KEY MESSAGES

1. In spite a of a notable market slump across Europe over the last two years, because of the economic recession, natural gas demand in E27 appears resilient with a small if negligent drop. Likewise in non EU countries in S.E. Europe gas demand appears to have suffered little with long term demand forecasts remaining positive.
2. Medium and long term market forecasts for EU27 gas demand indicate marginal growth by 2020 but much higher growth in the period 2020 to 2035, as the transition to gas fired power generation will move full speed ahead and the economy will have fully recovered.
3. In line with EU energy policy as adopted in a strategy document of Nov. 2011, the need for gas supply diversification has received full attention as an EU strategic priority. In that sense the development of the South Corridor is being supported through a variety of actions at both EU and national levels.
4. Officially South Corridor projects include; (i) The so called Nabucco pipeline which aims in transporting Caspian gas – excluding gas from Iran – to the centre of Europe, via a 3.000kms route through Turkey and the Balkan peninsula. (ii) The ITGI project which is a partially built pipeline already delivering Caspian gas to Greece and in future to Italy, via the Adriatic sea (iii) the TAP pipeline which is a completely new pipeline aspiring to deliver Caspian gas to Italy via Greece, and Albania and also through the Adriatic. (iv) The SEEP, AGRI and White Stream projects.
5. Officially not part of the South Corridor, as viewed by EU, but nevertheless serving the same purpose, is the Russian backed "South Stream" pipeline which will bring Russian gas to Europe through a south route, i.e. underwater via the Black Sea and then overland through the Balkans and onward to central Europe. Although this pipeline does not offer supply diversification – as in effect substitutes Russian exports and Europe via Ukraine – it does offer geographical diversification.
6. At the same time gas supplies prospects in the Caspian region appear tight in the short and medium term with the Shah Deniz II field expected to come on line in 2016/17 and offering limited gas quantities to the market. Some 16.0 BCM/y is envisaged during the field's first year of operation with only 10.0 BCM/y being made available to European customers, with Turkey having already signed for the 6.0 BCM/y. Additional gas supplies from other Azeri fields such as Umid and Absheron are not expected to come on stream before 2022, with

Turkmenistan appearing unwilling or unable or both to direct some of its gas export potential to Europe. Gas exports from Iraq, via Turkey, still remains a credible option but it remains to be seen if oil and gas production in Iraq is going to increase substantially over the coming years, while at present it is curtailed because of security concerns.

7. In addition to the above 4 pipelines (excluding S. Stream) there are at least another 3 gas transportation projects which aim in satisfying the same goal, i.e. to bring Caspian gas to Europe. These include the SEEP pipeline, promoted by BP, the White Stream pipeline and the AGRI plan, an ambitious project which aims to transport significant gas quantities via LNG through the Black Sea and then onwards to Europe. All in all we have today a total of six (6) competing projects for the same Caspian gas supplies and one more project, the South Stream which although it does not draw directly from Caspian gas resources, it does direct gas to the same European markets. It is abundantly clear that by 2020, and in view of little additional European gas needs, and limited Caspian gas supplies, there is going to be room for only two of the above projects, of which one will be the South Stream.

8. As far as Greece is concerned the gas pipelines of immediate interest include ITGI, TAP and the South Stream. Consequently, it is useful to find out the direct benefits that each of these pipelines will offer Greece and the degree of preparedness of each pipeline in terms of implementation.

9. A comparison of all three pipelines in terms of maximizing economic and social benefits to the host country, and having taken into consideration a large number of technical, geopolitical, economic and financial criteria, has shown that the ITGI pipeline is going to deliver most benefits. These benefits include the maximisation of investment prospects at local level, the creation of short and long term employment opportunities, and the substantial strengthening of energy security supply at national level. ITGI's role in regional development is highly important because of the pipeline's considerable length within Greece and its branching off to Western Greece which will benefit enormously from the establishment of a regional gas distribution company (ΕΠΑ). In addition ITGI tops the list in terms of implementation preparedness as the pipeline's construction prospects appear clearly well ahead of those of the other pipelines, because of its advanced engineering design, the issuing of the necessary permits and licenses. In short ITGI emerges as the most mature of all three pipeline projects.

10. The prominence of ITGI, in addition to the considerable socio- economic benefits it will bring to Greece, is also due to its broader regional significance. This is based on its capacity to

expand immediately northwards to Bulgaria and Romania and further afield (i.e. Hungary) and also through the necessary network adjustments to Serbia, thus helping these countries diversify their gas supplies which up to now rely almost entirely on imports from Russia. In the case of Bulgaria plans are already fairly advanced for the construction of the 170 kms Komotini – Stara – Zagora interconnector, known as IGB, already scheduled for 2013/2014. This means that by 2014 gas coming to Greece from the Turkish- Greek interconnector, which in practice is part of ITGI, will start flowing into the Bulgarian grid. Another important regional aspect of ITGI is its direct link to planned LNG terminals in Kavala and Alexandroupolis and its access to a sizeable underground natural gas storage facility situated offshore in the depleted South Kavala gas field, some 15 kms offshore from Kavala. This 400.00 m^3 gas storage facility, by the time it becomes operational in 2016, it can guarantee adequacy of supplies during peak demand periods not only for Greece but also for Bulgaria and beyond. ITGI's potential access to LNG terminals and to a large gas storage facility underlines its enhanced regional role in a way that no other (of the planned) pipeline schemes offers.

Executive Summary

With more than half of the energy consumed in the European Union coming from third countries, the EU is already the world's largest energy importer. Furthermore, given the fact that its own domestic energy production is on the decline, it will increasingly compete with other importing countries and regions for energy supplies. The EU also seeks to become cleaner with the use of gas as the primary fuel for electricity generation and thus to establish, stabilize and diversify transit routes. In this framework, SE Europe's role is considered to be very important in natural gas developments in view of current plans to secure enough gas for EU's domestic demand.

The idea of establishing a transport corridor for European gas suppliers, the so called South Corridor, from the Caspian region and the Middle East countries is one of the most crucial and strategic plans currently under development that will contribute towards EU's energy security. The South Corridor comprises a number of competing potential gas pipelines transcending SE Europe and Greece in particular.

The region of South East Europe and the Black Sea consists of a variety of exporting, transiting and importing states that make it difficult to make a clear distinction on each state's specific role. Overall one could distinguish between the net exporting states of the Caspian Sea, namely Azerbaijan, Kazakhstan and Turkmenistan, even though the latter does not export directly to any regional state and the net importing states that include everyone else with the partial exception of Romania (for oil & gas) and Croatia (only for gas) which cover the majority of their hydrocarbon needs through indigenous production. One major common characteristic for both exporting and importing states is that they aspire to become transiting hubs for the transportation Caspian/Middle East oil & gas resources to European markets.

The present study aims at comparing these pipelines and discussing their relative advantages and shortcomings with reference to Greece, which as a host country stands to benefit considerably from such major infrastructure works. Greece's benefits are twofold, comprising geopolitical and financial gains. A thorough analysis of these gains is also attempted in the current study.

The **first and second chapter** of this study provides an overview of the global and European natural gas markets and how these have developed over the past two to three years with projections for the next 20 to 25 year period. This analysis is structured on “demand” and “supply” basics. The basic trends regarding the global natural gas market indicate that global demand for natural gas is expected to increase strongly over 2010-16, reaching around 3,800 bcm by 2016. The bulk of this incremental gas demand originates from the non-OECD regions, especially the Middle East and Asia, while the growth of gas consumption in most OECD countries will be dampened by high gas prices. On the other hand the FSU region will be by far the most important producing region by 2016 and will help meet demand in Asia. OECD gas production should also increase, as additional output from Australia and North America compensates for rapidly declining European gas production.

Regarding the LNG market, growth of LNG trade is set to continue expanding over 2011-16 as new plants come on stream. Global LNG trade now represents 9% of global gas demand. Qatar was the largest contributor to additional LNG supplies and now represents one-quarter of global LNG supplies, twice as much as Indonesia, the second-largest LNG supplier. One should take into consideration that unconventional gas continues to impact gas markets as the interest in unconventional gas is spreading fast all over the world.

Several scenarios and trends for global gas demand and supply are also presented in **Chapter 2**. Most of the information included in this section has been abstracted from IEA publications, mostly the Medium – Term Oil & Gas Markets for 2011, the Golden Age of Gas special report and the most recent World Energy Outlook 2011.

A brief look at the European gas supply prospects in **Chapter 3** reveals that the European region will remain largely dependent on gas imports while indigenous production is steadily decreasing in most areas in the region, with Norway being the only exception. Total natural gas consumption in Europe in 2010 was 522 bcm of which 261 bcm corresponded to pipe-gas imports, 84,8 bcm to LNG imports and 176 bcm to indigenous production.

During the last two decades, natural gas consumption in Europe nearly doubled. From around 300bcm in 1990, gas demand in Europe, including EU-27 countries and other SE European countries reached 550bcm in 2007 and 522bcm in 2010, a drop attributed to recessionary pressures since

2008. The main driver for this spectacular increase in gas demand was without any doubt the power generation sector. Only during the last 5 years, gas consumption in the European power generation sector increased by some 60 bcm and more than 60 percent of gas consumption in Western Europe between 2010 and 2025 is projected to be used for electric power. Therefore by 2015 industry specialists estimate that imported natural gas will grow by more than 40 percent and rise to over 50 percent by 2025.

Chapter 3 presents also a comprehensive review of European Energy Policies and Strategies on security of gas supply. The European Commission believes that suitable conditions must be created for the promotion of alternative sources and routes so the supply of natural gas from the Caspian and Central Asia countries can be secured, and interregional pipeline projects can be realized giving special emphasis to Azerbaijan and Turkmenistan as potential new gas suppliers. On the other hand Azerbaijan and Turkmenistan have confirmed the availability of substantial gas volumes and have expressed a clear willingness to sell it to Europe.

Chapter 4 provides a comprehensive review on South Corridor and the several competing pipeline project plans. It should be pointed out that the "South Corridor" concept is promoted by EU for a number of other highly important reasons among which are the following:

(a) The need of creating a liquid and gas competitive market, part of a process in building a pan-European gas market where the free movement of gas is of paramount importance
(b) The implementation of EU's internal energy market (by 2014) and the ending of energy islands (by 2015) where integrated gas networks play a key role.
(c) The recognition of the corollary that an internal energy market and integrated gas networks guarantee political and economic stability

The South Corridor offers also an excellent opportunity to SE European countries to reinforce their regional role as part of a broader energy bridge. The struggle for control over regional gas supply routes between competing projects will propel certain countries to international attention as they will vie for influence and recognition as key transit gates.

In addition, **Chapter 4** provides a brief and updated description of the 7 gas transmission projects (ITGI, TAP, Nabucco, SEEP, South Stream, White Stream and AGRI Project). All these highly promoted pipeline schemes added together promise to deliver some 160 BCM's of new gas supply

to European destinations. At first glance there is no way that there is room, from a capacity viewpoint, for more than two such pipeline projects and for total gas quantities not exceeding at most 50.0 BCM's over the next 15-20 years. There is little doubt that seen over a longer time horizon Europe will need these extra supplies and perhaps more.

However, there are two important factors that need to be carefully considered at present. First of all from a demand point of view in the short term, and given the current economic downturn, such huge additional gas quantities cannot be absorbed by the European market. Secondly, gas supplies are still limited on the Caspian end since all the above pipelines, with the exception of the South Stream, are competing for the same Azeri gas sources and for limited, and as yet unavailable, inputs from Iraq. Even if the Shah Deniz Phase II offshore field in the Caspian Sea is fully developed, an unlikely outcome before 2017, and more gas is secured from other major Azeri gas fields and from Kazakhstan's yet unexploited Caspian gas reservoirs and somehow Turkmenistan's gas is transported over to Azerbaijan, there is no way that the predicted shortfall in gas supplies will be covered from these sources alone by 2020 – 2025.

These pipeline projects, with the exclusion of the South Stream, are competing projects for the same Caspian gas supplies. It is clear that by 2020, and in view of little additional European gas needs, and limited Caspian gas supplies, there is going to be room for only two of the above projects, of which one will most likely be the South Stream.

As far as Greece is concerned the gas pipelines of immediate interest include ITGI, TAP and the South Stream. **Chapter 5** is taking into consideration a wide variety of criteria and well established economic and technical parameters and attempts a comparison between these projects in order to find out the direct benefits that each of these pipelines will bring to Greece and the degree of preparedness of each pipeline in terms of implementation. Furthermore the comparison aims in finding out the degree of compliance of each pipeline to the criteria which are presented in within the study.

Of special interest is the comparison in terms of enhancing security of energy supply and economic impact. Security of energy supply is being dealt as part of stakeholder support and political risk criteria as it is generally accepted that all proposed pipelines to a larger or lesser extent contribute positively in this respect. However, it is important to establish which of the pipeline schemes

provides the best option and the greatest degree of energy security for Greece itself, as the first transit stop in improving the European gas market supply. Understanding the economic impact of the various pipeline projects is equally important as the flow of new gas supplies will inevitably lead to new investments and increased business activity at local and regional level.

In considering the economic impact from the construction and operation of major gas pipelines through Greece, the comparison was by necessity confined between ITGI and TAP as substantial economic and technical information was lacking in the case of South Stream. Economic impact was calculated for both pipeline projects under two broad time phases. The first being the construction phase and the second the 25 year operation phase.

By utilizing the input – output modeling methodology the economic impact of the two projects was assessed. This approach quantifies the spill – over effects to other sectors of the economy from the increased demand for intermediate goods (indirect effects) and increased final consumption due to higher household income (induced effects). This is achieved by utilizing a Leontief matrix, which takes into account the interdependencies across various economic activity sector.

By cross – comparing the two projects and due to the fact that ITGI is much longer regarding its onshore section, it was established that the construction of the project is expected to stimuli the domestic economic activity more than TAP. In focus, ITGI's construction is anticipated to produce 61.7 million euro more added value and 24 million euro more income for employees. Furthermore approximately 1.509 more persons are expected to be employed by ITGI than TAP during the construction phase.

In evaluating the contribution of the ITGI and TAP pipelines during the operational stage we must note that the ITGI project has a clear edge over TAP since it will be responsible for the creation of a regional distribution company in Western Greece (ΕΠΑ) and that will constitute a key driver for increased economic activity. Although, its operation does not require intense utilization of primary inputs its long term economic impact is substantial.

As the TAP project is not foreseen to have any impact whatsoever on the development of local and regional gas markets, ITGI's supremacy in that respect in self evident. Assuming an investment cost of 150 million and cash inflows for 3 scenarios, the project returns in any case is positive in terms of

Net Present Value (NPV). On the other hand, the TAP project is expected to deliver no cash inflows from operating activity (the financial analysis, concerning the economic impact over a 25 year period for both ITGI and TAP, is based on assumptions deriving from the operating experience of other ΕΠΑ's in Greece).

Furthermore, the creation of an EPA in the West Macedonia and Epirus region creates asymmetric economic opportunities and impacts for businesses. In the case of ITGI, NPV of cash flows varies from EUR 262 million in the pessimistic scenario rising to EUR 427 million in the most optimistic one. Likewise as shown in the same table total employment in terms of permanent jobs, varies from 663 in the pessimistic scenario rising to 859 in the optimistic one.

In summary, ITGI when compared to TAP in terms of short and long term economic impact emerges as a clear winner since it is a much larger net contributor with regard to employment opportunities and overall investments.

In addition to the considerable socio- economic benefits it will bring to Greece, ITGI's prominence is also due to its broader regional significance. This is based on its capacity to expand immediately northwards to Bulgaria and Romania and further afield and later through the necessary network adjustments to Serbia, thus helping these countries diversify their gas supplies which up to now relied almost entirely on imports from Russia. In the case of Bulgaria plans are already fairly advanced as construction for the 170 kms Komotini – Stara – Zagora interconnector is already scheduled for 2013/2014, which means that by 2014 gas coming to Greece from the Turkish- Greek interconnector, which is part of ITGI, will start flowing into the Bulgarian grid. Another important regional aspect of ITGI is its direct link to planned LNG terminals in Kavala and Alexandroupolis and its access to a sizeable underground natural gas storage facility situated offshore in the depleted South Kavala gas field, some 15 kms offshore from Kavala. This 400.00 m^3 gas storage facility, by the time it becomes operational in 2015, it can guarantee adequacy of supplies during peak demand periods for Greece and it creates synergies with the ITGI system. ITGI's direct access to LNG terminals and a large gas storage facility underlines its enhanced regional role in a way that no other (of the planned) pipeline schemes offers.

The role of the **Interconnector Greece – Bulgaria (IGB)** must be underlined in connection with the regional possibilities of ITGI. The IGB is a very important regional project directly related to ITGI

which will ensure energy security trough diversification of gas supply not only for Bulgaria, but trough the Bulgarian gas transmission network for Romania, Serbia and FYROM and further to other SEE and CE countries. Having a length of approximately 170 km, IGB will connect the Bulgarian with the Greek gas transmission grid starting from Komotini to Stara Zagora with a projected capacity of 3 bcm/ y and a possibility for extension to up to 5 bcm/ y. The pipeline will be commissioned in 2014 and planned investments are approx 150 M Euro from which 45 M Euro is an EU grant through EEPR. This fact confirms the importance of the project for the EU energy policy. Komotini is also the ending point of the TGI pipeline which is an integral part of ITGI project.

Shareholders in the IGI Poseidon pipeline project between Greece and Italy, which is part of the ITGI system, are also participants in IGB together with BEH. This means that the shareholders of IGI support the regional dimension and the common EU target to bring Azeri gas to the heart of the SEE region using TGI and IGB.

IGB will practically be the first piece of infrastructure to bring Caspian gas to the heart of SEE and CE through Greece and Bulgaria and provide the opening of the Southern Gas Corridor to the region. Both countries will be able to take direct part in generating revenue from regional gas transmission and trade. The scalability of the project, along with the granted EU financing, does provide assurances for its economic viability by taking into consideration the development of regional gas demand. In short IGB is an important project for Greece because it increases the Greek geopolitical role as a transit hub for Caspian gas to the SEE region. For the first time, Greece could become a major transit country, i.e. not only a final destination for gas supply, and will benefit from transit and trading opportunities.

Through this detailed and exhaustive comparison between the three pipeline projects, and having considered a large number of technical, geopolitical, economic and financial criteria, ITGI emerges as the most desirable option for Greece and the broader S.E. European region, a clear front runner having scored the highest marks. From Greece's point ITGI will undoubtedly bring in higher investments at local level and will also enhance regional development especially in Western Greece, while at the same time it will help strengthen the country's security of energy supply. Likewise ITGI tops the list in terms of implementation preparedness as the pipeline's construction prospects appear clearly well ahead of those of the other pipelines, because of its advanced engineering design, the issuing of the necessary permits and licenses.

From a regional perspective the ITGI pipeline will provide immediate access to much needed alternative gas supplies, will also strengthen regional energy security, facilitate cooperation and help spearhead gas market development, by ensuring adequate volumes and a continuous gas flow. In short ITGI will help increase gas market liquidity which is the basis for integrated gas and electricity markets; a prerequisite for the smooth functioning of the EU singlet (energy market).

Finally from a European stand ITGI appears as the most mature project in terms of licensing, risk minimization, engineering design and funding with the full involvement of key European institutions (i.e. EC – EEPR, Export Credit Agencies). It must also be stressed that ITGI, unlike the other projects, enjoys the full support and cooperation of the governments of Turkey, Bulgaria, Greece and Italy. Consequently, ITGI is accepted as the pipeline which is most ready to undertake the task of bringing new gas supplies from the Caspian region to the European markets and keep supplying them at competitive market prices and with full security in terms of uninterrupted gas flow.

Chapter 1

Introduction

With world demand for energy growing, natural gas is increasingly seen as a more environmentally friendly option compared to coal, an alternative to oil and nuclear, and a more mature technology than renewable energy sources such as solar and wind. While coal is cheap and abundant, it is a major pollutant, particularly of carbon dioxide. Low-emission nuclear power is relatively cheap to operate, but it has become the subject of renewed safety concerns in the wake of the 2011 nuclear accident at the Fukushima plant in Japan. And oil prices and production remain volatile, placing consuming countries reliant on it under considerable economic strain.

Longstanding issues such as control of transit pipelines, a lack of access to pipeline routes, and the availability of cheap resources such as coal and oil have constrained natural gas consumption in many parts of the world. International trade of liquefied natural gas (LNG) allowed producers to bypass pipelines, but LNG requires costly infrastructure for producers and the importers, and, while growing, is unlikely to reach the levels of shipments of dry gas. Some analysts see potential in shale gas and other unconventional sources as a way to boost domestic resources of countries once thought to have limited gas resources, lessening the potential for import dependence.

The world produced and consumed more than 100 trillion cubic feet of natural gas in 2009, representing approximately 20 percent of global energy production. About one-third of gas is exported and the rest consumed by the producing countries. North America, Europe, and Eurasia comprise about two-thirds of all natural gas consumption. Much of the future increases in consumption come from Asia, and increases in natural gas exports come from Middle East LNG. Unlike oil, natural gas production is not dominated by the countries with the most natural gas reserves. Iran and Qatar have the second and third largest reserves after Russia, but both provide only a small fraction of the world's total production. In 2009, both Qatar and Iran represented about 4 percent of global production. According to the U.S. Energy Information Administration (EIA) the United States is the world's largest producer but represents only a small fraction of global reserves.

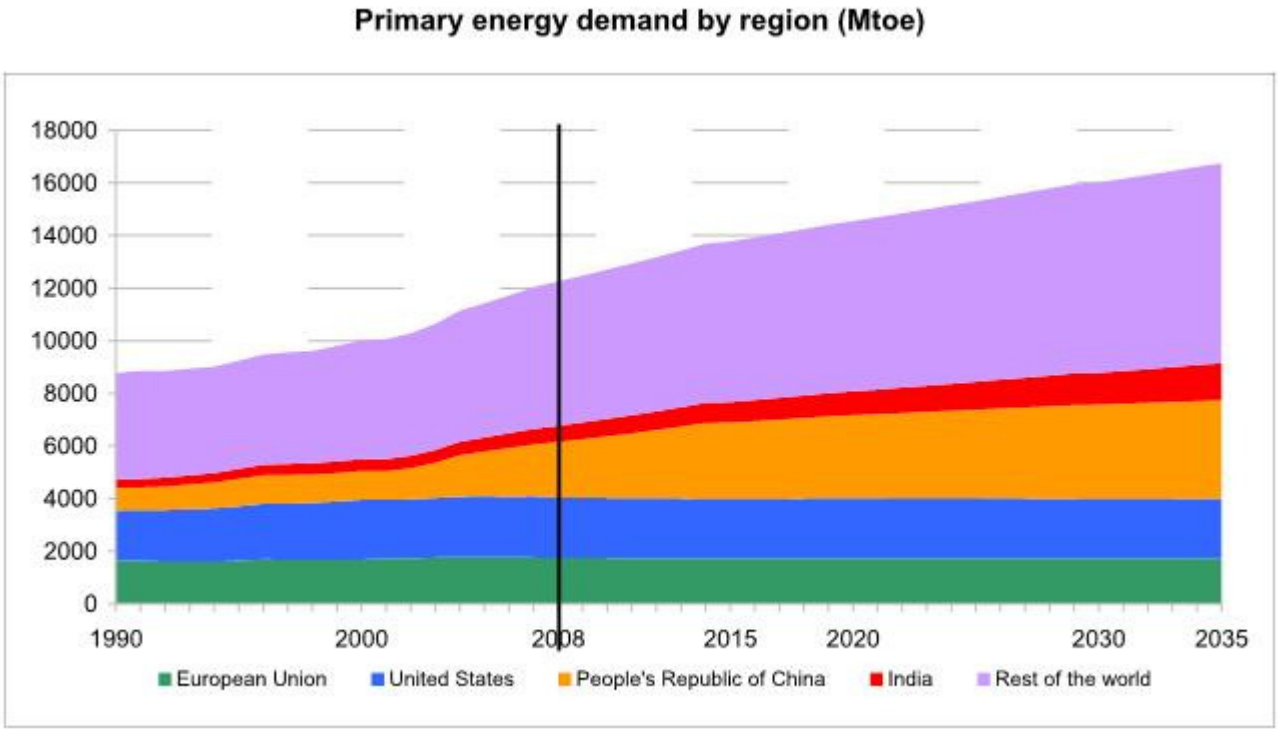
LNG currently accounts for about 30 percent of all natural gas trade. LNG capacity is expected to more than double between now and 2035 to about nineteen trillion cubic feet per year, up from nearly nine trillion cubic feet in 2009. But while LNG--shipped via large ocean tankers--provides countries with trade flexibility and helps avoid some of the geopolitical and geographic issues associated with pipelines, LNG has its own limitations. Despite tremendous global growth in LNG, an EIA 2010 global energy assessment found that pipelines, not LNG shipping, will remain the dominant mode of gas transportation for the next two decades. Currently, because natural gas is mostly traded by pipelines--in some cases with years-long contracts--prices are often regional.

The European Union as part of its energy policy, where the security of energy supply receives top priority, has focused on the need to diversify its gas imports in terms of geographic origin. As it clearly states in a recent Working Paper[1], "The EU energy policy has developed around a common objective of ensuring safe, secure, affordable and sustainable energy supplies for its economy and citizens. Delivering on this objective will require development of an integrated internal energy market, ensuring adequate infrastructure investments, realizing substantial energy savings, and fostering clean technology innovation and deployment. None of these policy priorities can be pursued without taking into account major evolutions on the energy scene beyond the EU borders. The external challenges need to be appropriately considered in the EU energy policy and response to them has to be an integral part of the EU action".

The Growth in Global Energy Demand

Global energy markets are undergoing a significant transformation. While in the past decades the OECD countries accounted for the majority of the world's energy consumption, in recent years the growth in demand is increasingly driven by the emerging economies, in particular China and India.

[1] Commission Staff Working Paper, key facts and figures on the external dimension of the EU energy policy, Brussels 7/9/2011



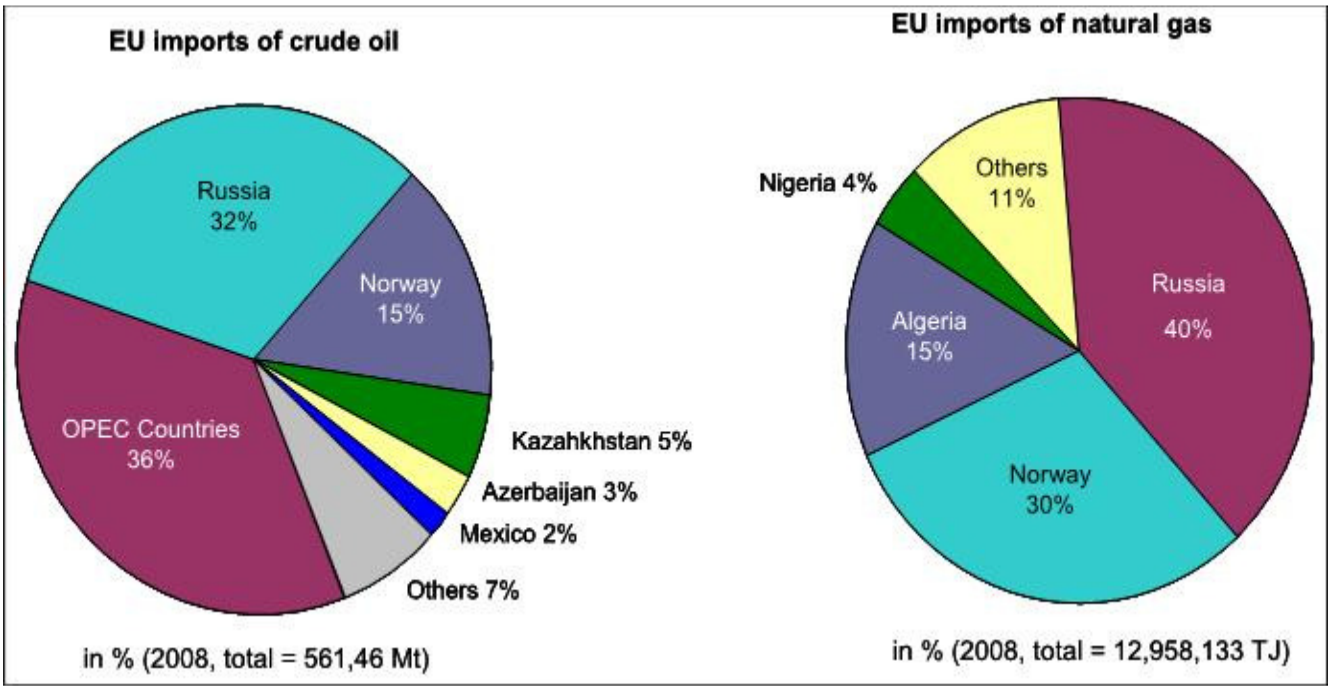
Source: European Commission

The EU energy consumption is expected to level out. Overall world energy demand, however, is projected to increase by more than a third between 2008 and 2035, nearly doubling in China and India due to the expected population and economic growth. High growth rates are also likely in the Middle East and the Caspian regions, where the demand is expected to increase by 70% and 50% respectively between 2008 and 2035.

The Security of Supply Dimension

The EU will increasingly compete with other importing countries and regions for energy supplies, given that its own domestic energy production is on the decline. With more than half of the energy consumed in the EU coming from third countries, the EU is already the world's largest energy importer.

Figure 1.2



Source: European Commission

Today, the EU imports more than 80% of the oil and more than 60% of the gas it consumes. If the current trends continue, import levels will reach more than 70% of the EU overall energy needs by 2030. The EU's geographical location puts it in close proximity of a number of energy-producing regions as well as at the intersection of important supply routes. Countries in the EU's neighbourhood already account for the majority of EU's imports in oil and gas. Russia, Norway, Algeria and Libya represent together 85% of the EU natural gas imports and almost 50% of the crude oil imports.

Table 1.1: *Top energy importing countries and regions, 2008*

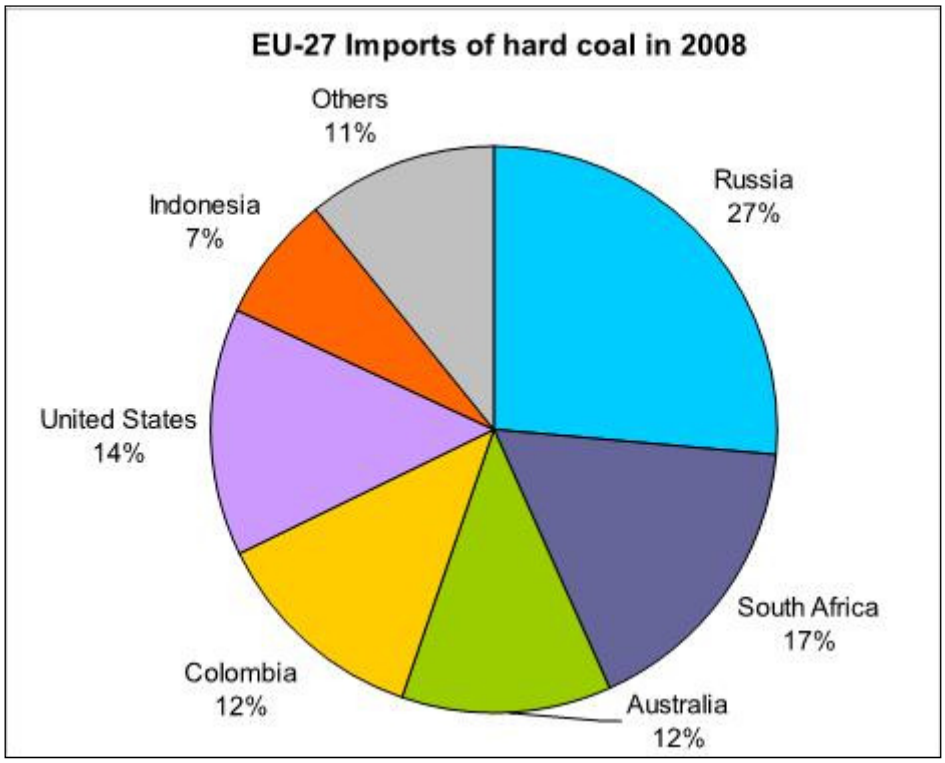
Country	Exports (ktoe)	Imports (ktoe)	Net imports (ktoe)
EU27	-482.554	1.495.097	1.012.543
United States	-167.141	798.737	631.596
Japan	-20.204	436.899	415.695
China	-67.930	278.355	210.425
Korea, Republic of	-44.656	238.639	193.983
India	-40.070	197.958	157.888

Source: International Energy Agency

The EU is also a major importer of natural uranium as its indigenous production, based in the Czech Republic and Romania[2], covers only slightly more than 3% of the EU's needs. In 2010, supplies from Russia, Kazakhstan, Canada and Australia represented two thirds of the EU's needs, complemented by deliveries from Niger, South Africa, Namibia and other origins as well as by use of highly enriched uranium for blending.

Indigenous production accounts for approximately 60% of the EU coal consumption. EU's major coal suppliers are located further away from Europe, with exception of Russia that is the EU's largest supplier of coal.

Figure 1.3:



Source: European Commission

The EU has already experienced a number of energy supply disruptions and its vulnerability is likely to continue rising in a context of more challenging international political environment, and difficult investment conditions and access to upstream resources in producing countries. Given its reliance on imported energy and few suppliers, the EU should continue addressing risks related to unexpected price fluctuations on the global energy markets stemming from imperfect competition and other market or regulatory failures.

[2] A new uranium mine is currently in the process to be developed in Finland.

The South Corridor, which comprises a number of competing potential gas pipelines transcending SE Europe and Greece in particular, is emerging as EU's gas safety net which, when realized, will indeed provide a much needed alternative. The present study aims at comparing these pipelines and discussing their relative advantages and shortcomings with reference to Greece, which as a host country stands to benefit considerably from such major infrastructure works. Greece's benefits are twofold, comprising geopolitical and financial gains. A thorough analysis of these gains is also attempted in the current study.

CHAPTER 2

GLOBAL AND EUROPEAN GAS OVERVIEW

In this part of the study we present an overview of the global and European natural gas markets and how these have developed over the past two to three years with projections for the next 20 to 25 year period. The analysis that follows is structured on "demand" and "supply" basics. Most of the information included in this section has been abstracted from IEA publications, mostly the Medium – Term Oil & Gas Markets for 2011[3], the Golden Age of Gas special report[4] and the most recent World Energy Outlook 2011[5].

2.1 DEMAND

During 2010 world gas demand climbed to an estimated 3.284 billion cubic meters (bcm), rebounding a surprising 7.4% from its 2009 level, one of the highest growth rates recorded over the past 40 years. This growth overshadows the 2.5% drop in gas demand experienced in 2009 and puts natural gas demand back on its pre-crisis track. Demand in most non-OECD regions was driven by economic growth and increasing needs in both the power and industrial sectors. Although OECD gas demand grew by 5.9% in 2010, this recovery is artificially inflated, as half of the increase was driven by abnormal weather reflecting very cold winter months across Europe and a hot summer in the Pacific region. Seasonally adjusted figures show that European gas demand is just back to 2007 levels at 568BCM's. By comparison, China's gas demand increased 22%, reaching 107 bcm, making it the fourth largest gas user behind the United States, Russia and Iran. Gas markets grew strongly In Asia, Latin America and the Middle East, and more moderately in Africa. Demand growth in Russia was also partially driven by exceptional weather.

Abundant gas supplies were available to meet the incremental demand of 227 bcm. Production increased in all regions, including across the OECD. A 60 bcm liquefied natural gas (LNG) wave hit the markets due to the completion of projects launched around the middle of the decade, bringing the increase of LNG production capacity to 100 bcm in 2009-10. Although some experts predicted a

[3] Medium- Term Oil & Gas Markets 2011, published by IEA, Paris, June 2011.
[4] "Are we Entering a Golden Age of Gas", IEA Special Report for WEA 2011, Paris, June 2011.
[5] World Energy Outlook 2011, IEA, Paris, October 2011.

slower increase in unconventional gas production in 2010, US shale gas production jumped by an estimated 50 bcm in 2010. The largest incremental gas supplies came from the Middle East and the Former Soviet Union (FSU), driven by a strong recovery in Russian gas production. Additional supplies in the Middle East came in large part from new Qatari LNG trains. Historical LNG consumers in Asia and new markets in the Middle East and Latin America, combined with a growing appetite for LNG in Europe, contributed to absorb these new LNG volumes. The continued rise of shale gas in the United States discouraged LNG imports, which dropped even further.

Power generation remains the main driver behind gas demand growth; use in this sector is estimated to have increased by 5% in 2010. Both gas turbines and renewable (including wind and photovoltaic) continue to dominate the investment picture for power generation across the OECD. But the strong growth of wind and solar generation tends to reduce the share of combustible fuels; as a result, gas must increasingly compete against coal at the margin. The use of gas by power generators depends not only on relative fuel prices, but also on country-specific factors such as electricity capacity mix, market structure and fuel supply arrangements, as well as the existence of carbon pricing. Additionally, the increasing deployment of variable renewable energy sources, particularly in Europe, impacts the relative attractiveness of future technologies, favouring gas-fired plants compared to capital-intensive options such as coal and nuclear power plants.

The surplus of gas, which materialized in 2009 with depressed demand and the increased supplies of both LNG and unconventional gas, was partly absorbed in 2010 by resurgent demand. Similarly 2010, energy buyers and producers wonder how long the surplus gas situation will last. The answer hinges on four factors. On the demand side, the main factors include economic growth, relative fuel prices and energy policy developments regarding nuclear, renewable and energy efficiency. The fourth factor – unrest in the Middle East – is more directly linked to supply.

According to IEA estimates, global demand for natural gas is expected to increase strongly over 2010-16, reaching around 3,800 bcm by 2016. The bulk of the incremental gas demand originates from the non-OECD regions, especially the Middle East and Asia, while the growth of gas consumption in most OECD countries will be dampened by high gas prices. There are ample supplies to meet this demand, coming mostly from non-OECD producing countries. China will be one of the fastest-growing and largest gas consumers; its gas demand is projected to double over the forecast period to 260 bcm. Meanwhile, the Middle East will represent 20% of additional gas

use. New supply volumes will come mostly from the existing largest non-OECD producers, FSU and the Middle East. The FSU region will be by far the most important producing region by 2016 and will help meet demand in Asia. OECD gas production should also increase, as additional output from Australia and North America compensates for rapidly declining European gas production.

Gas markets saw the results of the first wave of LNG liquefaction plants being brought online as LNG trade increased by 25% in 2010 to reach 299 bcm, the largest percentage increase ever seen. Global LNG trade now represents 9% of global gas demand. Qatar was the largest contributor to additional LNG supplies and now represents one-quarter of global LNG supplies, twice as much as Indonesia, the second-largest LNG supplier. Growth of LNG trade is set to continue over 2011-16 as new plants come on stream. On the export side, the gap is closing between the Middle East region (34%) and Asia-Pacific (38%) as the two largest global LNG exporters as of 2010. LNG imports continue to gain market shares in most regions, but declined in the United States and India, due to growth of domestic production. Asia retains the lion's share with 60% of global LNG imports, while Europe now represents 29%.

Unconventional gas continues to impact gas markets. Not only have these resources doubled the estimated recoverable gas resources compared to recoverable conventional gas resources, they are also more evenly distributed across regions. The bulk of unconventional gas production is currently located in North America. Interest in unconventional gas is now spreading all over the world, but with very different outcomes. While most countries are seriously looking at shale gas, coalbed methane (CBM) is also attracting attention in a number of others. The obstacles to developing unconventional gas are diverse though, and environmental concerns are increasingly in the spotlight and have deterred exploration in a few countries.

Different supply and demand balances, coupled with market dynamics, have caused regional market prices to drift further apart. Unlike 2009, when US and UK spot prices converged towards $4/MBtu, creating a sustained gap with much higher oil-linked gas prices, European spot and contract prices converged in 2010. Market prices nevertheless represent around 60% of wholesale gas prices in the world, while one-third of global prices is still subject to regulation. As global inter and intra regional trade increases, more countries could be exposed to oil-indexation or spot prices as they turn to imports. European gas prices have ranged between $8/MBtu and $10/MBtu as of

early 2011, below Asian oil-linked gas prices as $12/MBtu, but well above US Henry Hub (HH) gas prices at $5/MB/tu.

Assessing investment needs is as difficult as ever. The past two years have seen a wide boom and bust cycle as demand recovered by 7.4% in 2010 after declining 2.5% the year before. This global picture hides wide regional disparities that will translate into different requirements in terms of new production and transport infrastructure.

Various Scenarios for Gas Demand

In this year's World Energy Outlook published by the IEA[6] the increasingly important role that natural gas is expected to play in the energy mix is highlighted. It is the only fossil for which demand rises in all three scenarios worked out by the Agency underlining one of the chief attractions of gas: it is a fuel that does well under a wide range of future policy directions. Moreover, gas demand in all scenarios in 2035 is higher than the WEO-2010 projections. This reflects the impact of the years to 2015 of the 12th Five-Year Plan, announced by China in 2011, which envisages a major expansion of domestic use of natural gas. The global consequences of the damage to the Fucushima nuclear plant in Japan push up projections of future gas consumption, as natural gas is the fuel which benefits most readily form any switch away from nuclear power. Higher projected output of unconventional gas also acts to keep increases in the price of natural gas below the level envisaged in WEO-2010, increasing its competitiveness against other fuels. There is, nonetheless, still a large variation in the trajactories of gas demand between the three scenarios as shown in Table 2.1 and Fig.2.1

Table 2.1:

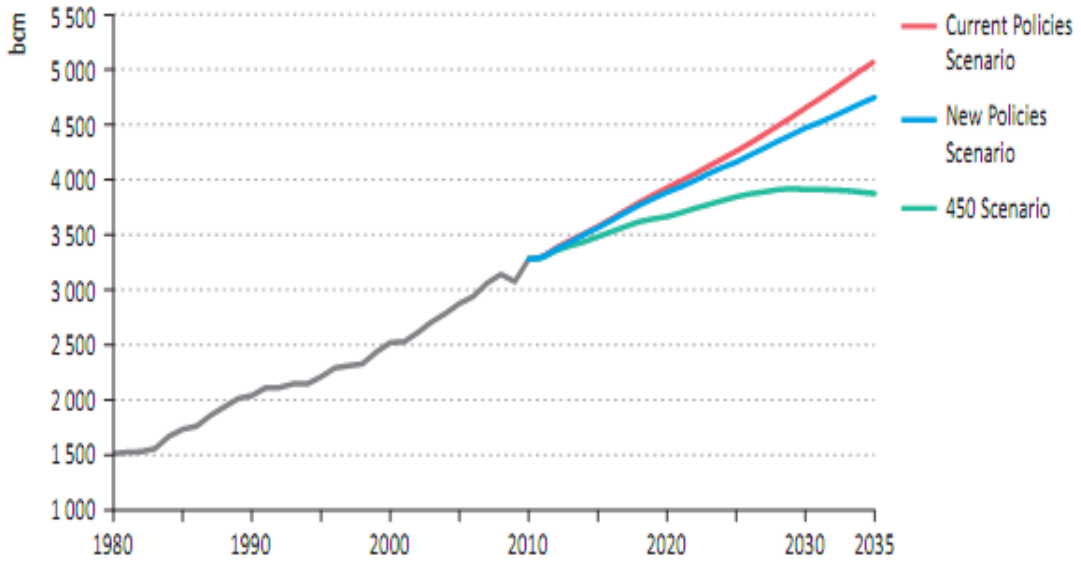
Primary natural gas demand by region and scenario (bcm)

			New Polices Scenario		Current Policies Scenario		450 Scenario	
	1980	2009	2020	2035	2020	2035	2020	2035
OECD	959	1.518	1.705	1.841	1.714	1.927	1.597	1.476
Non-OECD	557	1.558	2.183	2.909	2.215	3.180	2.068	2.400
World	**1.515**	**3.076**	**3.888**	**4.750**	**3.929**	**5.087**	**3.665**	**3.876**
Share of non-OECD	*37%*	*51%*	*56%*	*61%*	*56%*	*62%*	*56%*	*62%*

[6] Ibid. p.156

Figure 2.1:

World primary natural gas demand by IEA scenario

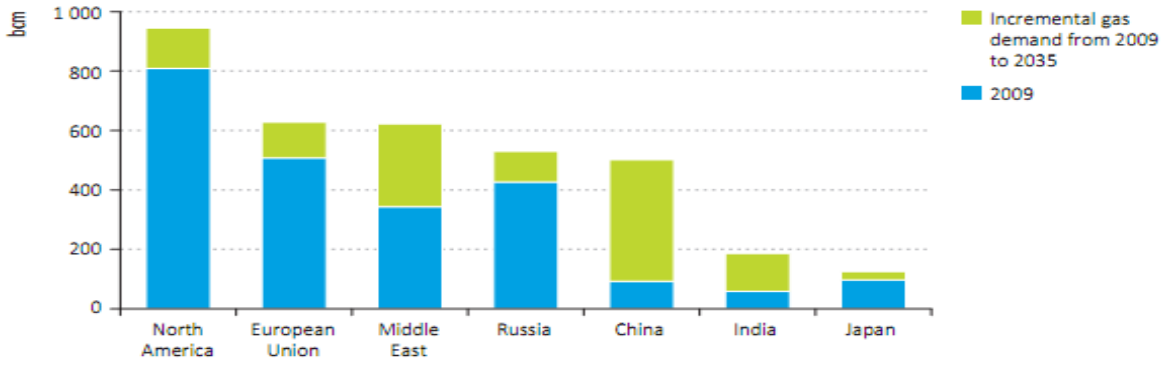


Regional and Sectoral Trends

Total demand from non-OECD countries overtook OECD demand in 2008 and is projected to grow at 2.4% per year the period to 2035 in the New Policies Scenario, compared with 0.7% in the OECD. A disaggregated analysis of the projections confirms that the fastest individual gas markets across the world are all outside the OECD (where the markets are sizeable, but more nature) (Figure 2.2). The largest increments in demand in 2035, compared to 2009, are China and the Middle East. Among the major non-OECD markets, only in Russia – where natural gas already accounts for more than 50% of primary energy use – is the growth in consumption more modest.

Figure 2.2:

Natural gas demand by selected region in the New Policies Scenario, 2009 and 2035



Notes: 2009 is the base year for gas projections. Rates of growth would be lower if 2010 figures were used as base year due to the impact of the economic crisis on gas demand in 2009.

Among the major countries and regions, China is the fastest growing, with annual average growth of 6.7%. Over the projection period as a whole, China accounts for a quarter of global gas demand growth (Figure 2.2-Table 2.2). Only around 10% of residential households in China presently have access to natural gas, well below the global average of 40%, and national policies are increasingly supportive of an expanded role for gas in China's energy consumption as a way to diversify the energy mix and reduce local pollution. Our projection for China's demand for gas in 2015 is nearly 200bcm in 2035, 11% of China's energy mix. Increases are spread across all of the consuming sectors, with the largest increment in power generation. Gas demand also expands quickly in other parts of Asia and in the Middle East: gas is a particularly attractive fuel for countries that are seeking to satisfy rapid growth in fast-growing cities.

Table 2.2:

Primary natural gas demand by region in the New Policies Scenario (bcm)

	1980	2009	2015	2020	2025	2030	2035	2009-2035*
OECD	**959**	**1 518**	**1 654**	**1 705**	**1 746**	**1 804**	**1 841**	**0.7%**
Americas	660	811	852	877	900	928	951	0.6%
United States	*581*	*652*	*680*	*685*	*692*	*703*	*710*	*0.3%*
Europe	264	537	604	627	644	666	671	0.9%
Asia Oceania	35	170	198	201	202	210	219	1.0%
Japan	*25*	*97*	*118*	*122*	*122*	*125*	*126*	*1.0%*
Non-OECD	**557**	**1 558**	**1 911**	**2 183**	**2 417**	**2 668**	**2 909**	**2.4%**
E. Europe/Eurasia	438	627	698	723	763	797	830	1.1%
Caspian	*n.a.*	*107*	*124*	*131*	*143*	*151*	*161*	*1.6%*
Russia	*n.a.*	*426*	*467*	*478*	*495*	*513*	*530*	*0.8%*
Asia	36	357	531	686	796	921	1063	4.3%
China	*14*	*93*	*197*	*301*	*366*	*435*	*502*	*6.7%*
India	*2*	*59*	*76*	*99*	*120*	*150*	*186*	*4.5%*
Middle East	35	343	402	450	509	578	622	2.3%
Africa	13	99	112	129	142	153	161	1.9%
Latin America	35	133	168	196	208	220	233	2.2%
Brazil	*1*	*20*	*41*	*60*	*70*	*80*	*91*	*5.9%*
World	**1 516**	**3 076**	**3 565**	**3 888**	**4 164**	**4 473**	**4 750**	**1.7%**
European Union	*n.a.*	*508*	*572*	*593*	*608*	*626*	*629*	*0.8%*

*Compound average annual growth rate.

The New Policies Scenario

According to IEA's special report on natural gas, a scenario known as the New Policies Scenario (NPS), has been worked out as part of World Energy Outlook 2011 which provides a useful point of reference against which to measure the impact of various alternative assumptions and sensitivities as elaborated in that report.

According to this scenario world economic growth will average 3.2% per year between 2008 and 2035, with the brightest prospects in non-OECD countries[7]. Gas prices were assumed to rise steadily in all regions *(see Table 2.1).* With regard to government policies, the New Policies Scenario assumed that action would be taken to implement the broad commitments and plans announced by countries around the world to tackle either environmental or energy-security concerns, even where the relevant measures remained to be identified. These commitments included the national pledges to reduce greenhouse-gas emissions, communicated formally under the Copenhagen Accord and plans to phase out fossil-energy subsidies.

The New Policies Scenario showed world gas demand rising from 3.1 trillion cubic metres (tcm) in 2008 to 4.5 tcm in 2035 – a total increase of 44%, equivalent to an average annual growth rate of 1.4% *(Table 2.1)*. The share of gas in overall primary energy demand increases marginally during the Outlook period, from 21% to 22%, as demand for other energy sources is expected to rise.

Regional Trends

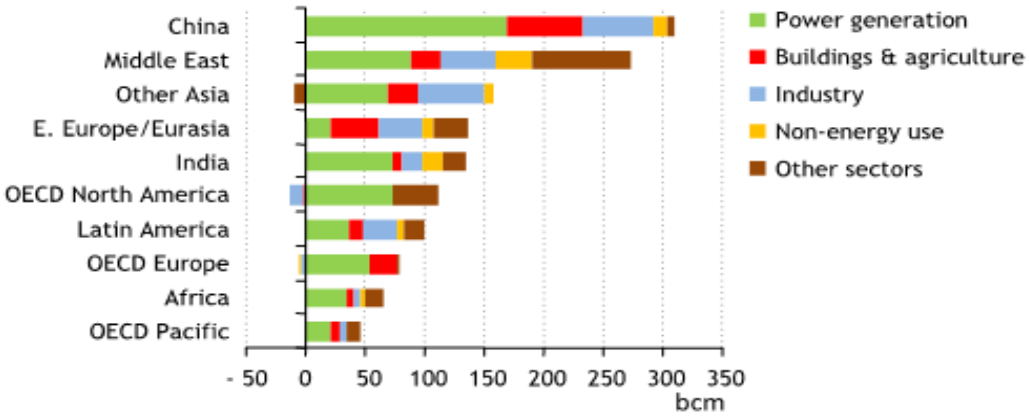
In the New Policies Scenario, gas demand grows in almost all regions over the next 25 years *(Figure 2.3).* Non-OECD countries are the primary drivers of demand, accounting for 80% of the increase. Their economies and populations grow much faster, and the scope for expanding gas use is much greater, that in the OECD. Globally, China sees the highest rate of growth in gas demand; it also accounts for the largest increment of growth in absolute terms.[8] All sectors support impressive demand increases. These are met by the opening up of new sources of supply, a mixture of indigenous production of conventional and unconventional gas and imports via pipeline and liquefied natural gas (LNG).

[7] GDP growth in the OECD and non-OECD was assumed to average 1.8% and 4.6% per year, respectively.

[8] The WEO-2010 New Policies Scenario did not take account of China's 12th Five-Year Plan, as its details emerged after the analysis.

Figure 2.3:

Incremental primary gas demand by region and sector in the WEO-2010 New Policies Scenario, 2008-2035



Gas demand also surges in the Middle East, driven mainly by the power sector. Gas-fired plants are brought online to replace oil-fired units and free up oil for export or value-added uses, such as petrochemical. Development of large, indigenous resources facilitates rising gas use. Strong demand in other non-OECD countries is matched by hydrocarbon developments. Brazil is expected to tap recently discovered offshore resources; in the Caspian region, gas use is expected to soar as production from new projects starts to flow. It is anticipated that gas use in Russia will grow only modestly from 2008 to 2035, as a result of continued improvements in energy efficiency (the replacement of older equipment, notably in the power sector) and the gradual elimination of subsidised gas prices.

OECD - Europe

In the New Policies Scenario, projected gas-demand growth in the mature OECD markets and particularly in Europe is considerably slower than in the non-OECD. Even though the United States and Europe remain two of the largest blocs through 2035, additional OECD gas demand amounts to just 19% of that in non-OECD countries. Limited scope exists for increased gas use in the residential sector in the OECD because of saturation effects. Although modest economic growth in the OECD lifts industrial output, more efficient gas use in the sector leads to a marginal drop in gas demand. Growing electricity production from gas-fired units continues to account for the lion's share of additional gas demand in OECD countries.

This is especially true in the case of Europe where gas demand is expected to grow by 0.5% overall i.e. from 555 bcm in 2008 to 582 in 2020 and 628 in 2035. Power generation, industrial and commercial use is expected to account for the bulk of the anticipated demand rise. S.E. Europe, whose economy is expected to grow at considerably higher rates than the rest of Europe, and where natural gas penetration in the energy mix is still minimal, will see a much bigger gas demand volumes than the rest of the continent.

Sectoral Trends

In the New Polices Scenario, power generation is the principal driver of natural gas demand in most regions to 2035, accounting for nearly half of incremental growth. Despite slowly, rising gas prices, combined-cycle gas turbines (CCGTs) are expected to remain the preferred choice for new power plants in many regions. With an array of risks confronting new power generation capacity, gas is a relatively low-risk option. Non OECD electricity demand rises rapidly, increasing the need for all sources of power generation, including gas. The competitiveness of gas-fired generation relative to coal is boosted in OECD countries by CO_2 prices, which are assumed to rise throughout the projection period. Continued support for renewable in regions where environmental or energy security concerns are high constrains the growth of gas use in the power sector, notwithstanding its ability to provide back-up for variable renewable-based capacity.

The buildings sector is responsible for 15% of additional gas demand during the Outlook period. Economic and population growth is expected to lift gas consumption in the sector, to meet additional space and water heating needs. Strong demand growth in non-OECD countries overall is driven by rapidly expanding urban populations, even though gas demand in buildings changes little in some non-OECD regions where the climate is warm or personal incomes are too low to support the construction of distribution networks. Demand growth for gas in buildings in the OECD is limited, whether for space or water heating, due to market saturation, slow population growth and the adoption of more efficient technologies.

Natural gas consumption by industry accounts for 17% of new demand over 2008 to 2035, rising in response to heightened economic activity and increased output across the industrial sector to fuel additional process heat and steam-raising in factories. Nearly all new gas demand in the industrial sector arises in the non-OECD, where economic growth is strongest. Another non-OECD trend is the

switching from oil to gas in industry, as gas is more economically and environmentally attractive. In contrast, in most OECD countries industrial gas demand declines as the impact of slowly increasing industrial output (due partly to the relocation of industries to non-OECD countries) is offset by efficiency gains and the growing use of electricity.

Gas use in the transport sector is responsible for just 4% of additional demand over 2008 to 2035. While powering gas pipelines today accounts for four-fifths of gas consumed in the transport sector, nearly all new gas consumption during the Outlook period arises from gas use in road transport (prominently in vehicles fuelled by compressed natural gas [CNG]). Non-OECD Asia, Latin America and OECD North America are responsible for the bulk of the increase. The scope for increased demand in the transport sector depends on the future market penetration of natural gas vehicles (NGVs), which comprise a minute share of the world car fleet today (less than 1%) and face infrastructure hurdles. A sensitivity analysis of gas demand as forecasted in the NPS is presented in Annex I.

2.2 Supply

On the production side, Russia is advancing major projects such as Yamal Peninsula, but it has yet to take final investment decisions (FIDs) on the next projects. Strategically positioned between Russia, Iran, China and Europe, the Caspian region will play a critical role. The Middle East and Africa offer a contrasting picture as new production will be more costly to develop but is needed to sustain economic development and fulfil export commitments. Only Qatar can meet comfortably both increasing domestic needs and export commitments. For Russia, uncertainties persist regarding Europe, its main export market; exports did not recover in 2010 due to competition from LNG supplies. Russia is turning to China, hoping to secure a slice of the pie in this huge and rapidly growing market. New projects, often based on LNG exports, will be challenging to develop. In the Northwest, Shtokman will face competition from Yamal LNG; both projects have some common foreign investors. The interest in developing greenfields in the Far East and Eastern Siberia is mounting after the Fukushima accident, which is expected to lead to higher gas demand in Japan. In the Middle East and Africa, a few countries have domestic market obligations (DMOs) in place to limit exports. Iran, the second-largest holder of proven gas reserves in the world, is a net importer and most LNG export projects are stalled. Oman is struggling to develop new tight gas fields to keep pace with its rising demand. Meanwhile, Iraq – and, more surprisingly, Israel, Cyprus and the East

African coast – could emerge as gas exporters in the long term, although there are still many obstacles to tackle.

The mood in the LNG business seems to be quite positive with six FIDs taken over the past two years. Therefore, a second wave of investment is forming to bring new projects on line by the middle of the decade. These new projects will not be low cost; construction costs are anticipated to be twice as high as those for plants that recently came online.

Expanding inter and intra regional transport capacity is crucial to enable higher gas consumption levels, particularly in Asia, which is currently attracting most investments. Globally, LNG regasification terminals are advancing slightly faster than inter-regional pipelines. Inter-regional developments depend not only on future demand developments, but also on unconventional gas supplies. Regasification terminals are usually smaller and require less capital than pipelines, and also benefit from the rapid development of LNG production. Floating regasification terminals enable rapid relief to countries with increasing import needs, especially in the Middle East, Southeast Asia and Latin America. Looking ahead, over 100 bcm of regasification capacity is currently under construction, while only tree inter-regional pipelines are being constructed or expanded. Intra regional capacity is moving ahead, albeit for different reasons: in Europe, the focus is on security of supply; North America is keen to bring new gas production to markets (primarily within North America). Finally, many importer/exporter countries are emerging. LNG exporters in Asia are turning to imports, while continuing to export LNG. Canada and the United States, both LNG importers, are planning liquefaction capacity to export their production.

Resources and Reserves

The world's remaining resources of natural gas can comfortably meet the projections of global demand growth in IEA's current Outlook to 2035 and well beyond. This occlusion has been reinforced over the last few years as our understanding of the recoverable resource base has expanded, particularly of the size of unconventional gas resources – from coal beds (coal bed methane), low-permeability reservoirs (tight gas) and shale formations (shale gas)[9]. Conventional recoverable resources of just over 400 tcm are equal to around 120 years of productions at 2010

[9] For example the recent assessment of worldwide shale gas resources from the US Energy Information Administration (US DOE/EIA), 2011.

levels; adding unconventional recoverable resources (which are of similar size) brings this figure to nearly 250 years (Figure 2.3).

The fact that unconventional resources are more widely dispersed than conventional resources has implications for gas security since all major regions now have total recoverable gas resources equal to at least 75 years of current consumption. This does not mean that gas is readily available in each region; resources require substantial investment – sometimes over decades – before they can produced and marketed. But it does imply that countries and regions have the option, if they so wish, to develop alternative, more diversified sources of gas supply; our analysis (IEA, 2011) suggests that plentiful volumes of unconventional gas can be produced at costs similar to those of North America (between $3 per million British thermal units [MBtu]. It is worth comparing the outlook for gas with that for oil where, even with growing output of unconventional oil, the trend is towards greater reliance on a small number of producers, with oil delivered to markets along a limited number of potentially vulnerable supply routes.

Proven gas reserves of 190 tcm are estimated based on operators' public filings or government records, and are only a relatively small proportion of the total resources (Cedigaz, 2010). Most of the proven reserves are conventional. Unconventional proven reserves for a significant share of the total only in the United States and Canada. Overall, 130 tcm out of the total proven reserves, a 70% share, are in Eastern Europe/Eurasia (mainly Russia) and the middle East (Iran and Quatar); however, these regions account for a much smaller share (46%) of the total estimated recoverable resources.

Figure 2.3:

Recoverable gas and production by region and type end-2010

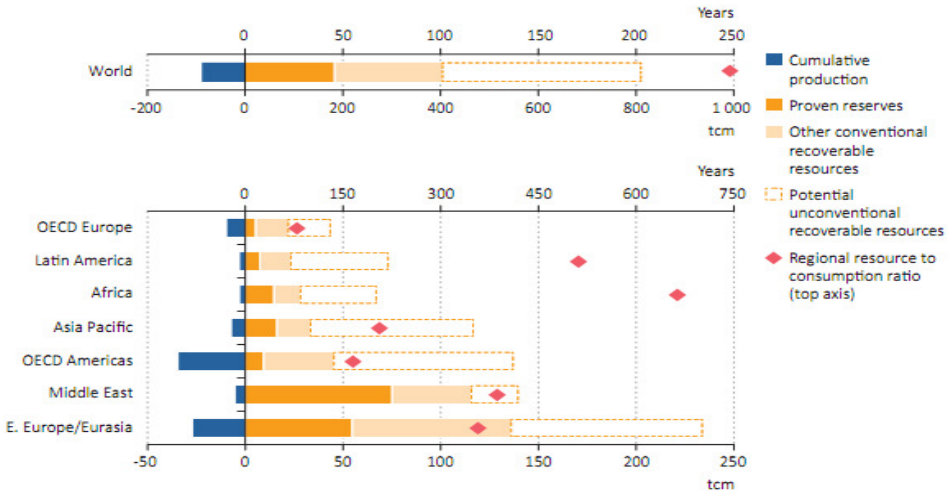
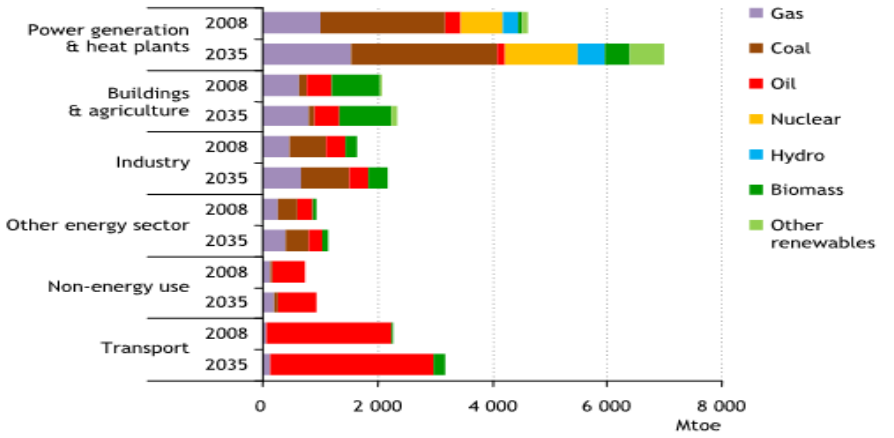


Figure 2.2:

World primary energy demand by sector and type in the WEO-2010 New Policies Scenario



Note: Non-energy use includes inputs to petrochemicals. Other energy sector includes energy consumed in oil and gas production, gas-to-liquids transformation and distribution losses.

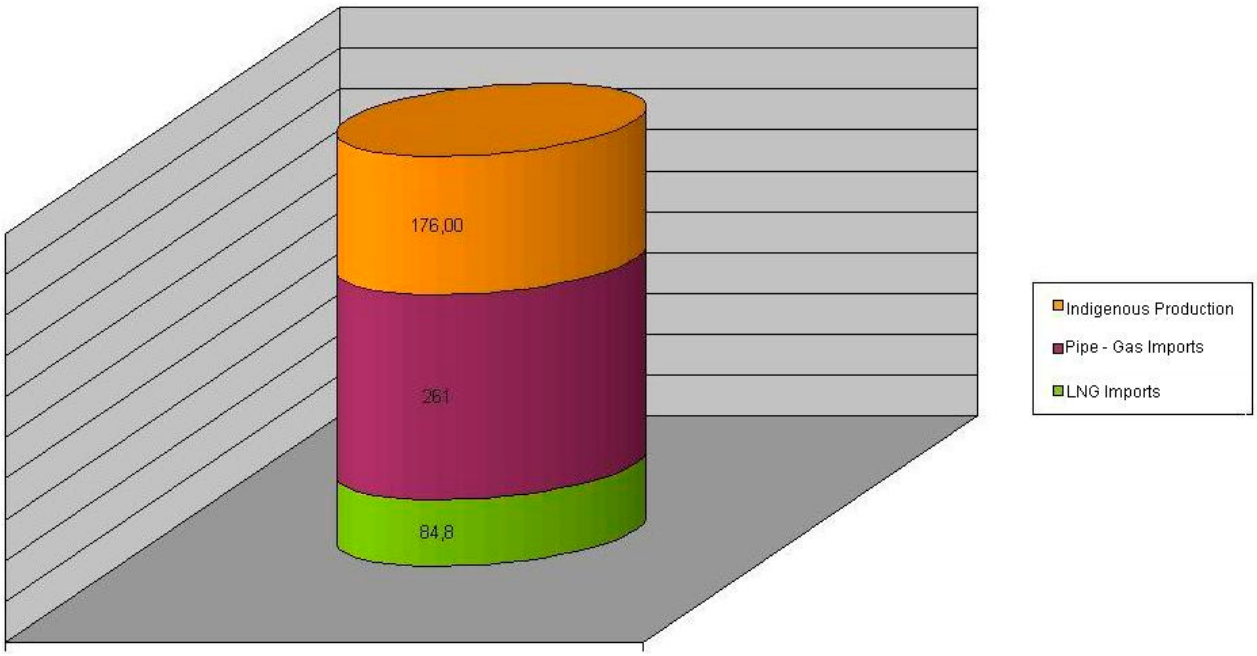
CHAPTER 3

EUROPEAN GAS SUPPLY PROSPECTS

3.1 PRESENT SITUATION

The European – Eurasia region represented about 38 percent of the world's gas consumption in 2009 and two-thirds of the world's pipeline trade. The region has a massive network of pipelines primarily running from Russia into Western Europe. Overall, the region represents about 48 percent of global natural gas exports, but nearly all of it is exported between countries in the region. Russia represented 20 percent of global exports in 2009--the highest of any country. Norway is the world's second largest gas exporter. The Netherlands and Uzbekistan are also high net exporters in the region. The total natural gas consumption in EU 27 (2010) was 522 bcm of which 261 bcm corresponded to pipe-gas imports, 84,8 bcm to LNG imports and 176 bcm to indigenous production[10] (*see Figure 3.1*).

Figure 3.1:
Natural Gas Consumption in Europe in 2010, including E-27 and other European countries (in bcm)



Total European Gas Consumption in 2010: 522 bcm

[10] BP Statistical Review of World Energy 2010, BP, London, June 2011

The region is largely characterized by tensions between Russia and some of its natural gas clients and transit countries. The EU, which obtains approximately 21 percent of its gas from Russia, has increasingly looked for ways to diversify access to natural gas, and is therefore looking into ways of transporting gas from the Caspian region, through gas pipelines and by also increasing its LNG imports from Northern Africa and the East Mediterranean (i.e. Israel, Cyprus). With natural gas demand dropping in Europe and shale gas production increasing in the United States, Russia fell to the world's second largest producer. However, as EU countries, particularly Germany, pull away from nuclear power, some analysts say the temporary glut in the European market is likely to disappear and put Russian gas back in play. EU governments are also investing in LNG and represented about 29 percent of global LNG imports in 2009. The EU is also looking at shale gas.

During the last two decades, natural gas consumption in Europe has nearly doubled. From around 300bcm in 1990, gas demand in Europe, including EU-27 countries and other SE European countries reached to 550bcm in 2007 and 522bcm in 2010, a drop attributed to recessionary pressure since 2008. In the Balkans and SE European countries in particular, gas demand also increased during the same period, although with a quite different growth pattern, mainly due to the political and economic reforms of the '90s in certain countries of the region. The main driver for this spectacular increase in gas demand was without any doubt the power generation sector. Only during the last 5 years, gas consumption in the European power generation sector increased by some 60 bcm (see *Figure*.3.2).

By 2010, some 35 GW of new gas-fired generation capacity came into line in Europe and thus the yearly consumption of the sector will exceed 200 bcm, for the first time, representing 35% of the total European gas demand. Incremental increases in gas consumption are also expected in nearly all the other sectors of the economy, during the next decade and therefore it is not easy to accurately forecast the future for European gas.

Gas demand forecasts vary, depending on the scenarios and the assumptions used, as well as on the time horizon looked at by each energy analyst. For the short-term, say over the next two years, there are deteriorating prospects for gas demand in Europe, mainly due to the ongoing eurozone crisis and general economic recession. For the medium-term, say the next decade, gas demand projections for Europe, nearly all energy think tanks and international organizations agree that

substantial new gas quantities will be needed to the continent's socio-economic development and also fulfil its environmental protection goals.

On the contrary, long-term forecasts differ substantially. Gas consumption growth rates (especially in the power generation sector), could be affected by a number of factors such as gas availability, high gas prices, carbon technologies and prices in power generation, CO_2 prices under ETS, lack of effective regulatory frameworks especially for gas transiting, growing dependence on gas imports, climate change policies etc. etc.

However, even for the low demand scenarios, significant investments will be needed across the entire gas supply chain so that the projected gas demand in Europe can be covered. According to a CERA's study, "investment decisions to commit more than 500 billion Euros will need to be made over the next 10 to 15 years, in order the projected gas demand in Europe to be covered. In the midstream alone, the European Gas Infrastructure Operators group considers that the industry needs to invest some 100 billion Euros over the next 15 years in national transmission systems reinforcement, new storage, interconnectors, import pipelines and LNG terminals, in order the forecasted demand of around 180-280 bcm of new gas supplies, to be made available for the European gas market by 2030. Even with conservative cost estimations for finding and developing gas fields, this implies upstream investments at least at the level of 250-400 billion Euros, excluding any amount for LNG liquefaction and shipping investments"[11].

3.2 Production and Consumption Trends

Natural gas is the fastest growing energy source according to industry experts. The consumption of natural gas is projected to rise by almost 70% by 2025 from 92 trillion cubic feet to 156 trillion cubic feet. The electric power sector makes up almost half of the total growth in world natural gas demand over this time period. The greatest increase in demand for natural gas is expected to occur among the emerging economies.

Industrial consumption of natural gas is also projected to rise over the next 10 to 15 years from 8 trillion cubic feet in 2003 to 10.3 trillion cubic feet in 2025 according to OECD reports. The largest

[11] *Securing the Future: Making Russian – European Gas Interdependence Work*, CERA, 2007

increases in natural gas consumption from 2003 to 2025 are anticipated in petroleum refining, metal durables, bulk chemicals and food industries. Residential consumption is also projected to grow over this time period by nearly 1 percent[12].

Russia is the world's largest producer of natural gas. In addition, the largest increases in world natural gas consumption are also projected to occur in Russia, Eastern Europe, and the emerging economies of Asia. Emerging economies in Asia are expected to almost triple its current consumption rate in 2025.

The emerging economies are also expected to experience the fastest growth in natural gas production. In comparison, the industrialized or 'mature economies' production in natural gas is projected to decline in 2025, making up only 29 percent while accounting for nearly 45 percent of world consumption. The emerging economies natural gas production is predicted to increase by 4.1 percent by 2025. As industrialized economies natural gas consumption grows and production rates slow down, while emerging economies production increases, the industrialized economies will increasingly be dependent upon imports of natural gas from the emerging economies.

More than 60 percent of gas consumption in Western Europe between 2010 and 2025 is projected to be used for electric power. However, while natural gas demand grows in Western Europe its production continues to decline in most areas in the region, with Norway being the only exception.

The growth in natural gas consumption continues to outpace its rate of production in Western Europe. In 2010 Western Europe imported approximately 522 billion cubic feet of natural gas. By 2015 industry specialists suggest that imported natural gas will grow by more than 40 percent and rise to over 50 percent by 2025. In order to address this trend, Western Europe has begun efforts to raise production by increasing the number of production facilities to meet its future demand for natural gas.

The natural gas sector is expected to grow faster in the SE European region mainly because the main driver for gas consumption growth is power generation which is emerging as one of the faster developing sectors of the broader S.E. European Energy market. The countries of South-East Europe will remain the fastest-growing markets in Europe. While each single SEE gas market is relatively

[12] *"The Oil and Gas Industry",* Issue 5/6 Updated, March 2010

small, a regional approach provides a sound basis for development. Romania and Croatia remain the two big gas producers of the region with 14,5 bcm annual production by both of these countries while the consumption of the S.E. region (excluding Turkey) is around 28.8 bcm. The three most depended on gas countries of the S.E. European region is Turkey, Bulgaria and Greece. Again, indigenous production of natural gas in S.E. Europe is fairly small compared to actual needs and corresponds to 22,17 % of total consumption in the reference year 2008. However, not all countries in the region are gas consumers. This is especially true in Western Balkans which in the vast majority of their geographical expanse do not have any gas infrastructure[13].

A market in transition

The US gas industry has undergone a resurgence, with output climbing from 511 bcm in 2009, overtaking Russia to become the world's largest producer. Last year, US production exceeded 600 bcm for the first time since 1973. Global LNG trade has also increased by third to 176 mn tones, or 8% of world gas production, opening up new markets for gas producers. However, demand has been lagging supply after the recession cut world consumption by 2% in 2009. As a result, the global gas market is over-supplied, with production now exceeding demand and spot prices low. The US output surge is due to an unexpected spurt in unconventional gas production, which now accounts for more than 10% of total US gas supply after a quadrupling in production to 78 bcm in just five years. Most of the recent increase has been from shale gas deposits that have only become technically and economically viable in the last five years. The success of US companies in bring unconventional gas resources to market has sparked interest in other regions where there are also thought to be large reserves. However even the most optimistic forecasts do not predict unconventional gas production from outside North America before 2015.

The surge in supply has cut US gas prices and reduced its need for imports by 30% in the last two years. Until recently the US was seen as one of the main markets for new LNG projects, with the EIA predicting a widening import requirement over the next decade. The reduction in US import requirements is forcing LNG producers with new capacity to look for alternative markets. Europe is benefiting from extra supplies, which are being backed out of the US, and from new LNG import terminals, which are allowing countries to diversity their sources of supply. As a result, spot gas market prices in the deregulated markets of the US and northwest Europe are starting to diverge both from long-term LNG and pipeline contrast prices and from the oil market. Russia in particular

[13] *" SE Europe Energy Outlook 2011",* Ed. C. Stambolis, published by IENE, Athens, 2011

is feeling the effects of Europe's access to more supplies, and Gazprom is coming under pressure to re-negotiate its contracts and reduce prices[14].

3.3 Imports Profile

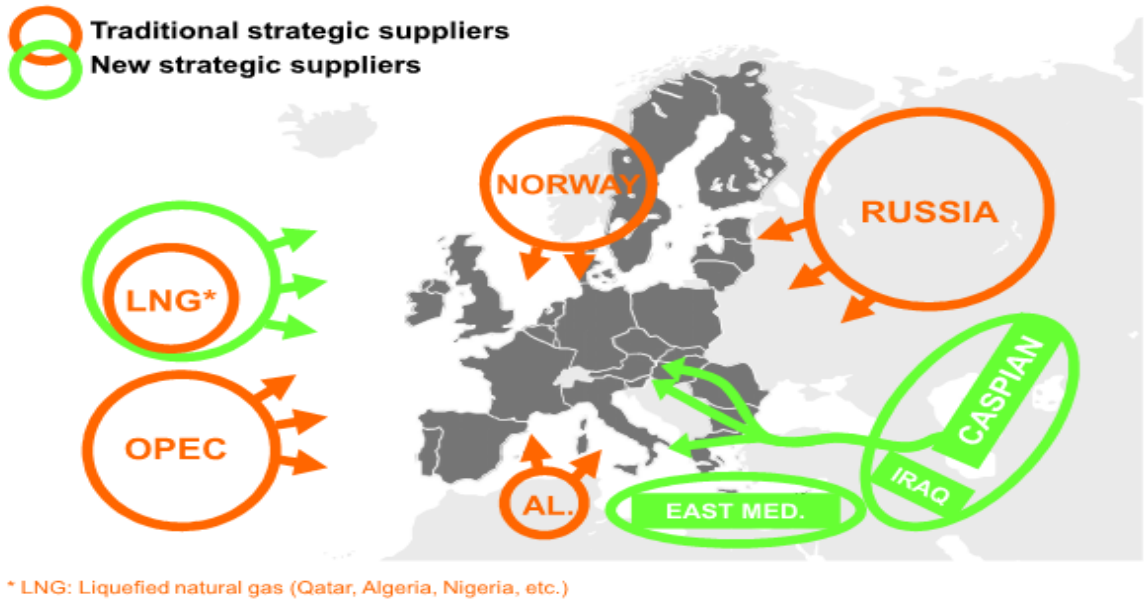
So far Europe has been importing natural gas from three main suppliers, mostly Russia, Norway and Algeria. As already mentioned 40% of natural gas imports come from Russia, corresponding approx to 104.5 bcm in 2010, 30% from Norway, i.e. 78.4 bcm and 15% from Algeria, i.e. 39.2 bcm (see Figure 3.3). Algerian exports are realised both through pipelines (underwater through the Mediterranean) and also by LNG. Some 16.2%, i.e. 84.8 bcm of imports are realised by means of LNG with Algeria, Nigeria, Egypt and Qatar supplying the bulk of this volume (see Figure 3.4). Although there is considerable activity by the European Commission, the EU Council and several companies in developing the so called 4th corridor, now known as the South Corridor, there are no actual imports as yet via this route. Only a tiny amount of gas, i.e. 0.75- 1.0 bcm, is imported annually by Greece through the Greek- Turkish interconnector, operated by DEPA and BOTAS, which commenced operation in the summer of 2007. This limited gas quantity originates from Azerbaijan and is transported through Turkey and therefore can rightly be called as the precursor to the South Corridor.

According to EU latest thinking there is a need to develop a whole new group of strategic gas suppliers along two directions. The first will include gas transmission through land pipelines via Turkey and with predominantly Caspian supplies, including Iraq. The second will be based on LNG exports from the East Mediterranean region where Egypt is already a key supplier and with Israel and Cyprus already making plans to export sizeable quantities by 2020. Figure 3.3 shows EU's latest thinking on traditional strategic supplies and the new strategic supplies[15].

[14] CGES's Global Oil Insight, Bimonthly Focus, *"Natural Gas - a market in Transition"*, July/August 2010, CGES, London, UK.

[15] Jean- Arnod Vinois,*"EU Policy for Security of Supply"*, Internal gas market and infrastructure in 17th BPSPA Conference, Vienna, April 7- 8, 2011.

Figure 3.3:
Traditional and New European Gas Suppliers



Source: European Commission

3.4 Pipelines vs LNG

Within the gas sector, LNG is playing an ever increasing role. Like all natural gas, LNG is cleaner than coal or oil, and it offers an opportunity to diversify energy supplies. The decreasing cost of LNG is making it more competitive in more markets and, at a time of heightened concern about political instability, it can also be a more attractive option than international pipelines that cross multiple borders. As a result, LNG demand is forecast to grow more quickly than for gas in general, at about 10% a year over the next ten years.

Global demand for natural gas may double by 2030, with LNG growing perhaps fivefold – driven by continued cost reduction. Despite the capital intensity of LNG projects and the complexity of the value chain, LNG supply capacity is increasing rapidly. Existing schemes are being expanded and many greenfield projects are moving ahead. Although the spot market for LNG is growing, new projects continue to be under- pinned by long- term sales contracts. Competition for supplies is increasing price connectivity between regions. Seizing the opportunities of this business requires the ability both to develop gas supplies and liquefaction capacity, and also to connect this to emerging and premium markets.

Today's LNG industry is very different from that of the 1990s. In 1990 there were nine LNG production sites with just 13 trains. Eight countries imported 56 million tones of LNG, with Japan accounting for two thirds. Last year there were sixteen LNG production sites with 70 trains, supplying 15 importing countries with over 140 million tones. Japan was still the largest imported but its share of the market declined to about 40%. And LNG accounted for 7% of the world's natural gas demand.

Figure 3.4:

Europe's gas Pipeline Supply

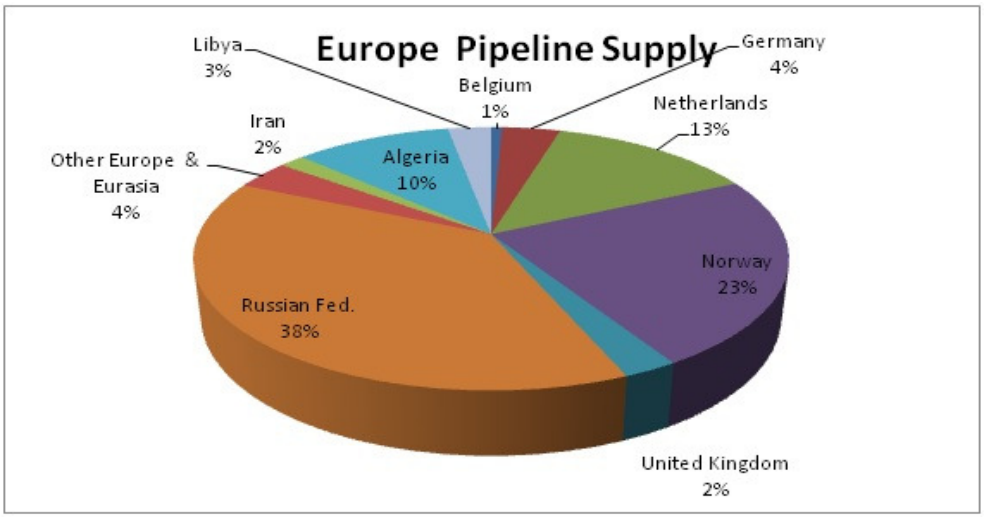
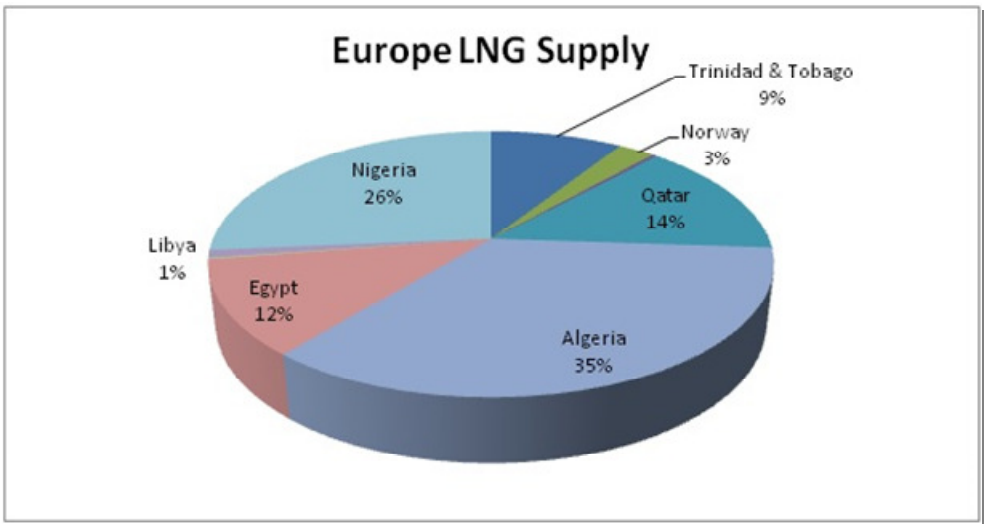


Figure 3.5:

Europe's LNG Supply



According to markets sources this is just the beginning. The IEA forecasts that liquefaction capacity will increase fivefold by 2030. That means about a hundred new liquefaction trains. Importing countries will need to build about 700 mtpa of degasification capacity. And the world's LNG shipping fleet will need to increase from 200 operational ships to 600. Those increases are already

well underway. New liquefaction capacity to supply about 70 million tones a year is under construction with a record number of ships ordered last year (i.e. 75), and many more potential projects have been identified. This activity underlines that investors and project developers have real confidence that the LNG market is going to continue to grow. This increase in production has been enabled by a significant reduction in LNG unit costs.

The IEA's analysis shows that total capital costs for new LNG projects will increase by about 40% from the mid 1990s to 2010 – with the greatest cost reduction being seen in projects to expand existing facilities and to build larger trains. While liquefaction costs have been systematically reduced over the past 20 years through the introduction of newer and more efficient trains, the more recent improvement has come through the increase in ship capacity- an increase of the order of 30% when 200,000 cubic metre ships come into service. Combined, these developments make LNG viable over longer distance than ever before.

Furthermore LNG allows access to otherwise inaccessible suppliers and can hence improve gas supply security. During the late 2000s, LNG markets began to globalise with a growing spot trade supplementing the traditional long term contract business and creating new opportunities for all players involved in it. With the exception of Greece and Turkey, SEE Europe lacks LNG import facilities and cannot benefit from availability of cargoes at what may be attractive prices. Development of LNG- related infrastructure would impose a substantial burden on already strained budgets in the wider Balkan peninsula, which may therefore be unable or unwilling to assume if SEE countries are at an obvious disadvantage to competitors which are in a position to offer LNG suppliers both more sizeable gas markets and higher import prices. Nevertheless, the SEE region may still have a powerful incentive to develop LNG import capacities due to its persistent lack of supply diversification and ensuing vulnerability to disruptions.

LNG will play an increasingly important role in European gas supply. Today LNG represents approx 20% of European (i.e.EU30) gas imports estimated of 300 BCM's in 2010. Total EU30 gas consumption for that year reached approx 560 BCM's. Main European LNG supply sources so far include Algeria, Nigeria, Libya and Egypt although of late Qatar has also started supplying LNG to European destinations. Appetite for LNG imports in Europe looks likely to continue with ever-rising demand. The current eurozone crisis and economic depression in certain European consuming countries is expected to have only marginal impact on LNG trade. In that sense potential LNG

exports from the emerging Israel – Cyprus axis may contribute greatly to European gas supply and also enhance security of supply as they will be adding one more supply point in what appears to be a rather limited supplier base[16].

3.5 EU Energy Strategy and Security of Supply

The EU currently imports 82% of its oil and 57% of its gas, making it the world's leading importer of these fuels. Only 3% of the uranium used in European nuclear reactors was mined in Europe. Furthermore there are European countries, such as Lithuania, Slovakia, and Bulgaria that rely 100% on one country for their imported supply. This trend will continue up to 2020 for Europe. Given the role of oil in the energy mix of the coming decades, maintaining uninterrupted crude-oil supplies to land-locked EU countries in Central-Eastern Europe, currently dependent on limited supply routes, is of strategic importance.

However, natural gas which is regarded by many as a back-up fuel will continue, to play a key role in the EU's energy mix in the coming decades and will gain importance especially for variable electricity generation. In the medium term depleting indigenous conventional natural gas resources call for additional, diversified imports. Gas networks face additional flexibility requirements in the system, the need for bi-directional pipelines, enhanced storage capacities and flexible supply, including liquefied (LNG) and compressed natural gas (CNG).

In a recent study by the Oxford Institute for Energy Studies[17], security of supply is defined as the ability of an energy system (national or regional) to meet demand in events of supply disruption, as well as to cope with normal fluctuations in demand patterns. Supply security is therefore a considerably wider notion than the need to achieve a diversified supply portfolio and as such includes aspects such as switch ability to other fuels (electricity, oil, biomass); efficiency gains; and interruptible contracts. Particularly with regard to European security of supply for natural gas in the course of the current decade, OIES[18] has drawn attention to the importance of natural gas source,

[16] C. Stambolis, "Gas/LNG Markets in Europe and the Eastern Mediterranean Region", paper presented at the Cyprus Energy Forum, December 8, 2011 (see www.imh.com.cy).

[17] A.Giamaroudis and S.Paleoyannis, "Security of Gas Supply in South Eastern Europe/ Potential Contribution of Planned Pipelines, LNG and Storage", The Oxford Institute for Energy Studies, NG 52, July 2011.

[18] See Anouk Honore (2010), European Natural Gas Demand, Supply, and Pricing: Cycles, Seasons, and the Impact of LNG Price Arbitrage, Oxford: Oxford University Press for the Oxford Institute for Energy Studies; also Florent Silve and Pierre Noel, Cost curves

transit, and facility dependence; the timing of needed investments; actual deliveries of natural gas volumes and the contracted volumes to fill available import capacity; and the specific price levels including transparency of price formation.

In its report to the June 2011 Energy Council[19], the Commission has estimated investment needs in energy infrastructures of European importance up to 2020 at about EUR 70 billion for high pressure gas transmission pipelines (coming into the EU and between EU Member states), storage, liquefied/compressed natural gas (LNG/CNG) terminals and reverse flow infrastructure.

The European Commission believes that there must create suitable conditions for alternative sources and routes so the supply of natural gas from the Caspian and Central Asia countries can be secured, and interregional pipelines projects can be realized giving special emphasis to Azerbaijan and Turkmenistan.

On 7 September 2011, the European Commission adopted the Communication on security of energy supply and international cooperation - "The EU Energy Policy: Engaging with Partners beyond Our Borders". The Communication sets out for the first time a comprehensive strategy for the EU's external relations in energy. Improved coordination among EU Member States in identifying and implementing clear priorities in external energy policy is central to the approach outlined by the Commission.

Furthermore, on 12 September 2011, the European Union adopted a mandate to negotiate a legally binding treaty between the EU, Azerbaijan and Turkmenistan to build a Trans Caspian Pipeline System. This is the first time that the European Union has proposed a treaty in support of an infrastructure project. The treaty will be concluded by the EU after a decision by all 27 Member States that the European Commission should lead the negotiations on behalf of them all. Over the last ten months, the EU has engaged in a regular dialogue with Azerbaijan and Turkmenistan, which figure among the key potential gas suppliers for Nabucco, ITGI (Interconnector Turkey- Greece-Italy) and TAP (Trans-Adriatic Pipeline). In January 2011, President Barroso signed a Joint Declaration with President Aliyev which supports the swift allocation of available gas resources in Azerbaijan.

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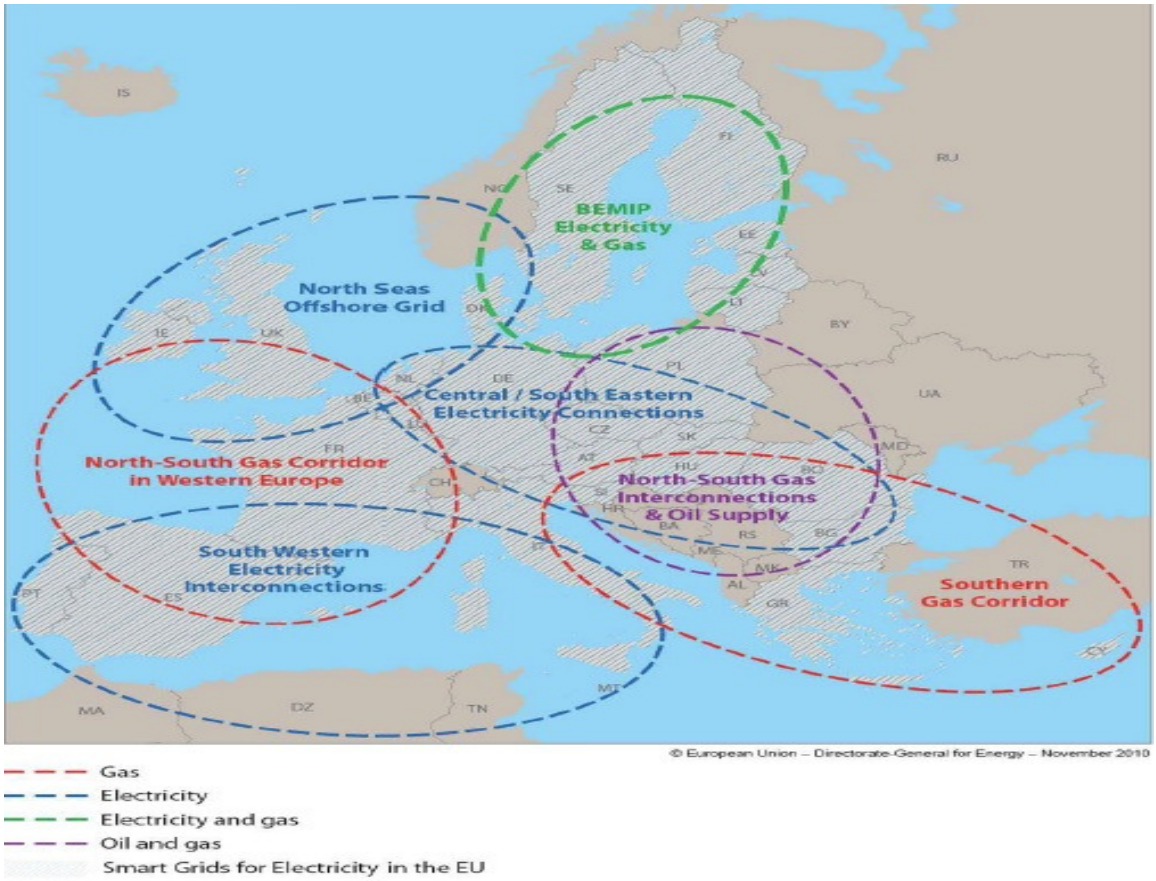
for gas supply security: the case of Bulgaria, Electricity Policy Research Group Working Paper 1031 (Cambridge Working Paper in Economics 1056), September 2010, University of Cambridge, www.eprg.group.cam.ac.uk.

[19] European Commission Report to EU Energy Council, June 2011.

Azerbaijan and Turkmenistan have expressed the availability of substantial gas volumes and a clear willingness to sell it to Europe. The European Union is ready to give the political and legal support for the gas deliveries to take place. The Southern Corridor aims in supplying Europe with gas coming directly from the Caspian basin and the Middle East. It intends to increase security of supply for European households and industry by diversifying gas sources and routes, thus minimising dependence on few suppliers and potential gas cuts. Consequently, on 19 October 2011, the European Commission unveiled its proposal for a Regulation on "Guidelines for trans-European energy infrastructure". This proposal aims at ensuring that strategic energy networks and storage facilities are completed by 2020. To this end, the Commission has identified 12 priority corridors and areas covering electricity, gas, oil and carbon dioxide transport networks (see Figure3.6).

Figure 3.6: *EU's Proposed 12 Priority Corridors*



According to this European Commission plan €50 billion worth of investment will be spend to improve Europe's transport, energy and digital networks. Targeted investments in key infrastructures will help to create jobs and boost Europe's competitiveness at a time when Europe

needs this most. The "Connecting Europe Facility" will finance projects which fill the missing links in Europe's energy, transport and digital backbone. It will also make Europe's economy greener by promoting cleaner transport modes, high speed broadband connections and facilitating the use of renewable energy in line with the Europe 2020 Strategy. In addition the funding for energy networks will help to further integrate the internal energy market, reduce the EU's energy dependency and bolster the security of supply. To assist with the financing of the Connecting Europe Facility, the Commission has also adopted the terms for the Europe 2020 Project Bond Initiative which will be one of a number of risk-sharing instruments upon which the facility may draw in order to attract private finance in projects. The pilot phase will start with in 2012.

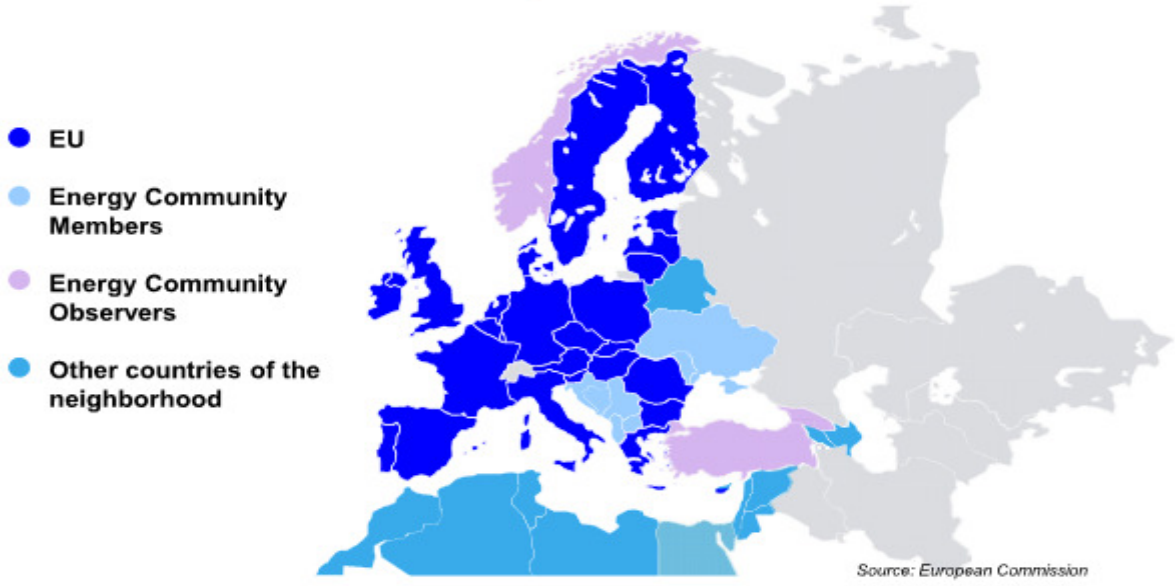
By focussing on smart, sustainable and fully interconnected transport, energy and digital networks, the Connecting Europe Facility will help to complete the European single market. Completion of the internal market in conjunction with integrated gas networks, in the view of the E.C, can enhance energy security and help guarantee political and economic stability (see fig. 3.7).

Connecting Europe: Energy

According to a written statement by European Commission on November 15th, 2011 the energy sector can look forward to €9.1 billion being invested in trans-European infrastructure, helping to meet the EU 2020 energy and climate objectives. The CEF will also help to remove financial gaps and network bottlenecks. The internal market for energy will be further developed through better interconnections, leading to security of supply and the possibility to transport renewable energy in a cost effective manner across the EU. As EC points out in its relevant document both citizens and companies need to be able to rely on energy being available at all times and at an affordable price. The money from Connecting Europe will act as a leverage for more funding from other private and public investors.

Figure 3.7:

Internal energy market and integrated gas networks guarantee political and economic stability



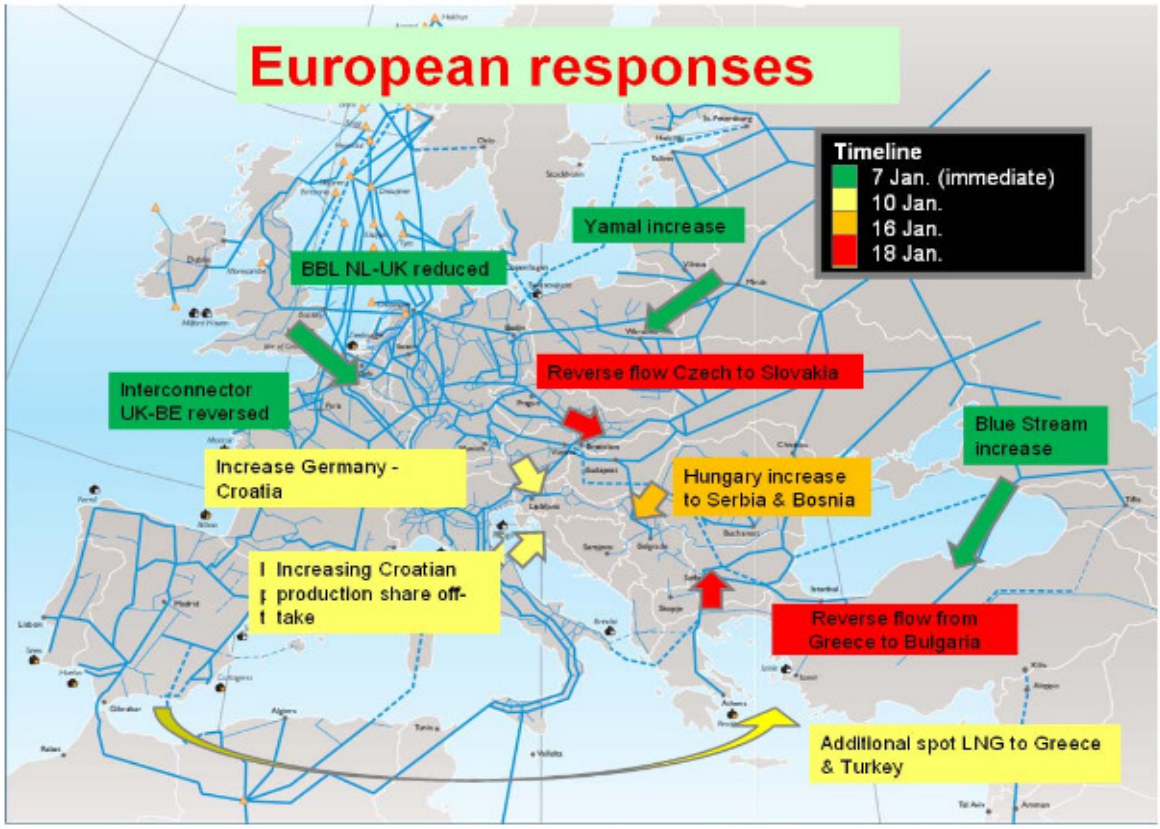
The Case of S.E. Europe

As far as S.E. Europe is concerned it is widely recognized that, together with Central and Easter Europe, it suffers from an overdependence on non-direct Russian natural gas inflows which reach it through three independent (unconnected) pipeline routes: from Ukraine it reaches the eastern Balkans, namely Romania, Bulgaria, Greece, and also the former Yugoslav Republic of Macedonia; from Ukraine via Hungary it reaches the central Balkans, namely Serbia and Bosnia & Herzegovina; and finally, via Austria and Slovenia it reaches the north western part of the Balkan peninsula (Croatia)[20]. The degree of vulnerability of the SEE region, in terms of security of supply, became painfully evident in the wake of the gas crisis of January 2009 between Moscow and Kiev, during which disruptions took a heavy toll on local economies, and even caused a humanitarian crisis in the context of residential heating. Supply difficulties at the time were further aggravated by serious inadequacies of the regional transport infrastructure, notably in capacities, reverse flow capabilities, unusual routes, and insufficient integration of the natural gas networks of central Europe and SEE. In Fig. 3.8 the European response to the January 2009 gas crisis is shown.

[20] Russian supply to Croatia was terminated at end-2010 and Croatian import needs are now covered by a new contract with Italian player ENI. This supply is to be complemented by another new gas contact with E.ON Ruhrgas (see sections below). In any event, capacities of existing international pipeline infrastructure in SEE are as follows: pipeline Romania – Bulgaria, ~27.6 bcm/y; pipeline Bulgaria – Greece, ~3.3 bcm/y; pipeline Bulgaria – the former Yugoslav Republic of Macedonia, ~0.8 bcm/y; pipeline Hungary – Serbia, ~6.1 bcm/y; pipeline Serbia – Bosnia & Herzegovina, ~0.7 bcm/y; and the pipeline Slovenia – Croatia is about 1.8 bcm/y; see Economicwww.stabilitypact.org Consulting Associates, Penspen, and Energy Institute Hrvoje Pozar, South East Europe; regional gasification study, Draft Final Report, October 2007, www.stabilitypact.org

Figure 3.8:

European Responses to the January 2009 Gas Supply Crisis



Source: Analysis of gas crisis presented to Gas Coordination Group by IEA, cited in European Commission, the January 2009 gas supply disruption to the EU: an assessment, p.23, July 2009, http://eur-lex.europa.eu

As Paleoyiannis and Giamouridis[21] observe these shortcomings have in fact constrained available intra-European natural gas flow which could otherwise have completely offset the impact of the disruption of Russian gas supplies on the Balkan region, as was the case elsewhere in the European Union (EU), where the impact of the Russian gas supply cuts remained limited. Should the necessary natural gas infrastructure have been in place at the time, the European shortfall of some 300 mcm/d could have been fully compensated by increased imports from alternative sources and also withdrawal from gas storage; the latter alone (spare storage) was estimated at approximately 800 mcm/d at the time.

Furthermore, SEE as a whole (and even more so individual markets within this region) has only limited access to indigenous supply and storage: indigenous supply is essentially limited to Croatia and Romania. What is more, access to the resources (including storage), is not possible due to lack of interconnectors; while, access to north European fields and storage is equally difficult due to

[21] Ibid p.2

pipeline limitations, as became evident in the January 2009 crisis. Furthermore, domestic natural gas supply in other Balkan states such as Serbia and Bulgaria is small, and for this reason unable to enhance national and regional security of supply in any meaningful way. Therefore the urgent need of interconnector, is of paramount importance and plan are already in hand to develop a basic interconnect network in S.E. Europe[22].

Meanwhile, access to alternative supplies such as Liquefied Natural Gas (LNG) and Caspian pipeline gas remains limited at best and, for most of the individual countries in this region, not an option at all. Current non-Russian supply in the wider region is limited to Greek LNG imports through its (southern) Revithousa terminal, to Greek pipeline imports from Turkey, and (as of January 2011) to Croatian pipeline imports from Italy (to be complemented by Hungarian supply from E.ON Ruhrgas).

However, at the moment, these diversified volumes are not shared with the Balkan hinterland in any systematic way and in this vein they cannot be considered a contributor to regional supply security.

As Paleoyiannis and Giamouridis[23] argue under a business-as-usual supply scenario, the region's precarious position vis-à-vis meeting its energy needs in natural gas is expected to be exacerbated in the future, as the Balkan peninsula moves towards increased energy demand levels due to macroeconomic gains as well as substitution of other inefficient and polluting fuels, in line with the relevant EU rules and regulation.

[22] C.Stambolis, "Interconnectivity and Energy Security in S.E. Europe", paper presented at the "15th National Energy Conference, Energy and Development 2010" organized by the Institute of Energy for S.E. Europe (IENE), see www.iene.gr/ energy-development2010/articlefiled4th Session/Stambolis.pdf.
[23] Ibid. p.6

CHAPTER 4

THE SOUTH CORRIDOR

4.1 BACKGROUND

Over the last 10 years a number of potential gas pipeline projects have taken shape with the view of transporting natural gas supplies from the gas rich Caspian region to the demanding, and until recently fast expanding, European gas markets. The original idea of establishing a new transport corridor for European gas supplies, initially known as "fourth corridor" which is now called the "South Corridor", was to help diversify European gas imports which to many appear to be dominated by Russian exports (although Russian gas volumes destined for the European market in 2010 reached 110.43 BCM corresponding to 23.4% of total EU 27's gas consumption). In that sense the South Corridor will help diversify gas import sources and broaden their geographical origin to the Caspian region (i.e. Azerbaijan, Turkmenistan, Uzbekistan, Kazakhstan), the Middle East (Iran, Iraq) and even Egypt, through the Arab Gas Pipeline (AGP).

Both the European Union and the Unites States consider that such a new gas transport channel will help strengthen Europe's energy security, diversify its gas sources and supply routes, and reduce its dependence on Russian gas. The need for gas route diversification and lessening European dependence on Russian gas became apparent following the January 2009 transit crisis where vital gas supplies to the EU, routed through Ukraine, were cut off for 20 days with losses of more than USD 2.0 bn to Gazprom and a much wider negative impact on energy infrastructure and supplies for several EU countries. A similar crisis, but on a smaller scale, had preceded in January 2006 again with significant gas supply disruption.

Table 4.1 South Corridor Pipelines's Main Characteristics

Project	Capacity (bcm/y)	Distance (kms)	Gas Origin	Estimated Gas (in Billion Euro)	Sponsors	Anticipated Start Up Date
ITGI	10 - 16	796	-Shah Deniz II	1.74	DEPA, Edison	2017
TAP	10 - 20	791	-Shah Deniz II	1.70	EGL, STATOIL, ENI	2017
Nabucco	31	3.300	-Shah Deniz II -Iraq -Turkménistan	7.9	OMV, TRANSGAZ, BEH, MOL, RWE, BOTAS	2017
South Stream	63	2.950	-Russian Fields	15.0	Gazprom, ENI, Wintershall	2016
White Stream	8 - 32	1.440	-Azerbaijan -Turkmenistan -Iraq	N.A	Not Disclosed	2016
SEEP	10	~1.000	-Shah Deniz II	1.0 – 1.5	BP	2017

The serious problems that arose mostly in Central and Eastern Europe as a result of the cut off of Russian gas supplies though the Ukraine route in January 2009 prompted EU to re-examine its entire energy security policy. The much delayed and inadequate response to the above supply crisis demonstrated the need for accelerating efforts to develop much needed alternative routes and most importantly the construction of several gas interconnectors (*see Figure 4.1., Interconnectors in SE Europe*).

Figure 4.1 *Proposed and Existing Natural Gas Interconnectors in SE Europe*

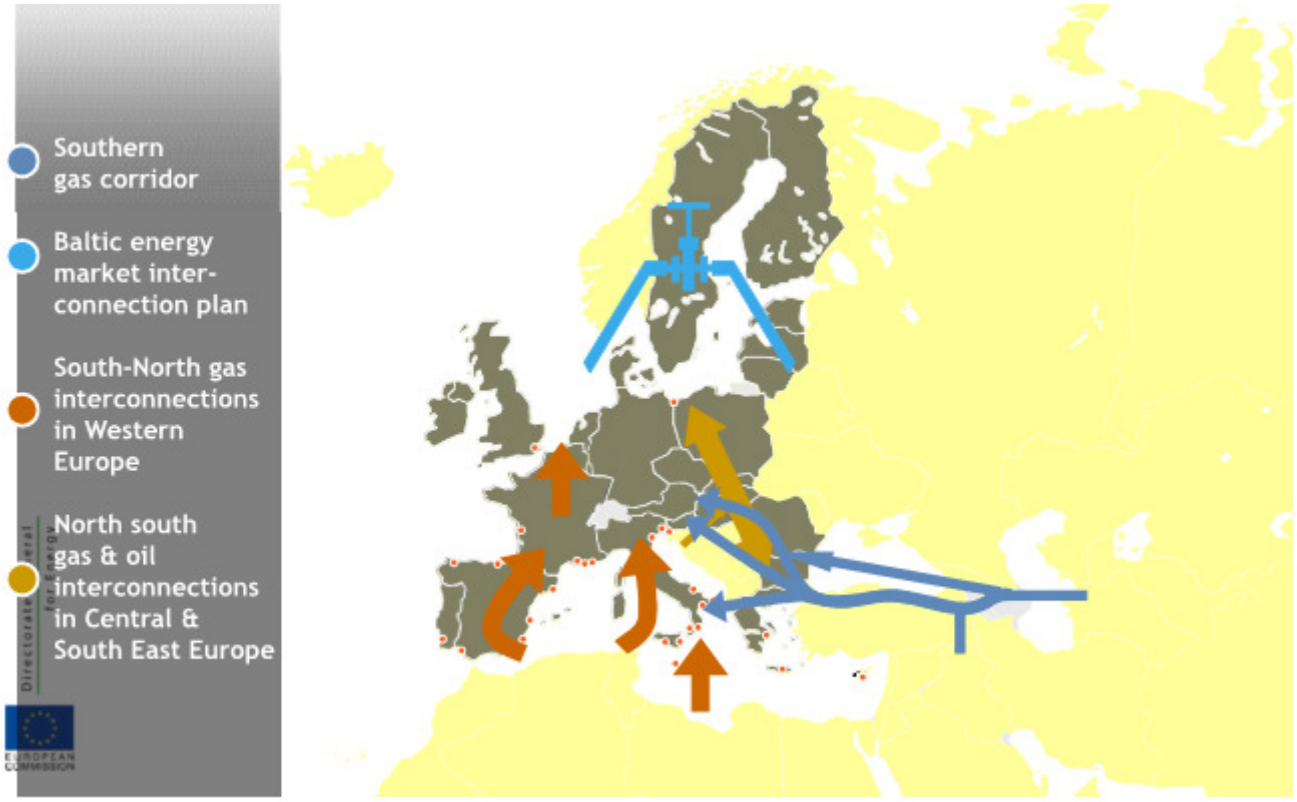
Source: *Spyros Paleoyannis, "Meeting the gas challenges in the Balkans and S.E. Europe", paper presented at the Hellenic – Bulgarian Cooperation in the Energy Sector, Sofia, April 29th 2010 organized by the Institute of Energy for S.E. Europe (IENE) in association with the Hellenic Business Council in Bulgaria (HBCB*

In that sense security of gas supply is ranking very high in EU's energy agenda with a special EU Regulation, No.994/2010, which complements the 3rd internal energy package, thus ensuring:

- Functioning IEM – best tool to secure supplies
- Investments/interconnections – opening of markets/diversification
- Consumer protection – beyond the market ("protected" customers, PSOs, supply standards)
- Cross-border co-operation – coherence at Union level, regional co-operation and solidarity
- Transparency – informed decisions by gas undertakings and crisis-response at national/Union level

Figure 4.2:

European Energy infrastructure priorities – gas and oil by 2020



Source: European Commission, Directorate General for Energy

EU's security of gas supply policy therefore includes the following tasks undertaken on a continuous basis and in consultation with the competent authorities (ENTSOG, NRAS, ACER)

- Risk assessment
- Preventive action plans
- Emergency plans

In the context of a realistic energy security supply policy EU is promoting natural gas which it sees playing a key role as back up fuel. Therefore the need for additional and diversified imports, and the ending of single source dependency in Eastern Europe, is vital. EU's infrastructure priorities for gas and oil by 2020 are best seen in Figure 4.2 as reported by Vinois[24]. At the same time there is a recognized need for network improvement, resilience and additional flexibility which can to a large extent be achieved through the construction and successful operation of a number of gas

[24]Jean- Arnod Vinois, op. cit

interconnectors. Therefore the linking of the EU to new gas sources provides energy security for the EU and its neighbours, through:

- Development of transit countries to stable economies and rule of law
- Aegean – Adriatic – Baltic – Black (2A2B) Plan (North South Interconnectors)
- Development of Southern Eastern Europe's gas market: Interconnections, Regulatory Work, Energy Community Gas Ring and establishment of gas hubs
- Good investment opportunities through solid regulatory framework
- Contribution to Caspian and Middle East countries development
- Contribution to the development and implementation of an EU external energy policy

In addition to pure energy security considerations the "South Corridor" concept is promoted by EU for a number of other highly important reasons among which are the following:

(a) The need of creating a liquid and gas competitive market, part of a process in building a pan-European gas market where the free movement of gas is of paramount importance

(b) The implementation of EU's internal energy market (by 2014) and the ending of energy islands (by 2015) where integrated gas networks play a key role.

(c) The recognition of the corollary that an internal energy market and integrated gas networks guarantee political and economic stability

Due to its geographic position, South Eastern Europe is directly affected from the prospect of the South Stream corridor, not only because regional pipeline projects could contribute to the improvement of its own energy security situation, but also because their implementation is expected to upgrade its geopolitical role in European gas supply.

As the struggle for European energy supremacy is now well under way with the various behemoth groups striving for lead positions, so is the competition between key energy exporters eager to cover the continent's slow but rising energy demand. Nowhere is this power game more visible than in SE Europe where a number of diverse energy routes, promoted by different industrial groups, are competing for limited oil and gas supplies to be transported from the Caspian region, via the Balkans, to Europe proper.

At the same time the prospect of the South Corridor offers an excellent opportunity to SE European countries to reinforce their regional role as part of a broader energy bridge. The struggle for control over regional gas supply routes between competing projects will propel certain countries to international attention as they will vie for influence and recognition as key transit gates.

Although the EU by encouraging diversified gas imports from the Caspian basin has championed the South Corridor, Russia whose gas exports to Europe is trying to limit, has emerged as a lead player in this new great game of gas pipelines, very much in the fashion of the old great game for Central Asia's control back in the 18th and 19th centuries. This time round the prize is not India but the dominance over European gas supplies and more specifically of the East-West supply routes. Beyond its existing but trouble prone gas pipelines network extending over Poland and Ukraine and the recently inaugurated Nord Stream gas pipeline, largely under water through the Baltic, Russia over the last four years has been promoting the gigantic South Stream pipeline which will aim to transport some 63 BCM's of natural gas, (not all of it Russian) first underwater through the Black Sea and then overland, crossing several Balkan countries to central Europe but also branching off to Italy, via Greece, with Bulgaria being the key hub on the European side.

Although "South Stream" pipeline is a well thought out plan and its sponsors have all the means and experience to see it through to construction, its final implementation will ultimately depend on Russian-Ukraine relations. Over the last few months it has become increasingly clear that in the case that Gazprom achieves a satisfying long term agreement with Naftogaz, Ukraine's corresponding gas company, plans for South Stream will be shelved for the time being which means that FID will not be taken in 2013 but will be postponed for much later. According to press reports (see Reuters of 26/12/2011) Mr. Aleksey B. Miller, Gazproms' CEO said that "the implementation of the South Stream project hinged on talks with Ukraine. South Stream has always been lined to Ukraine".

According to market analysts in the event that South Stream is not implemented by 2020, Russia will increase it gas exports to Europe via Nord Stream which already pups some 27.5 BCM to Europe, thus minimises dependence on existing pipeline network going through Ukraine.

4.2 South Corridor Suppliers

A concise review is presented of current and potential South Corridor gas suppliers including Azerbaijan, Turkmenistan, Uzbekistan, Kazakhstan, Iraq and Iran. Undoubtedly the development of gas reserves from nations located around the Caspian basin has been one of the most important developments in the natural gas supply scene over the last 10 years.

Azerbaijan produced around 9 bcm of gas in 2006. That level increased to 27 bcm by the end of 2010.Today the Shah Deniz gas field is the largest natural gas field in Azerbaijan. It is situated in the South Caspian Sea, off the coast of Azerbaijan, approximately 70 kilometres southeast of Baku, at a depth of 600 metres. The field covers approximately an area of 860 square kilometres. The Shah Deniz gas and condensate field was discovered in 1999. The Shah Deniz field is operated by BP which has a share of 25.5%. Other partners include Statoil (25.5%), SOCAR (10%), Total S.A. (10%), LukAgip, a joint company of Eni and LUKoil (10%), NIOC (10%), and TPAO (9%).

The Shah Deniz reserves are estimates to be between 1.5 billion barrels (240,000,000 m3) to 3 billion barrels (480,000,000 m3) of oil equivalent from 50 to 100 billion cubic meters of gas. Gas production was estimated to be approximately 7 billion cubic meters per day. The Shah Deniz field also contains gas condensate in excess of 400 million cubic meters. Apart of Shah Deniz field, two wholly undeveloped deposits in Azerbaijan, Absheron and Umid, have been undergoing exploration and are credibly estimated to contain 350 bcm of natural gas each. Azerbaijan expects to increase its production to 50 bcm/ y by 2025 on the strength of exploities these two news fields. Consequently Azerbaijan current deposits hold now 2,0 – 2,5 trillion cubic metre of exploitable gas deposits.

On the other hand Turkmenistan’s gas reserves are estimated to be 7 trillion cubic meters, the fifth-largest in the world. The first results of the survey indicate previous assessments have severely underestimated Turkmenistan's gas reserves. The BP Statistical Review of World Energy, an industry bible, sets the country's reserves at 2.67 trillion cubic meters. Analysts expect that to be upgraded in light of the information on South Yolotan. The findings suggest Turkmenistan should be able to confidently move ahead with plans to boost its exports of gas. At the moment, it sells most of its gas to Russia -- about 50 billion cubic meters a year, which is mostly resold to Ukraine -- and a little to Iran. But it has plans to export to China and Europe too, as well as significantly boost sales to Russia.

Uzbekistan has estimated natural gas reserves of 66.2 trillion cubic feet (Tcf), with the largest reserves in the Ustyurt Region. There are 52 natural gas fields in Uzbekistan with 12 major deposits, including Gazli, Shurtan, Pamuk, and Khauzak. These deposits, which account for 95% of gas production, are mainly in the Amudarya basin and the Murabek area in the southwest of Uzbekistan. The largest production is from the Gazli field. The second largest production is from Shurtan, which began producing in 1980 and accounted for 36% of Uzbekistan's natural gas production in 2000.

Kazakhstan's domestic hydrocarbon reserves amount to 3.3–3.7 trillion cubic metres of gas, of which 2.5 tcm are proven. However, Kazakhstan became a net gas exporter only in 2003. In 2007, Kazakhstan produced 29 bcm of natural gas and plans to increase its gas output to 60-80 bcm a year by 2015.The major natural gas fields are Karachaganak, Tengiz, Kashagan, Amangeldy, Zhanazhol, Urikhtau and Chinarevskoye.

Iraq's natural gas sector is believed to contain significant untapped resources which the Government of Iraq would like to develop for domestic consumption and export. Iraq holds reserves of 110 trillion cubic feet (app 3,5 trillion cbm), plus another 150 trillion in probable reserves, the world's tenth largest reserves and which are still largely unexploited. The biggest gas fields of Iraq are the following: (a) Miran with proven reserves of 12 trillion cubic feet of gas, (b) Akkas with proven reserves of 5.6 trillion cubic feet of gas and target production of 400m cubic feet per day, (c) Mansuriyah with proven reserves of 4.5 trillion cubic feet of gas and target production of 320m cubic feet per day and (d) Siba field with proven reserves 1.1 trillion cubic feet of gas and target production of 100m cubic feet per day.

Figure 4.3 *Gas Supplies in the proximity of Europe and S.E. Europe*

Source: Jean- Arnod Vinois, op.cit

According to Iran's Petroleum Ministry, the country's proved natural gas reserves are about 1,045.7 trillion cubic feet (29.61 trillion cubic metres) or about 15.8% of world's total reserves, of which 33% are as associated gas and 67% is in non associated gas fields. Iran has the world's second largest reserves after Russia. Iran still has huge potential for new significant gas discoveries: areas like Caspian Sea, North East, Central Kavir and especially areas starting from Aghar and Dalan gas fields in Fars province up to the Strait of Hormuz and Central Persian Gulf have considerable amount of undiscovered gas resources. There are also several discovered gas fields in Iran. These gas fields are Kabir Kuh, Milatun, Samand, Holeylan and Ahmadi. The Kabir Kuh gas field located in Lurestan province has 21 trillion cubic feet (590 billion cubic metres) of gas in place. According to Exploration Directorate of NIOC, there are about 150 unexplored anticlines in Iran. Nevertheless, due to the economic sanctions that have been imposed since 2006, and are progressnely growing stronger, there is a negative impact on the Iranian economy and as a result several gas field development projects have been postponed. Iran currently exports some 7,0 bcm annually via pipeline to BOTAS in Turkey through the Tabriz – Erzezam pipeline

4.3 Competing Gas Pipeline Projects

In addition to the South Stream project we have a number of competing gas pipelines with the EU sponsored Nabucco topping the list. This is 3.000km long pipeline aiming to transport some 30BCM's of gas to central Europe via Turkey. Two smaller and less auspicious pipelines, which also take advantage of Turkey's existing gas trunk line network, include the Italian-Greek-Turkish (ITGI) and the Swiss-Norwegian Trans-Adriatic-Pipeline (TAP) projects, which between them could transport some 25 BCM's. Yet another Black Sea gas pipeline under development is the USA backed "White Stream" with some 30 BCM annual capacity, which aspires to connect Georgia to Ukraine and Romania, and from there to central Europe. Today, we have a total of seven competing and non competing South Corridor gas supply projects which are shown in *Figure 4.3*. These seven projects are examined in detail in section 4.3. Also *Table 4.1* provides a concise description of these pipelines and a means of basic corporations.

Figure 4.4: *The South Corridor Gas Pipelines*

Source: SE Europe Energy Outlook 2011, a IENE study, Athens, June 2011

All these pipeline schemes added together promise to deliver some 160 BCM's of new gas supply to European destinations. At first glance there is no way that there is room, from a capacity viewpoint,

for more than two such pipeline projects and for total gas quantities not exceeding at most 50.0 BCM's over the next 15-20 years. There is little doubt that seen over a longer time horizon Europe will need these extra supplies and perhaps more. However, there are two important factors that need to be carefully considered at present. First of all from a demand point of view in the shorter term, and given the current economic downturn, such huge additional gas quantities cannot be absorbed by the European market. Secondly, gas supplies are still limited on the Caspian end since all the above pipelines, with the exception of the South Stream, are competing for the same Azeri gas sources and for limited, and as yet unavailable, inputs from Iraq. Even if the Shah Deniz Phase II offshore field in the Caspian Sea is fully developed, an unlikely outcome before 2017 and more gas is secured from other major Azeri gas fields (i.e. Nakhichevan, Absheron, Umid) and from Kazakhstan's yet unexploited Caspian gas reservoirs and somehow Turkmenistan's gas is transported over to Azerbaijan, there is no way that the predicted shortfall in gas supplies will be covered from these sources alone by 2020.

Hence, Russia's increased interest over the last few months to strengthen its position in the SE European region comes as no surprise. In a relatively short period of time Russia has concluded a series of bilateral type agreements with most countries of the region for the passage (ROW) of the South Stream pipeline network, through the setting up of joint ventures with the local gas distribution companies. These agreements are coming thick and fast as Gazprom has sought and succeeded in tying down with binding terms Bulgaria, Greece, Serbia, Hungary, Romania and lately Croatia. With secure overland routes and with Turkey having also consented to host the underwater segment of the pipeline in the Black Sea, the ground is now clear for Gazprom and its European partner, Italian firm ENI, to work out the construction details of this ambitious project.

At this point one must observe that implementation of the South Stream pipeline will not materially change much the current share of Russian natural gas in the EU imports since the bulk of gas to be transported through this particular pipeline will substitute some of the gas which at present is transported via Ukraine. In 2010, 70% of Russian natural gas exports to the EU passed through one distinct pipeline system in the Ukraine. According to Gazprom even when South Stream and North Stream projects are put into operation, the share of Ukraine in the Russian gas transit capacities to the EU will be tangible. Hence the role of South Stream is considered vital by its sponsors (i.e. Gazprom, ENI, EDF) in ensuring gas supply route diversification for the EU.

A late come in the South Corridor race is the BP promoted "South East European Pipeline (SEEP)" which proposes to carry some 20.0 BCM's from Azerbaijan to Central Europe, via Turkey, and by passing Greece. The preferred route is north via Bulgaria, Romania, Hungary to the Czech Republic and Australia. Although there are certain similarities with the Nabucco project SEEP's appears a far more manageable project and the fact that it is backed by BP it make it a formidable contender.

4.4 Profile of the Various Pipeline Projects

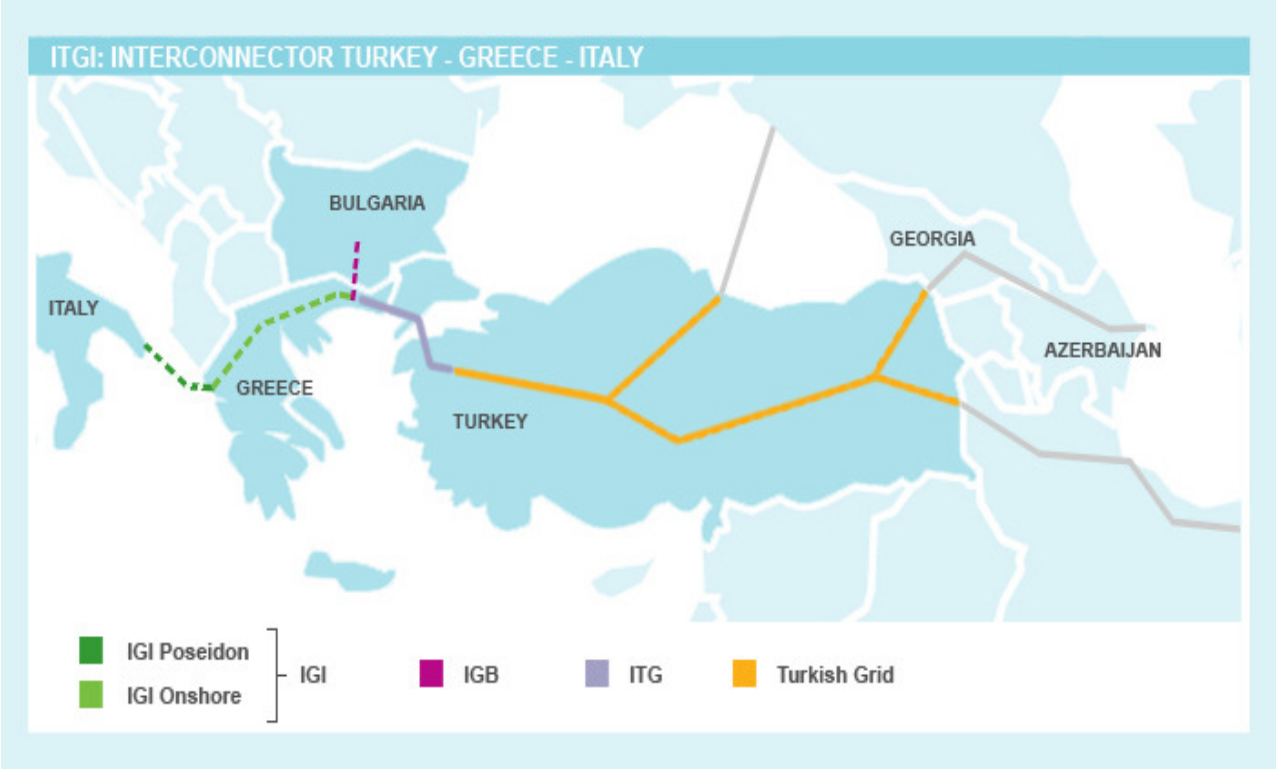
- ***ITGI***[25]

This interconnector is part of the broader Turkey - Greece- Italy gas pipeline project and is aiming at bringing Azeri gas to the European markets, via Greece and Italy. The project was first conceived in 2004 by Greece's Public Gas Corporation (DEPA) and Italian energy company Edison which have since set up a J/V company in order to study and implement the project.

After commencement of gas deliveries of Azeri gas to Turkey and the start of operation of the Turkey - Greece Interconnector in 2007, ITGI is probably the quickest moving project in the area. The ITGI pipeline will have a 590 Km and 42 inches onshore segment in the Greek territory and a 206 Km and 32 inches offshore segment, connecting the Greek and the Italian coasts in the Ionian Sea (from Parga to Otranto). The project, owned and operated by the recently established Poseidon SA (a 50-50 Edison and DEPA joint venture, but with 80-20 rights in the Foundation Volume Allocation respectively), has a 10 - 16 bcm per year gas transport capacity.

[25] www.igi-poseidon.com

Figure 4.5 *The ITGI pipeline project*



In accordance with decision 1364/2006, ITGI has been included in the projects of European Interest as a European Priority Project and enjoys proposed financing of the order of EUR 100 million from the European recovery plan for the construction of the IGI Poseidon pipeline only and a further EUR 45 million for the construction of IGB. In the long-term energy strategy to 2020, which has been published by the European Commission, ITGI is also highlighted as a key project in the effort towards opening up the Southern Corridor. In short ITGI aims to link upstream producers of natural gas in the Caspian region, with gas – thirsty markets in Europe. Greece and Italy are considering ITGI as a reverse-flow natural gas link in line with EU requirements.

Successful completion of ITGI will require the construction of a 42-inch gas pipeline from Komotini in north-eastern Greece to the Ionian coastline, crossing a total of 590 Km – including the existing Greek segment of ITGI – at a cost of some EUR 700 million. In addition, it will require construction of a 32-inch, 206-km underwater pipeline (1,370-meters deep) to Otranto in Italy at an estimated cost of Eur 1.040 million. Transport capacity will be initially 10 bcm/y, with upgrade capability to 16 bcm/y. Construction costs associated with the above-ground part of the planned link in Greece are to be borne by system operator DESFA, possibly with support from funds available under the NSRF 2007 – 2013. Construction of the underwater section of the interconnector will be undertaken by the two Poseidon partners Edison and DEPA.

To improve ITGI's chances, in June 2010 Poseidon signed an MoU with Turkey's BOTAS highlighting commitment to its implementation. In this context, the agreement included a number of provisions to improve business case certainty:

- ***(a)*** the Turkish side committed to the allocation of the necessary capacity in its national gas grid.
- ***(b)*** it included safeguars on flows to Greece and other SEE destinations (through the planned IGB).
- ***(c)*** it raised formally the possibility of Turkish participation in the planned ITGI pipeline project.
- ***(d)*** it raised formally Greek participation in planned capacity upgrades in the Turkish grid.

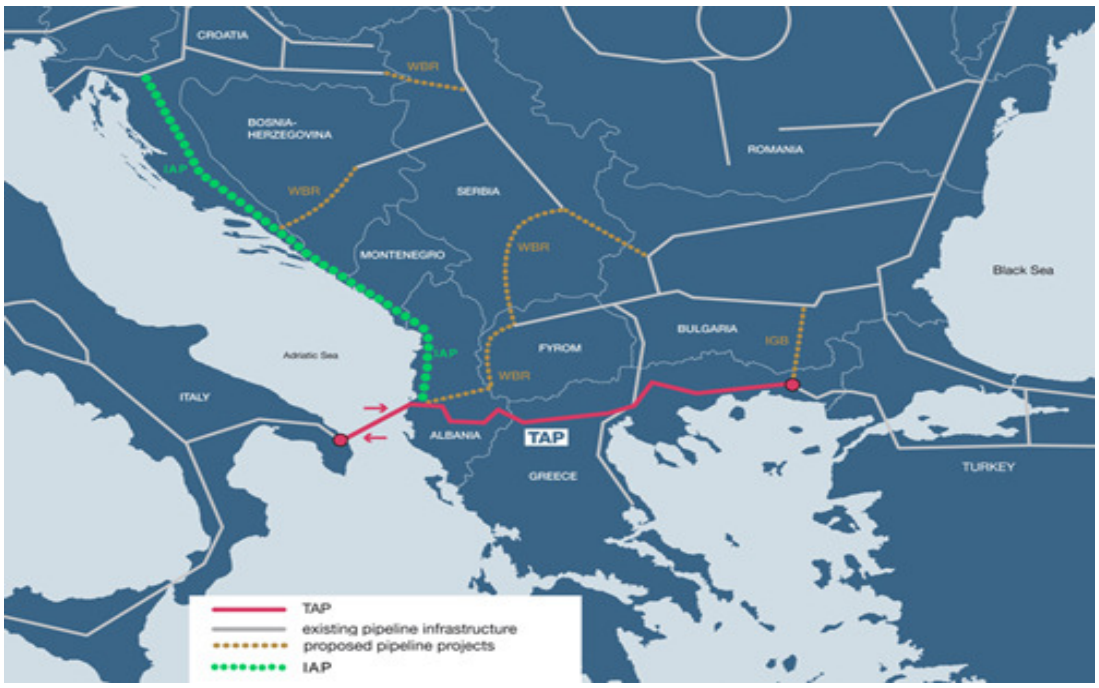
Furthermore in February 2011 it emerged that DEPA was in negotiations with Azerbaijan and Turkey on the transfer of its existing 0,75 bcm/y supply agreement with BOTAS (which sources Azeri gas), to either the state oil company of the Azerbaijan Republic (SOCAR), or to related export consortium Azerbaijan Gas Supply Company (AGSC). Successful transfer presupposes agreement of all three sides on a number of important issues, including clarification of the Turkish transit regime and fees. Due to the nature and wider implications of such an agreement it is fair to say that it also represents an important first step toward the realization of South Corridor natural gas supply projects such ITGI and IGB.

Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
Interconnector Turkey – Greece – Italy (ITGI)	**DEPA, Edison** (50/50 JV)	590 kms onshore 206 kms offshore (Greece)	**1,74 billion**	**2017**	**10-16 bcm/y**

- ***TAP – Trans Adriatic Pipeline Project***[26]

The project was first announced in 2007 by the Swiss power and gas company EGL, which has also active presence in Italy and the Balkans. The Trans Adriatic Pipeline project (a 520 Km and 36 inches pipeline linking Greece's gas transportation system with Italy via Albania), has 10 bcm of gas transport capacity a year, expandable to 20 bcm per year.

Figure 4.6 *The TAP pipeline project*



The TAP aims at connecting Albania and Italy with upstream gas sources in the Caspian through neighbouring Greece. TAP wants to connect to ITGI, in Komotini, Greece, thence crossing to Albania and finally reaching Brindisi, southern Italy through a subsea connection. The pipeline is designed with an initial 10 bcm/y transport capacity, and will be 48-inch in diameter. It will have a combined length of 682 kms onshore and 105 kms offshore. TAP falls under the provisions of the EU's Trans-European Energy Networks and is considered by the EU to be a Priority Project. EGL, which initiated the TAP Project, estimates that construction of the pipeline will cost about 1.7 billion euro. TAP is aiming to supply gas possibly to Greece and Albania. In a second stage, there are plans for pipeline extension to West Balkan countries i.e. Bosnia and Croatia.

[26] www.trans-adriatic-pipeline.com

In the first half of 2010, partners Elektrizitaets-Gesellschaft (EGL) and Statoil agreed to reduce their respective shares to 42,5% each, in order to give 15% to German giant E.ON Ruhrgas. The aim was to improve the rational for TAP through E.ON's demand potential, and thus boost its credentials vis-a vis key suppliers such as Azerbaijan. TAP has also drawn attention to the fact that financing can be provided by shareholder companies themselves, rather than having to resort to source of funding from international financial institutions.

In the same vein, despite signing in 2008 a 5.5 bcm/y supply contract with the National Iranian Gas Export (NIGEC) in September 2010, TAP announced it would not be seeking Iranian gas. Azerbaijani gas is thus now promoted by TAP as a primary and also adequate source for the project, even though this remain a rather questionable proposition given the delays and intense competition associated with supply from Shah Deniz II. Nonetheless, a speculated swap agreement with BOTAS could still allow TAP to access Iranian supply, while avoiding any negative political ramifications.

Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
TransAdriatic (TAP) (Connect Albania to Italy)	**EGL** (42,5%) **StatoilHydro** (42,5%) **E.ON** (Ruhrgas 15,0%)	686 kms onshore (478 Gr, 204 Alb, 4 It) 105 kms offshore	**1,70 billion**	**2017**	**10-20 bcm/y**

- ***Nabucco Pipeline Project***[27]

Nabucco, is the name of the pipeline which proposes to bring Caspian gas to Easter and Central Europe through Turkey and Austria (Baumgarten) via Bulgaria, Romania and Hungary it is without doubt one of the most important projects for Europe's gas supplies diversification. With a 3,300 Km length and a total capacity of 31bcm per year at its final phase, could bring substantial gas quantities from Azerbaijan, Iran, Iraq and even Egypt.

[27] www.nabucco-pipeline.com

Figure 4.7 *The Nabucco pipeline*

Apart from the support from its six sponsors with an equal 16,67% share, namely Bulgarian Energy Holdings (BEH), OMV, MOL, Transgaz, Bulgargaz, BOTAS and RWE, the project gathers strong political back-up both from the European Union and the USA. Nabucco has also been granted a TPA exemption by the European Commission. Furthermore, there have been reports on potential entry of new partners into the project. In the Balkans, the project concerns directly only Bulgaria at the moment: in fact except for the BEH, no other local energy player currently participates in this project, despite interest from some countries.

In this context, Sofia has already announced its intention to shoulder financing costs of approximately EUR 400 million stemming from its membership in Nabucco JV, including state guarantees. But as of May 2011 the original Nabucco cost estimate of some EUR 7,9 billion was under review, and there were unconfirmed media reports that this was being revised to as much as EUR 15 billion. In contrast, in June 2011 project partner RWE said that development costs were expected to increase, but not as much as rumored, and only to allow for the construction of an extra 500-km feeder from Iraq. Nonetheless, an overall increase in Nabucco development costs means that the project partners will have to bear part of this incremental burden.

Furthermore, in June 2011 the members of the Nabucco JV signed an agreement in Kayseri, Turkey which finalized the project's legal framework, offering regulatory clarity/stability and facilitating

project finance. Importantly, this agreement confirmed a previously discussed advantageous regulatory transit regime for Nabucco, under both EU and Turkish energy law.

But despite this progress, Nabucco continues to suffer from problems such as unconfirmed supply, multiple stakeholders/transit countries/ priorities, rising costs and potentially insufficient demand. There should be notice also that Nabucco needs much more gas than the other pipeline projects. Serious concerns persist on its mounting surrounded its cost (up to $20 billion at last estimate) and financing. Even with seed funds from the European Bank for Reconstruction and Development (EBRD), finding private sector investment for the project may prove difficult in today's economic environment. In addition the above shortcoming the problem of security adequate gas supplies from Azerbaijan and other countries remains paramount. The problem is further exacerbated following the intergovernmental.

Meanwhile, the Nabucco project enjoys an EU-compatible legal framework under the 2009 inter-governmental agreements (IGAs), guaranteeing the consortium's pipeline ownership and the transit regime. This necessitated years of negotiations and seems difficult to reproduce or transfer to another pipeline, if Nabucco is abandoned. The European Commission has expressed concern on this and related points. European Energy Commissioner, Guenther Oettinger, has reacted to these latest developments with diplomatically phrased expressions of concern. On gas pipeline options via Turkey, he stated that "Pipeline options within Turkey are led by Nabucco; but alternative options [involving] dedicated infrastructure under a strong legal framework are also being considered.

Project	Sponsors	Distance	Cost Euro	Start -Up	Capacity
Nabucco	**BEH TRANGAZ MOL OMV RWE BOTAS** (each with a share of 16.67%)	3.300 kms	**7,9 billion** (to expand to 14-15Bln for a maximum capacity)	**2017**	**31 bcm/y**

➢ ***SEEP – South East European Pipeline***

Figure 4.8: *The proposed SEEP pipeline*

As the October 1, 2011 deadline approached for gas pipelines competitors to submit commercial transit and tariff terms to Azerbaijan's Shah Deniz II consortium—one of the holders of the gas—BP, with a 25.5% stake in Shah Deniz, proposed its own alternative project, the South East Europe Pipeline (SEEP).

BP proposes an entirely new concept (and, potentially, system) for transporting Azerbaijani gas from Turkish - Bulgarian border to Hungary. Named the South-East Europe Pipeline (SEEP), it would for the most part use existing nationally-owned pipelines, pipeline sections, and inter-connectors, instead of building a Nabucco type pipeline along the entire route. BP's SEEP is a last-minute alternative as BP has not actually submitted an offer to the tender issued by Shah Deniz consortium. SEEP competes against three pipeline projects, including Nabucco, in this winner-take-all contest. According to market analysts SEEP is still very much a concept, and not much of a project at this point. But it can still be fleshed out by early 2012, just in time for the consortium's decision; and it seems in any case to spare most of the costs of building the Nabucco pipeline. Given BP's role as the Shah Deniz project operator, SEEP emerges as a strong outsider in this contest.

BP describes the SEEP as a scalable project, implying that it can increase its capacity later. Presumably this would depend on Turkmen gas reaching Azerbaijan across the Caspian Sea. The SEEP, however, does not involve a linear, easily scalable pipeline, but (as BP implies) a patchwork of pipelines, pipeline sections, and inter-connectors, all with varying parameters, characteristics, and ownerships. Scaling up the capacity across such a heterogeneous system needs to be explained more convincingly.

The October 2011 Izmir agreements on the transit of Azerbaijani gas to Europe through Turkish pipelines and the proposed SEEP, unlike Nabucco, do not envisage a transportation solution for Turkmen gas to Europe. Instead, they foresee throughput capacities matching the guaranteed gas volumes from Shah Deniz, at 10 billion cubic meters (bcm) per year from 2017 onward. In that sense, the transportation solution for Azerbaijani gas seems to be de-coupled from that for Turkmen gas. De-coupling would imply abandoning Nabucco's unique advantage which combines both solutions in a 31 bcm pipeline.

The plan for SEEP gas flow is to turn north from Turkey into Bulgaria, and onward to Central Europe. Apart from 1 bcm or 2 bcm annually that Azerbaijan plans to deliver via Turkey to Greece, no other volumes are known to be planned for delivery westward of Bulgaria at this stage.

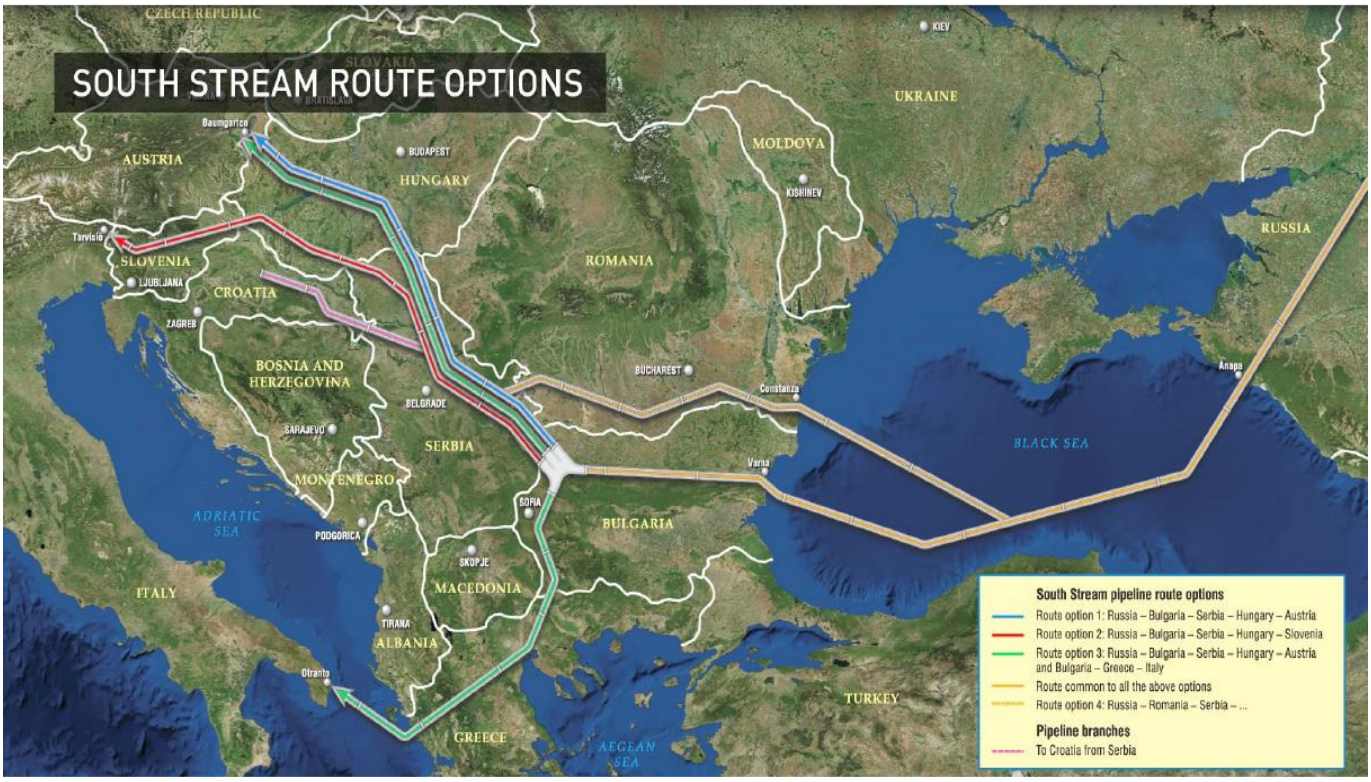
Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
South East European Pipeline (SEEP)	BP	Approximately 1.000 kms	1.0-1.05 billion	2017	10 bcm/y

➢ *The South Stream Project*[28]

In mid 2007, Russia announced its own plans to construct a new pipeline in the area in cooperation with the Italian major ENI and within the next months gained support from many countries in the area, namely Bulgaria, Serbia, Hungary and Greece.

The pipeline, which is planned to carry 63 billion cubic metres (2.2 trillion cubic feet) of natural gas per year, will link Russia with Bulgaria via its undersea segment in the Black Sea and then through its north and south branches will reach both to Central and Southeastern European markets.

Figure 4.9 *The South Stream Pipeline Project*



For the offshore section, the South Stream pipeline will cross the Black Sea from the Russian coast of Beregovaya (the starting point of the Blue Stream pipeline where a compressor station is sited) to the Bulgarian coast at Varna, with a 900kms (560 miles) pipeline reaching a maximum water depth of 2,000m.

[28] www.south-stream.info

For the onshore section there are two different routes through Bulgaria which are being considered: north-west and south-west. From the coastal town of Varna, the south-western route will pass through Greece and the Ionian Sea to southern Italy (this could also supply the Turkey-Greece-Italy pipeline). The north-western route will run to the northern region of Italy with an additional branch line to Austria. The offshore section of the pipeline is due to be commissioned by 2013.

The sections through Serbia and Hungary will both have a capacity of at least 10bcm per year. The pipeline construction will take approximately three years and is now waiting for planning approval from European Union competition and regulatory authorities.

The Russian-Ukrainian gas crisis may perfectly explain the logic behind Gazprom's by-pass-and develop strategy, as well as its plans for the development of the North and South Stream pipelines.

Although for the time being no final investment decision has been made for the project (this will be made in 2013), its announcement, combined with the uncertainties related to gas demand in the Balkans and Europe in the long-term, as previously discussed, the numerous regulatory barriers across the hosting countries and the geopolitical tenses in the broader area, has changed dramatically the game in the area and made the future of the gas supply pipelines under consideration more complicated and more uncertain.

EDF was expected to take a stake of at least 10% and possibly up to 20% in the pipeline's subsea section from ENI by end-2010. This prospect has now been pushed back towards the end of 2012 or later. Furthermore, in March 2011 Wintershall signed an agreement with the two existing partners to joint South Stream with a 15% stake. This will be taken by ENI's shares in the South Stream partnership, thereby leaving Gazprom as the majority shareholder in this project. Specifically, South Streams' ownership current structure is the following: Gazprom 50%, ENI 35% and Wintershall 15%.

The project has been facing difficulties with regard to offshore licensing in Turkey, but finally Turkey gave the licence on December 2011. The consortium has also been complaining about an alleged lack of equal treatment with EU-supported projects asking for similar TPA exemptions. In April 2011 Croartia confirmed its interest in participating in the project, while in August 2010 Albanian premier

Sali Berisha, raised the possibility of a spur from the Greek section of South Stream linking Igoumenitsa or any other Greek location with Vlore in Albania.

In June 2010, DESFA and Gazprom set up South Stream Greece SA, a 50/50 JV tasked with development and management of an 11 bcm / Eur 1 billion Greek section. According to statements by the two companies, the scope of this JV includes engineering, funding, construction and operation of the pipeline on the territory of Greece. In October 2008, the Greek parliament ratified an intergovernmental agreement on the matter. It should be mentioned also that South Stream's fate depends on an agreement between Gazprom and Naftogaz on the cost of upgrades in Ukraine.

Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
South Stream	**Gazprom** (50%) **Eni** (20%) **Wintershall** (15%) **EDF** (15%)	1200 kms onshore (Varna-Baumgarten) 900 kms offshore (Black Sea)	**15,0 billion**	**2016**	**63 bcm/y**

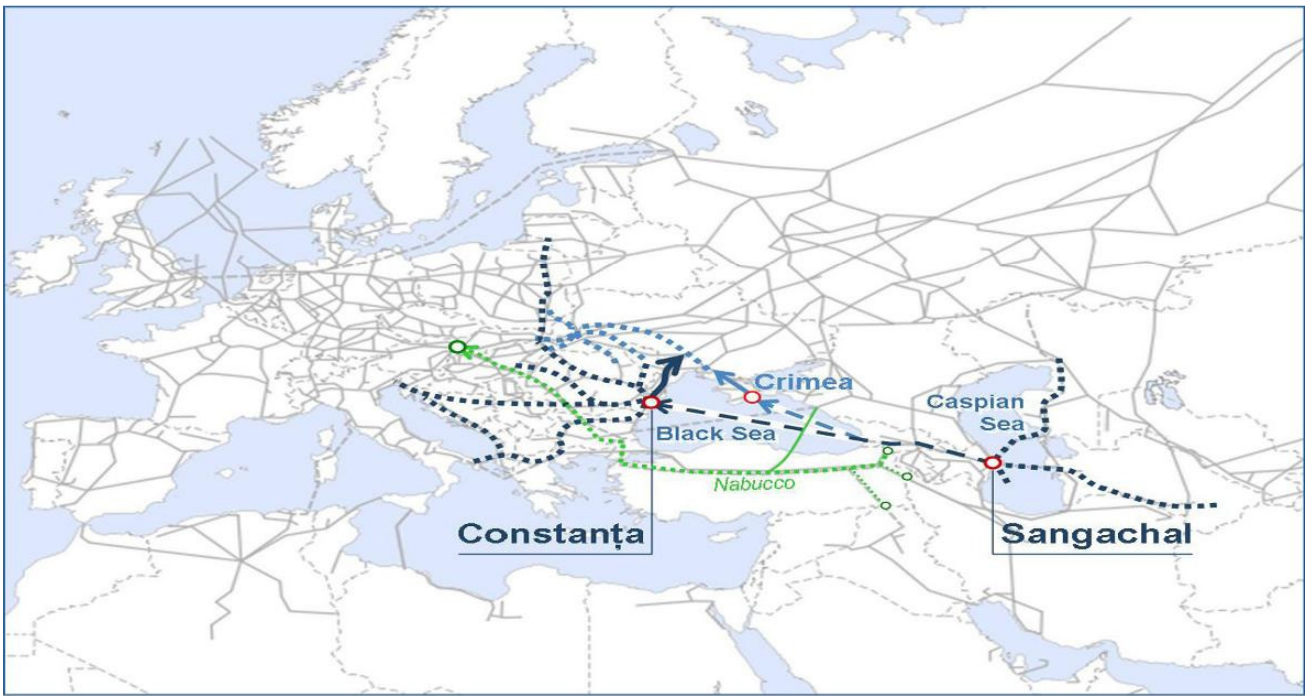
- ***White Stream Project***[29]

Also known as the Georgian-Ukrainian-European Union (GUEU) gas transportation project -- pledges to send up to 32 billion cubic meters (bcm) of gas per year from Azerbaijan via Georgia and the Black Sea on to Ukraine, Romania and Western European markets (the initial stages will grow from 8 bcm per year of delivered gas). By comparison, the much-touted Nabucco project estimates a maximum annual delivery load of 31 bcm. The project will be developed in stages with additional pipeline capacity being built to meet demand. The capacity can later be increased incrementally to much larger volumes.

The White Stream project was conceived in 2005 as part of the Southern energy corridor to transport gas from Azerbaijan and other countries in the Caspian Region via Georgia directly to countries on the Western side of the Black Sea (Romania, Ukraine) and onwards to markets in Central and Eastern Europe. The pipelines will cross the Black Sea in water depths in excess of 2,000 metres.

[29] www.gueu-whitestream.com

Figure 4.10 *The White Stream pipeline project*



Although more of a concept rather than a concrete project, this pipeline aims in supplying Azeri gas to north-eastern Europe, via Georgia, the Black Sea and Ukraine. The pipeline is currently supported by the Polish, the Ukrainian and the Georgian Governments and was first announced two years ago.

However, such a perspective, apart from serious geopolitical issues (especially after the recent Caucasus crisis), encounters also several other obstacles, namely substantial investment costs, high transit tariffs and questionable gas demand and ability for gas payments in the target markets.

The White Stream gas project could prove the Georgian government's trump card as it focuses on maintaining Georgia's business-friendly image among foreign investors, some energy analysts believe. As Ankara insists that 15 percent of transported gas via Turkey remains in Turkey gas producers and consumers opt for routes that pass through fewer transit countries by passing Turkey.

Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
White Stream	The composition of the consortium is not disclosed	415 kms onshore 1025 kms offshore (Black Sea)	NA	2016	8 - 32 bcm/y

➢ *The AGRI LNG Project*

The AGRI project envisages transporting Azerbaijani gas via pipelines to the Black Sea coast of Georgia, where it will be liquefied at a special liquefaction. This is a stage project as it starts with natural gas piped to Georgia, then liquefied, followed by LNG transportation and then gasification terminal. The gas will then be delivered to an LNG terminal at the Romanian port of Constanta via LNG ships. In a third stage LNG will be gasified and then directed towards covering the needs of Romania and other European markets. The capacity of the AGRI Project is considered in three variants - 2 billion cubic meters of gas per year, 5 billion cubic meters and 8 billion cubic meters.

Figure 4.11 *The AGRI project*

It is expected that Turkmenistan, participating in the project as a supplier, could supply liquefied natural gas across the Caspian Sea to Azerbaijan for further transit to Europe. The budget for this Azerbaijan-Georgia-Romania-Interconnection liquefied natural gas project is estimated between EUR 2 B and EUR 5 B, according to Azerbaijan's Energy Minister Natig Aliyev. Many analysts have expressed doubts over the viability of AGRI, believing it could face intense financial, security and political problems. They question who will fund the project, considering the EU's economic problems.

Azerbaijan, Georgia, Romania and Hungary signed the Baku Declaration on the draft AGRI on September 14th 2010 in Baku and few months later February 14th 2011 in Baku signed a protocol for

the implementation of the AGRI project. This document stressed the need to in providing support to the companies participating in the project in attracting the necessary funding for the feasibility study. The paper notes that it is important to identify the shortest route for the delivery of Azerbaijani gas to European markets, and therefore the creation of the Interconnector Romania - Hungary (Arad Szeged) is of the utmost importance.

Participants of the project include Azerbaijani's SOCAR, Oil and Gas Corporation of Georgia (GOGC), the Romanian ROMGAZ and Hungarian MVM. Each company will have has a 25 percent shareholding. In the future, Bulgaria may also join the project.

On November 2nd 2011 Serbian President Boris Tadic in a meeting with Romanian President Traian Basescu, said that Serbia which is seeking to diversify its energy supplies, is interested to "take part in as many gas pipeline projects as possible and is thus considering joining the (AGRI) project in order to secure LNG supplies to central Europe. On his part Traian Basescu said that Romania will support Serbia's bid to join the AGRI pipeline project aimed in supplying gas from the Caspian Sea to central European countries.

Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
AGRI	**SOCAR** **GOGC** **ROMGAZ** **MVM** (each with a share of 25%)	Liquefied natural gas from a Georgia based liguefaction plant will be transported by LNG tankers to an LNG Constanța terminal	**4 – 6 billion**	**2016**	**8 bcm/y**

4.5 The Role of Turkey

As both ITGI and TAP have to cross Turkey in order to deliver gas to Greece through the Greek – Turkish interconnector, and South Stream too depends to a large degree on Turkey's consent and assistance in order to cross the Black Sea, the role of the Anatolian mainland as host for the South Corridor is of paramount importance. This role has been further reinforced following the signing last November of the final agreement between SOCAR and BOTAS for the transiting of Azeri gas through Turkey. Under this accord Turkey committed itself to buying up to 6 bn cubic meters of gas from Azerbaijan by 2017 and in facilitating the flow of another 10.0 BCM through its extensive gas pipeline system to Europe. This deal is important because it clearly highlights not only Azerbaijani potential as an alternative to Gazprom, in line with latest EU strategy (see Chapter 4.0) but also because it underlines Turkey's strategic role in connection with Europe's security of energy supply. If we look at the map we shall see that Turkey lies at the crossroads of the supply routes that connect Russian, Caspian and Central Asia producers with consumers in western, eastern and southern Europe.

In addition to the geopolitical importance of the energy routes which transits Turkey, there are substantial energy transit fees which help the government with a tidy sum of money. This income would be at risk if oil and gas flows were interrupted by domestic terrorism or regional conflicts, such as the 2008 Russian – Georgian war. The interconnection between the country's domestic energy needs and its role in hydrocarbons transit is well illustrated in the November 2011 landmark agreement signed in October by the Turkish and Azerbaijani governments. A significant part of this agreement depends on Azerbaijan's Shah Deniz gas field, in the Caspian Sea 70km south-east of Baku, currently one of the world's largest gas development projects. When the field's second phase comes fully on-stream in 2016/ 2017, Shah Deniz II is expected to produce about 25bcm of gas a year.

But one big question remains unanswered: which pipeline will the consortium that controls Shah Deniz II use to deliver gas to Turkey and Europe? For the past decade EU governments have pinned their hopes on Nabucco, a project whose partners include Austria's OMV, RWE of Germany, Botas of Turkey and others.

Delays, cost overruns and an inability to nail supply deals in excess of 30 bcm's have plagued Nabucco from the start. According to Günther Oettinger, the EU's energy commissioner, the project

may end up costing €10bn - €14bn ($13.6bn - $19bn) rather than the originally estimated €7.9bn[30]. A significant segment of the pipeline will be built on Turkey's mainland. But the strategic imperative – as EU governments see it – of reducing dependence on Russian gas, is such that they are keen to make Nabucco work. Moreover, the project should receive a boost from Germany's decision last year to abandon nuclear power once and for all, as well as from an Italian referendum that rejected the Berlusconi government's plans to resume nuclear power generation. When some of the EU's biggest economies spurn nuclear power, gas delivered through Turkey becomes an even more vital part of the European energy mix. From Turkey's perspective, Nabucco is just one of several possibilities.

The other alternatives being ITGI and TAP and of late SEEP. Even with Nabucco's plans fading out following RWE's decision to pull out but mainly because of the consortium's[31] inability to secure additional gas sources outside Azerbaijan, Turkey's role as the key regional energy hub remains unchallenged.

[30] Tony Barber, "Security is vital to country's role in oil and gas transit", Financial Times, Investing in Turkey special supplement, November 22, 2011.
[31] RWE May Reconsider Nabucco Pipeline, Wall Street Journal Europe, January 18, 2012.

CHAPTER 5

SOUTH CORRIDOR PROJECT OUTLOOK WITH REFERENCE TO GREECE

5.1 STATUS OF PIPELINE PROJECTS

Of the several South Corridor pipeline projects there are three (3) gas pipelines which are directly related to Greece as a significant part of their segment is crossing the northern part of the country. The routes of these three pipelines, namely IGI Poseidon, TAP and South Stream, are shown in *Fig. 5.1.* In terms of historical precedence it is fair to state that the ITGI project was the first to announce a fully integrated plan in 2005 (IGI is the historical evolution of the IIG – Interconnector Italy-Greece) and hence obtain the official backing from the governments of Greece and Italy. The Trans Adriatic Pipeline (TAP) project became a serious contestant only in 2009 especially after the entrance of Norway's Statoil in the consortium whereas the South Stream, although it was announced as a concept in June 2007 it was not before 2010 that it emerged as a fully fletched project. The Nabucco pipeline is excluded from the present discussion as it does not cross any of Greece's boundaries. *Table 5.1* provides some basic information on the status of these new pipeline projects.

The profiles and technical characteristics of these projects have been fully covered in *section 4.4* of this report. The following notes refer to some latest developments concerning these three pipelines, which are pertinent to the next section of this study namely the comparative analysis of these projects. (*section 5.3*)

Figure 5.1: Current and planned gas Import and transmission Pipelines – South SEE

Source: *"Security of Gas Supply in South Eastern Europe", Potential Contribution of Planned Pipelines, LNG and Storage, Oxford Institute for Energy Studies, A.Giamouridis and S.Paleoyannis, July 2011.*

ITGI

- The latest milestones in the ITGI project include the issue of an international tender for the supply of turbo compressor units (December 2011), the approval by the Greek Ministry of Environment, Energy and Climate Change (MEECC) of the Supplementary Preliminary Environmental Impact Assessment (PEIA) and the completion by the Poseidon company of the Detailed Marine Survey (DMS).
- ITGI has already received most of the permits and licences required for the construction of the pipeline through Greece.
- Over the last three months significant progress has been reported on the Greek – Bulgaria interconnectors pipeline (IGB) as the PEIA study has been submitted to the competent authorities for the Greek section and the prequalification stage for the pipeline procurement has been completed.

TAP

- In late November 2011 negotiations commenced with the Albanian government (Host Government) for an agreement (HGA) setting out the specific requirements to be followed throughout the project's implementation. The Agreement will define the terms and conditions under which the development, construction and operation of the pipeline will be secured through a legally binding framework.
- In late September 2011 TAP moved closer in finalizing its Environmental and Social Impact Assessment process in Greece by submitting a PEIA to the Greek MEECC. This application is an addition to the scoping documents that TAP submitted earlier this year in preparation for its full Environmental and Social Impact Assessment (ESIA).
- In mid September 2011 TAP submitted its application for the construction of an independent Natural Gas System (INGS) to RAE, the Greek Regulatory Authority for energy. TAP's Greek section of the pipeline will be approximately 465 km long and will commence at Komotini, where it ties into the national grid system. The pipeline will then cross Greece, Albania and the Adriatic Sea, coming ashore in southern Italy.

South Stream

- According to a latest decision by the consortium Italy has been selected over Austria as the final destination of the South Stream gas pipeline. This decision was necessary as the European Commission blocked Gazprom's acquisition of a 50 percent stake in the gas trading platform of the Central European Gas Hub (CEGH) in Austria – an outlet also coveted by the rival EU – backed Nabucco gas link. One of the options for South Stream's route was to run from Russia under the Black Sea to the Balkans, with a branch passing through Austrian oil and gas company OMV's hub in Baumgarten. As a result of this latest decision there will be no transit through Austria but only a spur will run to it. As a result South Stream will now terminate in north Italy, rather than in Austria.
- The consortium is moving ahead with the completion of the project's Consolidated Feasibility Study.
- Final Investment Decision (FID) will be taken in the 2nd half of 2012.

Table 5.1:
Potential Pipelines to Europe from Azerbaijan and Russia through Greece

Project	Sponsors	Distance	Cost Euro	Start-Up	Capacity
Interconnector Turkey – Greece – Italy (ITGI)	**DEPA, Edison** (50/50 JV)	590 kms onshore 206 kms offshore (Greece)	**1,74 billion**	**2017**	**10-16 bcm/y**
TransAdriatic (TAP) (Connect Albania to Italy)	**EGL** (42,5%) **StatoilHydro** (42,5%) **E.ON** (Ruhrgas 15,0%)	686 kms onshore (478 Gr, 204 Alb, 4 It) 105 kms offshore	**1,70 billion**	**2017**	**10-20 bcm/y**
South Stream	**Gazprom** (50%) **Eni** (20%) **Wintershall** (15%) **EDF** (15%)	**1200 kms onshore** *(Varna-Baumgarten)* **850 kms onshore approximately** *(Varna-Igoumenitsa)* **900 kms offshore** *(Black Sea)*	**15,0 billion**	**2016**	**63 bcm/y**

Source: Companies

5.2 Technical and non Technical Obstacles Involved in Projects' Realisation

In assessing the prospects of the above three pipelines from an implementation viewpoint one must consider a number of technical and non technical obstacles which normally affect the progress of pipeline projects of this nature and which have been identified and are duly considered in the overall evaluation process of this report. The following can be considered as the most important obstacles:

Technical Obstacles

- Crossing of difficult terrain especially in mountainous areas
- Crossing existing infrastructures (e.g. underground, electricity transmission networks, tunnels, other pipelines)
- Crossing through protected natural areas (e.g. natura regions) and minimisation of environmental impact
- Underwater crossings of sea areas (i.e. Adriatic sea)
- Crossing populated areas
- Tie up with existing or potential natural gas infrastructure along the route (i.e. gas storage facilities, metering stations, LNG terminals)
- Location of ancillary gas infrastructure along the route (i.e. metering stations, compressors)

Non Technical Obstacles

- Authorisation procedures at different administrative levels
- Familiarisation with legal and regulatory framework
- Time consuming permitting procedures
- Public acceptance at local level
- Market issues including transit agreements
- Third party access procedures
- Financing issues
- Management issues

5.3 Evaluation Criteria

As the above three gas pipelines, namely ITGI, TAP and South Stream, transcend Greece in various stages of their routes as is clearly shown in *Fig. 5.1* it is important to know and appreciate their impact across a wide range of parameters including economic, social and environmental with reference to Greece. Although it is highly unlikely that all three pipelines will be built, at least in their present configuration, it is useful at this stage of the game to understand their strengths and weaknesses, their positive and negative points, and most importantly their expected contribution and long term impact to the local and regional economy.

In order to make a comparison between the above three pipelines and assess their overall contribution to Greece's economic and social landscape, a number of criteria have to be agreed on the basis of which the comparison will be made. Already the Shah Deniz II consortium, has announced a number of criteria for the export route selection (4). However, these criteria which are listed in *Table 5.2* are not exhaustive as they form only part of a broader set of criteria which are considered in our detailed comparative analysis (see section 5.3.)

Table 5.2:

Export route selection criteria as defined by the Shah Deniz consortium

Commerciality	based principally on full export chain value, including market prices and infrastructure access charges and tariffs
Project deliverability	technical and organisational capability to execute the project plans on schedule and within budget
Financial deliverability	ability to cover development costs through equity, loans, grants or other funding
Engineering design	scope and quality of the engineering plans
Alignment and transparency	willingness to cooperate technically with Shah Deniz and to align with the timeline of Shah Deniz FFD
Operability	the long-term capability to manage physical and commercial operations safely, efficiently and reliably

Scalability	the potential for expansion or addition of export facilities to allow transportation of increased volumes as further gas supplies become available
Public policy considerations	meeting the EC's stated objective of enhancing supply diversity of European natural gas markets, and ensuring sustained support from all stakeholders

Further to the above criteria as defined by the Shah Deniz consortium and which are related to the whole pipeline routes of the projects concerned (i.e. TAP, ITGI and Nabucco) our present evaluation will include a number of additional parameters. These additional criteria, which are listed below *(Table 5.3),* were deemed necessary as a proper evaluation should also consider the various risk factors involved together with the economic and social impact which is of vital importance when viewing a pipeline project from a country perspective.

Table 5.3:

Additional Route Selection criteria

- ***Environment, Safety, Society***
- ***Stakeholder support***
- ***Technological maturity***
- ***Economic risk***
- ***Political risk***
- ***Social risk***
- ***Economic Development Impact***

What follows is an analysis and discussion of the above criteria with reference to each one of the three pipelines.

Commerciality

ITGI: ITGI's target markets are Italy's (through Poseidon) and South Eastern Europe's (through IGB). It is important to note that these markets are more attractive to SD2 since their proximity to the source allows for a higher net back value for SD2 (i.e. more profit) compared to the Central European markets. Furthermore, IGI Poseidon has already at least 17 perspective buyers showing

interest in buying capacity rights within ITGI. IGB is currently the only realistic way of providing diversification of sources to South Eastern Europe, allowing for a break in Russia's monopoly. As a comparative measure, ITGI it would cost €179 million to transfer one bcm of gas through its network, compared to €790 million that would cost to transfer the same quantity through Nabucco (taking into account the published CAPEX of Nabucco, currently at €7.9 billion. In reality Nabucco's CAPEX has to be revised and is estimated to reach at least €14 - €15 billion, further increasing the cost of transport). It appears that ITGI is the most advanced solution, in terms of technological maturity, economic viability and risk aversion, to open the Southern Gas Corridor and allow Azerbaijan to sell gas not only on the Greek and Italian markets, but also to Bulgaria, Romania, Hungary and the Western Balkans (including the FYROM and Serbia markets and further to Bosnia Herzegovina). The advantage is that the project has already been partially implemented (the Greek-Bulgarian IGB connection is also under construction, supported financially by the EU). On the strength of all available information it can be argued that ITGI will be the most commercially viable solution amongst the three competitors of the Southern Gas Corridor which affect Greece.

TAP: Within the framework of the abovementioned comparison, it will cost €150 million to transfer 1 bcm through TAP, however this figure is not based on recently updated accurate cost estimates regarding the CAPEX, and it does not take into account the added cost that the newly announced expansion to Komotini will definitely incur. TAP, due to this technical immaturity is open to CAPEX overrun risk in terms of commercial viability. TAP on the other hand, offers only a theoretical opportunity for additional interconnections with Balkan neighbours through a proposed Ionian – Adriatic pipeline (IAP). IAP is a planned gas link from Fieri in Albania to Ploce in Croatia. However, little progress has been achieved in real terms by the end of 2011 towards its implementation. Among other issues related to IAP implementation, serious political problems between the government in Serbia and UNMIK/Kosovo may continue to impact negatively on related commercial considerations (Giamouridis and Paleogiannis, 2011). In a regional context IAP does not appears as strong in terms of economic impact and security of supply as IGB which it already forma part of ITGI and is under implementation.

South Stream: South Stream which is sponsored by Russia and will carry Russian gas bypassing Ukraine, is not contributing towards the diversification SE Europe's energy sources. In effect South Stream will not be bringing to Europe any new gas but will transmit the same gas that currently

goes through Ukraine. In that sense its commerciality is more or less guaranteed as its client base is fairly secure and is not expected to compete highly against the new pipelines bringing in Caspian gas.

Project Deliverability

ITGI: ITGI, has proven so far that it can react efficiently and quickly to any problems that might arise, utilizing the services of an experienced and dedicated team. Through careful business planning, ITGI has identified and mitigated, if not all, most of the associated risks it might face, ensuring IGI Poseidon's capability to execute the project within the estimated budget. From the start the project enjoys strong support from the governments of Greece and Italy which has helped constantly with the licensing process. The clearly defined structure of IGI Poseidon S.A. consisting of experienced and knowledgeable executives and engineers, further ensures that the project will have the necessary managerial structure in place to deal with any problems with swift and appropriate action in order to ensure a smooth and efficient execution of the project plan.

TAP: TAP's shareholders are also very experienced and prominent companies in the natural gas sector. However, the following points must be made:

- There appears to be some considerable delay in certain parts of the project particularly in licensing and a number of key technical issues. (e.g. front end design of the Kommotini – Greek/Albania border, tie up with the Greek natural gas system)
- No Greek or Italian sponsors are yet part of the project that would help strengthen the respective governments support,
- Only a small fraction of the gas transported within TAP will be actually commercially useable by the shareholders,
- TAP's route includes one more transit country with considerable country risk (Albania),
- TAP's current regulatory status, as well as its status on environmental permits is lagging behind,

Therefore several good questions arise on whether TAP will be able to respond to the requirements and time schedule of SD2.

South Stream: As the pipeline has a fairly secure gas supply and it has already signed inter governmental agreements with the countries through which it will be going and in addition it has set up J/V companies with leading local companies. Therefore, the project's deliverability to a large degree appears secured.

Financial deliverability

ITGI: The project has secured co-financing from the European Commission through the E.E.P.R. framework up to €145 million for the construction of both Poseidon and IGB. (For Poseidon €100 million out of an estimated total of ~€1 billion and IGB €45 million out of an estimated total of ~€150). ITGI's management has chosen to follow a hybrid model of financing which consists of a mixture at different percentages of corporate financing, loans from EIB and other European Financing Institutions (such as EC – EEPR) as well as the extensive use of facilities offered by Export Credit Agencies.

In view of the fact that Poseidon is sourcing gas from Azerbaijan, and that the main target is the Italian market and the shippers will be European entities, it is fair to disassociate the project from any risk which is related to the Greek state's current financial crisis. As the bulk of the natural gas to be transmitted through ITGI's pipeline is destined for the European markets with transit fees paid by non Greek customers the financial situation in Greece, now or later, will only play a minimal part in the operation of the pipeline.

Assuming that ITGI is selected by the SD2 consortium and firm ship-or-pay contracts are established (comfortably achieved assuming the selection by SD2), Poseidon will emerge as a relatively sound investment which can provide sufficient comfort to lenders in order to attract the necessary findings.

TAP: When considering country risk, TAP should take into account Albanian risk in addition to the Greek risk. Currently, TAP has not secured any kind of co-financing for the construction of the pipeline nor a comprehensive financing plan has been announced. On the other hand the financial strength and capabilities of Statoil ASA, its strong shareholder, are such that there is no doubt of TAP's ability to raise the necessary finance.

South Stream: As very few facts are known at this stage on the proposed financing a proper discussion of the project's financial deliverability cannot be made at this stage.

Engineering design

ITGI: ITGI is the most technically mature project of the Southern Corridor. Poseidon has almost completed its Front End Engineering Design (FEED) and has executed the Detailed Marine Survey (DMS).

In addition, Poseidon has secured the services of a dedicated third party company (Det Norske Veritas, DNV) in order to appraise and verify the standards that have been used by the engineer during the design process. Thusly, Poseidon ensures the adhesion to the highest recommended standards of design and construction, further enhancing the confidence of perspective lenders on the technical aspect of the project.

It is important to note that the reliability of the technical studies performed has been reaffirmed through the accurate cost estimate presented to SD2 which was almost identical with the cost estimate that the technical team of SD2 consortium derived using different methods.

TAP: It appears that TAP is still lagging behind in the execution of several technical studies, i.e. Front End Engineering Design (FEED), Detailed Marine Survey (DMS), as well as the Environmental Permitting activities. Due to TAP's relative technical immaturity, it is very difficult to derive a sufficiently accurate cost estimate of the project. Is it important to note that an accurate cost estimate is the cornerstone of deriving a commercially sound tariff, hence TAP will have difficulty deriving a conditional firm tariff to submit it to SD2.

The newly announced expansion to Komotini lacks all the related technical studies that would provide with a credible estimation on the cost, time schedule, etc. of the expansion, thus increasing the uncertainty on the entire project.

South Stream: No real progress has been made in this sector pending completion of the project's detailed feasibility study.

Alignment and Transparency

ITGI: ITGI is more than willing to cooperate technically with SD2 consortium. Furthermore, ITGI because of its technical maturity and regulatory progress, can ensure to align itself to the timeline of the Shah Deniz's full field development by taking on time the required FID.

TAP: TAP is not yet ready to take a Final Investment Decision (FID) in accordance with SD2's timetable, mainly due to its technical considerations and regulatory complications.

South Stream: *This section does not apply to South Stream.*

Operability

ITGI: ITGI has secured capacity rights in the upstream and downstream directions according to the Greek and Italian regulatory regimes. As a backup plan, in the event that the already signed IGA between Azerbaijan and Turkey fails, ITGI has already covered its base load. ITGI has secured the necessary capacity to transport the Azeri gas through Turkey's national grid with the Memorandum of Understanding (MoU) signed between BOTAS and Poseidon's shareholders. In this MOU ITGI clarifies its position vis-à-vis the additional investments that will be required in BOTAS grid on account of the extra gas quantities hat will be transmitted through the Turkish grid. (i.e. extra loops, various compression stations)

TAP: Concerning the pipeline's operability, TAP is not yet able to produce an IGA with Turkey, ensuring access to Turkey's national grid and proper capacity allocation in order to receive SD2 gas on the Greek border. Italian legislation dictates that in order for Tap's application to be considered or approved, a request for TPA exemption it must either:

- Submit proof that all the necessary authorizations allowing TAP to begin the construction have been issued, or
- Submit proof of an inter-ministerial or inter-governmental agreement between all three countries (Greece, Albania, Italy) specifically allowing TAP to submit a request for TPA exemption

Considering that the necessary inter-governmental agreement between the three countries is unlikely to be provided, TAP as it stands at present is not eligible for TPA exemption until after the

acquisition of all the authorizations, as mentioned above, which is an extremely lengthy process time wise.

According to the Greek regulatory regime, there is currently no availability at Kipi's entry point (Greek/ Turkish borders) or the downstream TSO controlled gas grid in order to accommodate for TAP's capacity requirements.

Likewise, TAP has no agreement that would secure its priority access within the Turkish national gas grid in case this is required for uninterrupted gas supply.

Also, TAP cannot obtain an exemption from law 4001/2011 regarding the full unbundling, which means that according to the EU third package, the owner of the pipeline has to be a different entity than the owner of the capacity right within the pipeline. It is noted that DEPA has already secured an exemption concerning this matter.

Considering the overall uncertainty concerning TAP's exemption status (regulatory issues) it is difficult to ascertain how the contracted SD2 quantities will be allocated within TAP's capacity.

South Stream: Considerable information is still lacking on this criterion and therefore a proper assessment cannot be made at this stage. However, given the size and organization of the project's shareholders and sponsors it is fair to assume that operability will not present a major problem. We must point out though that considerable work needs to be carried out in this front in order to secure all the necessary licenses.

Scalability

ITGI: ITGI will be able to provide 10 bcma initially with a potential upgrade (i.e. with the use of an added compressor) up to 16 bcma (according to the latest data) to the Italian Market through Poseidon. Through IGB, 3bcma with a potential upgrade to 5 bcma can be supplied to Bulgaria and to the rest of the South Eastern Europe. ITGI's scalability will provide further confidence to perspective lenders since it mitigates the risk of Poseidon being exposed to a single market (Italian).

TAP: At this point it is important to note that TAP's stated intention for an upgrade to 20 bcma is questionable, since it will be able to provide 10.0 bcm's per year of additional quantities to a

market that is it unlikely to be able to absorb them (Italy). Expansion of TAP to Albania and north to Montenegro and South Croatia is handicapped by the total lack of a natural gas grid operating in any of these countries. Therefore, it might take more than 10 years to be able to expand gas quantities in this region.

In view of the above, it appears that TAP's foreseen upgrade is mainly meant to accommodate the Iranian contracted quantities that EGL will need.

South Stream: Although there is considerable scope for expanding the pipeline's effectiveness in a broader regional basis there is serious lack of information on this subject from the consortium. Taking into consideration the pipeline's main parameters and given the background of the main shareholder (Gazprom) and its extensive operational experience scaling up of the project should not present a serious problem.

Public Policy Considerations (Including Security of Supply)

ITGI: ITGI is in complete agreement with European policy on route and source diversification. ITGI adheres to Europe's urgent request and policy to open the Southern Gas Corridor as soon as possible, while at a later stage, ITGI's modest size, allows for a larger project to complement the Europe's future gas demand as additional gas sources become available. (Absheron, Turkmenistan, Iraq, etc.) In addition, ITGI contributes further to regional energy security through its branching out to Bulgaria and further north (see IGB) and its option to link with the planned South Kavala gas storage facility, the planned Aegean LNG Floating Storage Regasification Units (FSRU) project in Kavala and also the planned Alexandroupolis FSRU project. The 'Poseidon' pipeline, the section of the ITGI that links Greece with Italy below the sea, fully covers European needs of diversifing energy sources and routes. Due to its capability of reversing the pipeline's flow, it will also enhance further the security of natural gas supplies in Southeast Europe. Gas supplies transported through ITGI will also be able to reach Bulgaria through a link to the proposed Interconnector Greece Bulgaria (IGB), which in turn will help balance gas supplies to Croatia, Serbia and Hungary.

TAP: Regarding TAP's EU policy considerations and considering that TAP has only one sponsor from a member state (E.ON with 15%) and TAP's route traverses Albania, which is not a member state with a considerably high country risk, and the fact that TAP will most likely try to allocate

some of its capacity to Iranian natural gas, it is questionable whether TAP will indeed be able to promote EU's best interests as much as ITGI. On the other hand TAP can help open a new gas market in the West Balkan region and thus help integrate the Balkan Energy Ring into the E.U. energy market. TAP is projected to commit up to 1 bcm gas supplies to the Balkans.

South Stream: It is difficult to judge this pipeline from a European Public Policy perspective as it is clearly not contributing towards gas import diversification, since the gas to be transmitted will be of Russian origin. On the other hand this project is a net contributor in terms of enhancing European security of energy supplies as its construction will reinforce Russia's deliverability capability (i.e. complete bypassing of Ukraine.) while Russian gas resources have an extremely positive long term outlook with secure and substantial deposits. The objective of the South Stream project is to create an alternative route of transporting Russian natural gas to European customers as of 2015 at the earliest with a planned total capacity of 63 billion cubic meters a year. South Stream further foresees the construction of a pipeline segment onshore to Southern and Central Europe. However, there is not enough information concerning the routes and the exact quantities that South Stream will transport to the Balkan market.

Environment, Safety, Society

ITGI: All the environmental licences required on the Italian and Greek side have been issued. It is important to note that the procedure for obtaining the environmental licences is a very time consuming and intense process. It took IGI Poseidon more than 4 years and with the full support of the Greek and Italian states in order to reach the current status where most licenses have now been awarded. Every care has been made by IGI Poseidon to minimize the impact on the environment as well as to respect the desires and concerns of the communities through which the pipeline will be routed.

TAP: TAP only recently submitted two scoping reports for the Italian and Greek side concerning the environmental studies, something which was undertaken for communication reasons, since the scoping reports are not a mandatory step in the procedure of obtaining the environmental authorizations. In late September 2011 TAP moved closer in finalizing its Environmental and Social Impact Assessment process in Greece by submitting a PEIA to the Greek MEECC. Consequently it is

highly unlikely that TAP will have in place all the necessary permits and licences for 2013 in order to adhere with SD2 FID which considerably increases the uncertainty on the entire project.

Consequently SD2 has informed TAP as well as ITGI that it will undertake its FID in 2013 and by that time the pipeline projects must have considerable certainty and be at a development stage that will allow for sufficient confidence to be selected as a carrier for SD2 gas.

South Stream: Although the consortium has a well defined policy on environmental protection the project is still at an initial stage with very little information on this criterion.

Stakeholder Support

ITGI: There must be mentioned that ITGI has been listed among the projects of pan European interest and that it has been designated as a project of common and public interest by the Greek Law, since the stakeholders also include the Greek government. Due to the above reasons ITGI is better positioned relative to TAP and South Stream.

TAP: TAP is also supported by the European Commission as a priority project under the TEN-E guidelines.

South Stream: This is a project of Russian interest and is not therefore considered eligible for EU priority funding or of serving EU energy policy objectives related to security of energy supply and supply diversification.

The following is a discussion of stake holder support issues at different levels.

- **Greek government:** ITGI is enjoying strong political support from both Greece and Italy as it is promoted by the Greek state-owned gas company (DEPA). As result, it has already secured TPA exemptions for most of its planned capacity, while its licensing applications are at a very advanced stage. South Stream will also be implemented with the participation of DESFA, but it has not less enthusiastic support, as this project creates tension with EU's diversification goals. TAP is lagging seriously behind in the licensing process.

- **Local communities in Greece:** Both ITGI and South Stream are facing certain degrees of reaction from a minority of local communities along the Greek Ionian coast. Despite the

active efforts of ITGI Poseidon to win public support, which included organising trips for local community leaders to natural gas facilities along the Italian coasts, the local councils of Perdika, Parga and Igoumenitsa have remained sceptical as in their view it conflicts with tourism development in the area. As it concerned ITGI pipeline it must also mentioned the exhaustive studies performed according to strict standards and regulations.

- **Other host countries:** While TAP seems to coordinate well with Albania, having signed two Memoranda of Understanding and Cooperation with the Albanian government (one for the TAP project and another for the Ionian Adriatic Pipeline), the south branch of South Stream is not clearly defined the criteria uncertainties in terms of implementation at local level.

Technical Risk

In essence both ITGI and TAP have approximately the same length that needs to be constructed in order to deliver gas to Italy. TAP's construction appears more difficult due to its elevation profile. The highest elevation point is at around 1.800 meters in the Albanian mountains, while the lowest section reaches 820 meters undersea. Such an altitude and topography variance constitutes an additional degree of difficulty in the project construction, and raises maintenance and security issues. On the other hand ITGI faces a much smoother inland terrain.

From a technical perspective, an offshore installation involves additional challenges and costs related to the depth range and the diameter of the pipeline. Higher depth requires pipelines of smaller diameter and higher safety standards, which substantially increases the required capital and operating expenses. South Stream involves the deepest off-shore section of the three projects, exceeding 2000 meters under the Black Sea. Poseidon is routed to pass through a maximum depth of 1370 meters in a steep terrain. In contrast, TAP's maximum pipe laying depth is estimated to reach 820 meters crossing a smooth terrain.

Economic Risk

This risk type relates to the overall economic risk and includes all economic variables with an actual or potential direct impact on energy. Economic factors can be viewed as including economic and population growth, the weight of energy in the country's sources of revenue or the size of its "energy bill", trade relations and competition for energy resources among consuming countries.

(The economic risk associated with the project construction has been dealt in the Financial Developing Section). The South Stream financial support package, although strong, its details, remain unknown.

Political Risk

Political risk is present wherever the political decisions of any economic or social agent may affect the function of the energy system. Such risk factors include political violence in the form of external conflict (international war), internal conflict (civil war, coup d'etat, extensive civil unrest, etc.), terrorism and violation of human rights. Other political variables affecting energy risk are those relating to the political regime, institutional quality, the rule of law, membership of international bodies, international political alliances, etc. (Doukas et al., 2011a). The political variables most closely linked to the energy sector include membership of the Organization of the Petroleum Exporting Countries (OPEC), whether the energy companies operating in the country are public or private, national or international, use of energy as a political weapon and involvement in multilateral energy initiatives.

The commercial viability of ITGI, does not depend on the findings of additional sources, as ITGI perfectly matches with Shah Deniz II gas volumes. In contrast TAP, in 2008 signed a 5.5 bcm/year supply contract with the National Iranian Gas Export Company (NIGEC), burdening the project with further political risk (especially in light of latest US and EU economic sanctions against the Iran), overlooking the preconditional reforms for further cooperation appointed by the EC (European Commission, 2001b) and therefore fending potentially interested governments and commercial players, who did not want to be perceived as undermining the international community in ongoing negotiations with the Islamic Republic. It was only recently (September 2010), announced that TAP would not be seeking Iranian gas, promoting Azerbaijani gas as a primary and also adequate source for the project. (Giamouridis and Paleogiannis, 2011).

Social risk

This category includes all risk factors relating to the living conditions, social well-being and cultural values of a given country or geographical location. Social risk factors can be regarded as including social equity, and social and labour conflicts.

Current economic and social conditions in Greece are such that do not present any serious threat for all three pipelines from a social risk perspective, although the danger of unforeseen labour conflicts and national strikes, leading to wider labour unrest is always there. In this sense social risks will only have a marginal impact on all 3 pipelines' implementation plans.

Economic Development Impact

In the case of a gas pipeline crossing a country in a transit capacity, which is the case of the three pipeline projects considered in the present study, there are inevitably economic benefits for the country concerned, i.e. Greece. Depending on the route taken, the ability to service (with gas) the local communities and, the effect to local economies in terms of business activity and job creation, the overall economic impact is evaluated. In fact we are talking about the impact on economic development. In that sense ITGI is expected to have a higher economic impact than TAP or South Stream since it has a much longer route through Greece but most importantly it crosses virgin territory in Western Greece which, according to stated plans, will accelerate the introduction of natural gas, with immediate result the setting up of the planned West Greece Distribution Gas Company (ΕΠΑ Δυτ. Ελλάδος). Also, through the construction of the interconnector Greece – Bulgaria (IGB), a project which is well underway, additional business activity will be created with the expansion of local gas networks. In terms of overall economic impact on Greece ITGI appears a clear forerunner. Section 5.4 of this report analyses in detail the Economic Impact on Greece from the crossing of the above gas pipelines.

Energy Sector Risk

Although considered as part of the overall pipeline assessment process, it has not been included as a separate criterion, to be marked since all three pipelines share more of less the same degree of energy risk. This type of risk is directly related to the countries holding the gas reserves (i.e. Azerbaijan, Russia) as it relates to the existence of energy resource reserves in absolute terms (size of resource fields) and in relative terms (ratio of reserves to output), and the reliability of the data on such reserves. The EC (European Commission, 2001a) classified this risk as "technical" (see Annex I), while Checci et al. (2009) termed it "geological". This risk factor has a pre-eminently physical dimension (the existence of a given amount of energy resources) which could be understood as a technical risk. But it also has a clearly economic dimension, because energy

reserves data are generally recognized in accordance with the "proved reserves" standard of the Securities and Exchange Commission (SEC), which requires that energy companies report only those reserves capable of being extracted at present prices and using existing technologies, under prevailing economic conditions. Finally, resource recovery policy, which sets output levels, is often influenced less by technical or economic considerations than by political ones.

5.4 Economic Impact on Greece

5.4.1. General Remarks

Although all three pipeline projects have been conceived as primary serving the transit routes of exported gas (Azeri in the case of ITGI and TAP and Russian in the case of South Stream) there are some distinct advantages from their crossing of the host country, in our case Greece. A number of factors are involved which result in net economic and social benefits. These factors combined will have an overall positive economic impact on Greece, as they will contribute towards:

(a) The creation of employment during the construction and operation phase.

(b) Generation of net income for the operating companies from transit fees.

(c) Net income to the Greek government from associated taxes.

(d) Flow of additional gas quantities to the Greek system which translates into further income for the operating company and the government (through taxes).

(e) The creation of new business opportunities in areas where natural gas will be introduced for the first time i.e. West Macedonia and Epirus, with gas availability in these regions enabling the setting up of regional distribution companies (applicable only for the case of ITGI).

(f) An increase, although marginal, of Greece's GDP.

In assessing the economic impact on Greece from the three pipelines projects considered in this study emphasis is given on the ITGI and TAP projects since they are far more mature than the South Stream. Furthermore in the case of ITGI and TAP we have available considerably more economic and technical information, which allow us to study in some length their overall economic impact on Greece. Table 5.4 shows some basic economic information on these two projects.

Table 5.4 *Basic economic data on ITGI and TAP*

Corridor Name	Total Construction Cost (Million Euro)	Cost of Offshore Section (Million Euro)	Cost of Onshore Section through Greece (Million Euro)	Cost of Onshore Section through Albania (Million Euro)
ITGI	1.740	1.040	700	n.a.
TAP	1.700	700	600	400

The impact to the economy from the construction of the pipelines can be assessed at two levels. Firstly from the economic benefits that will accrue during the construction phase, and secondly from the business activity that will follow during the operation stage and will span over a number of years.

As precise information on the routing of the Greek segment of the South Stream pipeline is lacking, by necessity the analysis regarding the economic impact is confined to the ITGI and the TAP projects. According to industry norms the laying of one kilometre of gas pipeline, in the rather smooth terrain of northern Greece, is likely to result 1,8 jobs per kilometre for a 30 month period that construction will take. That means that ITGI in the overall construction phase will create 1080 jobs while in the case of TAP 860 jobs in Greece. As it is shown above, ITGI transcends a longer distance within Greece and its economic impact by deduction will be greater.

But ITGI's true economic significance is not confined to the actual construction period. Far from it. Its true and very positive contribution to economic activity is directly related to the introduction of gas in the regions of West Macedonia and Epirus. Already plans are in place by the operator (DESFA) for the setting up of the regional distribution companies which will undertake to implement long term strategies for gas use in a fairly large geographical area focusing on the cities of Kozani, Veria, Edessa, Kastoria, Ioannina, Igoumenitsa and Arta and surrounding areas. It is difficult at this stage to quantify the anticipated investment over say a 15 year period (2015-2030) but on the basis of recent experience from the regions of Larisa – Volos and Thessaloniki, where regional distribution companies were set up few years ago and are now running, overall investment

is likely to exceed €1.5-€2.0 billion with thousands of kilometres of new pipelines to be laid (low and medium pressure) and gas conversions undertaken in the commercial and domestic sector. No similar activity is envisaged for TAP. In this sense the benefits to the local economy that ITGI will bring far outweigh those of TAP both during the construction and long term operation phase.

5.4.2. Input/Output Analysis

5.4.2.1. Description of the Methodology

Input/output analysis is a method used to characterize economic activity in a given time period, and to predict the reaction of a regional economy to stimulation, for example, from increased consumption or changes in government policy.

It uses matrices to describe the way in which the productive system satisfies final demand (consisting of consumption, investments and exports). An input-output matrix represents the links between an economy's resources and its consumption. The matrix may vary from the simple (three sectors: industry, services and agriculture) to the complex (over 500 branches). It is one of the only techniques applicable to the evaluation of the sectoral impacts of structural interventions, because it allows for the detailed division of an economy's productive structure. An input-output matrix can be compared to a macro-economic model that is highly simplified regarding the economic mechanisms represented, but which is extremely detailed from the sectoral point of view.

5.4.2.2. The purpose of the technique

Input-output matrices are used primarily in scenario analysis and simulation, where they serve to verify policy scenarios, based on the technological structure of the economy of the country and on the state of final demand. They can also be used in forecasting. In an evaluation they can be used with or without policy interventions, in the same way that a macro-economic model can be used. There are numerous applications of input-output matrices to the evaluation of development programs, including estimating impacts differentiated according to the different branches of an economy.

5.4.2.3. Circumstances in which it is applied

It is generally used at national level, as this is the level at which statistical data are collected for the construction of matrices. Regional matrices do exist and also lend themselves to input-output analysis. However, their statistical value is not as great because of the difficulty of monitoring the movement of goods that are not subject to customs duty.

5.4.2.4. The main steps involved

The following steps describe the implementation of the input-output tool from its initial construction, to effective simulations in the context of the evaluation. In reality, an input-output matrix is rarely constructed for an evaluation. In these cases, the implementation of the tool starts, in practice, with step 4.

- ***Step 1. Construction of a transaction matrix:*** The connections between the different branches of an economy are described. The rows of this matrix consist of the outputs, which concern resources supplied by a given sector to each of the sectors of activity and to the final demand. The columns consist of the inputs from the different sectors, i.e. the consumption per sector required for production.
- ***Step 2. Construction of a matrix of technical coefficients:*** This is based on the matrix of transactions. The technical coefficients are calculated from the values taken from the matrix of transactions divided by total production. The relative part of the value created by each branch for all the other branches can therefore be seen. The technical coefficients serve to provide indications on the technical structure of the modeled economy; they show which sectors have a high level of value added, productivity and exports. These coefficients are artificially fixed for the following steps.
- ***Step 3. Construction of an inverted matrix***: This is the result of a matrix transformation through which multiplier coefficients can be calculated. These coefficients summarize all indirect effects.
- ***Step 4. Hypotheses of primary impacts:*** A quantitative estimation is made of the main impact of the program, in the form of an increase in final demand (increase in public spending, increase in consumption, increase in infrastructure investment, etc.). The assumption of increased demand includes a breakdown per sector, so that it can be introduced into the matrix.
- ***Step 5. Estimation of total impact:*** The calculation of total impact is based on the assumptions of primary impact and of the inverted matrix. Based on the primary impact on a sector, the tool is used to estimate all indirect effects on all sectors, particularly in terms of consumption, production and employment.

5.4.2.5. Strengths and limitations of the approach

Strengths

The most interesting contribution of input-output matrices concerns impacts on sectoral distribution and trade. Leakages due to imports by the beneficiary country from Member States of the European Union and third countries may prove to be important for EU policy-making. Similarly, knowledge of the impact of sectoral demand may prove to be important, particularly if it is considered that some sectors must be stimulated to accelerate the growth rate.

Limitations

Input-output matrices are limited to the estimation of effects on demand, rather than supply. Therefore, they do not take into account one of the most important objectives that being the lasting effects on productive potential. Most effects on supply, which are likely to lead to a sustainable increase in the growth rate of assisted regions and enable these regions to catch up with more developed areas, are totally overlooked (for example, the creation of new productive capacity, improvement of the training and education of the workforce, construction of infrastructure, productivity gains throughout the economy, spread of technological progress and intensity of high-tech activities in the productive sector). It is all these effects on supply which can transform productive capacity in a lasting and irreversible manner. These cannot be estimated using this tool.

A tendency to over-estimate the impact of Structural Funds on demand has been observed, because the impact of interventions is not moderated by feedback effects, particularly regarding price changes originating in product markets, financial markets and the labour market.

5.4.2.6. Investment Cost Breakdown

Not all of the investment cost translates into increased domestic activity as part of the purchased goods and services are imported especially in the case of Greece. Thus, a methodology will be implemented to split the investment cost between imports and domestic production.

5.4.2.7. Presentation of Findings

By utilizing the input – output modeling methodology the economic impact of the two projects was assessed. This approach quantifies the spill – over effects to other sectors of the economy from the increased demand for intermediate goods (indirect effects) and increased final consumption due to higher household income (induced effects). This is achieved by utilizing a Leontief matrix, which takes into account the interdependencies across various economic activity sectors.

Table 4

Table 4: Economic Direct, Indirect and Induced Effects for Construction Phase						
Projects	**Domestic Intermediates Effect**	**Output Effect**	**Compensation of employees Effect**	**Gross Operating surplus Effect**	**Value added Effect**	**Employment Effect,** *in persons*
ITGI	484.381.822 €	915.680.328 €	168.455.123 €	262.246.190 €	432.474.750 €	10.563
TAP	415.184.419 €	784.868.853 €	144.390.106 €	224.782.449 €	370.692.643 €	9.054
Difference	69.197.403 €	130.811.475 €	24.065.018 €	37.463.741 €	61.782.107 €	1.509 €

Table 5 (a)

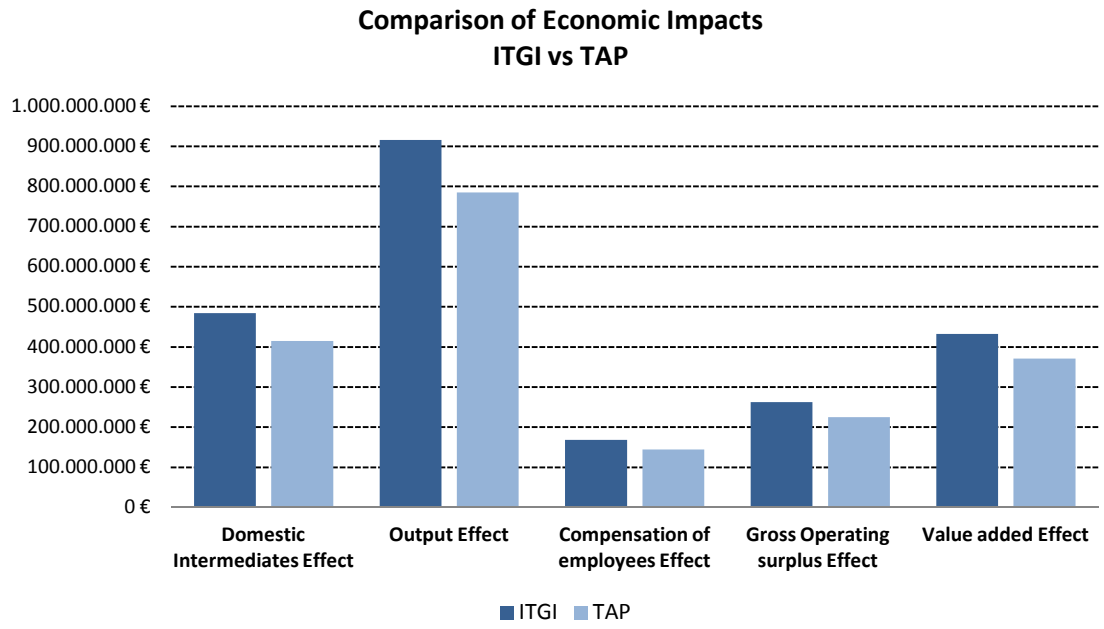
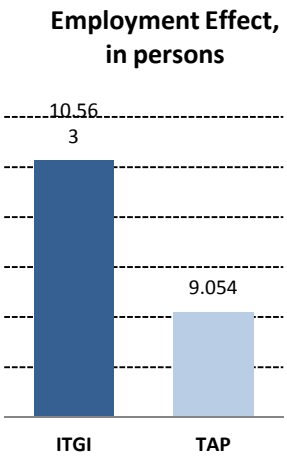


Figure 5 (b)



By cross – comparing the two projects and due to the fact that ITGI is much longer regarding its onshore section, it was established that the construction of the project is expected to stimuli the domestic economic activity more than TAP. In focus, ITGI's construction is anticipated to produce 61.7 million euro more added value and 24 million euro more income for employees. Furthermore approximately 1.509 more persons are expected to be employed by ITGI than TAP during the construction phase (see *Table 4*).

In evaluating the contribution of the ITGI and TAP pipelines during the operational stage we must note that the ITGI project has a clear edge over TAP since it will be responsible for the creation of a regional distribution company in Western Greece (ΕΠΑ) and that will constitute a key driver for increased economic activity. Although, its operation does not require intense utilization of primary inputs its long term economic impact is substantial.

Table 5

Natural Gas Investment Scenarios for Western Greece

Table 5:	Scenario 1: Pesimistic		Scenario 2: Medium		Scenario 3: Optimistic	
	ITGI	TAP	ITGI	TAP	ITGI	TAP
Years	**25**		**25**		**25**	
Investment Cost	150.000.000	0	150.000.000	0	150.000.000	0
Average Projected Inflows (EBITDA Terms)	25.000.000	0	30.000.000	0	35.000.000	0
Rate	3,50%	0	3,50%	0	3,50%	0
NPV of Cash Flows in €	**262.037.865**	0	**344.445.438**	0	**426.853.011**	0

Figure 6

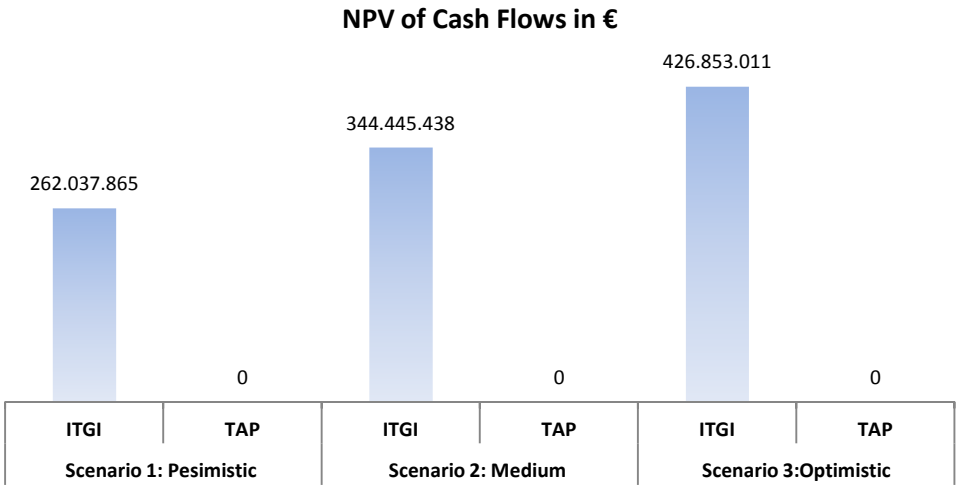


Table 5 summarises the financial analysis (based on assumptions deriving from the operating experience of other ΕΠΑ's in Greece) concerning the economic impact over a 25 year period for both ITGI and TAP. As the TAP project is not foreseen to have any impact whatsoever on the development of local and regional gas markets, ITGI's supremacy in that respect in self evident. Assuming an investment cost of 150 million and cash inflows for 3 scenarios, the project returns in any case is positive in terms of Net Present Value (NPV). On the other hand, the TAP project is expected to deliver no cash inflows from operating activity.

Furthermore, the creation of an EPA in the West Macedonia and Epirus region creates asymmetric economic opportunities and impacts for businesses. In the case of ITGI, NPV of cash flows varies from EUR 262 million in the pessimistic scenario rising to EUR 427 million in the most optimistic one (see *Table 6*). Likewise as shown in the same table total employment in terms of permanent jobs, varies from 663 in the pessimistic scenario rising to 859 in the optimistic one.

Table 6(a)

EPA related Employment Scenarios During Pipeline Operation Phase

Employment of EPA (25 years projections)	**Scenario 1:** Pesimistic	**Scenario 2:** Medium	**Scenario 3:** Optimistic	**TAP**
Total Employment	**663**	**766**	**859**	**0**
Subcontractors	330	360	380	0
Installation technicians & Studies	190	240	280	0
Permanent Personnel	130	150	180	0
Third Party employees	8	10	12	0
Resellers	5	6	7	0

Table 6 (b)

Employment Involved in Pipeline Operational Phase

Employment Involved in Pipeline Operations	ITGI	TAP
Pipeline Operations	25	20
Maintenance	50	35
Procurement	5	5
Total Employment	**80**	**60**

In summary, ITGI when compared to TAP in terms of short and long term economic impact emerges as a clear winner since it is a much larger net contributor with regard to employment opportunities and overall investments.

5.5 Comparative Analysis's of Greece related Pipeline Projects

As we have argued in the previous section *(see 5.4)* there are certain economic and social benefits to the host country, i.e. Greece, from the crossing through its territory of the planned pipelines. It is therefore of interest to find out which of the three pipelines considered will contribute most to the economy, both on a local and national basis with the least impact on the environment and the maximum gain in terms of increasing the country's security of energy supply. The above more or less describe the scope of the comparative analysis that follows. In comparing these three pipelines our aim will therefore be:

i. To evaluate the overall deliverability of the project from Greece's perspective.
ii. To assess the overall risk involved on a national and regional level.
iii. To ascertain the overall economic impact in terms of local and regional development, economic growth (GDP) and the strengthening of the country's investment potential.

The comparison process is based on two different groups of criteria. The first group includes the set of the 15 criteria as described and analyzed in section 5.4 and the second group includes purely risk related criteria which are described further on in this section. The following summarises the findings of these two evaluation approaches.

- **Evaluation based on 15 criteria:**

A comparison is made based on the marking of the various evaluation criteria which were presented and discussed in detail in section 5.3 (Tables 5.2 and 5.3). The marking follows a scale of 0 to 5 with the highest number indicating full satisfaction of the requirements presented by the aforementioned criteria and 0 showing either non satisfaction or non compliance, usually associated with the lack or relevant information. Full marks amount to 75 points for each pipeline project. In the case of the risk related criteria full marks indicate absence of risk and zero indicates the highest risk. Table 5.5 shows the results of this comparison with the assessment and marking of the different criteria based on careful analysis by the project team which has taken into consideration the corresponding strength and weakness, and the degree of compliance of each pipeline to the terms of the relevant criterion. The evaluation of the various risk factors, included in the above 15 criteria, was conducted with the help of the REACCESS methodology a detailed discussion of which follows.

Table 5.5:
Evaluation for the 3 Greece related South Corridor Projects

EVALUATION CRITERIA	SCORE		
	ITGI	TAP	South Stream
Commerciality	4	3	3
Project Deliverability	4	3	3
Financial Deliverability	4	4	3
Engineering Design	5	4	1
Alignment and Transparency	5	4	1
Operability	5	3	2
Scalability	5	3	2
Public Policy Considerations	5	3	2
Environment, Safety, Security	5	4	1
Stake holder support	4	3	3
Technical Risk	4	4	2
Economic Risk	3	4	3
Political Risk	4	3	3
Social Risk	4	4	4
Economic Development Impact	5	3	2
TOTAL MARKS	66	52	35
COMPLIANCE TO CRITERIA	88%	69.3%	46.6%

A first glance at *Table 5.5* shows that the ITGI pipeline is scoring the highest marks which is indicative of the project's overall its commerciality, maturity, its advanced level and deliverability in terms of engineering design, licensing, bankability and public policy considerations including a high

degree of security of energy supply. A full discussion on the comparison between the 3 pipeline projects is made in section 5.6.

- **Risk Evaluation:**

Parallel to the assessment based on the above 15 criteria a comparison was also made on overall risk by using the REACCESS methodology as this has been developed by the National Technical University of Athens. The REACCESS methodology, through the computerized tools presented in the project's report[32], was applied on the ITGI and TAP pipelines. REACCESS is a methodological tool for assessing the social, economic and political risks involved in the above two pipelines. This methodology has not been applied at this instance in assessing the South Stream pipeline project because of lack of suitable data. The results of this assessment are shown in *Table 5.6*

Table 5.6 *Overall Risk for the ITGI and the TAP Corridors*

Corridor Acronym	Status	Country of Origin	Region of Origin	Transport	Option A	Option B	Option C	Option D
ITGI	Planned	Azerbaijan	Caspian Region	Pipeline	52,80	41,24	47,24	206,20
TAP	Planned	Azerbaijan	Caspian Region	Pipeline	52,97	43,19	48,08	259,17

Table 5.6 shows the results of the risk assessment and indicates that the calculated overall risk for the TAP energy corridor is higher than that of the ITGI corridor. This result holds for all 4 options used for aggregating country risk[33]. This is due to the fact that TAP involves an additional country,

[32] "Economic and Socio-Political Risk Assessment for ITGI and TAP Natural Gas Pipeline Projects", School of Electrical and Computer Engineering, Decision Support Laboratory, National Technical University of Athens 2011 (www.epu.ntua.gr)

[33] According to the REACCESS study, a number of options were considered:

- **Option A:** Albania is the country with the highest economic and socio political risk within the countries participating in the TAP pipeline (52,97), as well as within the countries included in the ITGI pipeline. However, its country risk index is only marginally higher than that of the second riskier country which is involved in both pipelines (Georgia, with 52,80). As a result, the resulting overall risk of TAP with this option is only marginally higher than that of ITGI.
- **Option B:** The average of the $r_{esp(n)}$ value of TAP's corridor countries is raised around 4,7% (about 2 percentage points) higher, compared to ITGI's, due to the addition of Albania.

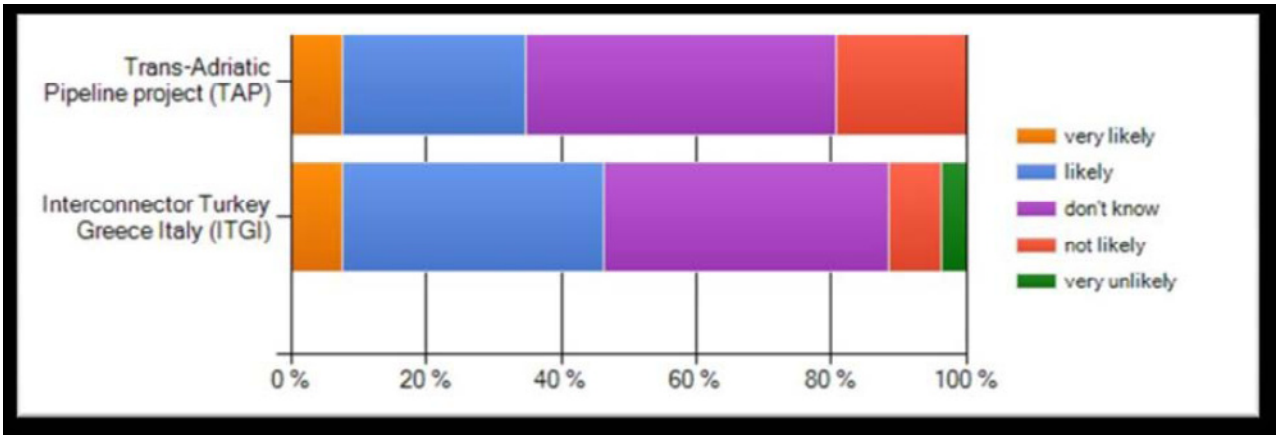
Albania, with significant economic and socio political risk, which thus influences substantially the final results in all options of the TAP pipeline's risk assessment. Namely, the ITGI pipeline passes through six countries, while the TAP pipeline crosses seven countries (the same six as the ITGI project plus Albania). For a full discussion of the Albanian factor in TAP's risk assessment see Appendix B.

The increased risk index of the TAP corridor, due to the additional transit country – Albania – is also corroborated by a related study with the application of graph theory in oil and gas supply corridors (Doukas at el., 2010). The results of this study are also in accordance with the fact that ITGI is a relatively mature project, supported by binding inter-governmental agreements, having the full political support of the Italian and Greek governments, being characterized by the EC as a key project in the effort towards opening up the Southern Corridor and being included in the Projects of European Interest. TAP, on the other hand, requires more political support, and back up from the EU in order to, somehow, recompensate for its weak consortium's structure. Even though Statoil's participation raises the consortium's credibility, it appears that the consortium's dominant stakeholders, lack the necessary influence and experience in international gas links and seem distant from the EU's reality and status quo.

The above results are also in agreement with a recent survey, published in April 2011, regarding the European Southern Gas Corridor (La Belle, 2011). That specific survey presents the opinion of informed actors on the effectiveness, viability, likelihood and barriers towards construction of all pipeline projects comprising the EU Southern corridor. It becomes obvious from *Figure 5.7* that the perceived likelihood of the ITGI project being actually built is quite higher than that of the TAP project. In particular, ITGI was viewed by 47% of respondents as "very likely" or "likely" to be built; for TAP this percentage was only 35%.

- **Option C:** The TAP pipeline results exhibit an increase of around 2,2% (about 1 percentage point) compared with the results attained from the ITGI Corridor assessment, regardless of the fact that this option's calculation is based on the effort of "softening" the influence of the country that contributes the most to the corridor risk (compared to Option A).
- **Option D:** Due to this option's calculation nature, the final result of the TAP assessment equals the result obtained in Option D of the ITGI assessment plus the $r_{esp(n)}$ of Albania. The effect of the inclusion of the additional country is more pronounced in this option, resulting in an overall risk of TAP that exceeds that of ITGI by about 26%.

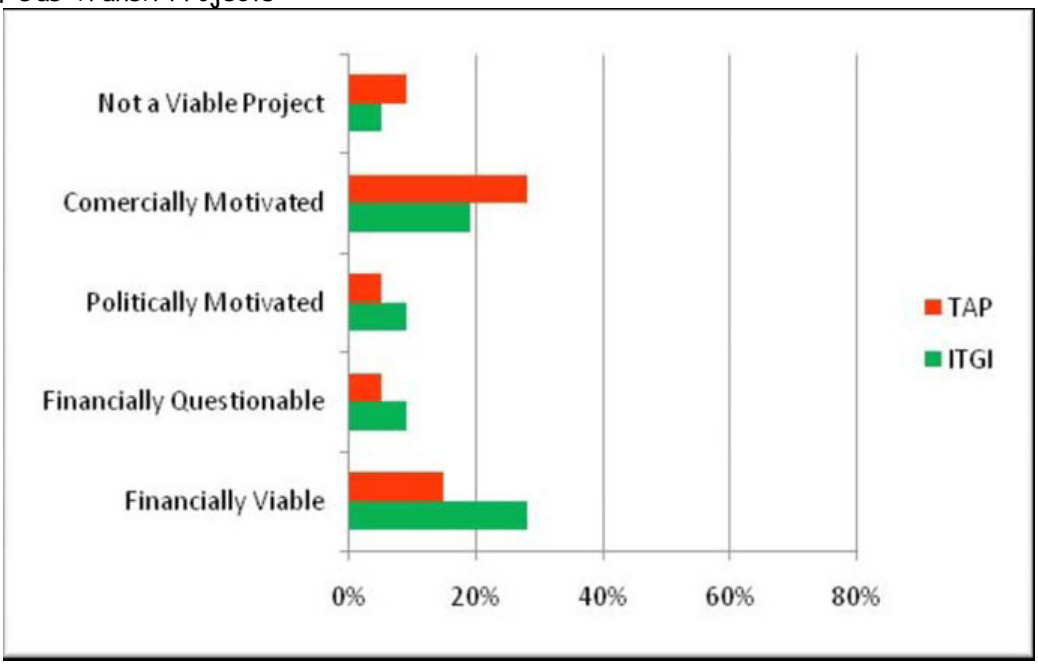
Figure 5.7:
Expected Likelihood of Projects being completed



Source: La Belle, 2011

Figure 5.8 describes the respondents' perspective of each pipeline project. In terms of viability, political motivation and financial motivation the ITGI project exhibits precedence, a fact which is directly related with the existing political support, its good match with the Shah Deniz II gas volumes, as well as it being the most advanced and cheapest solution, parameters explained in the previous paragraphs. TAP scores better in commercial motivation and financial questionability, possibly due to the credibility Statoil bestows to its consortium.

Figure 5.8:
Perspective of Gas Transit Projects



Source: La Belle, 2011, authors own collaboration

It has to be noted that this study is limited to the economic and socio political risks that are related to energy supply. It does not involve economic / financial assessments of the two projects but is

purely a risks assessment. The incorporation of technical and economic parameters, such as investment costs, potential intermediate gas markets, operation and maintenance and resource capacity can be also taken into account for an overall quantification.

5.6 The Eurozone Crisis and its Impact on South Corridor Pipeline Projects

According to a report recently published by the London based European Bank for Reconstruction and Development (EBRD), the euro zone's debt crisis will hinder the economies of Central and S.E. Eastern Europe next year because of their close trade and financial links. In its report on the economy prospects for the 29 countries in which it invests, EBRD said that growth among countries in Southeastern Europe with close ties to Greece will be slower than previously expected as a result of that country's debt problems and the effect on its banks[34].

The EBRD warned that the damage inflicted on the euro zone's eastern neighbours could be even greater if larger economies such as Italy and Spain are frozen out of international bond markets, leading to a possible failure of some large euro-zone banks. The EBRD's forecasts are far weaker than those released by the International Monetary Fund in September 2011, largely reflecting the rapid deterioration in the euro-zone economy since then.

The development bank's bleak assessments and these of other institutions such as the IMF, of the impact that the deepening crisis is having on much of the rest of Europe have no doubt added to the external pressure on euro-zone politicians to bring the crisis to an end. The EU's last ditch summit of December 8-9, 2011 which was convened as a response to pressure by banks and institutions to take action to save the euro apparently failed to calm the markets as it became clear by their performance since then. The post-summit communiqué proclaimed that each euro-zone country will enact a constitutional rule to balance its budget, will take corrective action if its "structural" deficit exceeds 0.5% of its gross domestic product, and will face penalties if its actual deficit exceeds 3% of its GDP. Chancellor Merkel had hoped that these rules would be embodied in a revised version of the current EU treaty and therefore enforceable by the European Commission through the European Court of Justice. Yet Britain's unwillingness to modify the existing treaty without additional safeguards for the British economy means that the new rules would apply only to the 17 euro-zone countries and others that wish to join them, but that they don't constitute an

[34] IENE, S.E. Europe Energy Review, No: 30, September/October 2011

official EU treaty and therefore cannot be enforced by the commission and other EU institutions. So there really is no enforcement mechanism for the new budget rules, even if all of the euro-zone governments agree to sign a new accord. The result looks like a replay of the old Stability and Growth Pact, which had similar goals and penalties but was soon violated by Germany and France and then watered down to be completely ineffective. Most economists agree that at the root of the euro upheaval is a balance of payment effects of a 13-year-old one-size-fits-all monetary policy and a fixed exchange rate for a collection of disparate countries in very different stages of economic and structural development. That means that the December agreement may be a step in the right direction but is neither necessary nor sufficient to bring calm to the euro area.

Therefore uncertainty and poor economic growth prospects will continue to dominate the euro-zone area at least over the next 12 months. "As a result economies in central and Eastern Europe with close trade and financial links to the euro-zone will slow sharply next year as a result for the currency area's twin fiscal and banking crises. Since the start of the euro zone's crisis fiscal crisis in late 2009, euro-zone policy makers have launched a number of initiatives designed to bring it to an end, but the efforts have always fallen short of what was needed", observes EBRD Deputy Chief Economist Jeromin Zettelmeyer.

The EBRD further notes that the economies of eight countries in Central Europe and the Baltic states are expected grow by 1.7% in 2012, half the rate of expansion it expected as recently as July 2011. The development bank's economists don't expect the euro zone to fall back into recession, but neither do they expect it to grow much, and that will hit demand for exports from Central European and S.E. European nations. But the difficulties faced by major Western European banks in raising funds will a more negative impact. In many S.E. European and Central European countries, banking systems are dominated by subsidiaries of Western European institutions, and their troubles at home will mean they will cut back on lending in the region.

Analysts predict that countries in Southeastern Europe will also see a slowdown in exports to the euro zone, and are vulnerable to the difficulties experienced by Greek banks, which are major providers of credit in a number of Balkan economies notably in Albania, Serbia, Bulgaria and Romania. But Greek banks have already taken big losses on their holdings of Greek government bonds, and may be further damaged only if Athens fails to fully repay on time its debts. According

to the October 26, 2011 deal reached between the Greek government and the EU, IMF and ECB there will be sufficient funds in the first half of 2012 in order to recapitalize Greek banks if necessary. In that sense the banking sanitation in SE Europe is not expected to deteriorate any further. The EBRD said it expected seven economies in southeastern Europe to grow by 1.6 % in 2012, having forecast an expansion of 3.7% in July. The EBRD further notes that Albania, Romania and Serbia are most exposed to the Greek economy.

According to the EBRD countries further to the east of the euro-zone, which are less reliant on it as an export market and a source of credit, will suffer as a result of the crisis, but to a lesser extent. In experts the Russian economy to grow by 4.2% next year, a slower expansion than the 4.7% forecast in July, while it expects Ukraine's economy to grow by 3.5%, having projected an expansion of 4.5% in July. However, it warned that in its "downside scenario," growth in countries like Russia would be further reduced because of the largest fall in commodity prices. The EBRD said it expected Turkey's economy to be severely affected by the euro zone's problems, as the currency area is its main export market and a major source of capital inflows. The development bank slashed its growth for the next year to 2% from 4%.

With S.E European growth prospects in decline and with the Eurozone tipping into recession and European banks squeezed for credit as they are obliged to strengthen their capital base, the question areas if funding for the above three pipelines and particularly for ITGI and TAP, will really be available when the construction phase starts in 2013 and beyond. Could the current eurozone and Euro area banking crisis act as an impediment and prevent the implementation, let alone progress, of these projects? Could Greece's contracting economy and its dependence on EU's bailout funds be able to support the construction of such major infrastructure projects as the three gas pipelines reviewed in this report?

Although the above questions are highly legitimate and naturally spring to mind when discussing investment in Greece and to a large extent reflect public concern on this country's long term economic prospects, one has to be careful and disassociate local from international investment projects and examine the actual situation. More specifically one has to identify as to where and when funding will be required. In that respect the following observations are relevant and will help us understand the true dimensions of the project funding requirements involved in the case of the three transcending pipelines:

(a) All three gas pipeline projects are part of international consortia with the Greek segment of the pipeline only forming part of the overall project.

(b) Funding for these pipeline projects, including the Greek segment, will not be raised in Greece but through the international markets where again European banks will provide only part of the required funding. In that respect euro-zone lending constraints will only have limited impact.

(c) The bulk of the required funds will be needed in 2014, 2015 and 2016 by which time world economic conditions will be different and financing prospects will have eased.

(d) ITGI in particular has already secured part of its finance from EU institutions (i.e. EIB, EBRD) and from export credit guaranties with only part of funding needs, less than 40%, required to be raised in the international markets. Likewise in the case of TAP funding is secured through credit lines agreed by its partners who enjoy high credit ratings and close cooperation with leading financial institutions.

(e) As the operation of all pipelines and the deliverability of the gas volumes to be transmitted through them and directed to the European markets, does not depend on gas sales in Greece (or Albania in the case of TAP) the provision of credit by international lenders does not take into consideration the state of Greece's economy or that of S.E. European countries, but rather the state of the European gas market. The long term prospects of this market and who is marketing the gas which will flow through the above pipelines, is what really counts.

5.7 Discussion

The comparison between the three gas pipelines which are planned to bring additional gas supplies to the European market, and parts of which will go through Greece, revealed a number of interesting facts related both to the construction and operation a phases of the three projects. Beyond the pure examination and marking of the various selection criteria, where ITGI is clearly ahead of TAP and South Stream having scored the highest marks, the evaluation process proved most useful in understanding the true impact of the planned investments. What became explicitly clear is that in all cases these are Europe driven projects as the bulk of the gas that will move through the pipelines is destined for the European gas market. Consequently the funding involved

for all 3 pipeline projects, which will be largely raised in the international markets with the necessary European input, is not constrained by the present Eurozone crisis. If nothing else, if we are to believe EU/IMF stated policies, actual construction costs will be lower in 2-3 years because of greater competition in the Greek and Italian markets.

An interesting observation has to do with the history of each of the pipeline projects and how the oldest project, i.e. ITGI, is clearly emerging as the most mature project in almost all counts, followed in time sequence by TAP and South Stream. This is not surprising since large pipeline projects normally take years to define and even longer to develop. What really counts at the end is the security of demand and therefore the buyers (i.e. if they are in place of not) and the support of the host country or countries.

Financing, which is a determining factor from the operator's point of view, is secondary from the project's development point of view. In a sense this becomes available if all other conditions are right. The current adverse economic climate in Greece, although prohibitive in many ways for Greek based and operated projects, is not seen as an insurmountable barrier when it comes to internationally driven projects such as the three gas pipelines in question where the buyers operate Europe wide and are not confined to Greece.

Table 5.6

Overall evaluation of the 3 South Corridor pipelines which transcend Greece

Pipeline	ITGI	TAP	South Stream
Total Marks	66	52	35
Compliance to Criteria	88%	69.3%	46.6%

CHAPTER 6

WHERE DO WE GO FROM HERE?

In the pages that preceded an effort was made to present and discuss the pros and cons of each pipeline with reference to Greece. The evaluation between the three competing pipeline schemes although useful in order to understand the various complexities involved was by no means exhaustive especially with respect to the economic and commercial constraints involved. The final verdict from the supplier's point of view will of course be made by the SD II consortium. However, the current study is useful in the sense that for the first time it brings together and makes publicly available a substantial amount of evaluation information from the host country's perspective.

As the Shah Deniz II consortium is currently considering three apparently competitive bids (i.e. Nabucco, TAP and ITGI) for the long term sale of its gas supplies it appears that the race for building the first East – West gas corridor is coming to its end. But, the actual process for the implementation of the second phase[NB] of the South Corridor is just starting. Therefore it would be useful to understand what lies ahead by identifying the various key stages in the project's development sequence:

(1) By the end of March 2012 the Shah Deniz II consortium will announce its decision as to which one of the three pipeline schemes satisfies more its selection criteria as well as the buyers that will negotiate the Gas Supply Agreements and therefore will invite the successful buyers and pipeline promoters to enter into detailed negotiations with the view of signing binding agreements (Gas Transportation Agreements – GTAs & Gas Supply Agreements – GSAs) by June 2012.

(2) In the meantime from the time of pipeline selection up to the Final Investment Decision (FID) estimated for mid 2013, SDII should proceed with all the pre Front End Engineering Design (FEED) activities and the selected pipeline should finalize its financing scheme and any other missing item necessary in order to conclude its FID.

(3) First half of 2013 – The selected Project and SD II consortium will take simultaneously the FID to go ahead and construct the pipelines and develop the SD II field.

[NB]The first phase having been the Greek – Turkish gas interconnector, in operation since November 2007.

CHAPTER 7

CONCLUSIONS

Having considered the natural gas demand and supply situation at global and European level, both on a current and long term basis, the need for diversification of supplies becomes evident. In this respect the development of the South Corridor, which aims at bringing in new and significant gas supplies to Europe from the Caspian basin, an as yet potential supply source, is of paramount importance. Certain of the proposed EU endorsed gas pipelines, i.e. ITGI and TAP are routed through Greece as well as the south axis of the Russian sponsored South Stream gas pipeline.

Greece's significance in offering a safe and reliable route of fresh gas supplies to European markets is obvious. What is less obvious at first glance is the regional importance of some of these pipelines since their routing through Greece helps considerably with the development of a vibrant regional gas market. ITGI emerges as the most important of all these pipelines both from a regional perspective and in terms of time precedence for the actual construction.

Once the SD2 consortium selects ITGI as the most suitable route and final investment decisions are taken (i.e. by both SD2 and ITGI) the ITGI project can be ready and delivering gas to Italy much faster than any of the other pipelines. A considerable part of ITGI's infrastructure is already in place and almost all of the licensing procedures have been completed, two decisive factors, which will enable a much faster implementation. At the same time there do not appear to be any significant economic- political risks involved as the pipeline does not pass through a third country as is the case with both TAP and the South Stream. At the same time ITGI's importance in a regional context is currently underrated as its contribution in accelerating gas market integration – in accordance with EU and Energy Community guidelines- in SE Europe is not well understood. As the present study clearly shows ITGI's advantages in terms of regional development far outnumber those of the other pipelines.

Having taken into consideration a wide variety of criteria, and well established economic and technical parameters, ITGI emerges as the most desirable option for Greece and for the broader S.E. European region. From Greece's point ITGI will undoubtedly bring in higher investments at local level and will as well enhance regional development especially in Western Greece, while at the

same time it will help strengthen the country's security of energy supply. From a regional perspective the ITGI pipeline will provide immediate access to much needed alternative gas supplies, will also strengthen regional energy security, facilitate cooperation and help spearhead gas market development, by ensuring adequate volumes and a continuous gas flow. The role of the Greek – Bulgarian interconnector (IGB) which is branching off ITGI, and is already in an advanced development stage, is especially important in this context as it will secure additional gas supplies to Bulgaria and further afield thus enabling a substantial diversification of gas suppliers. In short ITGI will help increase gas market liquidity which is the basis for integrated gas and electricity markets.

Finally from a European stand ITGI appears as the most mature project in terms of licensing, risk minimization, engineering design and funding with the full involvement of key European institutions (i.e. EC – EEPR, EIB, EBRD). It must also be stressed that ITGI, unlike the other projects, enjoys the full support and cooperation of the governments of Turkey, Bulgaria, Greece and Italy. Consequently, ITGI is accepted at EU level as the system of pipelines which is most ready to undertake the task of bringing new gas supplies from the Caspian region to the European markets and keep supplying them at competitive market rates and with full security in terms of uninterrupted gas flow.

CHAPTER 8

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APPENDIX A

IEA'S SENSITIVITY ANALYSIS

Sensitivity analysis of gas demand[1]

While the assumptions underlying IEA's New Policies Scenario are all plausible, none appears to be infallible. Some factors may change markedly, with far-reaching consequences for energy demand and the share of gas in the energy mix. In view of these uncertainties, IEA tested the sensitivity of gas demand to certain changed assumptions, using the WEO- 2010 New Policies Scenario as the baseline.

This sensitivity analysis was carried out by re-running the World Energy Model (WEM), the principal tool used to produce global energy projections, for each new assumption in isolation (i.e. all other assumptions were unchanged). This allowed the researchers to quantify the sensitivity of gas demand to changes in each chosen factor: natural gas prices, oil prices and electricity mix. The assumptions were varied both positively and negatively from the levels assumed in the New Policies Scenario (Table 2.2). The sensitivity analysis was used to enhance understanding of the effects of different drivers.

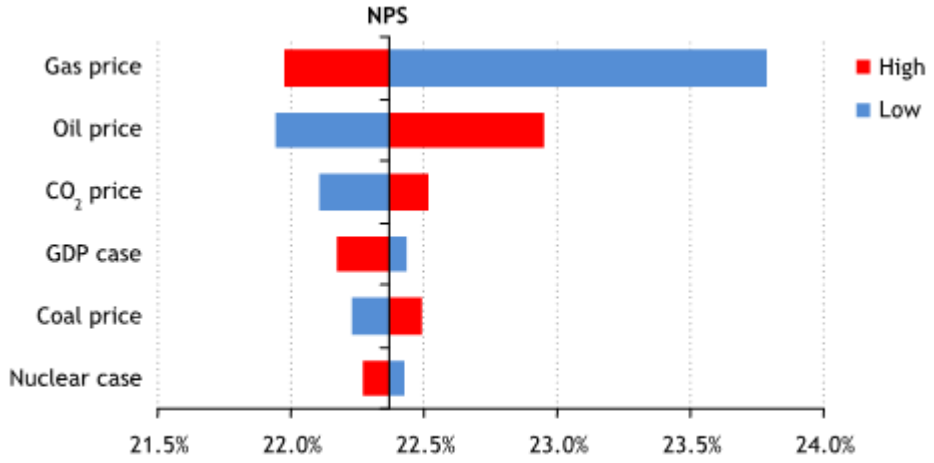
Table 2.2:
Summary of sensitivity cases and assumptions relative to the WEO-2010 New Policies Scenario

Variable	Assumptions (between 2009 and 2035)	
	Low case	High case
Gas price	The increase in prices in all regions is reduced by 67%.	The increase in prices in all regions is raised by 33%.
Oil price	The increase in the international crude oil price (average IEA crude oil imports) is reduced by 33% (resulting in lower refined product prices).	The increase in price is raised by 67%.
Coal price	The increase in the international steam coal price (OECD imports) is reduced by 67%.	The increase in price is raised by 67%.
CO_2 price	In all regions where carbon pricing is assumed to be introduced, the increase in price to 2035 is reduced by 100% of the increase in the EU carbon price.	In all regions where carbon pricing is assumed to be introduced, the increase in price to 2035 is raised by 100% of the increase in the EU carbon price.
GDP growth	The rate of GDP growth is 0.5% per year lower in all regions.	The rate of GDP growth is 0.5% per year higher in all regions.
Nuclear power	The global gross capacity additions are reduced by 10% (no change in the assumed lifetimes of existing plants).	The global gross capacity additions are raised by 10% (no change in the assumed lifetimes of existing plants).

[1] International Energy Agency, "*Are we Entering a Golden Age of Gas? : Special Report*", World Energy Outlook 2011

Across the range of these sensitivities, the share of gas in world total primary energy demand in 2035 varies between 21.9% and 23.8% compared with 22.4% in the New Policies Scenario (Figure 2.3) and 25.3% in the GAS Scenario. The largest increase in market share occurs in the low gas price case, which stimulates gas demand at the expense of a drop in demand for competing fuels. The largest drop in the share of gas occurs in the low oil price case, due to much higher oil demand (which has the effect of pushing up total primary energy demand) and a small reduction in gas use (which is a result of less switching from oil to gas).

Figure 2.3:
Share of gas in world primary energy demand in the sensitivity cases, 2035

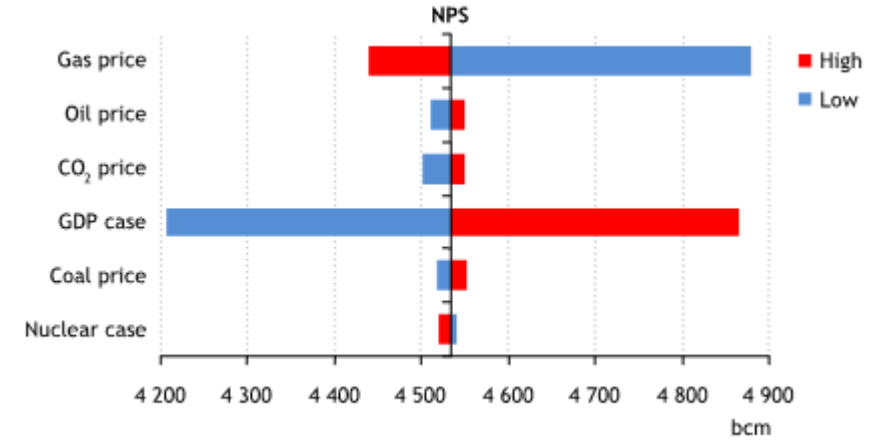


Note: NPS is New Policies Scenario.

Global primary gas demand increase most in the high GDP growth and under low gas prices. Correspondingly, gas demand falls most in the low economic growth and high gas price cases (Figure 2.4). Gas demand in 2035 ranges between 4,2 tcm (in the low GDP price case) and 4,9 tcm (in the high GDP and low gas price cases), compared with 4,5 tcm in the New Policies Scenario. Gas demand in power generation and industry reacts most to varied rates of GDP growth, reflecting the strong relationship of those sectors to the level of economic activity. The power sector proves to be the most sensitive to changes in gas prices. This is the result of two combined effects: the changing for electricity and the changing fuel mix used to produce this electricity. Gas prices strongly influence merit order (the dispatching of power plants typically on an hourly basis, based on their running costs) and, in the long term, changes in investments decisions. Surprisingly demand for gas is hardly affected by changes in oil and carbon prices. Gas demand is also unaffected by reducing the share of nuclear power in the electricity mix. In this case, fewer new nuclear plants are built in

non- OECD countries, where most of the growth in nuclear capacity is expected and cheaper coal usually fills the gap.

Figure 2.4:
Global primary gas demand in the sensitivity cases, 2035

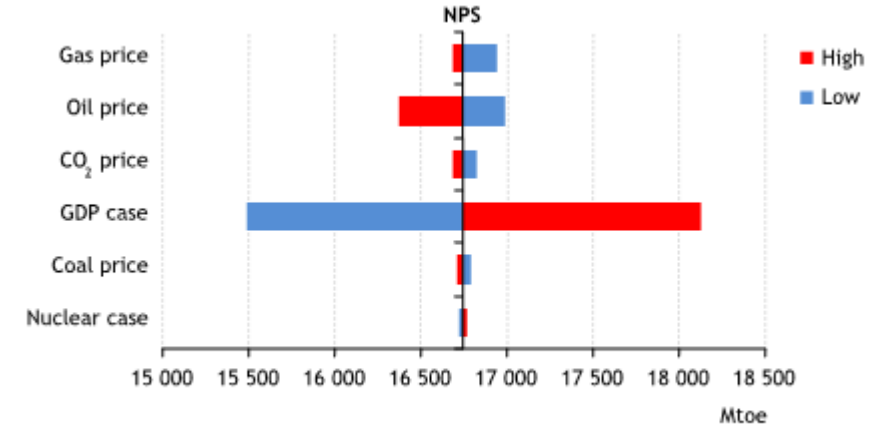


Note: NPS is New Policies Scenario.

Global primary energy demand is also affected most by changes in the GDP (Figure 4.5). World total primary energy demand in 2013 ranges from 15 500 million tones of oil equivalent (Mtoe) in the low GDP case to 18 150 Mtoe in the high GDP case – these represent a –7.5% and +8.3% change, respectively –relative to the New Policies Scenario baseline. Higher or lower levels of economic activity directly influence overall global energy needs. Oil and coal demand are most sensitive to changes in the rate of economic growth, followed by gas. The sensitivity of oil consumption arises because the transport sector accounts for the majority of oil demand and the rate of vehicle purchase and use depends highly on economic growth. Likewise, electricity demand is highly responsive to economic activity and is the primary driver of coal demand, especially in the emerging economies, where GDP growth is highest. Changes in oil prices, through their direct impact on oil demand, also have a relatively large impact on primary energy demand.

Figure 2.5:

Global total primary energy demand in the sensitivity cases, 2035



Note: NPS is New Policies Scenario.

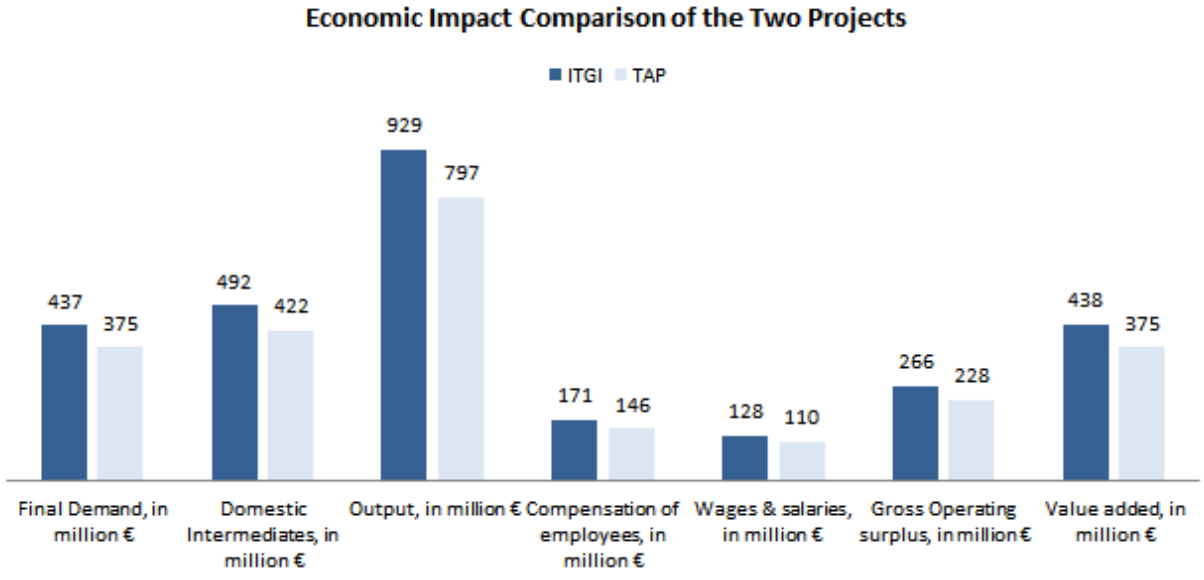
APPENDIX B

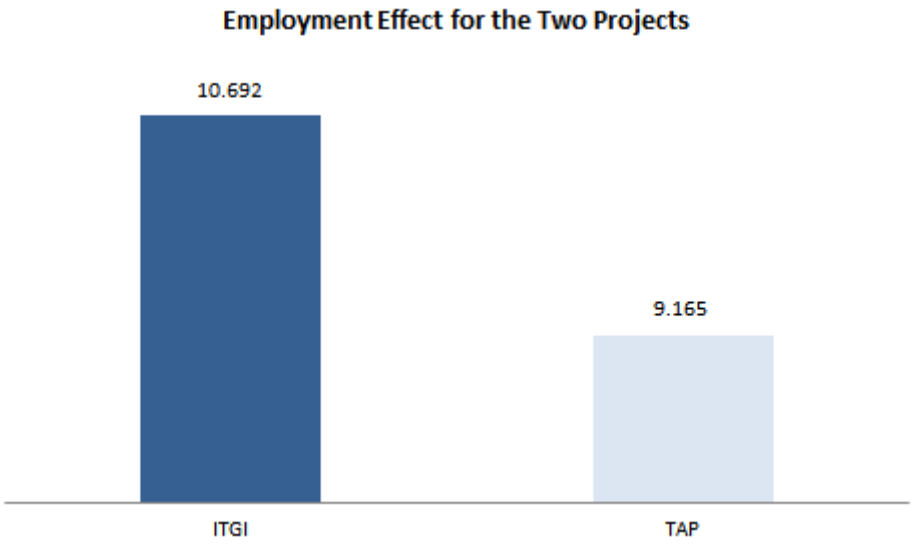
ECONOMIC INPUT – OUTPUT ANALYSIS DATA

The following analysis is based upon Input-Output Analysis of the economic activity of 59 industry sectors of the Greek economy. Its results are based on the TYPE II approach that include TYPE I effects plus the induced effects caused by endogenizing household spending to the model, which generates from the direct and indirect effects on the economy. The construction of the model was based upon Eurostat's "Manual of Supply, Use and Input-Output Tables" and the relative data were drawn by the New Cronos database (Eurostat's database). In brief, by cross – comparing the ITGI and TAP projects in the model, the following results surfaced.

TYPE II Economic Impact for Construction Period

	Domestic Production Effects			Income Effects				
Projects	Final Demand, in million €	Domestic Intermediates, in million €	Output, in million €	Compensation of employees, in million €	Wages & salaries, in million €	Gross Operating surplus, in million €	Value added, in million €	**Employment Effects**
ITGI	437,15	492,15	929,30	170,69	128,10	265,53	438,01	10.692
TAP	374,70	421,85	796,55	146,31	109,80	227,60	375,44	9.165
Differential	62,45	70,31	132,76	24,38	18,30	37,93	62,57	1.527





Comparison of the two projects in view of their economic impact during their construction phase reveals that ITGI project has more positive economic impact than TAP. In detail ITGI project will generate:

- ITGI returns more than TAP by 62.57 million euro in Value Added terms
- 62.45 million euro more demand increase
- Domestic transactions or flows between industries will be by 70.31 million euro via ITGI's implementation
- Final industry output will be by 132.76 million more than TAP
- Employees will be more compensated by ITGI than TAP. In terms of Wages and Salaries, ITGI's construction will result to 18.3 million euro for workers in excess of TAP.
- Industries will benefit more by ITGI's construction by 37.93 million euro.
- Finally, the construction of the two projects is expected to create a ripple effect in the economy that can be translated in an increase of the employment throughout the economy by 10.692 people due to ITGI's construction. TAP's corresponding result is 9.165.

As stated above, results incorporate all three kinds of effects; Direct, Indirect (Business spending) and Induced effect (Household spending).

The following two tables summarize model's results for the anticipated economic impact for each project to be undertaken.

ITGI, by Industry TYPE II Economic Impact

Industries	Domestic Production Effects			Income Effects				Employment Effects, in 1000 persons
	Final Demand, in million €	Domestic Intermediates, in million €	Output, in million €	Compensation of employees, in million €	Wages & salaries, in million €	Gross Operating surplus, in million €	Value added, in million €	
Products of agriculture, hunting and related services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Products of forestry, logging and related services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Fish and other fishing products; services incidental of fishing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Coal and lignite; peat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Uranium and thorium ores	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Metal ores	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other mining and quarrying products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Food products and beverages	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tobacco products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Textiles	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Wearing apparel; furs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Leather and leather products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pulp, paper and paper products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Printed matter and recorded media	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Coke, refined petroleum products and nuclear fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Chemicals, chemical products and man-made fibres	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Rubber and plastic products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other non-metallic mineral products	5,85	7,77	13,62	2,24	1,69	3,29	5,53	0,13
Basic metals	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Fabricated metal products, except machinery and equipment	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Machinery and equipment n.e.c.	34,30	37,29	71,59	12,54	9,87	15,47	28,04	0,88
Office machinery and computers	1,00	1,42	2,42	0,52	0,41	0,50	1,02	0,05
Electrical machinery and apparatus n.e.c.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Radio, television and communication equipment and apparatus	1,98	3,13	5,11	1,23	0,97	0,88	2,12	0,06
Medical, precision and optical instruments, watches and clocks	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Motor vehicles, trailers and semi-trailers	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other transport equipment	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Furniture; other manufactured goods n.e.c.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Secondary raw materials	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Electrical energy, gas, steam and hot water	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Collected and purified water, distribution services of water	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Construction work	227,51	271,93	499,44	79,37	60,06	132,99	212,68	6,06
Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Wholesale trade and commission trade services, except of motor vehicles and motorcycles	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Hotel and restaurant services	1,16	1,07	2,23	0,29	0,23	0,86	1,15	0,03
Land transport; transport via pipeline services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Water transport services	3,65	1,99	5,64	0,48	0,39	2,30	2,78	0,03
Air transport services	4,06	2,82	6,88	0,89	0,70	2,53	3,43	0,04
Supporting and auxiliary transport services; travel agency services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Post and telecommunication services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Financial intermediation services, except insurance and pension funding services	84,20	87,65	171,85	43,02	29,33	53,72	98,03	1,50
Insurance and pension funding services, except compulsory social security services	26,04	37,53	63,58	14,68	10,92	15,35	30,08	0,69
Services auxiliary to financial intermediation	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Real estate services	6,42	1,62	8,03	0,41	0,31	6,00	6,42	0,02
Renting services of machinery and equipment without operator and of personal and household goods	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Computer and related services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Research and development services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other business services	1,25	2,25	3,50	0,88	0,68	0,61	1,49	0,06
Public administration and defence services; compulsory social security services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Education services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Health and social work services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sewage and refuse disposal services, sanitation and similar services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Membership organisation services n.e.c.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Recreational, cultural and sporting services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other services	39,72	35,68	75,40	14,14	12,52	31,04	45,22	1,15
Private households with employed persons	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total	**437,15**	**492,15**	**929,30**	**170,69**	**128,10**	**265,53**	**438,01**	**10,69**

TAP, by Industry TYPE II Economic Impact

Industries	Domestic Production Effects			Income Effects				Employment Effects, in 1000 persons
	Final Demand, in million €	Domestic Intermediates, in million €	Output, in million €	Compensation of employees, in million €	Wages & salaries, in million €	Gross Operating surplus, in million €	Value added, in million €	
Products of agriculture, hunting and related services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Products of forestry, logging and related services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Fish and other fishing products; services incidental of fishing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Coal and lignite; peat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Uranium and thorium ores	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Metal ores	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other mining and quarrying products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Food products and beverages	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tobacco products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Textiles	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Wearing apparel; furs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Leather and leather products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pulp, paper and paper products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Printed matter and recorded media	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Coke, refined petroleum products and nuclear fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Chemicals, chemical products and man-made fibres	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Rubber and plastic products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other non-metallic mineral products	5,02	6,66	11,68	1,92	1,45	2,82	4,74	0,11
Basic metals	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Fabricated metal products, except machinery and equipment	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Machinery and equipment n.e.c.	29,40	31,96	61,36	10,75	8,46	13,26	24,04	0,75
Office machinery and computers	0,86	1,22	2,08	0,45	0,35	0,43	0,87	0,05
Electrical machinery and apparatus n.e.c.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Radio, television and communication equipment and apparatus	1,70	2,68	4,38	1,06	0,83	0,75	1,81	0,05
Medical, precision and optical instruments, watches and clocks	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Motor vehicles, trailers and semi-trailers	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other transport equipment	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Furniture; other manufactured goods n.e.c.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Secondary raw materials	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Electrical energy, gas, steam and hot water	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Collected and purified water, distribution services of water	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Construction work	195,01	233,08	428,09	68,03	51,48	113,99	182,30	5,20
Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Wholesale trade and commission trade services, except of motor vehicles and motorcycles	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Hotel and restaurant services	0,99	0,92	1,91	0,25	0,20	0,74	0,99	0,03
Land transport; transport via pipeline services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Water transport services	3,13	1,71	4,84	0,41	0,34	1,97	2,38	0,02
Air transport services	3,48	2,41	5,90	0,77	0,60	2,17	2,94	0,03
Supporting and auxiliary transport services; travel agency services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Post and telecommunication services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Financial intermediation services, except insurance and pension funding services	72,17	75,13	147,30	36,87	25,14	46,04	84,03	1,29
Insurance and pension funding services, except compulsory social security services	22,32	32,17	54,49	12,58	9,36	13,16	25,79	0,59
Services auxiliary to financial intermediation	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Real estate services	5,50	1,39	6,89	0,35	0,27	5,14	5,51	0,02
Renting services of machinery and equipment without operator and of personal and household goods	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Computer and related services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Research and development services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other business services	1,07	1,93	3,00	0,76	0,59	0,52	1,28	0,05
Public administration and defence services; compulsory social security services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Education services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Health and social work services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sewage and refuse disposal services, sanitation and similar services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Membership organisation services n.e.c.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Recreational, cultural and sporting services	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other services	34,05	30,58	64,63	12,12	10,73	26,61	38,76	0,98
Private households with employed persons	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total	**374,70**	**421,85**	**796,55**	**146,31**	**109,80**	**227,60**	**375,44**	**9,16**

1. Indicators and multipliers

In the general neoclassical microeconomic approach, the production functions relate the amounts of inputs used by a sector to the maximum amount of output that could be produced by that sector with those inputs.

xj = f(xij, Lj, Cj) Production function

xj = output of sector j (products)

xij = interindustry flow (goods, services) from sector i to sector j (intermediates)

Lj = labour requirements of sector j

Cj = capital requirements of sector j

f = technology

2. Indicators

In input-output analysis a fundamental assumption is that for a given period the interindustry flows of products (xij) from sector i to sector j and primary inputs (L, C) depend on the total output of sector j (xj). If we assume constant returns to scale and fixed relations of all inputs, a set of technical input coefficients reflects the technology. In most productions not only different products but also different skills of labor and different types of capital goods are required. Therefore, the set of input coefficients in a broader notation of matrix A encompass input coefficients for products (intermediates), capital, and labor (primary inputs).

aij = zij/xj Technical input coefficients

aij = input coefficient

zij = input of type i in sector j (products, capital, labour)

xj = output of sector j (product)

Using the definitions of the technical input coefficients, production can be specified in the following form:

xj = min(z1j/a1j, z2j/a2j, ….. , znj/anj) Leontief production function

3. Multipliers

Three of the most frequently used types of multipliers in input-output analysis are those that estimate the effects of the exogenous changes of final demand (consumption, investment, exports) on

- outputs of the sectors in the economy,
- value added and income earned by the households, and
- employment that is expected to be generated by the new activity levels.

3.1. Output multipliers

An output multiplier for a sector j is defined as the total value of production in all sectors of the economy that is necessary at all stages of production in order to produce one unit of product j for final demand. The output multiplier corresponds to the column sum of the inverse.

If a government agency, for example, were trying to determine in which sector of the economy to spend an additional Euro, a comparison of output multipliers would indicate where this investment has the greatest impact in terms of total Euro value of output (cumulative revenues) generated throughout the economy.

Output multiplier is defined as:

$$Oj = \Sigma \alpha ij \text{ , } i=1$$

The output multiplier (cumulative revenues) represents for each industry one unit of final demand and the direct and indirect requirements for domestic intermediates. Multipliers of this sort may overstate the effect on the economy in question if some sectors are operating at full capacity and a substitution of input takes place.

3.2. Income multipliers

Income multipliers attempt to identify the impacts of final demand changes on income received by households (labour supply). The central equation of the static input-output models is used to calculate the direct and indirect requirements for wages which are incorporated in one unit of

output for final demand. This calculation is equivalent to an assessment of the wage content of products.

(63) $Z = B(I-A)^{-1}$ Direct and indirect requirements for wages

B = vector of input coefficients for wages

I = unit matrix

A = matrix of input coefficients for intermediates

Z = vector with results for direct and indirect requirements for wages

3.3. Employment multipliers

When employment multipliers are calculated, the major difference to the calculation of the wage content of products is that this time physical labour input coefficients are used instead of monetary labour input coefficients.

(64) $Z = E(I - A)^{-1}$ Direct and indirect requirements for labour

E = matrix of input coefficients for labour (1.000 persons per millions of DEM of output)

Z = matrix with results for direct and indirect requirements for labour (persons)

References

1. Eurostat, “Manual of Supply, Use and Input-Output Tables”, http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-RA-07-013

2. Scottish Input-Output Tables: Methodology Guide, http://www.statisticsauthority.gov.uk/assessment/code-of-practice/codeof-practice-for-official-statistics.pdf

3. The Washington Input-Output Tables, http://www.ofm.wa.gov/economy/io/

APPENDIX C

THE ALBANIAN FACTOR IN THE RISK ASSESSMENT OF TAP

The influence that Albania has in the TAP Corridor's Assessment was widely anticipated, given the fact that Albania is a country in transition[1]. The indices used indicate that the country presents serious internal problems, slowing down the modernization process. A discussion of the various risk factors considered follows:

- **Energy Risk (84,92):** Albania's energy imports (97% of which are oil products) skyrocketed to 50% of total primary energy supply (TPES) in 2005, compared to 11% in 1990. Albania's Energy Strategy projects a dramatic rise in import dependence. Albania's oil market is liberalized but is still affected by product smuggling, fuel quality issues and only partial collection of tax revenues. The administration lacks the financial resources to regulate the sector and ensure accountability, notably to monitor effective competition condition. In addition, the energy system in Albania is under considerable stress for several reasons. In 1990, Albania emerged from the previous regime with outdated energy technology and an energy infrastructure that had depreciated considerably due to inadequate investment and maintenance. In recent years, individual components of the electricity system have been further stressed by the rapid increase in energy demand and by structural transformation, as well as by increased consumption of energy imports (at international prices), as domestic supplies decline. Supply bottlenecks and demand imbalances (due, in part, to excessive electricity use for heating and to non-payment) have constrained electricity supply and harmed the stability of the grid (IEA, 2008).

- **Political Risk (52,15):** Since the Parliamentary elections in June 2009 Albania finds itself in a political crisis. The election campaign was characterized by polarized political climate and violations, including almost daily incidents between rival political gangs and clashes ranging from minor scuffles to exchanges of gunfire between supporters, the bombing of an opposition candidate's home in Tirana and the death of two people, which undermined public confidence in the electoral process. Additionally, Transparency International ranked the

[1] *"Economic and Socio-Political Risk Assessment for ITGI and TAP Natural Gas Pipeline Projects"*, School of Electrical and Computer Engineering, Decision Support Laboratory, National Technical University of Athens 2011 (www.epu.ntua.gr).

country in 2006 at the 111th place among 163 countries, with a corruption perception index ranging between 2,4 and 3 out of 10 (higher values indicate lower corruption). Corruption in Albania not only has devastating effects on the incomes of the population, it also ruins the foundations of democracy in the country. Therefore, the need for tackling corruption and fostering a democratic political culture has been highlighted (European Forum for Democracy and Solidarity, 2011).

- **Social Risk (45,02):** The UNDP's Human Development Index of 2006 (combination of wealth and quality of life) ranks Albania at place 73, leaving behind other European countries like Ukraine, Turkey, the three South Caucasus republics and Moldova. The index reflects the major social progress in Albania, which in 2003 was at place 95 in the same index. Nevertheless, parameters such as confidence in the electoral process, corruption and developing media freedom demand further reform as they remain serious drawbacks. In its Progress Report, the EC suggests that Albania should foster the freedom of media and expression by adopting new laws on defamation, media ownership and press freedom which are fully in line with the international standards (European Forum for Democracy and Solidarity, 2011).

- **Economic Risk (29,80):** Albania has achieved strong economic growth over the past five years, driven mainly by the services and construction sectors and reflecting significant diversification of the economic base, while the agricultural sector remains the largest source of employment. The government has taken steps to enhance the business environment and has adopted broad structural reforms to foster growth in the private sector. Although foreign direct investment has increased in recent years, levels still remain among the lowest in the region. Albania's overall economic freedom is constrained by weak property rights and pervasive corruption. The weak property rights are largely a result of political interference in the judiciary (The Heritage Foundation, 2011).