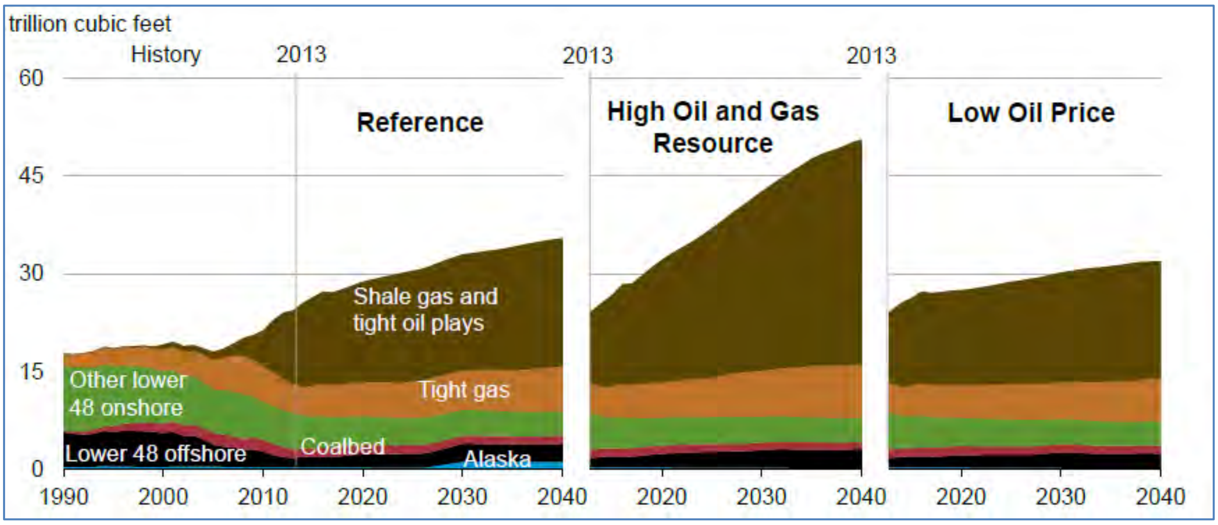
In the longer term, gas production is expected to grow significantly. The proven gas reserves in the United States were estimated at 11,000 bcm by the EIA on 31 December 2o14[13]. They included 5,655 bcm of proven shale gas reserves. Despite increasing gas production in recent years, the proven reserves have continued to increase, mainly due to a better understanding of the shale gas potential and its extraction methods. However, they decreased in 2015 with the fall in gas prices. Nevertheless, these gas resources remain enormous: they were estimated at 64,450 bcm on 31 December 2013, including nearly 17,000 bcm of shale gas[14]. This vast potential envisages continued growth in US gas production, enhanced by falling costs made possible by productivity gains. The EIA is projecting an increase of 45% in gas production between 2013 and 2040 in the Annual Energy Outlook 2015 reference case (AEO 2015)[15]. It will reach 1000 bcm in 2040. Shale gas production is gradually increasing by 2% per year on average and will reach 555 bcm in 2040. In May 2016, the EIA published a draft of the AEO 2016 (AEO 2016 Early Release)[16], which takes recent changes into account (falling gas prices, resilience of production, and start of LNG exports). In the reference case, gas production will reach 1200 bcm in 2040. Shale gas production will reach 821 bcm in 2040, or an increase of 3% per year on average for the period 2014-2040. The Henry Hub price quoted in 2015 dollars bounces back to $4.40 in 2020 and remains at around $5 between 2025 and 2040.

Future natural gas production mainly depends on the level and cost of the shale gas and *tight gas*[17] resources, technical improvements, domestic demand, and oil and gas prices. The EIA, in its AEO2015, has therefore set out three other scenarios (low oil price, higher oil price, and abundant resources). Production increases in all the scenarios, but the growth rate varies considerably depending on the scenarios. In a low oil price scenario,

12. EIA, Short Term Energy Outlook (STEO), 10 May 2016, www.eia.gov.
13. EIA, "U.S. Crude Oil and Natural Gas Proved Reserves", 23 November 2015, www.eia.gov.
14. EIA, "Shale Oil and Shale Gas Resources are globally abundant", *Today in Energy*, EIA/DOE, Washington D.C, 10 June 2013.
15. EIA, Annual Energy Outlook 2015 (AEO2015), April 2015, www.eia.gov.
16. EIA, Annual Energy Outlook 2016 (AEO2016), Early Release Summary of two cases, May 2016, www.eia.gov.
17. The reinforcement of environmental standards by the EPA (the elimination of gas flaring among others) will impact on future production costs.

the EIA forecasts that production will reach around 900 bcm in 2040, 10% less than in the reference case, with the LNG exports being much lower, while in an abundant resources scenario, production will increase to 1,433 bcm in 2040. Shale gas production is very sensitive to underlying assumptions. In the low oil price scenario, shale gas production will reach 511 bcm in 2040, while in the abundant resources scenario it will increase to nearly 1,000 bcm.

Graph 7: Natural gas production projections by source by 2040



Source: EIA (AEO 2015).

US LNG export projects

The increase in shale gas production, which has been faster than the growth in domestic demand, and the high LNG price up to 2014, prompted US producers to turn to LNG exports. In the United States, LNG exports are subject to authorisation by the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC). While the first export projects to countries, which have not signed Free Trade Agreements (FTAs) with the United States, have required more than two years of investigation to be authorised, since 2013 the DOE has accelerated the pace of its LNG export authorisations. In April 2016, out of the approximately 40 projects proposed in the USA, 13 received authorisation from the DOE to export to countries which do not have FTAs with the United States. Not all the proposed projects will be developed. The total proposed export capacity (around 400 bcm/year) is greater than the world LNG imports in 2015.

Seven projects have received authorisation from FERC. With these authorisations, the regulatory obstacle which prevented the United States from becoming a significant exporter on the LNG market was raised.

Projects under construction

Out of the seven projects approved by FERC with a capacity of 140 bcm per year (Table 1), the first one, Sabine Pass LNG, came into production in late February 2016 and four other projects are under construction. By 2020, the US export capacity could reach 84 bcm per year, with around 825 LNG carriers (of 170,000 m^3) per year which will carry the LNG for export markets.

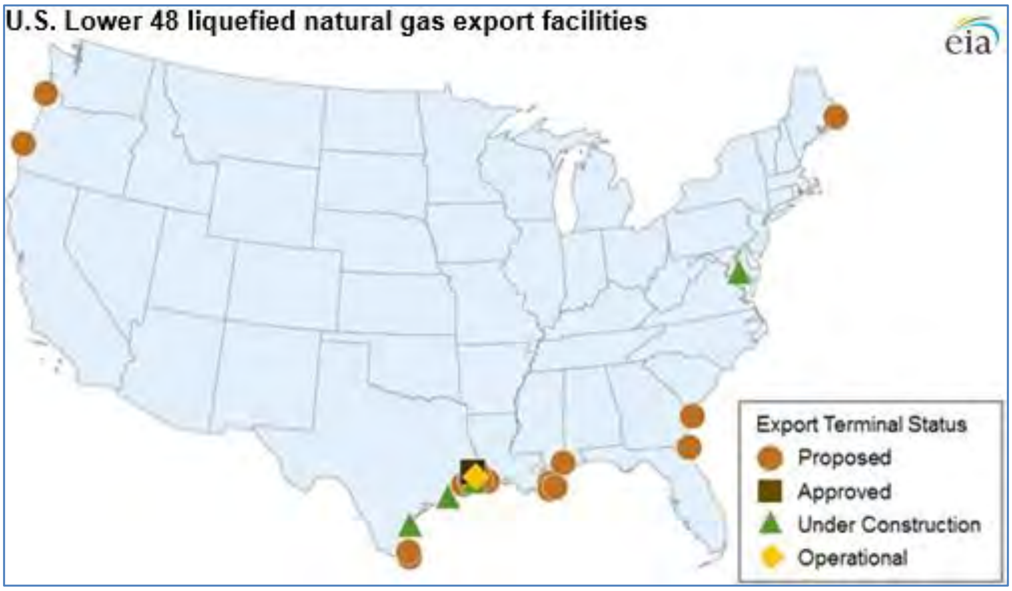
Table 1: LNG export terminal projects approved by FERC.

Project/place	Operators	Capacity (Gm3/an)	Number of trains	Status	Starting date of the first train
Sabine Pass, LA	Cheniere/Sabine Pass LNG (trains 1 to 5)	29,9	5	Trains 1 and 2 (operationnal) Trains 3 to 5 (under construction)	February 2016
Sabine Pass, LA	Cheniere/Sabine Pass LNG (train 6)	6,0	1	FID expected in 2016	2021
Cove Point LNG, MD	Dominion–Cove Point LNG	7,0	1	Under construction	2018
Cameron LNG (Hackberry), LA	Sempra–Cameron LNG	18,0	3	Under construction	March 2018
Cameron LNG (Hackberry), LA	Sempra–Cameron LNG	13,3	2	FID expected in 2017	2021
Freeport, TX	Freeport LNG	17,6	3	Under construction	2019
Corpus Christi, TX	Cheniere – Corpus Christi LNG (trains 1 et 2)	12,0	2	Under construction	Late 2018
Corpus Christi, TX	Cheniere – Corpus Christi LNG (train 3)	6,0	1	FID expected in 2016	2022
Lake Charles LNG, LA	Southern Union – Lake Charles LNG	20,0	3	FID expected in 2016	2020
Magnolia LNG (Lake Charles), LA	Magnolia LNG	10,6	4	Authorised by FERC in April 2016. FID expected in 2016	2021
	TOTAL	**140,2**	**including 84.4 under construction**		

Calculated based on 1 Mt of LNG = 1.33 bcm

Source: EIA.

Map 1: LNG export projects in the United States



Source: FERC, EIA, terminal operators

The growth of the United States' export capacity is gradual and the consequences of this new capacity on the gas markets will mainly be felt from 2018. In 2016 and 2017, the export capacities only apply to the Sabine Pass liquefaction plant (Graph 8).

Graph 8: Increase in US LNG export capacity *(Projects under construction on April 2016)*

Source: EIA, terminal operators.

The operators of the five projects under construction have signed contractual commitments for an export capacity of around 80 bcm/year. In addition, several projects (Lake Charles, Golden Pass, Magnolia, Jordan Cove, Elba Island and the additional trains at Sabine Pass and Corpus Christi) have negotiated sales contracts, but have not yet made their final investment decision. Excess supply in the world LNG market will not facilitate decision-making and obtaining funding. The first two projects are projects based on existing import terminals, with a lower cost than a *greenfield* project. This is not the case of the Jordan Cove project, whose future is uncertain following the decision by FERC in March 2016 not to authorise the construction of the liquefaction plant nor that of the pipeline set to supply it. Furthermore, although the US projects do not have to bear the price risk (due to the *tolling* agreements, i.e. the reservation of liquefaction capacity for a fixed rate for periods of 15-20 years, on a *use-or-pay* basis), they will have trouble finding buyers ready to commit to 20 years.

The majority of the capacities (more than half for the five projects under construction) have been reserved by LNG aggregators to be sold on the markets offering the best price. Aside from the contracts signed with the LNG aggregators, most of the contracts signed with the US operators were by Asian buyers (mainly Japan and India), but also Europeans, who also saw an opportunity of diversifying and lowering the price of their LNG supplies. The contracts signed by the European operators (apart from the aggregators) total approximately 20 bcm per year. However, these contracts do not include destination clauses and the LNG can be sold on any market.

The US LNG deliveries started in late February 2016 with the first LNG cargo from the Sabine Pass plant (Cheniere) exported to Brazil. Between late February 2016 and late April 2016, six cargoes were exported. Understandably, they were headed for the countries offering the highest *netback*[18] (see Map 2). A single cargo was for Europe (Portugal). Europe, where the LNG is in competition with pipeline gas imports, is at a disadvantage compared to other areas where competition occurs among LNG exporters, because the regasification cost has to be added[19].

Map 2: World LNG estimated landed prices (February 2016)

Source: FERC. The landed price is calculated on a netback b

18. That is to say, the highest margin after deducting from the landed LNG price 1. the LNG transport costs and 2. the costs for providing the LNG to the liquefaction plant (Henry Hub price increased by 15%) and possibly the liquefaction cost if the calculation is made on total costs, or without the liquefaction cost if the calculation is made on the short-run marginal costs.

19. In the case of Europe, competition occurs with gas imported by pipeline in gas form. It is therefore necessary to add the regasification cost. In most of the other importing countries (with the exception of China), competition takes place among LNG exporters. Therefore, there is no reason to add the regasification cost.

The key features of US LNG export projects

The US exports will lead to a change in the marketing and pricing of LNG. Indeed, **the US export contracts are structured very differently from traditional LNG supply contracts**.

Prices indexed to the US spot price

One of the key features of the US LNG exports is **the indexing of their price to the US Henry Hub gas spot price**. This indexing allows buyers to diversify prices from oil-indexed contracts (most of the LNG contracts, with notable exceptions, like the contracts between Qatargas and British buyers).

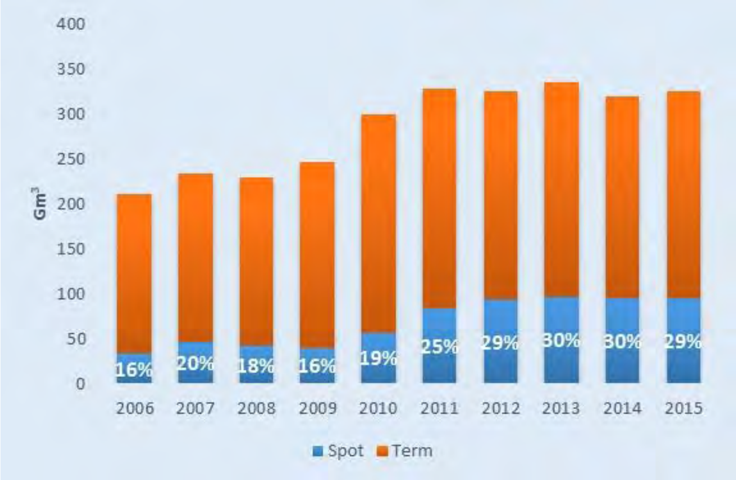
Flexible contracts

The US projects provide buyers with great flexibility. Most buyers have signed ***tolling* agreements**, i.e. the reservation of liquefaction capacity for a fixed rate for periods of 15-20 year on a *use-or-pay* basis. In this case, if the buyers decide not to take the LNG, they will only have to pay the fixed reservation fee ($2.25 - $3 /MBtu for the first Cheniere contracts), instead of the full cost of the LNG in traditional contracts containing *take-or-pay*[20] clauses.

Additionally, **the US contracts do not include destination clauses**. Hence, the buyers can sell the LNG on the market of their choice. In this way, US LNG introduces more flexibility into the global LNG market. Currently, only a limited volume of the global LNG supply has a contractual flexibility allowing it to respond to market price signals. This flexibility is restricted to spot and short-term LNG sales, which accounted for 29% of the market in 2015 (96 bcm).

20. This sales mechanism places the price risk on the buyer of capacity and not on the terminal operator, who is guaranteed fixed revenues. This specific feature of US LNG contracts is very important in the current context of excess capacity in the LNG market. If the prices on the import markets do not cover the short-term variable costs, there is no economic incentive to produce LNG. Hence, the liquefaction plants could not be used at full capacity, even though the terminal operators' revenues are guaranteed by the *tolling* agreements.

Graph 9: Evolution of spot and short-term LNG sales



Source: GIIGNL, IGU.

The US exports will almost double the quantity of flexible LNG by 2020. They will have a significant impact on regional LNG prices since US LNG will tend to be exported to the markets offering the best *netback*, resulting in a regional price convergence and the acceleration of market globalisation. This convergence is currently seen in the market, but it is explained by the fall in crude oil prices (which drove down the price of oil-indexed long-term contracts) and the lower LNG demand in the Pacific basin, which has therefore driven the price of spot cargoes down.

Lower costs than other projects

The US export terminals currently under construction benefit from lower costs than those of new liquefaction projects in the United States and in the rest of the world, because they are located at former LNG receiving terminals (except Corpus Christi) profiting from the existing infrastructure. According to LNG World Shipping, the current projects have an average cost of $825/t of LNG compared to $3,000/t for the new Australian projects currently under construction[21]. Cheniere indicates a cost of $600/t, which makes it one of the cheapest projects in the world[22].

21. LNG World Shipping, 5 January 2016, www.lngworldshipping.com.

22. Cheniere, presentation at Ifri, Jean Abiteboul, Président, Cheniere Marketing, 26 January 2016, www.ifri.org.

Economics of export projects faced with falling prices

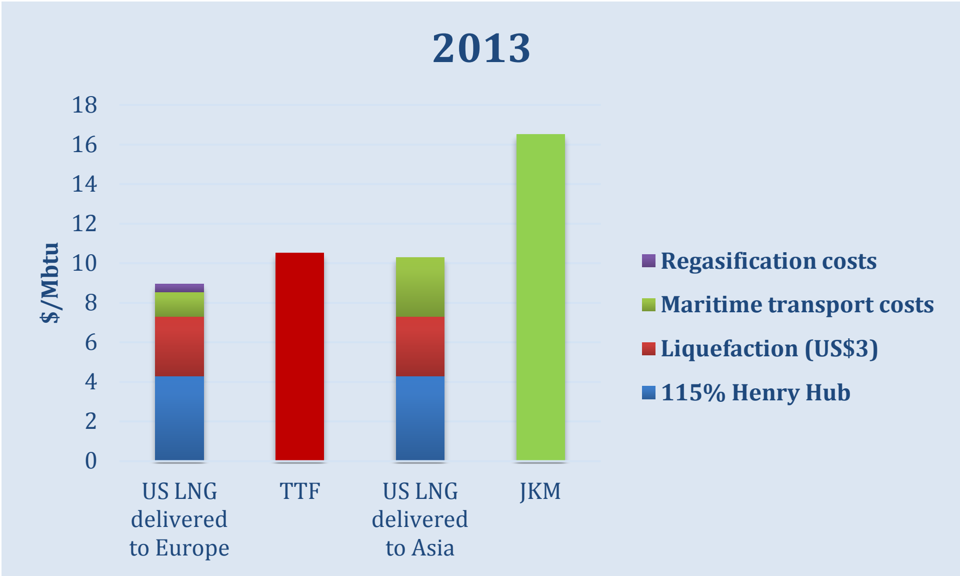
With the fall in crude oil and LNG prices (close to $4/MBtu for spot sales in Asia and Europe in April 2016), the economics of the US LNG projects is called into question in the short term. **Indeed, it depends on the gas price differential between the United States and the rest of the world.** However, it should be noted that these projects are long term (the off-take agreements signed with US operators are over 20 years). A distinction should also be made between the impact of falling prices on investment decisions and the construction of new projects and its impact on built projects/projects under construction and consequently on export flows.

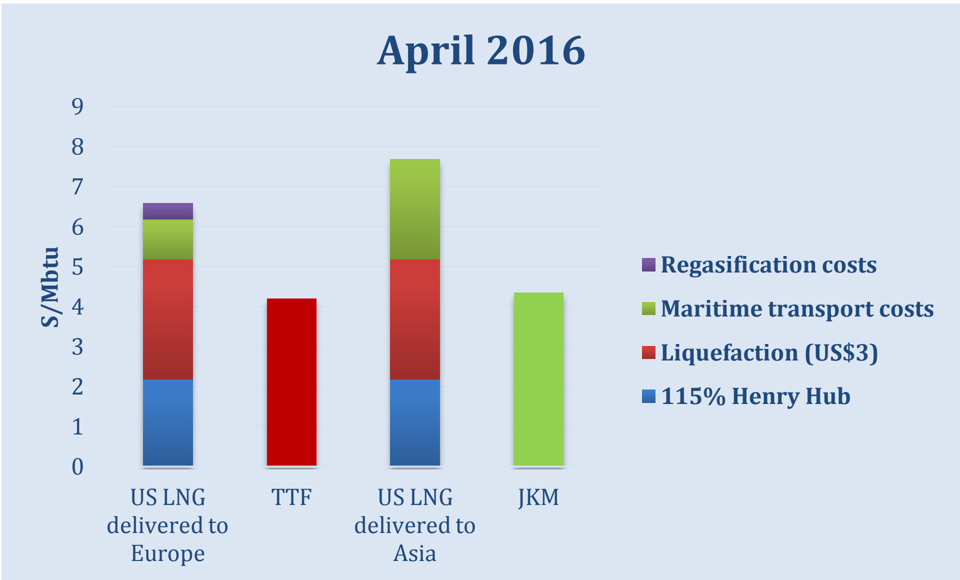
Investment in LNG projects

The funding for new projects will depend on the projects' **long run marginal cost** (LRMC). This includes the Henry Hub (HH) gas price, the fuel cost for liquefaction (15% of the HH price), the liquefaction cost, and the shipping cost. This price will be compared to the price of gas on the import markets. In Europe, where most gas contracts are now indexed to the spot market, the spot price (TTF or NBP) will be the benchmark price (therefore regasification costs will need to be added), while in Asia, where competition takes place among LNG exporters, the benchmark price will be the delivered price of LNG (before regasification) on the Asian market (JKM)[23]. On this basis, Graph 10 compares the cost of US LNG delivered to Europe and Asia with the gas prices in these markets in 2013 and in April 2016.

23. The JKM is the benchmark price for LNG spot cargoes delivered DES (*Delivered ex ship*), consequently including the shipping costs to Japan and South Korea.

Graph 10: Economics of new US LNG projects (LRMC)





Source: Author.

While in 2013, the prices in Asia and Europe generated high profit margins, particularly in Asia ($6.20/MBtu), and to a lesser extent in Europe ($1.60/MBtu), **the situation turned around in 2016**. The spot prices in Asia and Europe no longer generate profit margins and **the cost of projects is higher than the European and Asian prices**. At today's prices, it is also difficult to invest in a new liquefaction plant in the United States. This situation explains why investment decisions are postponed or projects cancelled.

In 2015, final investment decisions (FIDs) were only taken for three projects: Freeport LNG T3, Corpus Christi LNG T1-2, and Sabine Pass T5. In 2016, FIDs are expected for the Jordan Cove LNG, Magnolia LNG, Lake Charles LNG, and Elba Island projects and the Cheniere project expansions. However, the low price environment is threatening to delay, or even cancel FIDs in *greenfield* projects. Excelerate, which delayed the FID of its project at Port Lavaca, finally abandoned the project in September 2015, despite its very low cost ($545/t)[24]. At current prices, it is feared that the second wave of US LNG projects (after those under construction) may be postponed, or even cancelled, until the market tightens sufficiently so that prices increase on a lasting basis.

The export flows of existing projects and those under construction

For existing projects and those under construction, the rationale is different since the investment has already been made. The operator (or even the holder of the *tolling* agreement) will no longer think in total costs, but in **short run marginal cost** (SRMC), in view of the fact that the investment costs are stranded and that any margin above the variable cost is profitable. This equals to considering the liquefaction cost as stranded[25].

On this basis, Cheniere in a presentation in January 2016[26], indicates margins of $1 for Europe and $1.80/MBtu for Asia.

Table 2: Margins from the Cheniere export project

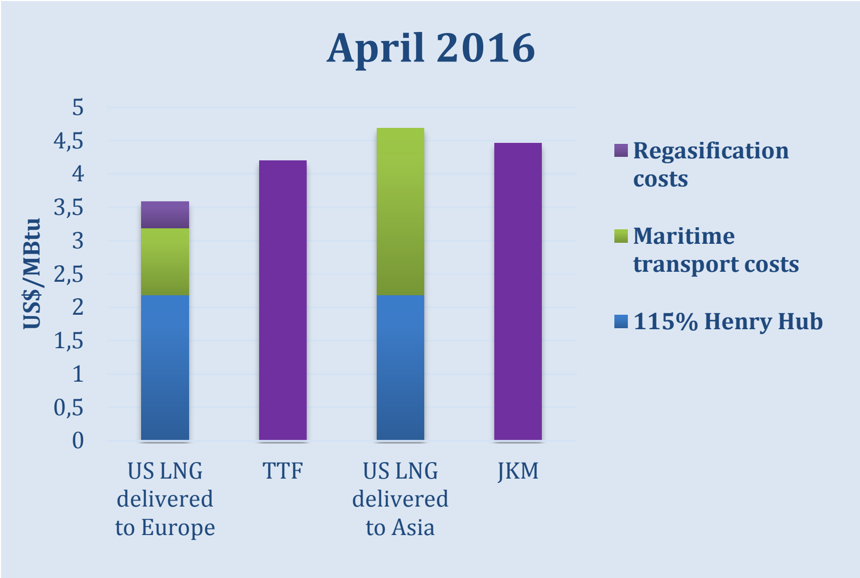
Delivered Price To: (MMBtu)	Europe	Asia
Gas	$2.60	$2.60
Transportation	1.00	2.50
Regasification	0.40	0.00
Total Cost	$4.00	$5.10
Landed Price	$5.00 (TTF)	$6.90 (JKM)
Margin	$1.00	$1.80

Source: Cheniere, IFRI presentation, January 2016.

24. *Reuters*, "Oil Price Crash Claims First U.S. LNG Project Casualty", 30 December 2014, www.reuters.com.
25. The shipping cost, if a forward contract has been signed with a shipowner, may also be considered as stranded and only the variable shipping cost will be considered.
26. Cheniere, January 2016, *op. cit*.

However, it should be noted that with the fall in spot prices in both markets[27], the margin in April 2016 is only $0.60/MBtu to Europe and has become negative in Asia (Graph 11).

Graph 11: Economics of US existing or under construction LNG projects (SRMC)



Source: Author.

Therefore, while up to 2014, it was considered that US LNG would be exported to Japan or Korea, given the substantial price premium that these markets paid and their growing demand, Europe provides a better premium than Asia. However until now, it is the Latin American markets, and the new Middle Eastern and Indian markets, which have provided the best netback to US exporters, given the low European prices and the addition of the regasification cost in the case of Europe.

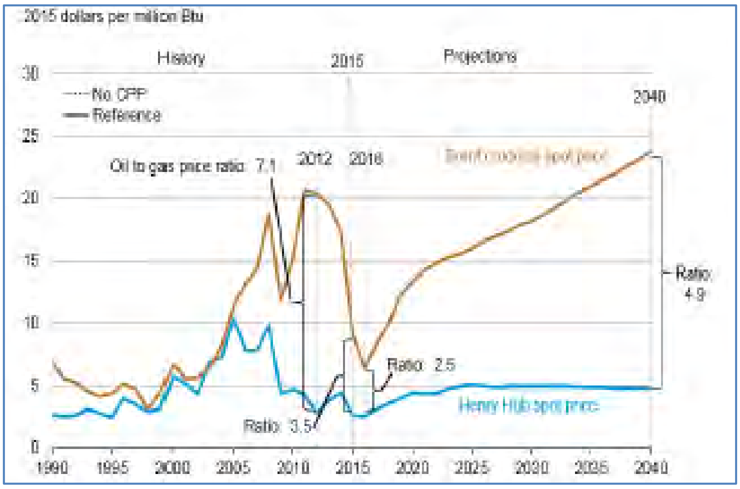
Outlook for LNG exports

In the short term, despite the reduced profitability of exports, these should however grow with the ramp-up of the Sabine Pass plant. The EIA (STEO, May 2016[28]) is anticipating LNG exports of 5 bcm in 2016 and of 13 bcm in 2017. Indeed, the exports are guaranteed by the off-take agreements that Cheniere has signed. In the event that the LNG is not taken off (which the agreement allows for), the buyer must pay the fixed liquefaction fee. In the medium-long term, the profitability of LNG exports should improve

27. The HH price is $1.9/MBtu in April 2016. The European spot price (TTF) is €12.7/MWh, or $4.2/MBtu in April 2016 and the JKM stands at $4.46.
28. EIA, Short Term Energy Outlook (STEO), 10 May 2016, www.eia.gov.

significantly. The economics of the projects indeed depends on the *spread* between the gas price in the United States and that of the import markets, which is largely determined by the oil price, particularly in the Pacific basin. In the EIA reference case (AEO2016 Early Release), oil and gas prices experience their biggest increase from 2017 to 2020[29]. After 2020, oil prices continue to grow, but at a slower rate, while the US gas price remains virtually unchanged. **So, the energy equivalence ratio between the price of Brent and the Henry Hub price, which was 3.5 in 2015 – and which is expected to drop to 2.5 in 2016 – will start to increase in 2017 and should reach 4.9 in 2040.**

Graph 12: Ratio between the price of Brent and the US gas spot price



Source: AEO 2016 Early Release.

In the EIA reference case, this differential improves the US LNG projects' economics which becomes very profitable. This renewed profitability provides strong export growth. Therefore, the EIA projects that the country will become a net LNG exporter from 2016. The net LNG exports will reach 68 **bcm** in 2020 and nearly 190 **bcm** in 2040**. This is a very sharp increase compared to the AEO's 2015 reference case (59 bcm** in 2020 and **94 bcm** in 2040). This revision is explained by the increase in the differential between the gas and oil prices. It should also be emphasised that the US LNG is strategic for buyers, since it helps to diversify supply – which is a major concern in Europe – and **diversify price,** which is an advantage for Asian buyers, given the uncertainty about developments in oil prices.

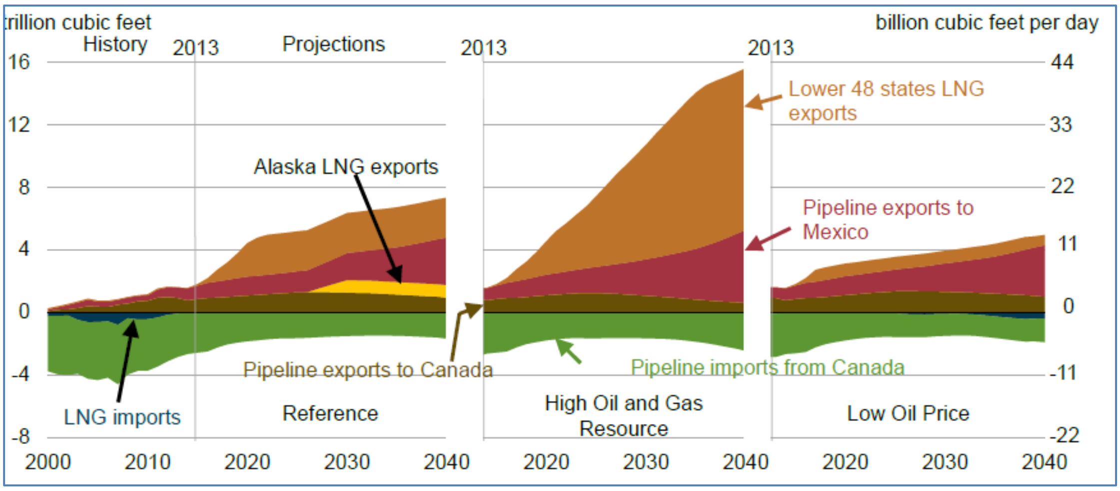
29. The crude oil price in the EIA reference case should reach $77 per barrel in 2020.

Graph 13: US LNG export projections

Source: EIA, AEO2016 and AEO2015.

However, the oil price level is subject to considerable uncertainty. The *spread* between the oil and gas price, which is a determinant for the level of LNG exports, could also be lower than the EIA's reference case, which would result in making LNG exports less attractive. The AEO 2016 Early Release will be supplemented by other scenarios on its full publication. However, it should be noted that in 2015, the AEO 2015 specified three very contrasting scenarios for future LNG exports (see Graph 14), including a low oil price scenario leading to very reduced LNG exports (around 20 bcm per year), which seems unlikely today. It would mean that the new liquefaction plants built and under construction are quite simply not/scarcely used. The high resource scenario resulted in LNG exports of 200 bcm by 2030 and of 300 bcm by 2040.

Graph 14: Export projections for natural gas and LNG by 2040, according to the AEO 2015



Source: EIA, AEO 2015.

In that regard, the AEO 2016 reference case appears more likely, although it depends on a relatively high oil price level ($77/b in 2020). It should be noted that the IEA, in its *New Policies Scenario* (NPS), forecasts LNG exports from North America (including Canada) at 82 bcm in 2025 and 95 bcm in 2040.

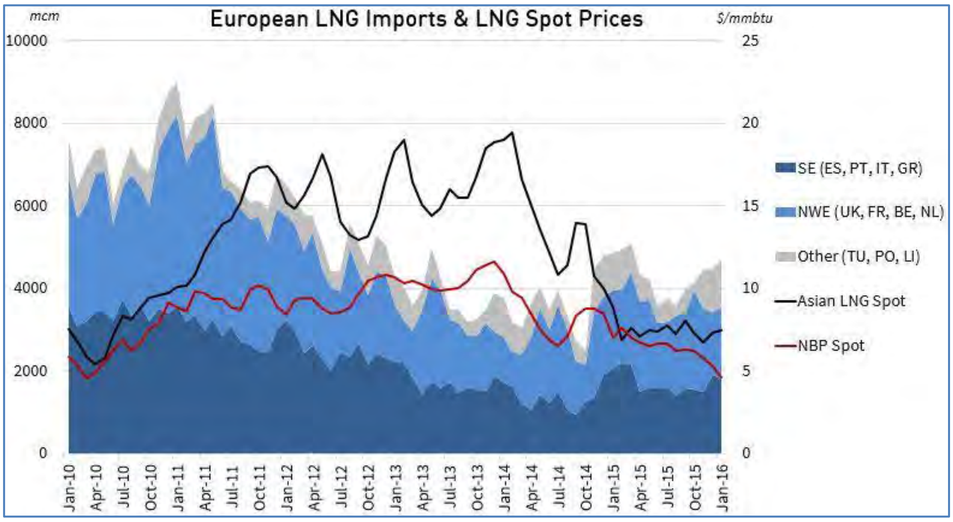
The role of LNG in Europe

LNG is returning to Europe

Whereas during the period 2011-2014, global LNG supply was restricted by insufficient liquefaction capacities to meet the high Asian demand which followed the Fukushima disaster, from mid-2014 the situation reversed. New liquefaction plants came into production, while supply slowed down. In 2015, demand from Asia, which imports nearly three-quarters of global LNG volume, declined. So, **Europe was the main driver of the increase in international LNG trade which reached 323 bcm in 2015. After falling by 50% between 2011 and 2014, European imports increased by 12% in 2015 to 50 bcm.**

Since 2014, the premium paid by Asia has fallen sharply and even disappeared in 2016. In 2015/16, the spot LNG prices sold in Asia converged towards the European spot market prices, and fell to nearly $4/MBtu in April 2016. Falling prices in Asia resulted in improving the attractiveness of the European area for LNG exporters in the Atlantic basin and in eliminating the economic incentive to reroute cargoes to Asia.

Graph 15: LNG imports in Europe



Source: Timera (according to the IEA, Reuters and ICE).

The low prices are restricting its return

Although Europe is becoming a more attractive market compared to Asia, Europe is in competition with buyers around the world and in early 2016, higher premiums were made on other import markets (Latin America, the Middle East, and India, see Map 2). Therefore, **the quantities of LNG imported into Europe in the first quarter of 2016 fell slightly in relation to the same period in 2015, and the inflow of Russian and Norwegian[30] gas at low prices is likely to prolong this situation**. Graph 16 shows the daily LNG emissions from European terminals. After their sharp increase in late 2014 and early 2015, these stabilised and began to decline in relation to the peak of the first quarter of 2015.

Graph 16: Daily emissions of European LNG terminals 2014-2016

Source: GLE (ALSI).

LNG should increase its share in the European gas mix

The global liquefaction capacity (417 bcm per year in late 2015) will continue to grow rapidly: at the start of 2016 a liquefaction capacity of 188 bcm per year is under construction around the world. Australia, which is currently adding seven new plants (three came into production in 2015) should become the world's largest exporter by the end of the decade, overtaking the current largest LNG supplier in the world, Qatar, and

30. Russia increased its exports to Western Europe by 53% in the 1st quarter of 2016 compared to the 1st quarter of 2015 and Norway by 5% (Platt's, "Portugese [*sic:* Portuguese] LNG Cargo no Signal of US Impact", 29 April, 2016, www.platts.com.)

followed by the United States. This rapid growth will help to increase the surplus in the LNG market and competition among suppliers. Faced with the slowdown in Asian demand, larger quantities of LNG could end up in Europe, which has a considerable and largely under-utilised LNG import capacity. In early 2016, the capacity of the 23 European terminals totals 201 bcm per year (excludes small-scale terminals). In late June, the Dunkirk terminal will add 13 bcm/year in capacity. Despite the increase in LNG imports in 2015, the terminals were only used at 27% of their capacity.

This new situation and the European policy for LNG (Box 1) will help **to significantly increase LNG imports in Europe**. These could reach 83 - 90 bcm by 2020[31], hence returning to a level close to 2010/2011. This recovery is conditional upon increased European demand for gas which began in 2015 and could be promoted by a greater coal-to-gas substitution, made possible by the low gas prices and closure of older coal power stations. However, apart from the United Kingdom (where a carbon tax applies) and Italy (where environmental restrictions impact on coal power stations), coal-to-gas substitution in the other European countries will be gradual, depending on the rise in CO2 prices, which are still too low to stimulate coal replacement. Furthermore, competition between European market suppliers is likely to restrict the share of LNG in the European supply, and that of US LNG in particular. **The strategy of traditional suppliers to Europe, and that of Gazprom in particular, is a deciding factor in the share that US LNG could take in Europe**.

31. CEDIGAZ, 2016 and IEA, Medium-Term Gas Market, 2015.

Box 1: The European Commission's LNG Strategy

In February 2016, the European Commission released its sustainable energy package with a certain number of measures intended to increase the Union's energy security[32]. This package includes an LNG strategy, which aims to make Europe, often described as a 'last resort' market for LNG exports, an attractive region.

The Commission is putting forward the favourable economic situation in the global LNG market which provides the EU with a unique opportunity to enhance its security of supply and competitiveness, as markets are becoming exposed to more competition among international suppliers. It also states that the emergence of FSRU *(Floating Storage Regasification Units)* technology changes the dynamics of investment in import capacities. The Commission is referring to the Klaipėda FSRU terminal in Lithuania as an example, which has helped the country to increase the diversity of its supply and competitiveness[33].

To improve the access of all Member States to LNG as an alternative gas source, the LNG strategy identifies three key actions that the EU must implement:

- build the infrastructure necessary to complete the internal market, so that all Member States may access international LNG markets, either directly or through other Member States. The Commission recognises that in north-western Europe, the markets are competitive, well connected, and have access to various sources of gas, including terminals providing substantial LNG import capacities. However, the gas markets are less developed in the Baltic Sea, central European, south-eastern European, and south-western European regions. Based on the list of projects of common interest, the LNG strategy, also includes a list of major infrastructure projects so that all Member States have access to LNG.

32. European Commission, 16 February 2016, https://ec.europa.eu.
33. Access to the global LNG market has reduced the gas price on the Lithuanian market. The terminal played a role in negotiating a 23% reduction in the price of Russian gas imported to Lithuania.

- to complete the internal gas market so that it sends the right price signals, attract LNG where it is needed and thus, facilitate the necessary investments in infrastructure;

- to cooperate closely with international partners to promote global LNG markets which are free, liquid, and transparent. This implies a dialogue with current and future suppliers and with the other major consumer countries so that LNG can be freely marketed on global markets, both under normal market conditions and in the event of external shocks.

Box 2: No US LNG in France?

Exports of US LNG are a source of important benefits for Europe: diversification and security of supply and competitiveness of the gas price. Yet in France, the Minister for Environment and Energy, Ségolène Royal, has recently taken a stand against importing shale gas and wants, "to examine legally how we can ban shale gas imports[34]". This position is not sustainable, neither from a legal nor from a technical point of view. The French Act of 13 July 2011 prohibiting hydraulic fracturing only applies to the use of hydraulic fracturing technology on the French territory, and not the import of gas produced using this technology. Furthermore, banning the import of US LNG would be contrary to WTO rules. From a technical point of view, it should be recalled that US LNG is obtained from US gas production, which is made up of 50% shale gas and 50% conventional gas. The gas molecules do not have a label when they enter the US gas network to be sent to the liquefaction plants. On the integrated European market, the US LNG imported into a country other than France will flow in Europe and in France (in the same way that electricity obtained from nuclear power plants will be exported to countries which have banned nuclear production in their own countries). Finally, from the point of view of the European energy policy, this initiative goes against efforts made by the Commission to promote LNG (US amongst others) and is contrary to the European initiatives for better integration of the networks between the Iberian peninsula and France, which aims to allow the imported LNG into southern Europe to flow freely into Europe.

34. P. Le Hir, "Ségolène Royal peut-elle faire barrage au gaz de schiste américain?", *Le Monde*, 11 May 2016, available at: www.lemonde.fr.

The French operators (excluding Total) have contracts with Cheniere to import 2 bcm per year of LNG. Engie has a long-term contract to import 0.8 Mt per year of LNG (around 1.1 bcm per year) from the Sabine Pass plant. EDF has a short-term contract to import 23 cargoes until 2018 and a long-term contract to import 0.77 Mt per year of LNG from the Corpus Christi plant. Furthermore, Engie has a *tolling* agreement with Cameron LNG to import 4 Mt per year, a part of which has been sold to Asia.

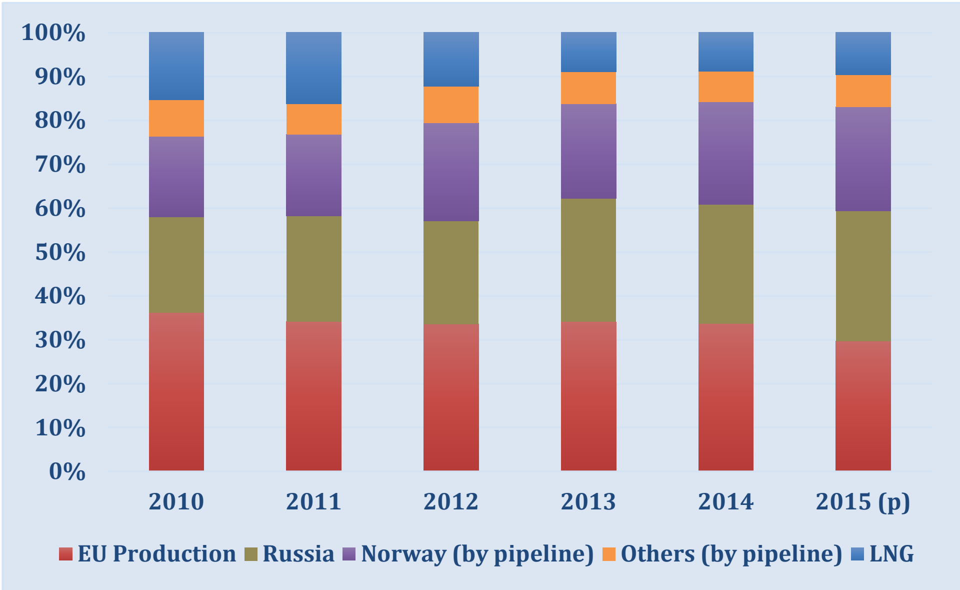
US LNG is a potential threat for Gazprom

US LNG exports lead to increased competition on the European market at a time when it is already in surplus. The EU's gas consumption (427 bcm in 2015[35]) is lower by more than 100 bcm to that of 2010, although it increased again in 2015 (+ 4.5%). The decline observed between 2010 and 2014 is mainly due to the drop in consumption in the electricity sector, in the face of weak demand for European electricity, competition with coal, and the rise of renewable energies. A series of milder winters than normal has also limited demand from the residential/commercial sectors[36].

For the suppliers to the EU, part of the fall in demand was offset by the decline in European gas production, particularly in the Netherlands (Groningen) and in the United Kingdom[37]. Furthermore, the fall in LNG imports also helped pipeline exporters to maintain their export levels. So, whereas the share of LNG in the EU supply fell from 15% in 2010 to 10% in 2015, that of pipeline imports increased from 48% to 61%. Annual exports by Russia to the EU have fluctuated between 110 bcm and 130 bcm during the period[38].

35. CEDIGAZ, First estimates, April 2016.
36. M.-C. Aoun, S. Cornot-Gandolphe, "The European Gas Market Looking for its Golden Age?", *Études de l'Ifri*, October 2015, www.ifri.org.
37. *Ibid*.
38. 130 bcm to 160 bcm for Gazprom sales to Europe excluding the former USSR.

Graph 17: EU gas supplies



Source: CEDIGAZ, 2015 estimated.

But this situation could change. The US LNG is potentially a threat for Russia, the main supplier to the EU. The capacity of European hubs to absorb surplus LNG is indeed mainly determined by the **LNG capacity to replace the flexible volumes of long-term contracts, in particular from Russia whose contracts include significant.**

Competition between US LNG and Russian exports

The importance of Europe in Russian gas sales

Russia produced 595 bcm in 2015, ranking second worldwide behind the United States. This production, which is dominated by Gazprom, is down by 1% compared to 2014[39]. Gazprom's production is down by 6% to 419 bcm, whereas that of independent producers increased by 10%. The decline in Gazprom's production is explained by the fall in sales on the Russian market and the reduction of its market share due to the rise of independent producers, and by the decline in exports to countries in the former USSR, mainly Ukraine. Gazprom, which has a monopoly for Russian pipeline gas exports, is the world's leading gas exporter. In 2015, the group exported nearly 200 bcm. **Sales to Europe are the main source of revenue for Gazprom.** In 2015, Gazprom increased its exports to Europe[40] by 8.7% to 159 bcm. The increase is particularly pronounced for exports to Germany, Italy, and France. The average price of Russian gas delivered to Europe fell in 2015: according to Gazprom[41], it settled at $246/1,000 m³ on average, as opposed to $349 in 2014[42]. However, it should be noted that the decrease is applied to prices in dollars and not roubles, which have increased by 12% due to the devaluation of the Russian currency. Hence, despite the fall in the dollar price, **sales revenues in Europe** increased by 24% to 2186 billion roubles (€29.5 billion). They **account for 64% of Gazprom's revenue from gas sales**.

Due to the increase in deliveries to the European market and a weak rouble, Gazprom reported a fivefold increase in its net profit in 2015. However, its debt increased by 26% between late December 2014 and late

39. CEDIGAZ, First estimates, 2016.

40. Countries in the European area in Gazprom's statistics include the EU, but not the Baltic countries, Switzerland, Bosnia and Herzegovina, Macedonia, Serbia and Turkey.

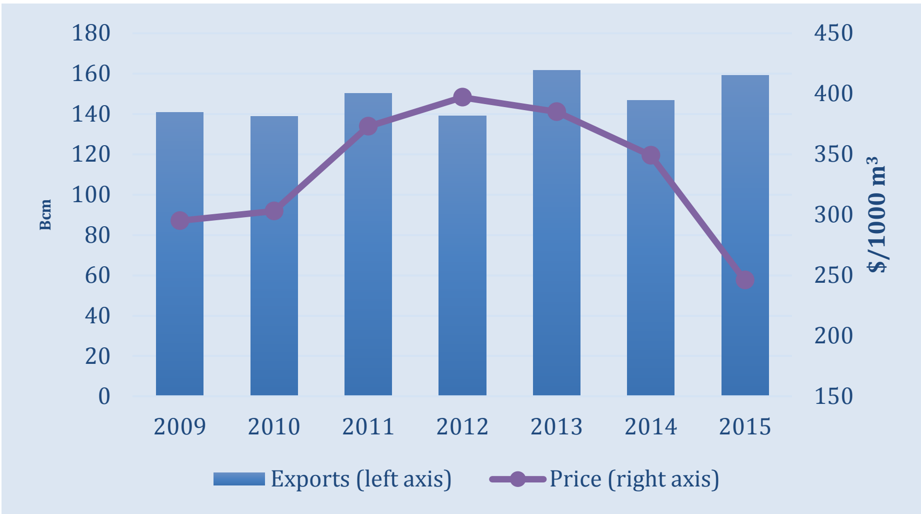
41. Gazprom, 2015, IFRS Consolidated Financial Results, 28 April 2016, www.gazprom.com.

42. Or $7.01/MBtu in 2015, as opposed to $9.95 in 2014 (based on 1,000 m³ = 35.09 MBtu, or 8,850 kcal/1,000 m³, t = 20° C, conversion used by Gazprom: www.gazprom.com.)
It should be noted that it is the average price for Europe and the “other countries”.

December 2015 (2,023 billion roubles) and its free cash flow was down by 40% (to 390 billion roubles). These results reduce the group's financing capacity and force it to optimise its investments, particularly upstream and in gas transmission (suspension of the Vladivostok LNG project and TurkStream pipeline project). However, for some upstream and transmission projects (Nord Stream II in particular), co-financing with European partners is envisaged. Modernising ageing production and transmission facilities will however require additional financial input in the future, reducing other project funding opportunities.

Gazprom's stated objective is to maintain a share of at least 30% of the European market in the medium and long term[43]. Gazprom anticipates increasing its sales to Europe to 162.6 bcm in 2016 and to about 166 bcm in 2017 and 2018[44].

Graph 18: Sales and average price of gas delivered to Europe by Gazprom



Source: Gazprom

43. *Gazprom*, Investor Day, p.9, February 2016, www.gazprom.com.

44. *Bloomberg*, "Gazprom Sees Record EU Exports as It Shrugs Off U.S. LNG", 1st February 2016, www.bloomberg.com.

Gazprom has surplus capacities

In the mid-2000s, Gazprom had decided to invest in new production and transmission capacities to deal with the anticipated increase in European demand[45]. In particular, the company has invested in developing the Bovanenko field, in the Yamal peninsula (on completion, the field will have a production capacity of more than 115 bcm per year). Its transmission capacities to Europe were increased by 55 bcm per year in 2011/2012 due to Nord Stream I and reached 240 bcm per year[46].

Following the fall in demand on the Russian market and a smaller than expected increase in European demand, Gazprom's excess production capacities are estimated at between 100 bcm/year[47] and 170 bcm/year[48]. Under these conditions, **Gazprom has gas at a low marginal cost and therefore considerable room for manoeuvre to meet the threat posed by US LNG**. Its unused excess production and transmission capacities would enable it to sell gas on the spot market at a sufficiently large scale to affect prices, with the latter serving as a benchmark price for the development of competing LNG.

And increased competitiveness through falling prices

The great majority of Russian gas exports to Europe are sold via long-term contracts of 10-35 years. These contracts, which are legally binding and subject to international arbitration, contain *take-or-pay* (ToP) clauses which require buyers to pay for a minimum annual quantity of gas, regardless of whether they take this quantity or not. These contracts, which were historically linked to petroleum product prices, are subject to review every three years, based on changes in the market conditions. Since 2010, with the fall in gas demand in Europe and the development of gas hubs, buyers have required more flexibility in contracts and greater indexing to market prices. Gazprom has deployed a resistance strategy of agreeing after tough negotiations (and often following litigation) to revise its contract prices, while maintaining price indexing linked to petroleum product prices. **The Group has also granted a combination of concessions**

45. According to the IEA's WEO 2006, EU demand increased from 508 bcm in 2004 to 726 bcm in 2030 (IEA, World Energy Outlook 2006, November 2007).
46. M.-C. Aoun, S. Cornot-Gandolphe, "L'Europe du gaz à la recherche de son âge d'or ?", *Études de l'Ifri*, October 2015, www.ifri.org.
47. J. Henderson, T. Mitrova "The Political and Commercial Dynamics of Russia's Gas Export Strategy", OIES, September 2015, www.oxfordenergy.org.
48. *International Gas Report*, No. 791, 8 February 2016.

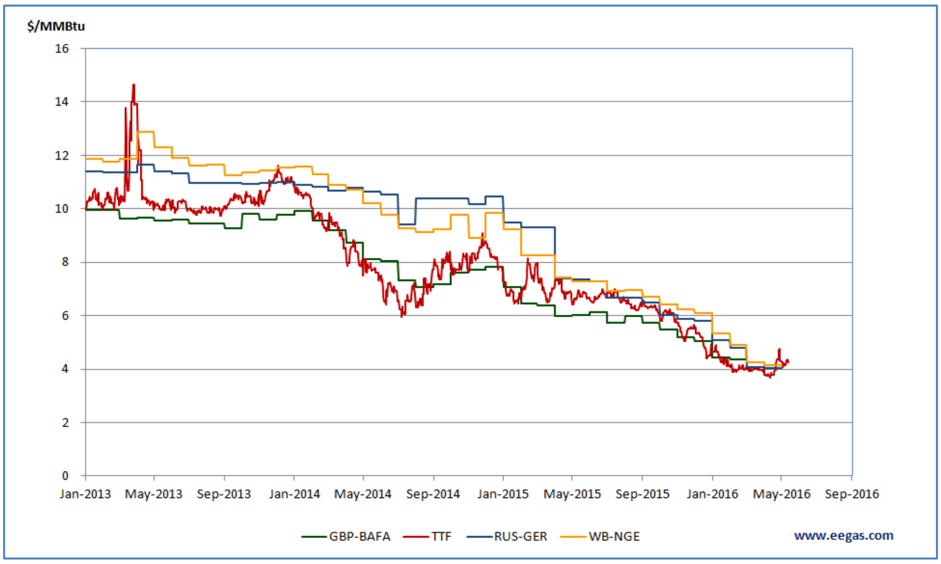
to its European customers including reductions on the prices of its oil-indexed gas deliveries, prices linked to the spot prices for deliveries in addition to the ToP quantities, backdated compensation covering the difference between the contractual price and the market price, and indexing partly linked to market prices ("hybrid system").

These concessions have already had a considerable impact on the indexing of the gas price in Europe. The International Gas Union (IGU) states that 64% of the volumes consumed in Europe in 2015 were indexed to the gas markets and only 30% to oil/petroleum products, with the remainder (mainly from gas produced outside of north-west Europe) being subject to regulated prices[49]. However, whereas in north-west Europe 92% of the volumes were indexed to the gas markets, this rate decreases to 56% for central Europe, 32% for the Mediterranean countries, 15% for the Baltic countries, and less than 10% in south-east Europe[50].

Following these concessions, the price of Russian gas, which averaged $12/MBtu in 2012 fell to $11.20 in 2013, and then to $10.5/MBtu in 2014[51]. **Since July 2014, the sharp fall in oil prices has automatically led, through the correlated indexing formulae, to lower prices with around a six- to nine-month lag.** So on average in 2015, the average price of Gazprom exports to Europe was $7.3 /MBtu. In April 2016, the price of Russian gas at the German border fell to $4.02 /MBtu, its lowest price since 2004. The changes to contracts, combined with falling oil prices, have resulted in a 66% drop in prices since 2012 and have helped to realign the Russian gas prices to those of the spot markets (Graph 19).

49. IGU, Wholesale Gas Price Survey – 2016 Edition, May 2016, www.igu.org.
50. This situation has resulted in the European Commission opening an investigation against Gazprom for abuse of a dominant position and anti-competition practices in the eastern European countries in 2012, and to issue a Statement of Objections to Gazprom in April 2015. See M-C Aoun, S. Cornot-Gandolphe, "The European Gas Market Looking for its Golden Age?", *op. cit.*
51. IMF, average price of Russian gas delivered to Germany, www.imf.org.

Graph 19: Price of Russian gas in Europe *vs.* spot price



GBP-BAFA: average price of gas at the German border; TTF: spot price for the Dutch hub (Title Transfer Facility); RUS-GER: Price of Russian gas at the German border; WB-WGE: Average price of imported gas in Europe..

Source: East European Gas Analysis (eegas).

Furthermore, Gazprom has also agreed to **more flexibility in the off-take clauses in long-term contracts**, with reductions of ToP levels from 85% - 90% previously to 70% for its main customers. Gazprom has a portfolio of long-term contracts of around 190 bcm/year with its European customers, and the minimal contractual quantities, subject to ToP obligations, are estimated at 133 bcm/year up to 2022[52]. These are the quantities in excess of these minimal quantities that US LNG could (theoretically[53]) replace.

A price war?

As we have seen (Section 2), in the short term, the fall in gas prices on the global markets is making it difficult to develop new US LNG projects. But in the medium term, the increase in oil prices and the relative stability of US gas prices (AEO 2016 scenario) should improve the economics of US projects. Furthermore, falling prices will not prevent US LNG from existing projects or those under construction from arriving in Europe, if the European price allows for the short-run marginal costs of projects to be

52. OIES, Henderson, J. (2016) "Gazprom – Is 2016 the Year for a Change of Pricing Strategy in Europe?", Oxford Institute for Energy Studies – www.oxfordenergy.org.

53. For this to happen, all countries should have access to a regasification terminal and there should be no congestion on the transmission network.

covered and if Europe provides a better premium than those of other LNG buyers. So, to counter this threat, particularly in its key market of Western Europe[54], Gazprom could apply a similar strategy to that of Saudi Arabia in the oil market to maintain its market share and to discourage the entry of US LNG into its market. The aim would be twofold:

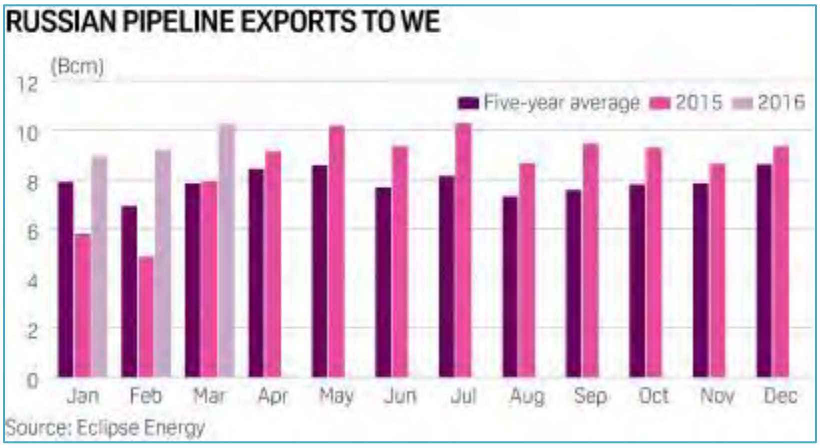
- **In the short term, preventing LNG imports from existing terminals or terminals under construction**. This would lead to Gazprom setting prices lower than those required by the US LNG exporters (short-run marginal cost),
- **In the medium term, discouraging the construction of new LNG projects,** which would require a sufficiently volatile price to deter investment decisions.

Gazprom has made it clear that it intends to defend its share of at least 30% of the European market. The question is how far Gazprom would be willing to lower prices to squeeze out the competition.

In a price war, the question of volumes does not arise for Gazprom. Due to its excess production and transmission capacities, Gazprom has considerable room for manoeuvre to increase its exports to Europe[55]. This is what the Group has been doing from April 2015. After their fall in the first quarter of 2015 due to a restrictive policy[56], volumes exported to Europe increased quickly, with the price of Russian gas being aligned to the spot price, or sometimes even lower. In early 2016, Gazprom has continued with this policy: the quantity of gas delivered during the first quarter of 2016 via the Nord Stream, Yamal and Brotherhood pipelines reached 28.3 Bcm, or an increase of 53% compared to that of the first quarter of 2015 and much higher than the average of the last five years (Graph 20). **Gazprom's total exports were up by 18%, in the first quarter of 2016 (51 Bcm) compared to the same period in 2015**[57].

54. The first US LNG cargo was exported to Portugal, which is not one of Gazprom's markets.
55. Currently provided that quantities transited via Ukraine are increased, which Gazprom did in 2015. Despite the difficult climate between both countries, deliveries of gas to Europe *via* Ukraine increased by 8% in 2015 to 67 bcm.
56. During the winter 2014-2015, Gazprom limited its sales to some European customers with a double objective: to restrict the possibility of its volumes being re-exported to Ukraine and to avoid a price crash on an already well-supplied market. Following the failure of this policy on both fronts, Gazprom discontinued it in March 2015 (OIES, 2015).
57. Natural Gas Europe, “Russia's Q1 Exports Up, Revenues and Margin Down”, 13 May 2016, www.naturalgaseurope.com.

Graph 20: Russian exports to Western Europe



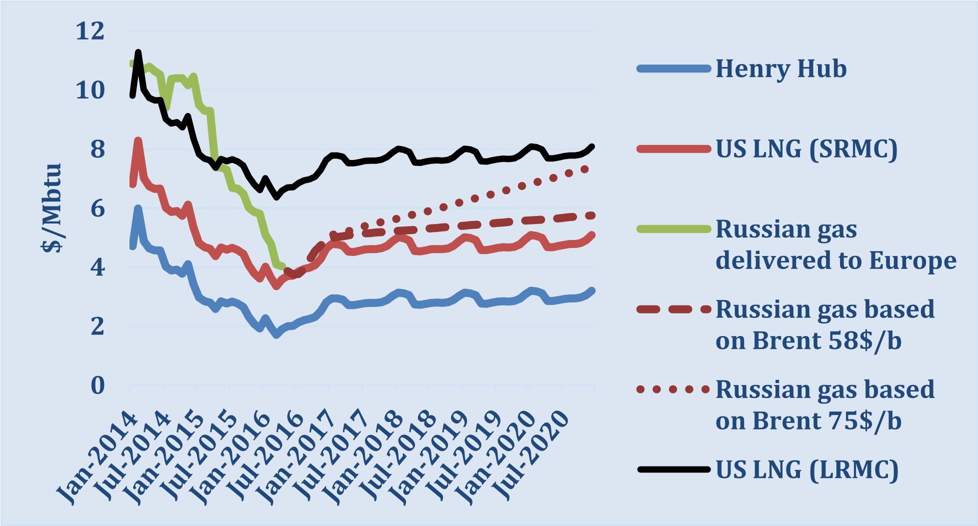
Source: Platt's[58].

In the short term, the fall in prices favours Russian gas in relation to US LNG

With regard to prices, at the Henry Hub price of April 2016 ($1.9/MBtu), the US LNG exporters have a short-run marginal cost of $3.6 (see Graph 11) while the price of Russian gas delivered to Germany was $4. The difference between the price of the Russian gas and the marginal cost of the LNG has decreased significantly in recent months. It averaged nearly $3 in 2015. In April 2016, it was no more than $0.4 (Graph 21).

58. *Platt's*, "Portuguese LNG Cargo no Signal of US Impact", 29 April, 2016, www.platts.com.

Graph 21: Price of Russian gas at the German border and SRMC of US LNG



Source: EIA, IMF, Author.

Therefore, commercially it is not unreasonable for Gazprom to defend its market share since the gas price is already close to the short-run marginal cost of US LNG exports. If a price war was very costly in 2015, the falling prices in 2016 make it much more feasible. In 2015, the shortfall due to a price war would have cost Gazprom $13 billion[59]. At the April 2016 prices, this cost is reduced to $1.8 billion.

Furthermore, it should be emphasised that the **indexation of long-term contracts to the oil prices with a six- to nine-month lag will continue to drive the price of Russian gas delivered to Europe down**: the low price of Brent in the first quarter of 2016 (less than $30/b in January 2016) will have an impact on the Russian price in the third quarter of 2016. A situation the government recognised in its economic forecasts for 2016[60]. Consequently, **the Russian price could fall below the marginal cost of US LNG**, even if the Henry Hub price remains at a very low level, favouring Russian gas over US LNG. Furthermore, competition from US LNG will be limited in 2016 (the first Sabine Pass train came into production in late February and the second one in May

59. The cost of aligning the price for deliveries to Europe, excluding Turkey, 132 bcm in 2015, to that of the US marginal cost.

60. According to the review of the macroeconomic and social factors in Russia by the Ministry of Economic Development in May 2016, the price of exports to European countries outside the USSR could fall on average to $159.2/1000 m^3 in 2016, and only rise to $174.8/1000 m^3 in 2019. See *Tass*, "Russia's Natural Gas Export to Decline to 184 bln Cubic Meters in 2016" — Outlook, 6 May 2016, http://tass.ru.

2016). The issue of competition from US importers will arise more urgently after 2017 (in 2018, US export capacities should reach 42 bcm per year, and these capacities will be added to the Australian capacities[61] affecting the international market). Additionally, so far other markets than Europe have provided higher margins.

However, the profit margin of Russian exports to Europe is falling

How far could Gazprom go?

It should be emphasised that **the cost of delivering gas from western Siberia remains high**. The total development cost of a new field in western Siberia, as well as the associated transmission costs, was estimated at $10.2/MBtu delivered in Europe in 2014, but the impact of the devaluation of the rouble is bringing this cost down to about $6.5/MBtu[62]. However, as Gazprom has surplus production capacities, **the short-run marginal cost is a more relevant measure of the cost of delivering Russian gas to Western Europe**. The estimated marginal cost varies greatly from one source to another. Moreover, this cost is highly volatile depending on the RUB/USD exchange rate used and the export tax. The government applies a tax equivalent to 30% of the value of gas sales. Yet, the price of Russian gas delivered to Europe has fallen greatly, reducing the absolute value of the tax.

In a 2015 study, James Henderson (OIES)[63], reports **a marginal delivery cost of Russian gas to the German border of $3.8/MBtu.** This figure comes from the marginal production cost in the fields estimated at $0.36 /MBtu, to which the tax on extractive industries (MET mineral extraction tax) of $0.35/MBtu, the transmission cost in Russia ($0.81 /MBtu), the transmission cost by Nord Stream ($1.17/MBtu) and the export tax are added. Bloomberg quotes Alexander Kornilov, an energy analyst in Moscow, reporting a cost of $2/MBtu to take away the gas in western Siberia and transport it to the German border[64].

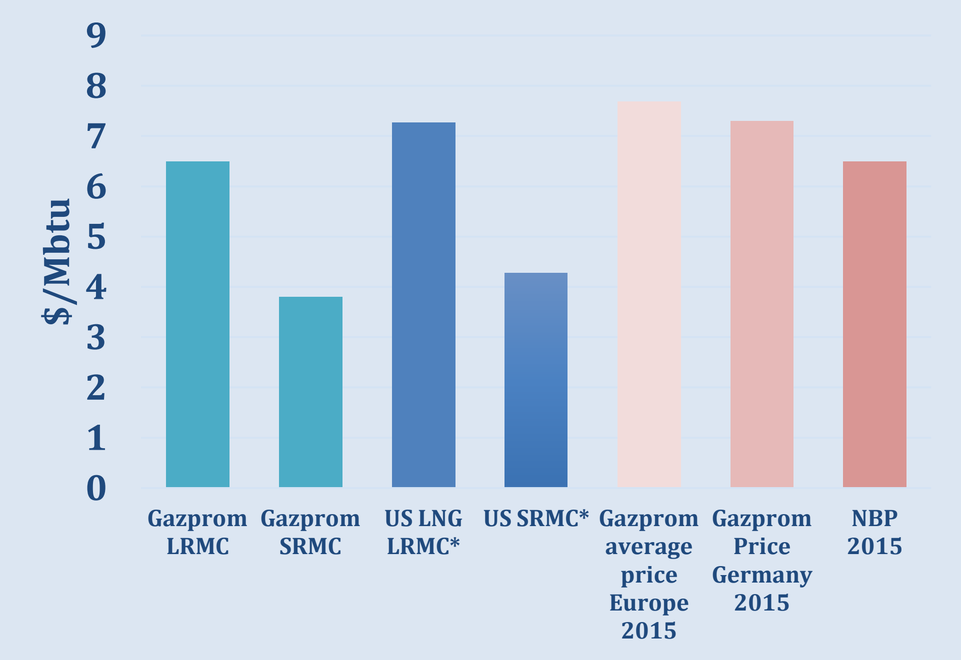
61. Even if the Australian LNG is not imported in Europe because of the distance, it will reduce import flows from exporters in the Atlantic basin to the Pacific basin, which will increase competition between suppliers in the Atlantic basin.

62. OIES, The Political and Commercial Dynamics of Russia's Gas Export Strategy, James Henderson, Tatiana Mitrova, September 2015, www.oxfordenergy.org.

63. Calculated with an exchange rate: 1 USD= 60 RUB. OIES, *ibid*.

64. *Bloomberg*, "Russia Has Room to Play Saudi Oil Game With EU Gas", VEB Says, 19 February 2016, www.bloomberg.com.

Graph 22: Russian and US gas prices and costs



* Henry Hub price: $2.5/MBtu.

Sources: OIES, Gazprom, FMI, Reuters, Author.

So, **a strategy of aligning prices to the marginal cost of US producers (at April 2016 prices) would not allow Gazprom to cover its costs**. Therefore, such a policy does not seem very realistic. However, a slight rise in Henry Hub prices to $2.5 /MBtu (the example in Graph 22) increases the marginal cost of US LNG above the Russian cost.

At the current price levels, the profit margin of Russian exports to Europe is drastically reduced. In the first quarter of 2016, Gazprom reported that the average price of Russian gas exported to Europe, excluding the former USSR, dropped to $166 /1000 m^3. Despite the increase in its exports by 18%, revenues were down by 29%[65]. Exports to Europe are traditionally the main source of Gazprom's profits. However, according to Gazprom's Deputy CEO, Valery Golubev, in the first quarter of 2016, profits on sales abroad were closer to those made in some Russian regions. At these levels, Gazprom would have difficulty financing its investment programme, especially as it has to pay $1.5 billion more this year in extraction taxes[66].

65. Natural Gas Europe, "Russia's Q1 exports up, Revenues and Margin down", 13 May 2016, www.naturalgaseurope.com.

66. The government has increased the tax on extractive industries (MET) applied to Gazprom by 36.7% for the year 2016. *Reuters*, "Russia to Raise Mineral Extraction Tax Rate on Gazprom by 36,7% in 2016", 10 October 2015, www.reuters.com.

Such a strategy would also require the government to be prepared to accept a drop in its gas revenues. However, revenues from oil and gas exports account for 44% of the national budget, although gas is far behind oil. In the difficult economic and budgetary situation that Russia is experiencing (with a fall in GDP of 3.7% in 2015 and a deficit of 3%) the government's priority is rather to find new sources of revenue.

So, a strategy of aligning Russian gas prices to the US LNG marginal cost seems difficult to implement as long as the US gas price is at such low levels.

But does Gazprom have a choice?

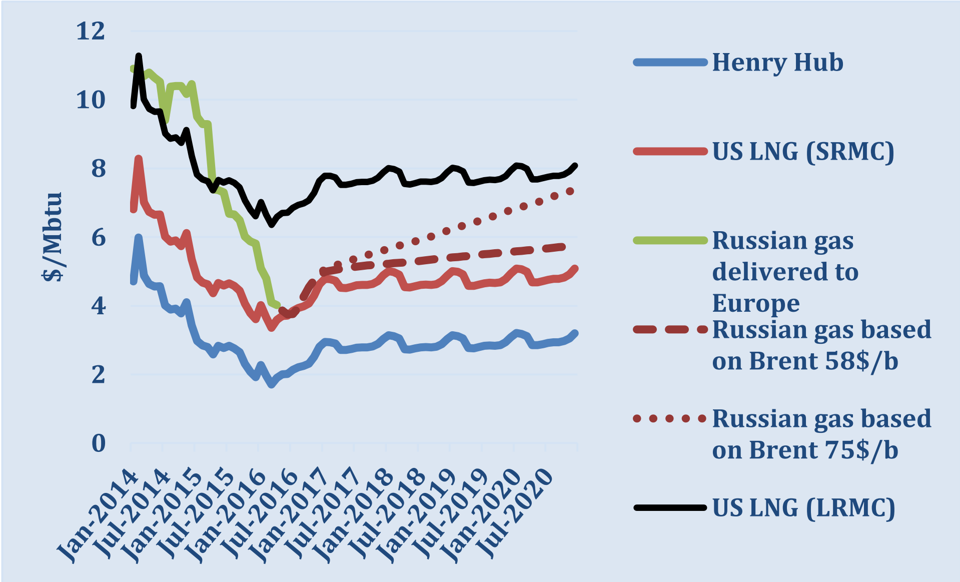
The oil price recovery (even modest) will lead to a higher price for Russian gas in a six- to nine-month lag. The World Bank has just revised its forecasts for the crude oil price upward to $41/b on average in 2016 and $50/b in 2017[67]. Although this upturn is good news for Russian finances, it would help to make US LNG more attractive than Russian gas for European customers. These could then reduce their purchases of Russian gas to the advantage of US LNG imports, since the Russian contracts give them this possibility.

Gazprom will then have to make a choice: either maintain its price and lose its market share, or adjust its price and maintain, or even increase its market share. Gazprom has clearly stated that the Group wanted to maintain its market share in Europe. The increase in its sales in 2015 and in the first quarter of 2016 appears to indicate that the company is preparing for this price war. **The increase in the Henry Hub price forecast for 2017 (to $2.9 MBtu on average), and then to $3.2 by 2020 (*futures* price on 20 May 2016), will reduce the effort required, while creating a price ceiling for Gazprom's sales.**

Graph 23 illustrates the evolution of Russian gas prices under two oil price assumptions and compares it to the marginal cost of US LNG (short and long run).

67. World Bank, April 2016, http://pubdocs.worldbank.org.

Graph 23: Possible evolution of Russian gas prices and US LNG costs



Assumptions:

Short-run marginal cost (SRMC) and long-run marginal cost (LRMC) of US LNG based on the Henry Hub futures of 20 May 2016

Russian price (dash) based on the Brent futures of 20 May 2016 ($58 /b in December 2020)

Russian price (dotted) based on oil price increasing to $75 /b in December 2020.

Source: CME, Author.

Graph 23 shows **that with a rise in the crude oil price to $58/b by the end of 2020 (and even more if crude goes up to $75/b as the EIA projects), oil-indexed Russian gas would become uncompetitive compared to US LNG on the basis of short-run marginal cost**. In this case, European buyers would benefit from reducing their purchases of Russian gas to the minimum ToP quantities and replacing it with LNG. The graph also shows that the long-run marginal costs of US projects remain higher than that of Russian gas. On this basis, there are no economic incentives to develop new LNG projects to Europe.

Table 3 compares revenues from gas sales in a market share defence scenario of aligning the Russian gas price to the short-run marginal cost of US LNG, with a *status quo* scenario, where the price of Russian gas increases according to the crude oil price prompting European buyers to reduce their purchases to the minimum ToP obligations.

Table 3: Gazprom's revenues from gas sales according to two scenarios

	2017	2018	2019	2020	TOTAL
European Demand (Gm^3)	527.5	535.0	542.5	550.0	
Scenario 1: secure market share					
Gazprom exports (31%) - Gm^3	163.5	165.9	168.2	170.5	
Price SRMC ($/MBtu)	4.7	4.7	4.8	4.9	
Price SRMC ($/1000 m^3)	163.6	165.5	166.9	170.5	
Revenues (billion $)	26.8	27.5	28.1	29.1	111.3
Scenario 2a: maintain oil indexation (crude: 58$/b in 2020)					
Gazprom exports (Min ToP)- Gm^3	133.0	133.0	133.0	133.0	
Russian price ($/MBtu)	5.1	5.3	5.5	5.7	
Russian price ($/1000 m^3)	179.5	186.1	192.6	198.8	
Revenues (billion $)	23.9	24.8	25.6	26.4	100.7
Scenario 2b: maintain oil indexation (crude: 75$/b in 2020)					
Gazprom exports (Min ToP)- Gm^3	133.0	133.0	133.0	133.0	
Russian price ($/MBtu)	5.4	5.9	6.5	7.1	
Russian price ($/1000 m^3)	187.8	207.1	228.1	249.1	
Revenues (billion $)	25.0	27.6	30.3	33.1	116.0

Assumptions:

European demand: 511 Bcm in 2015 (source: Gazprom), increasing to 550 Bcm in 2020, mainly due to substitution for coal in the electricity sector.

Scenario 1:

Gazprom maintains a 31% share of the European market.

Prices aligned to the short-run marginal costs of US LNG.

Scenarios 2a and 2b:

Gazprom sales are limited to the minimum ToP contractual quantities

Russian price calculated according to the changes in Brent

Btu conversion: 1000 m^3 = 35.09 MBtu, or 8850 kcal/1000 m^3, t = 20° C.

Source: Author (adapted from OIES).

In the event of a rise in the crude oil price to $58/b by the end of 2020, the falling gas prices largely offset the loss in revenues due to the decrease in quantities exported at their minimum ToP. This calculation is very theoretical[68], but it indicates that **with a modest rise in the oil price, a market share defence strategy and the alignment of gas prices to the SRMC of US LNG would be more profitable than a *status quo* strategy**.

The result is different **in the event of a sharper rise in the crude oil price (to $75/b by the end of 2020).** In this case, **the *status quo* strategy is preferable**. This example shows that **different strategies should be applied to maximise the sales revenues to Europe, depending on the US gas price and the changes in the crude oil price.**

If a market share defence strategy is followed by Gazprom, it requires Gazprom to adapt its commercial policy, which the Group started in 2015 with a change of strategy towards Europe.

A new strategy vis-à-vis Europe

Gazprom's strategy vis-à-vis the European market has changed significantly over the past two years. Initially, it was influenced by deteriorating relations between Russia and Europe following the conflict between Ukraine and Russia after the annexation of Crimea[69]. So, after abandoning the South Stream pipeline, Gazprom replaced it with TurkStream in December 2014 and Russia announced that it would not renew the transit agreement via Ukraine which ends in late 2019. Instead, it would sell its gas to European customers at the Turkish-Greek border. In December 2014, Gazprom ended its asset swap with BASF which gave Gazprom complete control of the joint venture WINGAS. This policy was consistent with the announcement made by Alexey Miller that the company was discontinuing its strategy of direct sales to European end users[70].

However since June 2015, the strategy has undergone a full turnaround with a more active commercial approach consistent with European realities.

68. This calculation assumes that all the surplus of LNG goes to Europe and that the European buyers reduce their purchases of Russian gas to the minimum contractual obligations and replace the volumes with US LNG imports, which in the current state of the European network would not be feasible.

69. See M.-C. Aoun, S. Cornot-Gandolphe, " The European Gas Market Looking for its Golden Age?", *op. cit.*

70. *Interfax*, 6 December 2014, "Europe Will Have to Care About Delivering Russian Gas From the Turkish Border".

This strategy incorporates the enhancement of Gazprom's export capacity to Europe with the Nord Stream II project (two lines with a capacity of 55 bcm/year)[71], the completion (uncertain) of two TurkStream lines[72] (a capacity of 31.5 bcm/year) and the construction of an LNG export terminal on the Baltic Sea (Baltic LNG, with a capacity of 10 Mt per year of LNG, or 13.5 bcm per year). With these three projects, Gazprom's export capacity to Europe would be increased to 340 bcm per year, and double its current exports to Europe. If an assumption is made that Russia intends to reduce (but without stopping) exports through Ukraine in the long term (about 50 bcm per year instead of 140 bcm per year of capacity via Ukraine), Russia's export capacity would then be close to 250 bcm per year (200 bcm per year, if TurkStream and the LNG terminal are excluded, which is intended for the international market,). The completion of Nord Stream II (as well as the use of the OPAL pipeline at 100%) is necessary to increase volumes exported to Europe at controlled costs[73].

71. The agreement to extend the pipeline between Gazprom (50%) and Eon/Uniper, BASF/Wintershall, OMV, Engie, and Shell (10% each), was finalised in September 2015. This project deeply divides Europe: it is criticised for not being compliant with the Energy Union, for increasing dependence vis-à-vis Russian gas, and for weakening transit via Ukraine, while its advocates stress that the pipeline is a commercial project which will provide greater security of supply. Germany's role in the completion of the pipeline will be critical. In addition to the German partners involved in the project, Germany is the leading importer of Russian gas and this project would allow it to increase both its purchases of Russian gas, but also its transit to other European countries, at the expense of the current transit through Ukraine and central European countries. The many underground gas storage facilities owned by Germany (49 storage facilities and 24.5 bcm of working gas in 2015, including a part held directly by Gazprom through its asset swap with BASF) increase the security of supply to customers and also offer opportunities for the commercial optimisation of deliveries according to prices.

72. The project was cancelled in November 2015.

73. The Ukrainian network is old and requires modernisation investments (Mott MacDonald estimates that $4.8 billion would be required to be invested in the network, but up until now this investment has not been made). The Ukraine has just increased its transit tariff (now a regulated entry/exit tariff) from $2.7/1000 m³/100 km to $4.5 (to which VAT at 20% must be added). *Sputniknews*, "Ukraine Raises Gas Transit Tariffs for Gazprom by Over 50%", 19 January 2016, http://sputniknews.com.

Map 3: Transmission capacities of Russian gas to Europe (existing and planned)

Source: Gazprom, Investor Day, February 2016.

The new strategy revives acquisitions in the European downstream sector and extends co-operation in the Russian gas upstream sector. So, in October 2015, Gazprom and BASF completed their asset swap. Under the agreement, Wintershall transferred its trading business and natural gas storage activities that both companies were operating jointly to Gazprom. This includes the gas trading companies, WINGAS, WIEH (Wintershall Erdgashandelshaus, Berlin) and WIEE (Wintershall Erdgashandelshaus, Zug) and the gas storage facilities operated by Astora (Rehden and Jemgum in Germany and Haidach in Austria). In return, Wintershall acquired stakes in two blocks in western Siberia with a production capacity of 8 bcm/year. The new acquisitions by Gazprom in gas trading and storage **give the company effective ways to adjust its commercial policy according to gas prices and competition**. Storage facilities are indeed an indispensable tool for optimising gas sales and meeting short-term price changes.

However, the most striking part of this new strategy is commercial. In exchange for the removal of the flexibilities included in the contracts, Gazprom would be willing to give up indexing its long-term contracts to oil with its European customers, at least in the liberalised markets of north-western Europe[74].

74. OIES, October 2015, *op. cit*.

So, in March 2016, **Gazprom renegotiated its sales/purchase agreements with Uniper** (a subsidiary of Eon), hence putting an end to the dispute against the German company since 2014[75]. It also renegotiated the terms of its contracts **with Engie** in April 2016[76]. Although the terms of the new contracts are confidential, statements by Uniper and Engie both report that with these agreements, they have "de-risked" their long-term supply contracts for the coming years, due to a **price adjustment to market conditions**, which seems to indicate that the price adjustment is now linked to changes in the gas spot prices in the respective markets, and no longer to changes in petroleum product prices. This adjustment is particularly important for importers at a time when the gas and oil prices are changing in contrasting ways. Already in 2014, Eni, whose supplies from Russia completely depend on transit through Ukraine, had arranged that its contracts were indexed entirely to the spot market[77].

Furthermore, **Gazprom has been testing a new sales mechanism since September 2015**. Hence, it has used the **auction mechanism** to sell 3.24 bcm over three delivery points in Germany. At the end of this process, a total volume of 1.2 bcm was sold to 15 customers for the October 2015-March 2016 winter period. Gazprom stated that these results confirmed the complementarity of the pricing mechanisms between the prices set out in the long-term supply contracts and the market prices[78]. After the test in September 2015, the company announced a new auction, this time, for the Baltic markets. The auction took place in March 2016 and 420 million m^3 (Mm^3) were sold this way (560 Mm^3 offered). It accounts for 10% of the volumes sold by Gazprom to the Baltic countries in 2015.

Although the auctioned volumes are currently limited, **Gazprom's goal is to sell 10% of its sales through this mechanism**[79]. These sales, organised by Gazprom Export from Saint Petersburg, allow the Group to sell additional volumes at a controlled price (the auctions have a reserve price) in addition to its long-term contracts without this strategy turning against the price level of long-term contracts. These sales also remove the potential need for the buyers to purchase LNG spot cargoes (US or other).

75. See at: www.eon.com.
76. See at: www.engie.com.
77. *Reuters*, "Italy's Eni wins 1st Non Oil-indexed Gas Deal from Russia", 23 May 2014, www.reuters.com.
78. See at: www.gazpromexport.ru.
79. *Reuters*, "Russia's Gazprom aims for More Gas Auctions in Europe this Year", 1st March 2016, www.reuters.com.

So, after years of fighting to maintain the oil indexation of its contracts, **we are witnessing a substantial change in Gazprom's commercial policy vis-à-vis its European customers with a more or less rapid progression to gas market indexing, depending on the customer**. Although the US LNG is not the trigger for this change, it has contributed to it by increasing the competition on the European market. However, it should be emphasised that Gazprom still officially defends its position in favour of a hybrid system[80].

By adopting this policy, Gazprom is building a strategy for the long term. Initially, it will be in a position to support a price war to maintain its market share, although this price war cannot be an end in itself or last too long. The increase in low-price Russian gas deliveries will make access to the market more difficult for existing projects and delay or even cancel investment in new LNG projects. Furthermore, Gazprom's goals of significantly increasing its export capacity in terms of infrastructure, as well as its production capacities, indicate to potential competitors that Gazprom has a significant surplus capacity in the medium to long term, likely to impact markets. Finally, by testing new forms of marketing its gas while keeping its long-term contracts, Gazprom is acquiring a tool to use surplus capacities opportunistically through the auction mechanism or on spot markets when it is in its interest, what Sadek Boussena and Catherine Locatelli call the "strategy of uncertainty"[81].

80. E. Burmistrova, "Current Opportunities of the European Gas Markets", Flame Conference, Amsterdam, 10 May 2016, www.gazpromexport.ru.

81. S. Boussena, C. Locatelli. *Guerre des prix ou instrumentalisation de l'incertitude sur les prix: quelle stratégie pour un fournisseur dominant sur le marché gazier européen?*, Cahier de recherche EDDEN n° 1-2016 - 23 p. 2016. <hal-01284518>.

Conclusion

US LNG, delivered or not to Europe, is a *game changer*

US LNG is a *game changer* for the European (and world) market. It has considerable implications for the security of European gas supply and its competitiveness, whether the LNG comes onto the European market or not.

In a market with excess capacity, as is the case for the European and global LNG market, the fact that significant LNG capacities are ready to be exported to Europe has the effect of capping the gas price to the US spot price increased by transportation and regasification costs (about $8 considering total costs and $4 with variable costs). The US LNG is also an important lever for renegotiating contracts with traditional suppliers under more favourable conditions.

US LNG also provides Europe with a greater security of supply. In the midst of the Russian-Ukrainian crisis, President Obama stated that America was willing to supply Europe with LNG. Nowadays, the growth in the United States' LNG export capacity increases the security of European gas supply. The European Strategy for LNG should enhance this security by facilitating the construction of missing infrastructure (import terminals or interconnecting pipelines) so that each Member State may have access to this energy source.

From a commercial point of view, it is difficult to forecast the volumes of US LNG that will be exported to Europe. The US contracts do not include destination clauses. The European buyers and LNG aggregators can therefore optimise their portfolio, which is even more necessary in the current low gas price context, making LNG less attractive than other sources of imported gas in Europe. Other markets than Europe have shown greater profitability so far. So, out of the first six cargoes exported by Cheniere, only one went to Europe (Portugal). However, Europe remains the last resort market to sell surplus LNG. In view of rising global exports capacity and weak demand from traditional Asian buyers, US LNG should be shipped to Europe, particularly from 2018.

Gazprom's reaction to this new competition seems to indicate that the group is preparing to defend its market share. The low Russian gas prices, which reflect the falling crude oil prices, are comforting this strategy. The increase in its exports and its auctioned sales are reducing the need for additional imports. But the rise in oil prices will require an adjustment of its prices and its commercial policy. However, a price war cannot be an end in itself, or last too long, neither for Gazprom nor for the Russian state. An extended low price would not be more advantageous for customers. It would have the effect of reducing, or even cancelling, the incentive to invest in new projects and would cause a shortage of LNG at the turn of the decade, when the market surplus will have been absorbed by the increased global demand. This risk of under-investment is significant at current oil and gas prices, and the strategy of traditional gas suppliers as regard the European market could increase it. This difficult situation requires cooperation between buyers and LNG producers to ensure that the necessary investments after the first wave of LNG projects, currently under construction, are made.

List of graphs, tables, maps and boxes

Graphs

Boxes

Maps

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