



**Banca Monte dei Paschi di Siena**

Una storia italiana dal 1472

## Natural Gas

The first “clean energy” in the world and a key resource  
for Italy’s future

*Siena, december 2014*

*Research & Investor relations Area*



**MONTE  
DEI PASCHI  
DI SIENA**  
BANCA DAL 1472

## Bullett Points



- Natural gas relevance has increased through the years for two different reasons: among fossil fuels is the least polluting. Is available in large quantities in several areas of the world. Therefore, it is an ideal source to provide power supply to big industrial plants. Moreover, the liquifying process generates GNL that can be loaded on tankers and transported from one side to the other of the oceans.

- Natural gas future is not easy to predict: increasing use from emerging countries should be beneficial, on the other hands production in the USA has swollen over the recent years thanks to the discovery and exploitation of the shale gas deposits and the fracking technology. In Europe, Russian gas supplies might be affected by geopolitical unrest and this could be detrimental for some countries, such as Italy who is still importing 30% of total gas supplies from Russia.



Natural Gas burning: Andrea Dardi archive



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Although renewable energies development has been impressive during the last decade, fossil fuels usage still amount at about **90 %** of the total in the world: crude oil, coal and natural gas all belong to this group.

Within fossil fuels the most interesting is certainly the natural gas, (about **24%** market share).

When burning, natural gas releases a much smaller quantity of CO<sub>2</sub> and no other dangerous greenhouse gases and heavy residual. Therefore we can well say that natural gas is the “**cleanest**” of all the fossil energy fuels.

Apart from the beneficial environmental issues, natural gas advantages are related to other very important logistic and industrial matters.

As far as transportation is concerned, natural gas can be dispatched through pipes or via sea by cargo tankers after changing state from gas to liquid, crude oil does not have such flexible features. Italy depends heavily on natural gas: this energy has replaced crude oil in many fields of activity and after decades has become paramount for the energetic future of the country. In **1973** the Italian natural gas consumption was about **17** billions cubic metres and in **2006**, two years before the great economical crisis they were **86** billions cubic metres. In the same period natural gas market share as energy source raised from **10%** to **34%** of the whole. For this reason all the relevant geopolitical issues affecting producing countries are paramount for Italy as well.



Armenian pipeline

## *Natural Gas in the World*

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- Natural gas transportation issues are extremely important because they affect gas distribution in all the consuming countries such as Italy.
- Total extension of world gas pipelines amount at about 900 thousand kilometres. The United States of America own the biggest network, about 550 thousand kilometres (data provided by world factbook), the chart shows that.
- From the engineering point of view, the gas tubes involve several components, therefore proper maintenance of the pipes is a key factor.
- Pipelines are generally made of steel. Reinforced steel is used to counter pressure in marine pipelines networks.

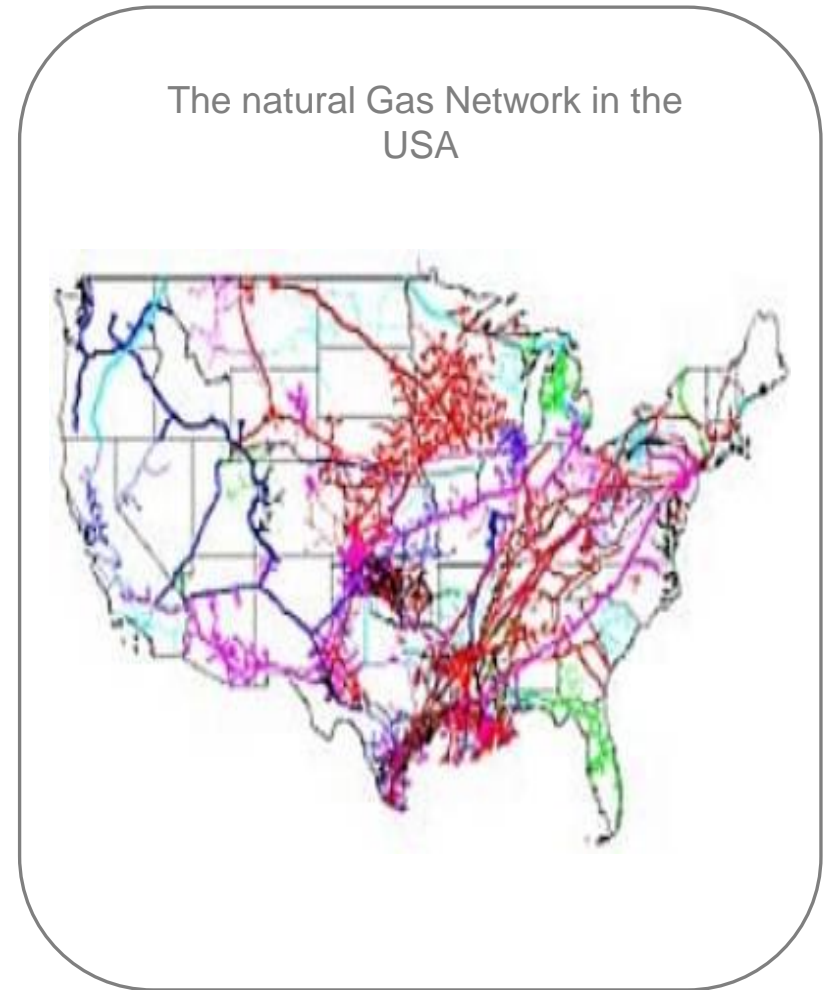


Chart provided by National Energy Lab. DOE



LNG tanker: Reuters picture

- Natural gas is very different from crude oil because it can change state from gas to liquid: this enable sea transportation. by loading tankers Therefore we can say that natural gas is a very versatile source of energy.
- Because of that, natural gas is suitable to manage sudden energy needs due to other sources disruption. We had a remarkable example in Japan, where natural gas was imported to supply energy after the disaster of the nuclear powerplant in Fukushima.

# A paramount innovation: the “shale gas” discovery



➤ We can say without fear of committing mistakes that shale gas discovery has been the major keystone in all the energy world over the last 10 years . It has changed not only the general market picture, but the balance of power between producing countries as well.

➤ The chart shows historical growth of shale gas in the USA production: in the 2000 was the 2% of total, in the 2012 it gained a 40%, chunk, a real revolution.

➤ Natural gas can often be found in rock formations, to exploit it, US engineers have been developing a new technology named “fracking”, which was started in Texas.

➤ “Fracking” (or “hydraulic fracturing”) is the injection of a high pressure fluid into the rock vein. This generates micro-fractures into the rocks allowing the “trapped” gas to get out of it.

Natural gas freed in this way is then collected in transported to the consumption points.

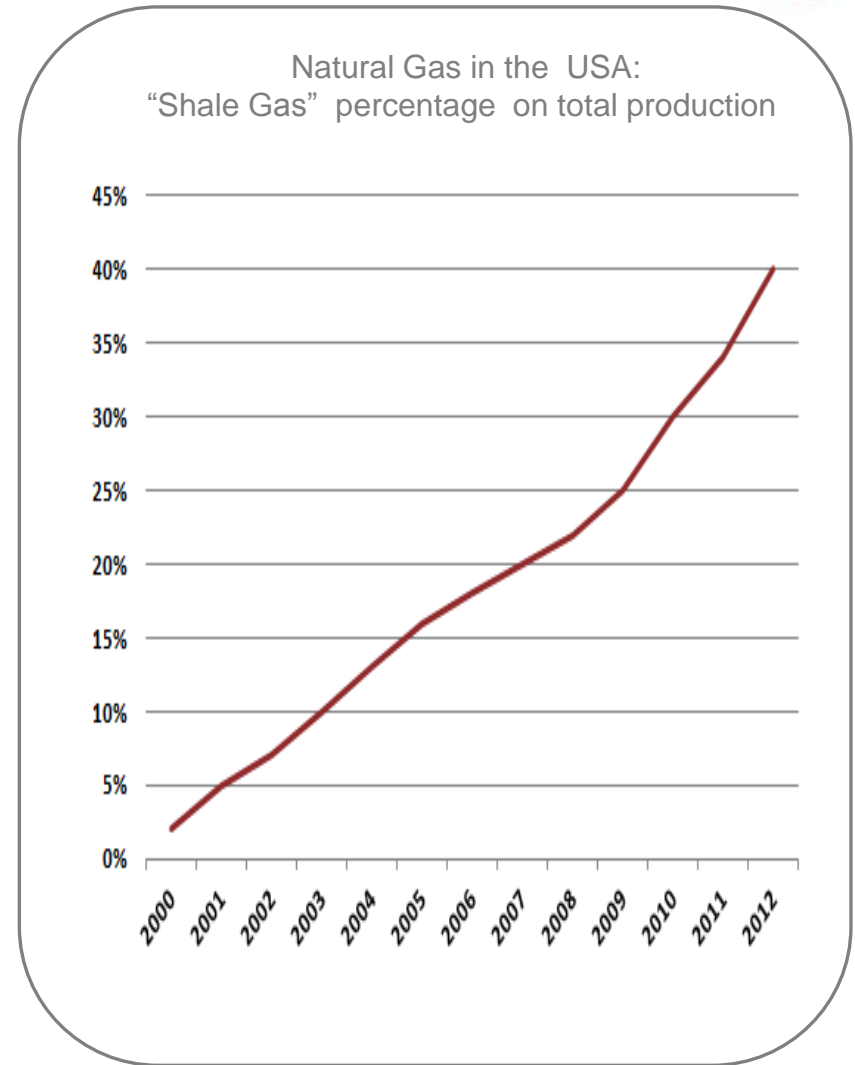
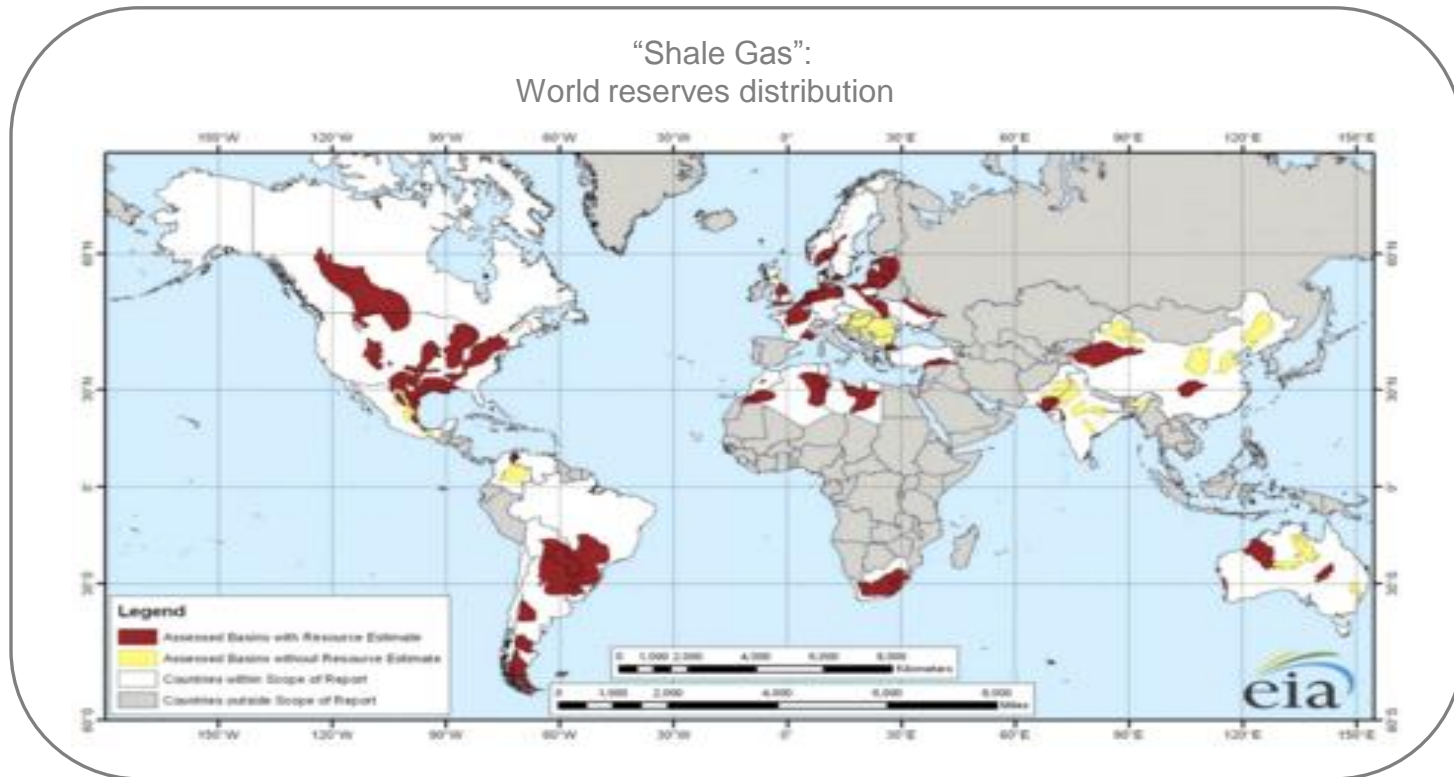


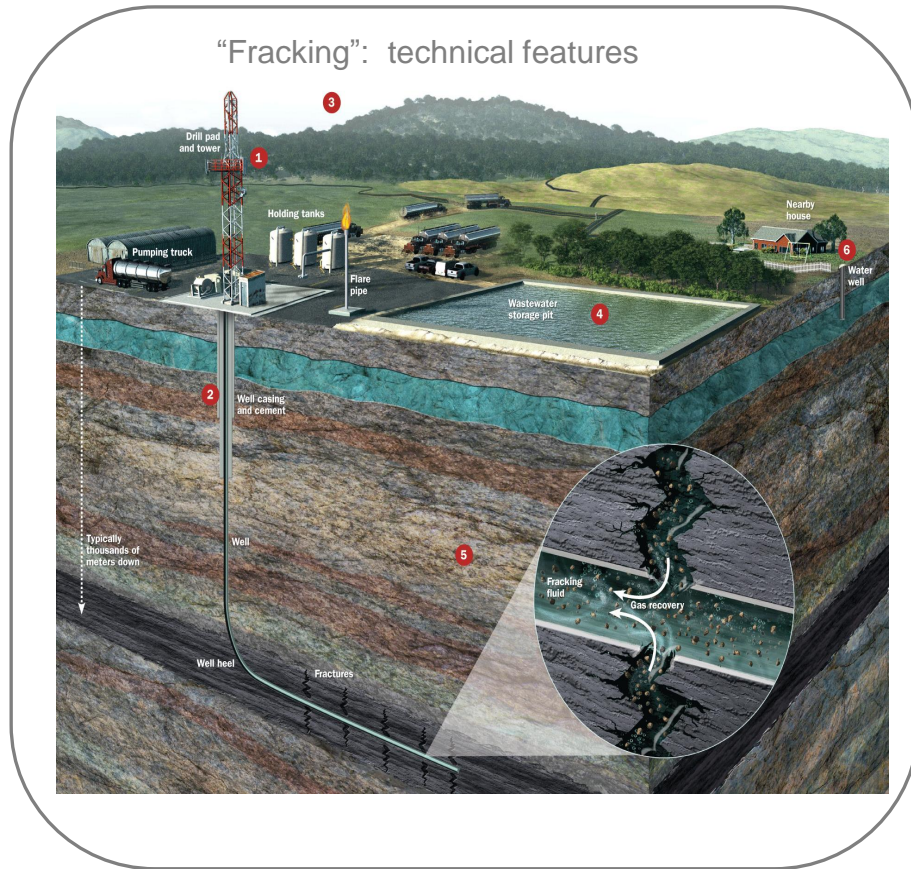
Chart processed by Area Research BMPS on DOE data





Map provided by US Energy Information Administration (EIA)

- This map shows the world locations of shale gas reserves : we can see that shale reserves are widespread, but mostly in the Americas. According to recent estimates, amount of shale gas reserves should be about **206 trillion cubic metres** worldwide.
- Most abundant shale gas reserves are in: China (**31** trillion cubic metres), Argentina (**22**), Algeria (**20**) and the USA (**19**).



from [www.Dutchsinse.com](http://www.Dutchsinse.com)



Picture from [Dorsogna Blogspot.com](http://Dorsogna Blogspot.com)

➤ In the left side picture we can see the key elements of fracking: water is taken from the inner vein and pumped into the rocks. This creates fracturing and gas is freed and collected. The right picture shows the residual treatment in the sedimentation.

## Environmental implications

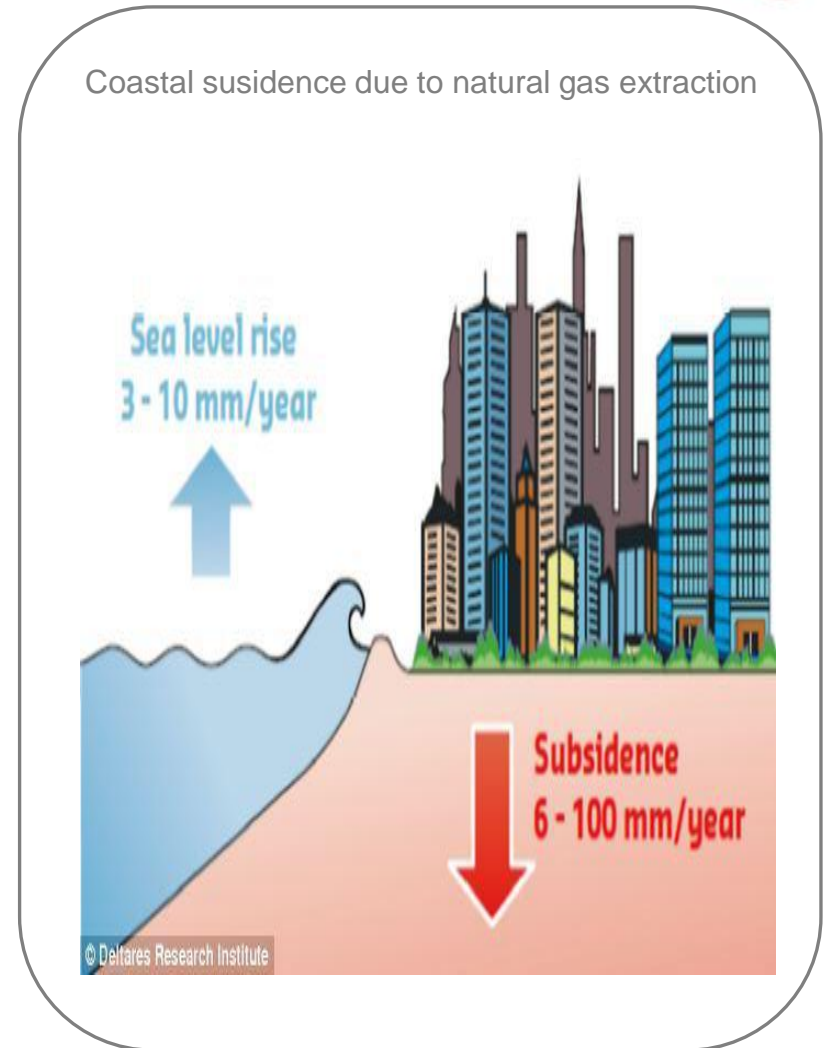


➤ We explained why natural gas can be considered the cleanest energy among the fossil fuels: nevertheless, there are other environmental implications. Those are mainly related to the extraction activity.

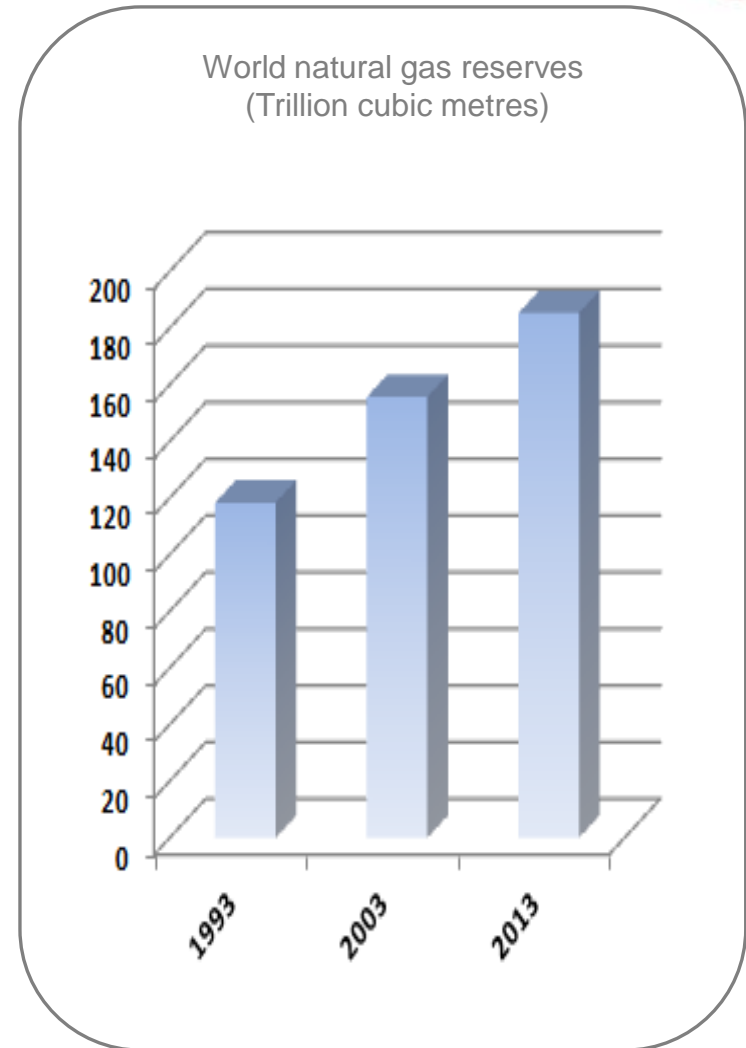
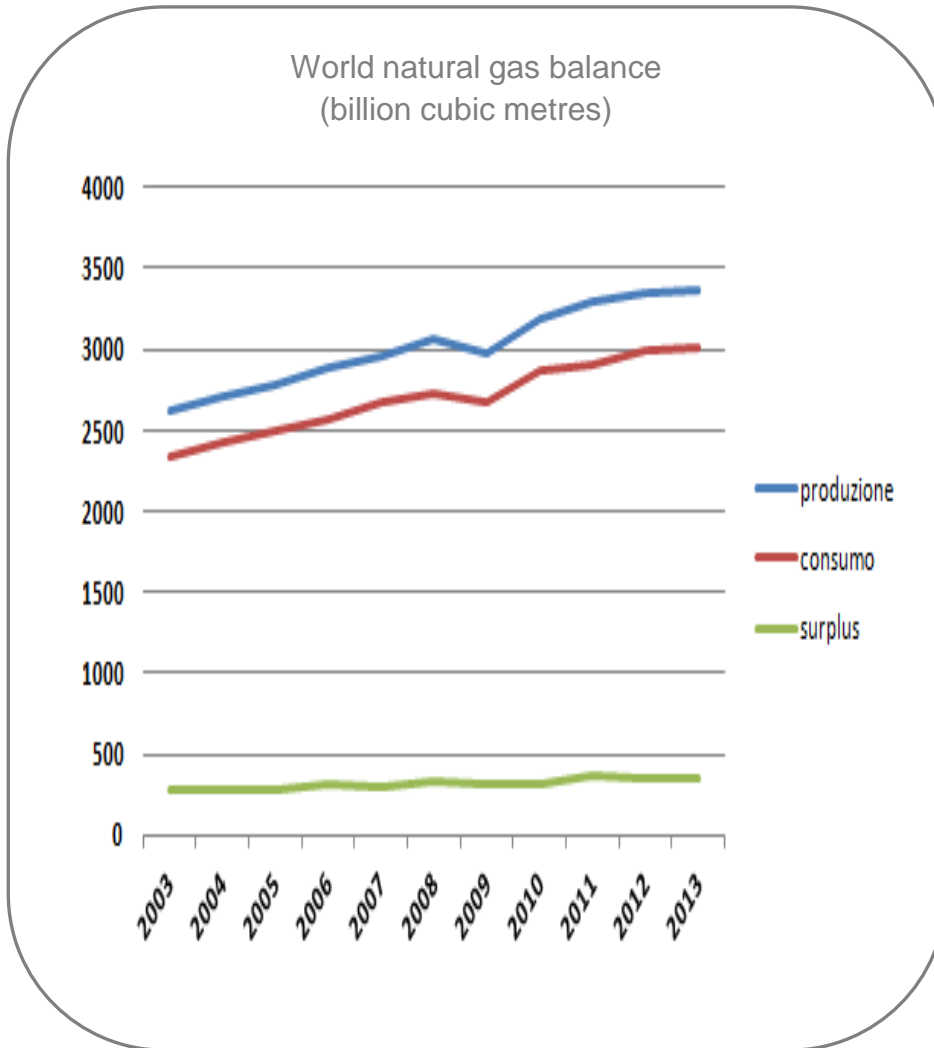
➤ Picture shows the “subsidence phenomena”: taking the gas out of earth surface might cause an internal pressure decrease. This is potentially very dangerous in coastal areas because it leaves the ground exposed to sudden rise in sea level and big waves.

➤ As far as “Fracking” is concerned, the risk is about both the natural gas which cannot be collected is wasted into the air and landscape desertification.

Fracking has been cited as a possible cause for micro earthquakes as well, more serious studies need to be carried out to prove this.



Picture from Deltares Research Institute



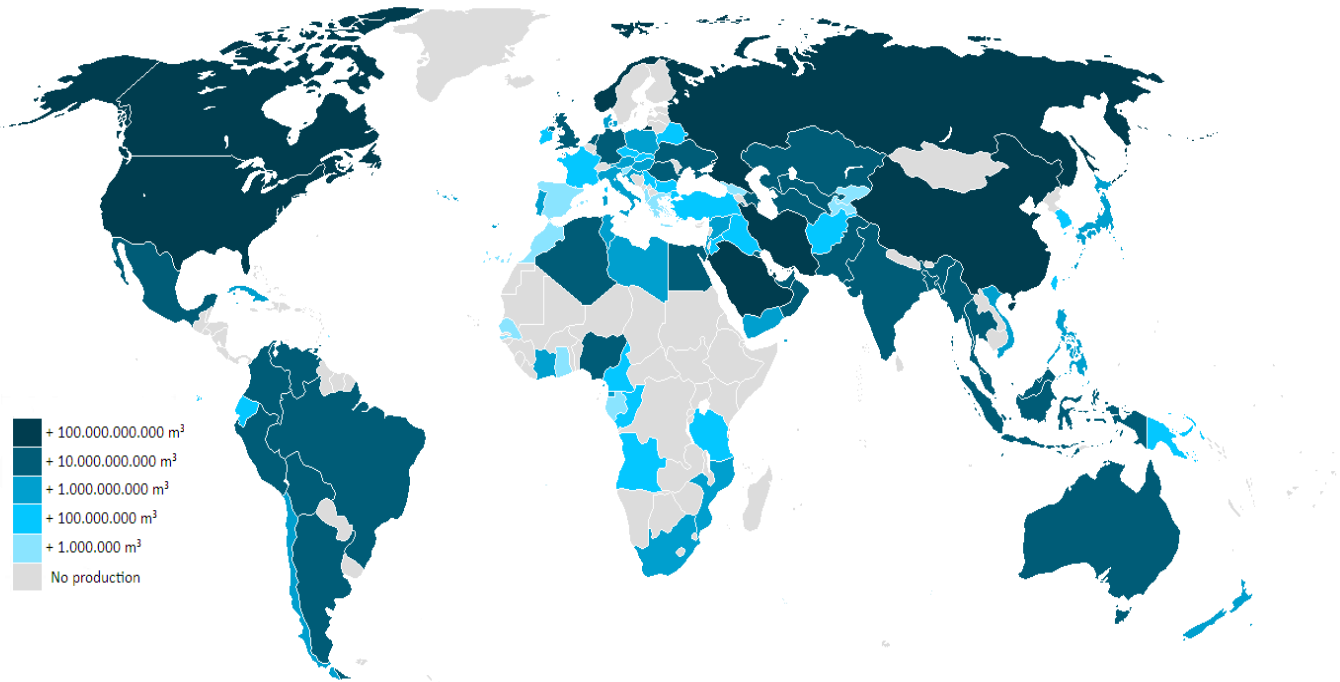
Area Research BMPS processing on British Petroleum datas



- The charts in the previous slide, show fundamental changes through the time: production, consumption and reserves.
- Over the last decade production has always been greater than consumption: this is consistent with the observed structural surplus.
- Production rose by **28,5%** from **2003** to **2013** peaking at a **3369** billions cubic metres while at same time consumption rose **28,8%** at **3020** billions cubic metres.
- Consequence is structural surplus. In **2013** it marked the top at **349 billions cubic metres**; in relative terms, growth was smaller, **+25,9%** in comparison to **2003**.
- Production excess contributed to keep prices relatively low, much lower than oil (but this year 2014 has been another story, crude oil prices have been collapsing recently): we can say that on the back of historical experience, natural gas has been the most convenient fossil fuel since year **2000**.
- This is confirmed by the numbers concerning the world reserves rising **56%** in the period starting in **1993** to **2013**. The historical high at **185,3** trillions cubic metres was reached last year. This statistics is considering only the proven reserves and not theoretical estimates of the shale gas reserves..



World natural gas production by county , year 2013 (cubic metres)

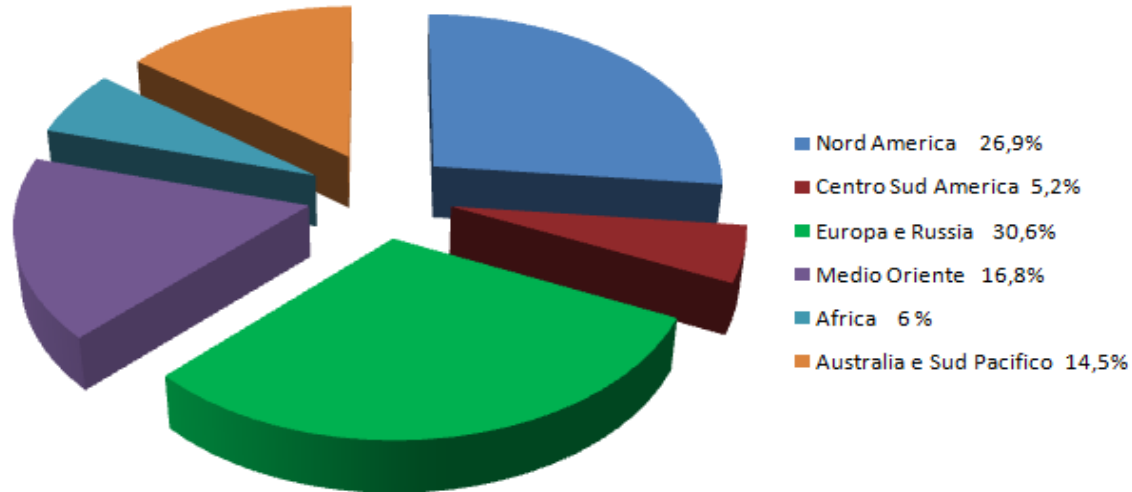


Source [www.geology.com](http://www.geology.com)

- This chart shows the production by country: in dark color we can see the most important areas. North America, Russia and Iran show the highest production which is over 100 billions cubic metres per year.



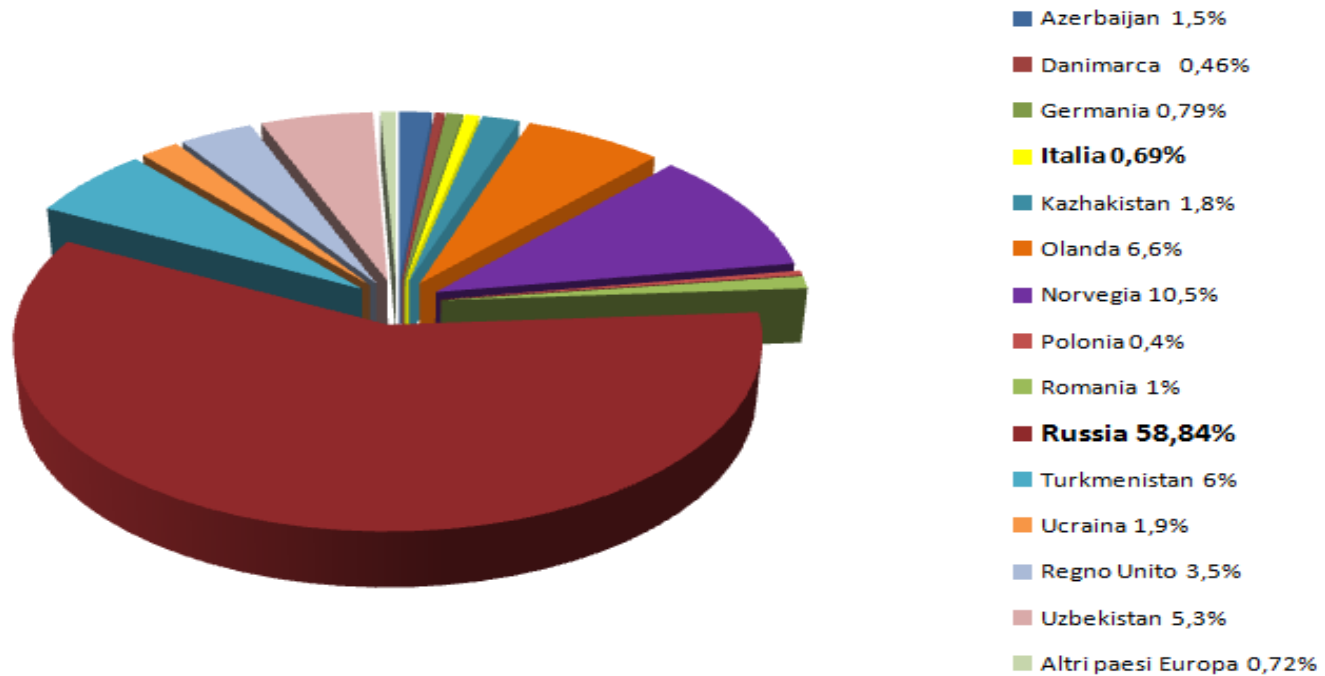
World production: market share by macroareas (%)



Area Research BMPS processing on British Petroleum data

➤ This chart is interesting because it allows us to observe that natural gas production is widespread across all the continents: Europe is the first producing area, total quantity produced in Europe was **1033 billions cubic metres in 2013**.

Production: single countries market share in Eurasia (%)



Area Research BMPS processing on British Petroleum data

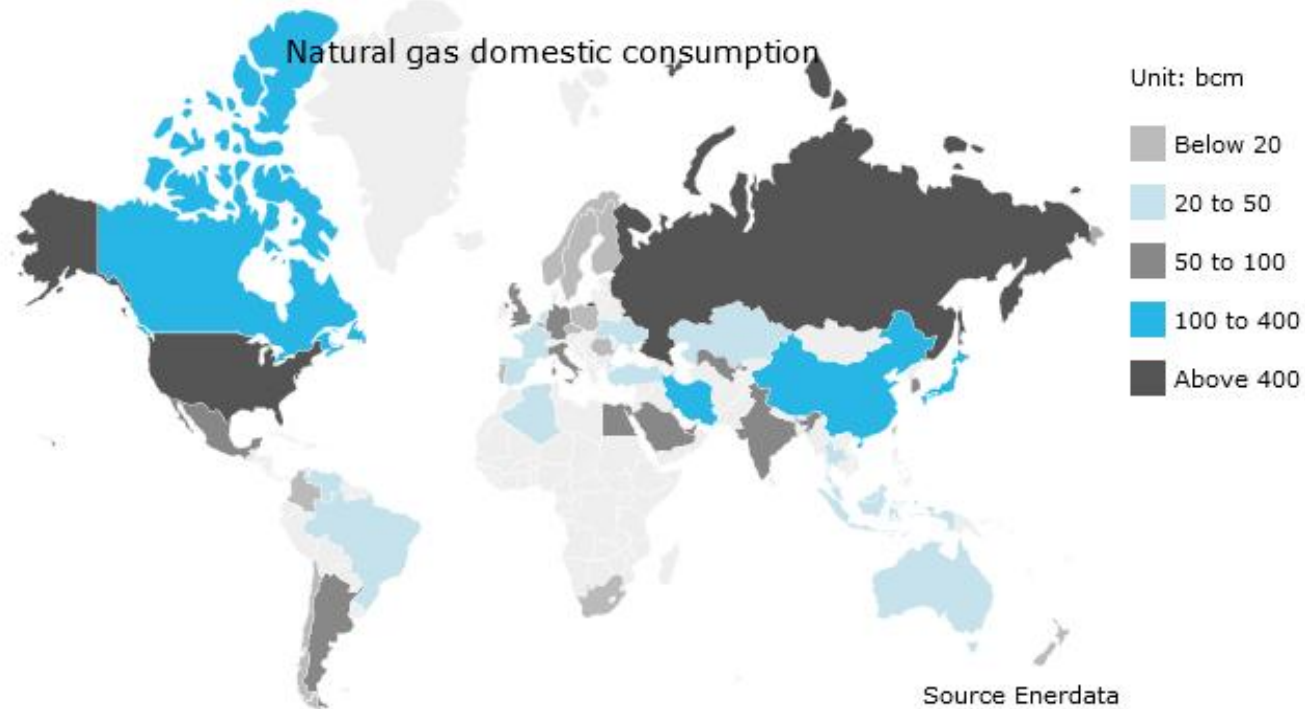




- It is interesting to find out how the Eurasia natural gas production is shared by country: in the slide 16 we saw how the global production could really be considered relatively balanced in the different macroareas..
- Within **Eurasia** this is not confirmed because natural gas production is mostly concentrated in few hands.
- Among the 14 mentioned countries, **Russia** and **Norway** control about **70%** of Eurasian production which was well over **1000 billions cubic metres** in the **2013**.
- The remaining **30%** is shared between 12 different countries; the picture is that the production market in Eurasia is a oligopoly of the two major stakers, although the Netherlands, The United Kingdom , Uzbekistan and Turkmenistan have all an important role.
- In the other continental Europe countries, the most industrial like Germany and Italy, natural gas production is much lower, the two countries produced respectively **0,69%** e **0,79%** of total. France relies less on gas and more on nuclear power.
- The bottom line is that in theory the enormous concentration of natural gas production leaves Italy very exposed to sudden geopolitical changes. in other countries.



World natural gas consumption in 2013 ( billions cubic metres)

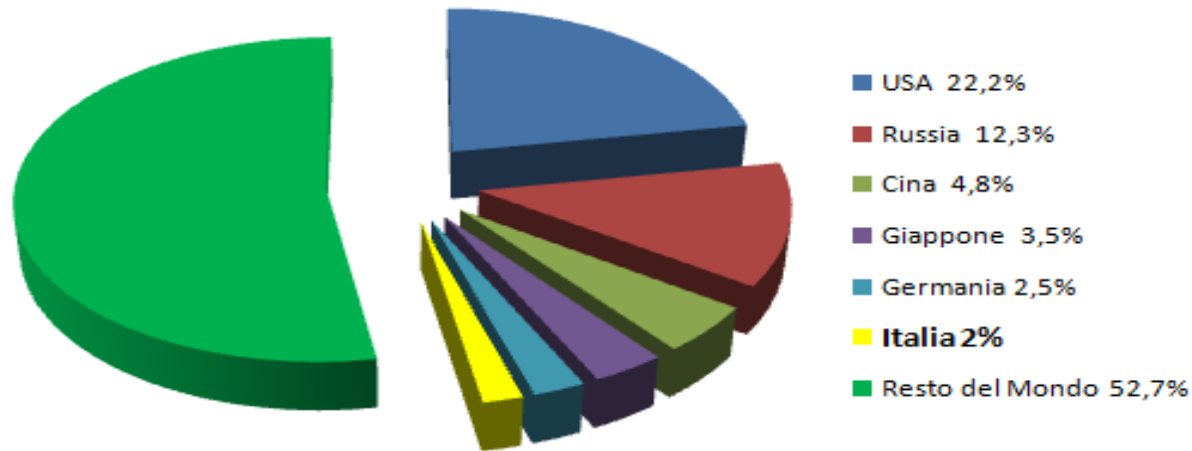


Source: [www.enerdata.com](http://www.enerdata.com)

- This chart shows that USA and Russia are world leaders in the consumption of natural gas as well with over 400 billions cubic metres per year. As far as consumption is concerned, Italy and Germany are two extremely relevant countries.



Natural gas consumption: single countries market share (%)

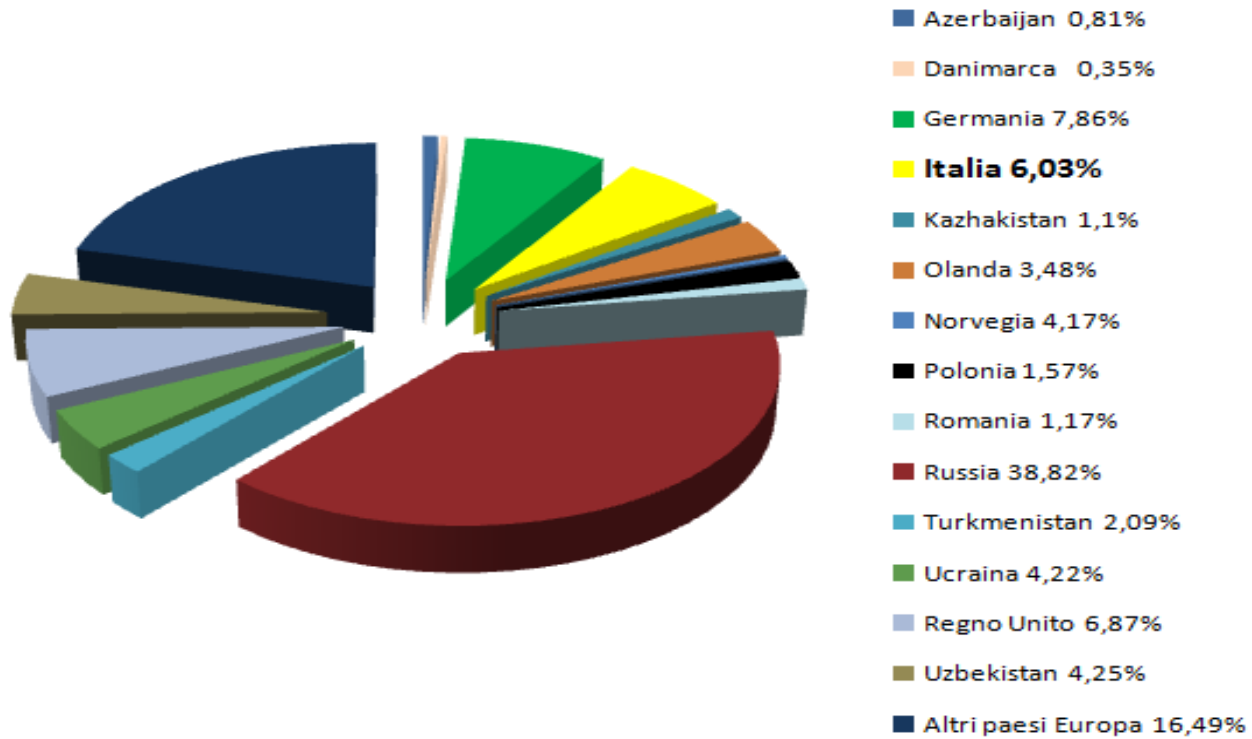


Area Research BMPS processing on British Petroleum data

➤ This chart shows that the **USA** are the most important consuming country, followed by Russia, China and Japan. **Italy consumption is about 2% of world total, much more than production.**



Natural gas consumption: Eurasia market shares (%)



Area Research BMPS processing on British Petroleum data



- In the Eurasian consumption distribution **Russia** is the first as expected, but this country is not matching production, running a remarkable surplus (slide 18).
- On the other hands, the two eurozone most industrial countries, Germany and Italy, show natural gas consumption respectively at **7,86%** and **6,03%** of the whole, much higher than production. The UK shows a deficit as well.
- Should the “Shale gas” be taken into the account, the general picture would show a well balanced position in the big macroareas, and a relevant disequilibrium at local level.
- This is mostly true in Europe: Germany and Italy depend on natural gas supplies and must rely on imports to satisfy their energy needs. **Importing from Russia**, which is a close country and running a big natural gas surplus, seems to be the most practical solution.
- As far as this issue is concerned, the progressive deterioration of the normal political relationship between the Eurozone and Russia due to the Ukrainian unrest might cast dark shadows on this paramount supply channel in the future.
- For Italy this could mean redefining the foreign “natural gas supply mix” in case the “**worst case scenario**” will turn to be true. The country has many options, as we will see.



- Natural gas price formation depends on supply-demand relationship, but there are some key differences in price determination according to the very different calculation methodologies in different countries.
- Several academical papers can be found about natural gas price: we highlight “Natural Gas Prices on Three Continents” by Erdos and Ormos published on “Energies 2012”.
- There are three different areas contributing to natural gas price formation: **USA**, **Europe** (reference for the russian gas) and **Japan** (paramount for LNG far-eastern trade).
- Gas price determination in Europe is based on formulas entailing a link with crude oil and its subproducts.

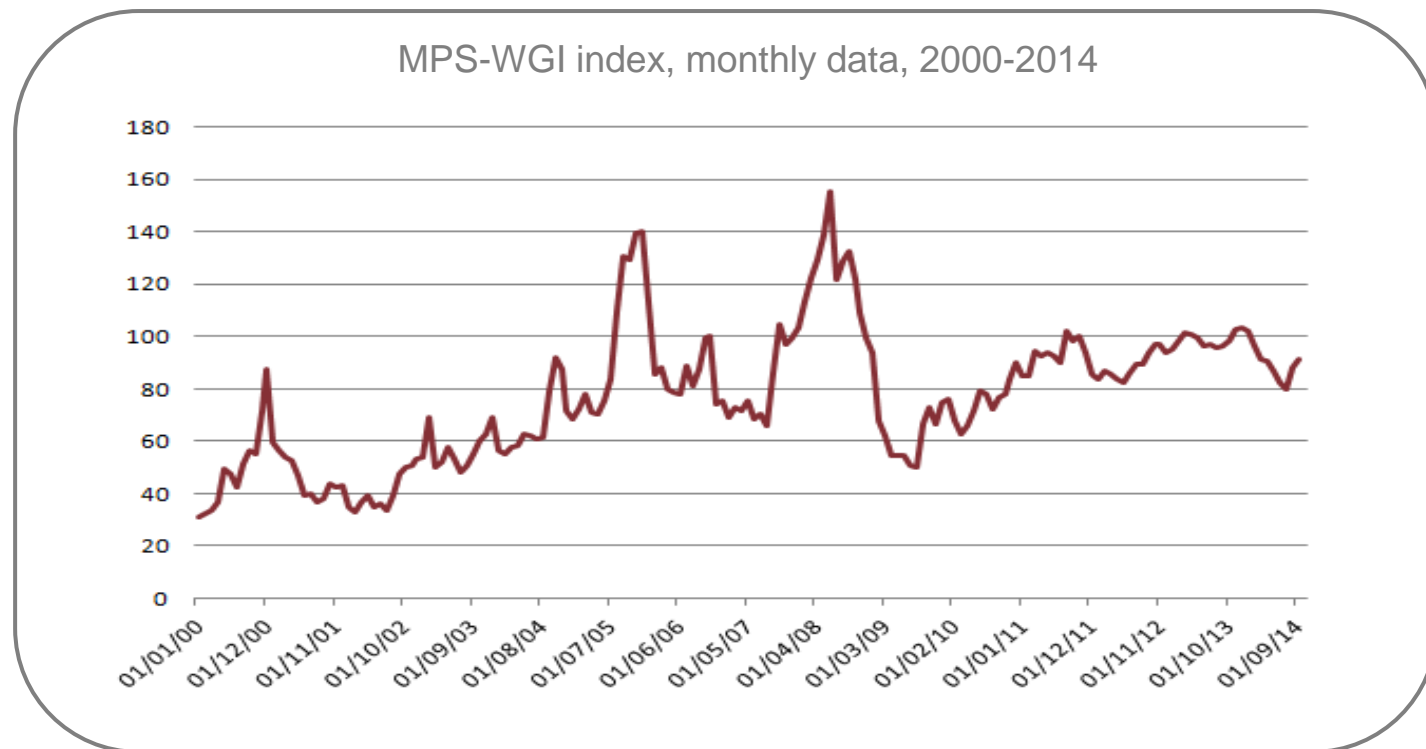


Fancy “rising process”



- The link between natural gas and crude oil prices has been discussed at both practical and academical levels but no univocal view has emerged. In the past, crude oil transactions overwhelmed natural gas activity but now this is no longer true.
- It's a matter of fact that LNG trading rose from **137** billion cubic metres in **2000** to **289** billion cubic metres in **2010**, more than doubling in ten years: natural consequence is that natural gas can be now considered totally independent from crude oil pricing.
- Nevertheless, gas price fixing in Europe is still based on formulas where crude oil and its by products, such as fuel oil, have a sheer predominance: **Russia** for instance has a pricing system where natural gas price is 80% indexed on fuel oil.
- The actual indexing changes depending on the country; in western Europe can reach **80%**, while in most eastern Europe countries can be as high as **95%**.
- **LNG** is linked to crude oil price as well; after **China** entered in this market, this link slackened in **Japan** as well.
- In the **USA**, the natural gas market is regarded as totally independent from crude oil: therefore natural gas price fixing in this country is not based on formulas. The fact that the USA status has changed from net importer to net exporter over the last 10 years is a further confirmation.
- The Research Area of BMPS has been developing a new natural gas price index. This is called **MPS-WGI** (World Gas Index).

## Natural gas price in the world: MPS-WGI index



Area Research BMPS processing on Bloomberg data

- This price index aims to represent the **natural gas price pattern in the world**: The algorithm is a weighted average of three different time series: the futures contract listed New York (NG), in London (FN), and the **LNG Japanese index (LNGJLNJP)**.
- The chart shows a weak rising long term trend: the **two remarkable peaks in 2005 and 2008** were caused respectively by a temporary shortage in the USA and by the big “energy bubble” before the great crises, started in the last quarter of 2008. During the last three years natural gas prices have been very stable.



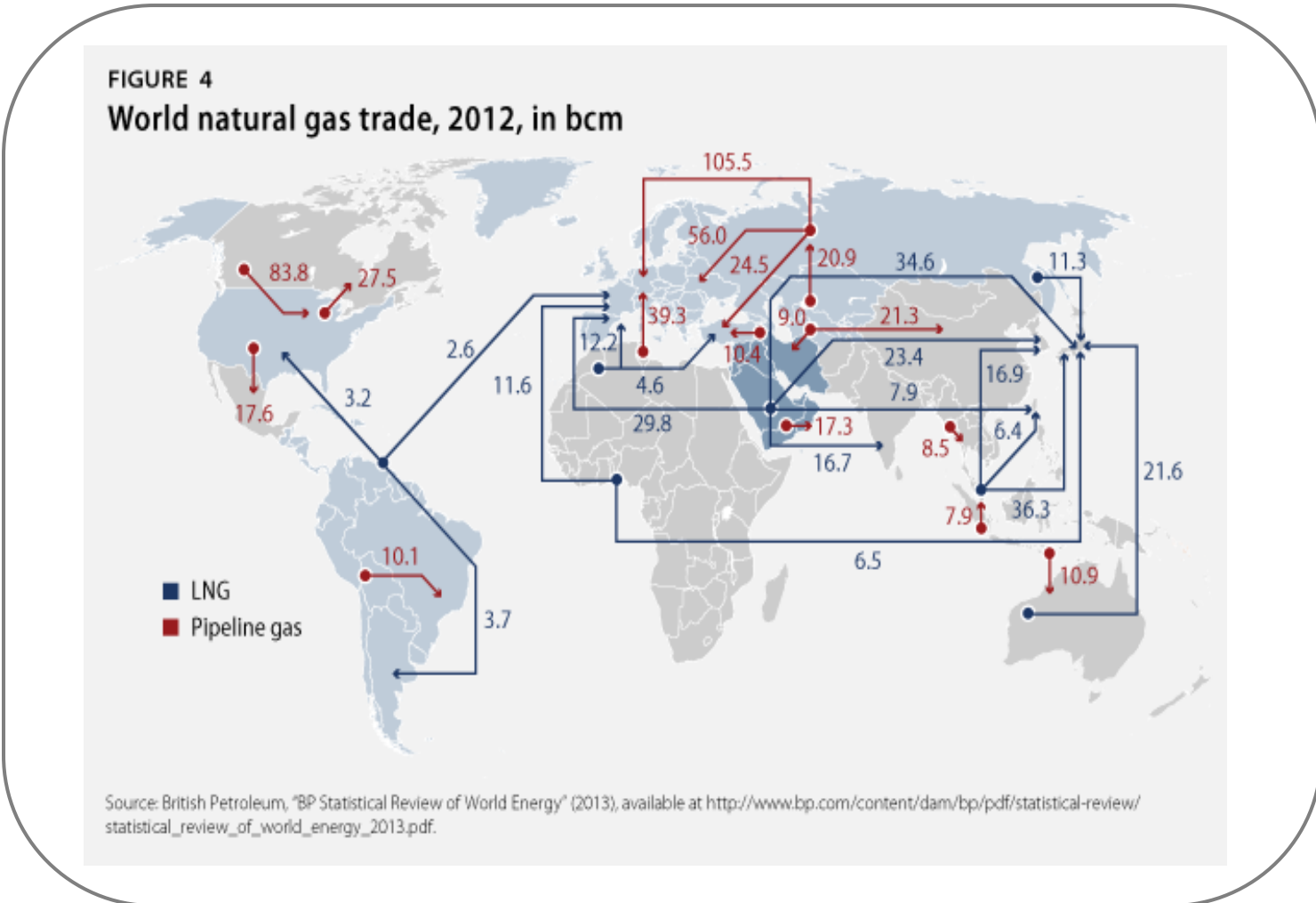


Chart supplied by British Petroleum



- The previous chart is important because **represents the natural gas flows**: (billion cubic metres) in the world trade: marked in red we can see the pipelines and in blue color the LNG tanker sea routes. There is a clear prevalence of the export flows from Russia to continental Europe, the largest in the world.
- “**Deregulation**” and “**competition**” in the world have certainly caused the raise of new players changing the structure of the “natural gas system”.
- Today we have **two major markets**: **production** and **transportation**, including all the related services and activities: competition is a fundamental condition for efficiency. Gas transportation depends heavily on the policies put into practice by the big plant owners, but the resale and allocation contracts cut with operators create competition allowing fair pricing and lower transaction costs.
- Increased competition means more market complexity in the world trading system: today there are two prevailing models. The “**bilateral trading**” model, which is based on bilateral decentralized negotiations between operators, and the “**poolco**” model. In the “poolco” model, a central company must be identified; this company coordinates individual decisions.
- Experience shows that both models seem to be working well, if correctly implemented.

## The future outlook: fundamental changes



- Among the most important factors counting for a continuing change in the “world gas system”, we think that the major is the new role of the USA from net importer to net exporter of natural gas.
- This is true for **crude oil** as well, an heated debate is taking place in the USA concerning this matter (Edward L. Morse, head of commodity research, Citibank): meanwhile, world crude oil prices collapsed from **100** to **63** Usd and gas prices are holding the lows.
- The USA reduced crude oil imports by **di 8,7 million of barrels per day** in a very short time: this is larger than joint exports of Saudi Arabia and Nigeria together.
- The same thing happened in the natural gas market: in the year 2000 the country was net importer, now is one of the first in exports, challenging Qatar (for l'LNG) and Russia for the leadership.
- This great change made the old beliefs fading away. In 2008 the most of the people thought that world fossil fuel reserves could not last for very long, at the same time international market prices were skyrocketing.
- The **new USA role** is increasing international competition in the export markets affecting world fuel prices in a negative manner, now prices are spirallyng downwards, a scenario unexpected until a few years ago.

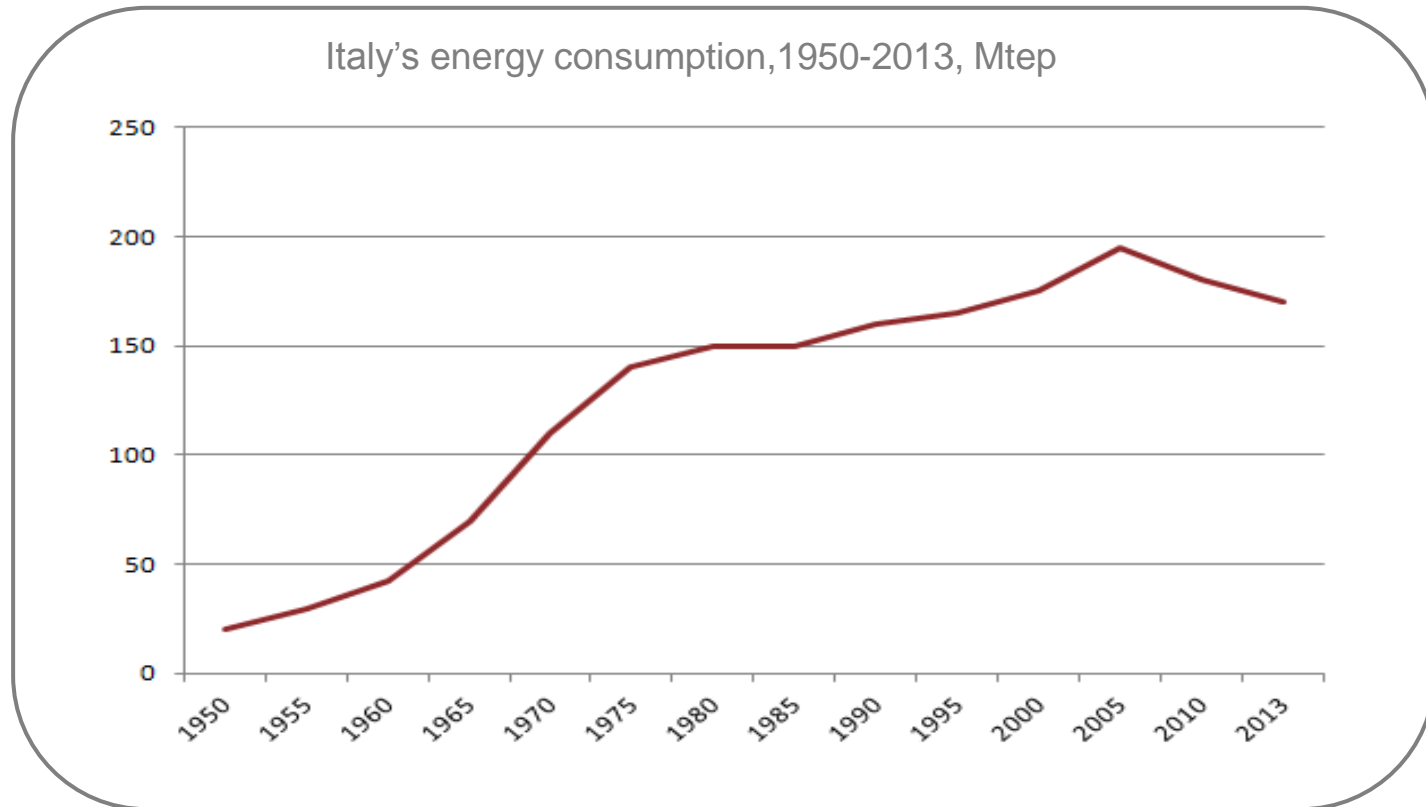


Sede Eni

## *Italy and the Natural Gas*

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# Energy consumption in Italy: historical trend

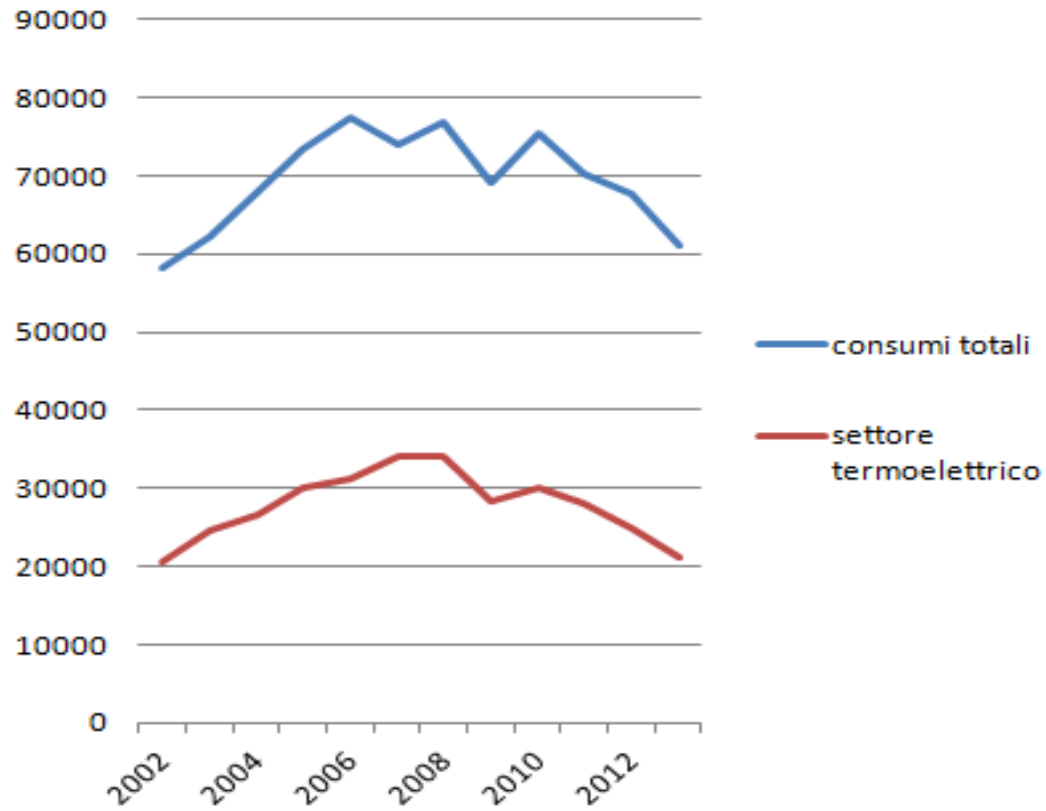


Area Research BMPS processing on Autorità Energia Elettrice e Gas datas

- The chart represents the trend of energy consumption in Italy from 1950 al 2013, in million tonnes of oil equivalent (MTEP).
- After world war two enrgy consumption grew moderatly unti 1960, then accelerated sharply from 1965 to 1975 showing average yearly growth above 10%. They stabilized in the 1980-1990. decade; after 1990 consumption grew again at faster pace peaking slightly below 200 MTEP in 2004-2005.
- Since then, energy consumption trend has experienced a remarkable decline.



Natural gas consumption in Italy: 2002-2013 (millions cubic metres)



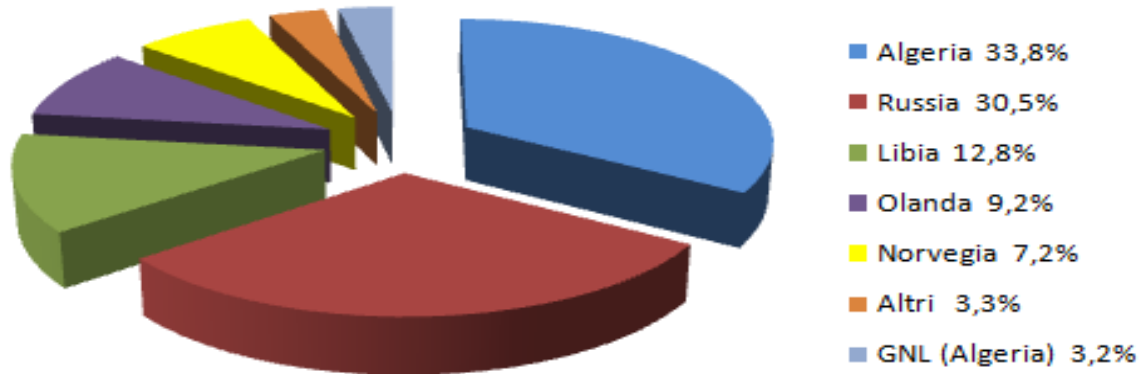
Area Research BMPS processing on SNAM rete gas datas



- The chart shows the natural gas **gross consumption** and by the **thermoelectric sector** from 2002 to 2013.
- After peaking in **2005** ( **86265** millions cubic metres) and in **2008** (**34171** millionns cubic metres for the thermoelectric usage), natural gas consumption in Italy experienced a considerable fall (**-20%** e **-37%** respectively), matching the **economical crises** progression and the industrial production decline.
- **Natural gas growth target** for 2020 was projected at **100 billions** cubic metres in **2010** by **Enel, Eni ed Unione Petrolifera** but it looks really dufficult now. Economical crisis impact and renewables growth in electrical energy poduction are the key factors. Year **2015** is quickly approaching and total consumption of natural gas is now about **70 billion cubic metres**, therefore is very unlikely that the target wanted by the authorities will be reached in five years time.
- As far the italian energy consumption is concerned , in **2013** we had a continuation of steep decline in electrical energy consumption, **now back to 15 years ago levels**.
- In Italy, **renewables** have now become the first production source for the **electical energy**, **overtaking natural gas**. However, we must always bear in mind that in terms of total **primary energy** consumption, renewables amount to **“just” 18%** and that therrmoelectric power stations supplied by natural gas are still essential for Italy’s energy future.



Italy's natural gas imports by foreign supplier



Area Research BMPS processing on ENEL datas

- Imports have become even more important to satisfy **il Italy's need** of natural gas. Imports market share are now **90%** of total and are the key factor to grant supplies continuity.
- Imports are provided by pipelines for the greatest part, **97%** of total. GNL imports, mainly from Algeria, are still very small, about **3%** of total natural gas imports.





Italy's imports: foreign pipelines entry points



Chart provided by SNAM retegas



- The chart in the previous slide quickly shows the entry points of the foreign gas pipelines into Italy. We can see three major directions in the network: from **north**, **north east** and **south**.
- This is the current situation: natural gas is supplied through four major pipelines and two regasification units.

(\*) The *Transmed* is the pipeline for the algerian gas. It is over **2.000 kilometres long**, **370** in Tunisia, **380** lying in the sea depth and **1.470** in Italy. The first stretch (**550 km**) starts from the Hassi R'Mel production site to the Tunisian border; the **italian entry point** is located in Minerbio, next to Bologna, where the gas enters into the italian distribution system.

The pipeline owner is **Transmed S.p.A**, shared at 50% by Eni and Sonatrach, the algerian company.

The *Greenstream* is a pipeline running underwater, **520 km** long, which links the treatment plant in Mellitah, on the Libyan coast, with the italian entry point in **Gela**.

Capacity is ranging from **8 to 10 billions cubic metres** per year. The Mellitah complex (built by Eni in 2004 for 12 billions USD), treats the natural gas coming from two different sites: the first, Bahr Essalam, offshore, 110 kilometres far from coast; the second one, Wafa, is in the middle of the libyan desert, next to the algerian border. Eni is operating both sites holding a 50% share; the other partner is the National oil corporation, a libyan company owned by the government.

The *Trans Austria Gasleitung* supplies Italy with the **russian gas**.

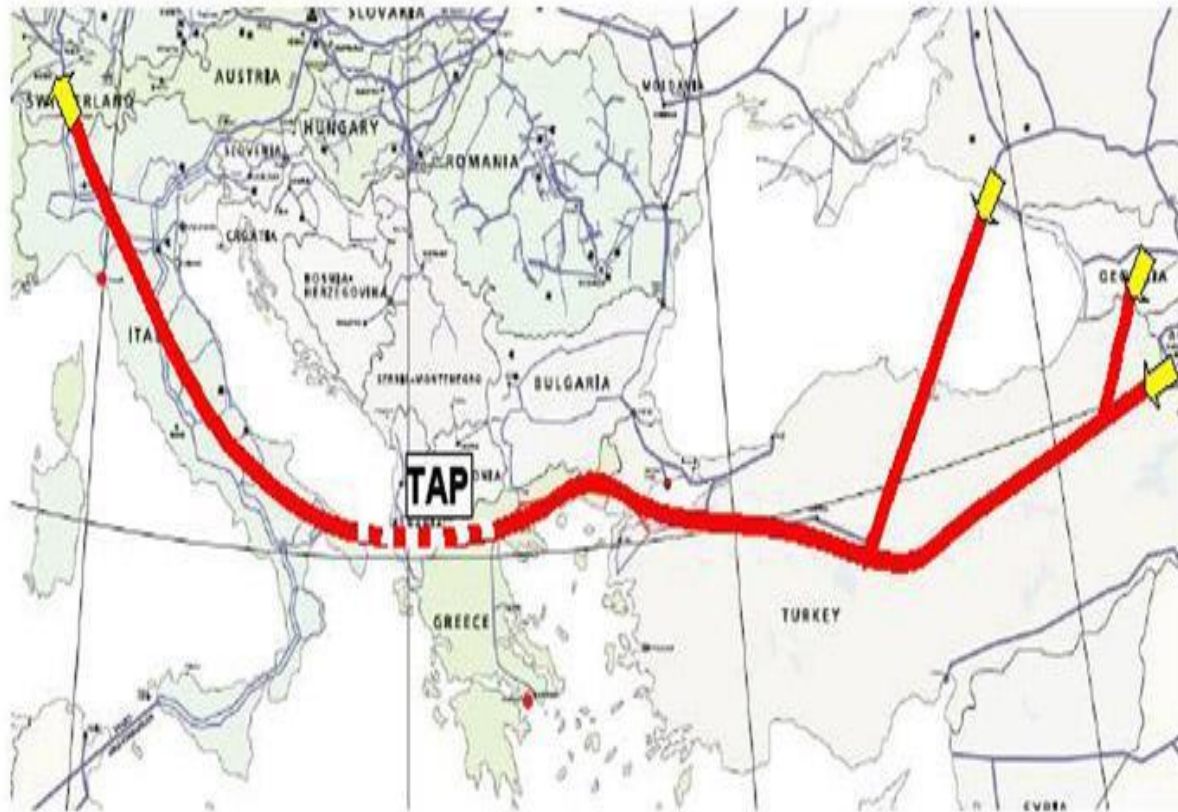


- The **transAustrian pipeline**, supplying Austria, Slovenia e Croazia as well, is owned by Trans Austria Gasleitung GmbH. At the end of 2011 this company was held jointly by Eni (89%) and Omv Gas GmbH (11%). From december 22° ,2011 the **Eni share was transferred to Cassa depositi e prestiti**, while la Omv Gas GmbH changed its name into Gas Connect Austria GmbH.
- The **Transitgas** is the pipeline transporting gas from Norway and the Netherlands through Switzerland. The entry point in Italy is located in Val d'Ossola, capacity is about **15,5 billions cubic metres**.
- This pipeline is 293 kilometres long, starting from Wallbach (next to the german-swiss border) where it gets **connected to the “Trans Europa Naturgas Pipeline”**, it ends at Gries Pass, on the italian-swiss border.
- The whole infrastructure is managed by Transitgas AG, a company owned by Swissgas (51%), Fluxswiss Sa (46%). E.ON Rhurgas Ag owns a 3% minority stake.
- There are two **regasification plants** operating in Italy: the first one is in **Panigaglia** (La Spezia) where the gas imported from Algeria and Norway is treated, the second one is in **Porto Levante** (Rovigo), supplied by tankers from Qatar, Egypt, Trinidad & Tobago, Guinea.

(\*) *informazione supplied by ENI*



Europe: the new "TAP" pipeline under development



Map provided by Voxnews.info



- Huge interests are at stake in the game revolving around the new gas infrastructures under development. The “**Southern Gas Corridor**” (SGC), is one of the major directions engineered for the **trans-European energy network (TEN-E)**.
- The main SGC talks concerned the choice between the **Trans-Adriatic Pipeline (TAP)** and the “**Nabucco pipeline**” network. Here the **financial interests of the single countries involved are so relevant** that the risk is dwarfing the European meaning of the whole project.
- The options are these: the natural gas coming from production sites in Azerbaijan, north of Caspian Sea, would be directed towards Europe through alternative routes. The “**Nabucco West pipeline**” would connect **Bulgaria and Austria** through **Romania and Hungary**, while the “**TAP pipeline**” is designed to supply Italy with gas directly, via **Turkey and Greece** ( see the map in slide 40).
- The TAP pipeline might be potentially linked to other networks in the **Mid-Asian** areas in order to create a thick web of supplying options. If we think about an emerging gas power like **Turkmenistan**, we understand the big geopolitical importance of the “southern corridor”.
- The **Shah Deniz** consortium on 28<sup>th</sup> June, 2013 showed to favor the TAP project rather than “Nabucco West”. According to the current estimates, the year **2019** should see the TAP starting operations.
- The “**South Stream**” pipeline, is a Russian project aiming to provide continental Europe with gas bypassing Ukraine. As we can imagine this development encounters fierce opposition by some countries because of geopolitical reasons. The USA for instance, have always opposed this project.



- The Natural Gas worldwide market can be regarded as “crucial” for several reasons:
    - ❑ The role of the USA as leading gas producing country in the world has become prominent over the last 10 years, thanks the “Shale Gas” and the **fracking** extraction technology.
    - ❑ Natural gas **supply abundance** had a “calming reflection” on prices during the last few years, as the MPS-WGI price index confirms.
    - ❑ **Sea transportation and regasification** is set to grow along with the GNL trading in the world. This is very true in the **Far East**; Japan has become more dependent from GNL supplies after the Fukushima nuclear disaster.
    - ❑ In **Europe**, authorities are targeting Russia after the Ukrainian unrest. They are willing to shrug off excessive gas dependence from Russia and prefer strategic development solutions finalized to create viable alternatives.
    - ❑ In **Italy**, the relative importance of gas imports is greater than in the other countries. Consequence is that **geopolitical instability** could compromise natural gas supplies and this is potentially troublesome, but energy consumption decline due to the economical crisis is making the scenario less gloomy.
- Italy has several alternatives to Russian potential gas disruption; for instance, as gas trading partner, Algeria is a bigger than Russia.

# Contatti

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## Report written by:

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