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Part 1. Energy Demand and Supply Current and Future Trends in Europe and the CIS region

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EU Eastern Neighborhood:
Economic Potential and Future Development

Work-Package 5

COOPERATION IN THE ENERGY SUPPLY FIELD

Part 1. Energy Demand and Supply Current and Future Trends in Europe and CIS Region

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Introduction

Energy and transport are at the core of many of the issues affecting Europe's current well-being and long-term international competitiveness. Energy problems due to expansion of energy consumption and increase of geopolitical imbalance between supply and demand, that world faces in the XXI century, begins with expanding economy, growing population and rising standards of living.

In the presidential conclusion of the Brussels European Council (23/24 March, 2006) it is stressed that "Europe is facing a number of challenges in the energy field: the ongoing difficult situation on the oil and gas markets, the increasing import dependency and limited diversification achieved so far, high and volatile energy prices, growing global energy demand, security risks affecting producing and transit countries as well as transport routes, the growing threats of climate change, slow progress in energy efficiency and use of renewable power-carriers, the need for increased transparency on energy markets and further integration and interconnection of national energy markets with the energy market liberalization nearing completion (July 2007), the limited coordination between energy players while large investments are required in energy infrastructure" (Council of the European Union, 2006).

European economies are becoming increasingly dependent on imported energy commodities, raising their supply risk and sustainability of future supplies and the geopolitical balance.

Green Paper of March 2006 is an excellent document describing the actual problems of sustainability, competitiveness and security of energy for EU-25. Growing dependence of EU on imported energy resources is considered as a threat for three reasons: too high dependence on import (up to 70% of energy and 80% of gas) by 2030; too high import from 3 neighbor countries; high prices affecting competitiveness. These challenges are common to all of Europe.

Stabilization of prices, development of a long-term prognosis, infrastructure improvement and sufficiency for power-carriers supply, increase of suppliers reliability – all these issues are of immense importance for energy security.

Uneven location of power resources, difference in development levels and characteristics of energy sector determine development of countries and companies interests. These challenges, if allowed to aggravate, will inevitably undermine economy, standards of living and national security.

It is beyond dispute today that prosperity and way of life of every nation are conditioned by energy use. This makes sense to strengthen energy cooperation and security of EU through future development of energy markets and diversity of its energy resources supply. To support economic development the EU needs steady, reasonably priced and sustainable energy supplies.

The energy security challenges differ between consumer and producer countries. This may somewhat complicate the relations between the two groups. Also, it is worth stressing that up till now there has not been any unified EU energy policy. Additionally, in many producer countries the state plays a very important role, often as an owner of major producers of energy commodities. This further complicates the dialogue, due to somewhat different objectives and powers of private companies, and national governments.

Differences between the interests of parties are linked not so much to current problems of prices and supplies (although a few such disagreements was recently observed in the CIS region), but rather to assurance of future supplies, returns on investment and pricing mechanisms.

Several oil and gas exporting countries are very much dependant on revenues from this single sector, with insufficient diversification of their economies. On the other hand, potential problems with securing sufficient energy commodity supplies would risk economic stability and development of energy importing countries.

Approaches to solution of the energy problems are different.

The first one can address the problem of sustainability of the current energy markets, lack of confidence between energy importers and exporters in respect to reliability of future deliveries, conflicts around transit of power resources and other current problems.

For the EU states it is more efficient to deal with the countries, which have achieved political stability and in which oil and gas are produced by private companies (Grigoriev, 2006). But, actually highest reserves of hydrocarbons are in the countries where state-owned companies are operating in this field. Russia is one of such examples.

Another direction may focus on studying long-term prognosis and prospects of energy production and energy consumption, determination of their influence on economic growth and the need to diversify energy sources and transit routes. This is the field where we should look for future answers.

All these issues are under active discussion and require solution to provide mankind with energy resources for economic and social development. They should be resolved taking into consideration requirements of long-term political, economic, social and environmental sustainability. Consequently, it will determine energy sector and economy throughout the XXI century.

The geographical scope of this paper covers the whole European continent and the former Soviet Union countries but the focus is mostly on current EU member states and large CIS energy commodity producing countries.

Major tasks of the paper are:

- to asses the existing trends of energy consumption and imports trends (mostly oil and gas),
- to develop scenarios of future energy needs of EU,
- to study on production and export potential of major CIS oil and gas producers,
- to enlighten proven and probable commodities reserves and
- to review existing and planned transportation infrastructure.

According to this tasks, the first section analyses the oil and demand trends and forecasts in EU, second and third sections examine Russian and Caspian energy supply and potential resources. Last section characterizes transportation options, infrastructure capacity trends and prospects.

The work on this paper will be continued in the second year of implementation of ENEPO project. It will consist of an analysis of:

- existing and potential obstacles to intensified trade in energy commodities,
- existing barriers to enlarge FSU production and export potential to the EU,
- barriers to investment in an energy sector,
- geopolitical characteristics of relations between commodity producing countries and "transit countries" of the CIS,
- alternative transportation infrastructure in EU and its political challenges.

As a consequence comprehensive analyses can contribute to determining of the best policy and best prospects of energy security in EU countries, the sustainable production expansion in CIS producer countries, and security of the transportation routes.

1. Energy Demand Current and Future Trends in Europe: Focus on Oil and Gas

Europe is entering a new energy era. EU energy demand continues an upward trend while energy resources are limited. Consequently, the EU is increasingly dependent on external sources of energy. In 2004, its import dependency for oil amounted to 92.4 and for gas 74.9 percent,[1] and certain to rise, with hydrocarbon reserves running down. Energy become more expensive, and huge investment is needed over the next years to maintain and increase production capacity and replace ageing infrastructure in order to meet expected energy demand increases.

[1] Source: Enerdata Yearbook l book 2005.BP. Statistical Review. Dependence on import is calculated as a share of import of energy commodities in internal consumption of a country or region.

1.1. Current Trends in Oil and Gas Demand in Europe

1.2.1. Oil

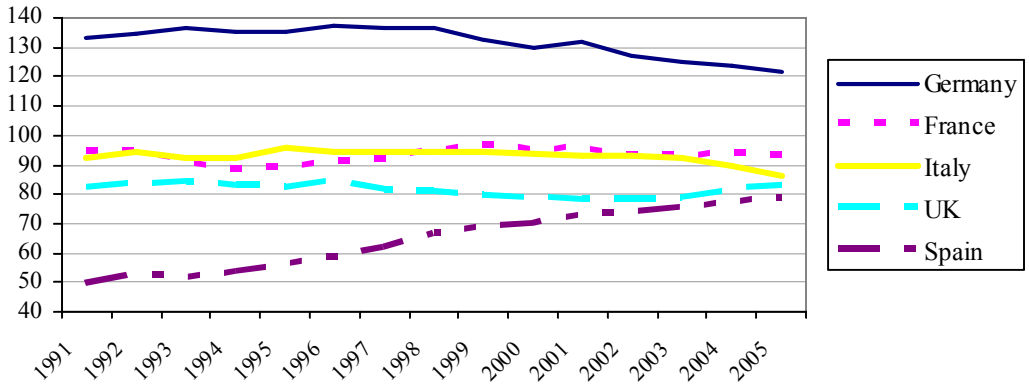
Between 1991 and 2005 oil demand in the EU expanded at an annual rate of 0.5%, on average, much slower than in other parts of the world (1.6% average annual growth in North America, 3.5% growth in Asia and Pacific region). In the recent years demand growth seems to have moderated even further, to the average of 0.4% annually between 1999 and 2005[2]. EU27 accounted for around 19% of total global oil consumption in 2005.

Oil consumption in the whole European continent and the former Soviet Union (FSU) region taken together actually declined quite substantially between 1991 and 2005, by 1% annually on average. This is explained by the major decline in oil consumption in the FSU taking place between 1991 and around 2000 when the consumption reached the trough. In Russia, oil consumption roughly halved between 1990-1991 and 2000-2001, in Kazakhstan the consumption level in 1999 was one third of those from 1990-1991 and in Ukraine 2000 consumption was only 20 percent of the 1990 level.

The demand trends differed quite substantially among the EU economies and other European countries. Germany, the largest EU consumer has seen its demand rising somewhat between 1990 and 1996 while the last decade brought a gradual but consistent decline. Between 1999 and 2005 demand was declining by 1.4% annually, on average. In France, Italy and the UK demand was broadly flat over the last 15 years. In contrast, Spain witnessed a rapid rise in oil consumption, by 3.4% annually, on average (see Figure 1.1). These five countries account for roughly two thirds of the total EU27 demand.

Figure 1.1. Oil Consumption in Large EU Economies, 1991-2005 (million tons)

[2] Calculations presented in this section are based on BP (2006) data.



Source: BP (2006).

Among other EU economies, Benelux countries have seen fast increase in oil consumption since 1991, accelerating to 3.4% annually over the period 1999-2005. By 2005, Netherlands, Belgium and Luxembourg together accounted for 12% of total EU demand. The trends in other countries were mixed. Poland, Greece, Austria have seen their consumption increasing most of the time throughout the last 15 years, in Romania demand fluctuated substantially mirroring volatile economic growth to rebound over the last 5 years, while Sweden and Hungary have seen generally declining trends.

Apart from EU and FSU, countries Turkey, Switzerland and Norway belong to the group of large European consumers. Turkey exhibited rising, albeit volatile trend, while demand in Norway, after increases during 1990s started to decline in most recent years and oil consumption in Switzerland was very slowly declining over the last 15 years.

2.2.1. Natural Gas

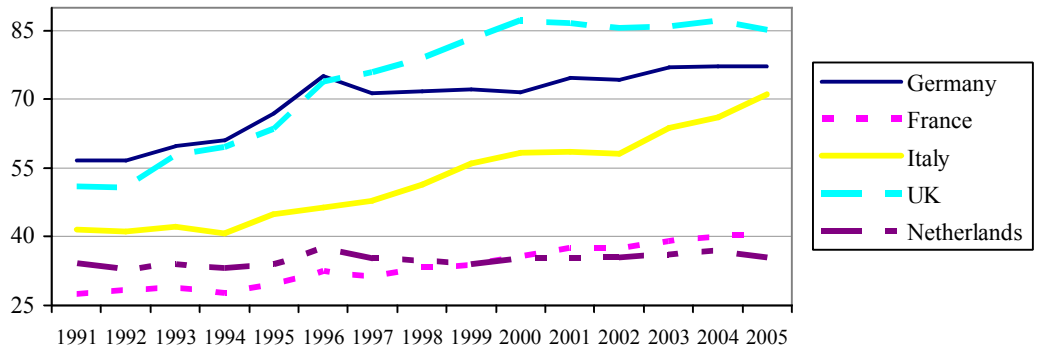
Between 1991 and 2005 gas demand in the EU expanded at an annual rate of 2.8%, on average, slightly above the global growth rate (2.2%). In the recent years demand growth seems to have moderated somewhat, to the average of 2.4% annually between 1999 and 2005. EU27 accounted for around 18% of total global gas consumption in 2005[3].

[3] Calculations presented in this section are based on BP (2006) data.

Gas consumption in the FSU was still some 20% above EU27 level in 2005, down from double the EU level back in 1991. Extremely high reliance on gas in FSU countries, compared to other regions in the world is explained by abundant gas reserves in Russia and several Central Asian countries and prevalence (until recently – 2005-2007, in some cases: Ukraine, Georgia, Moldova, Belarus) of very low import and domestic prices. In contrast to oil, a decline in consumption of natural gas in FSU was more muted and since 1997 one observes a continued increase averaging 1.8% annually during 1999-2005.

Gas demand has been growing in almost all EU countries, but the dynamics differed between member states. UK, the largest EU consumer has seen stagnation of demand since 1999 (0.4% annual growth during 1999-2005) after a period of rapid increase during 1990s. In Germany, after strong growth till 1996 gas consumption slowed down to see some rebound more recently (1.2% annual growth during 1999-2005). In contrast, demand dynamics in Italy and France has stayed high during the last 15 years averaging at 3.9% and 2.8% annually since 1991, respectively. Netherlands, another large consumer has seen its demand broadly stable since 1991 (see Figure 1.2). These five countries accounted for 70% of EU27 gas demand in 2005 (but well below gas consumption of Russia alone).

Figure 1.2. Gas Consumption in Large EU Economies, 1991-2005 (million tons)



Source: BP (2006).

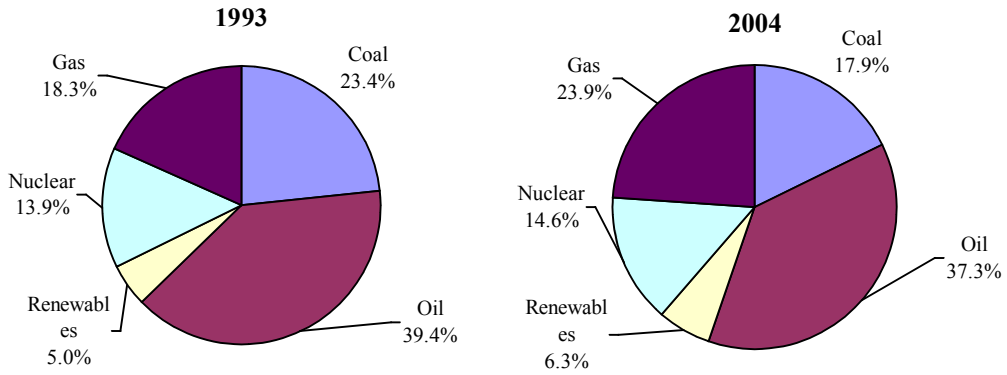
Among other EU economies, demand growth was very fast in Spain (12.6% annually since 1991) where gas increased its role in the energy mix from insignificant in early 1990s to 18% of the total energy supply in 2004. Belgium, Poland and Hungary have also seen a continued increase in consumption, to the tune of 2.5-4% annually. Slovakia and Sweden are the only EU27 countries with demand declining since 1999.

Apart from EU and FSU countries, only Turkey is a significant European consumer of gas, with new import pipeline infrastructure allowing for demand growing at nearly 15% annually since 1999.

3.2.1. Oil and Gas in the Energy Mix

Oil dominates in the EU energy mix with a share of above 37%, just below the world average of around 40%. Between 1993 and 2004 the importance of oil in the total EU energy consumptions stayed broadly stable. One major change in the structure of consumptions was related to the decline in the importance of coal (from 23.4% down to below 18%) and a fast rise in natural gas consumption – from just above 18% to almost 24% share in the energy mix. Nuclear energy accounted for around 14% of the total consumption while renewable sources of energy continued to increase, albeit from a low base – by 2004 they accounted for just above 6% of the total (Figure 1.3.)[4].

Diagram 1.1. EU25 Total Energy Consumption by Fuel, 1993 and 2004 (% shares)



Note: Data based on gross inland consumption figures calculated from primary production, trade, and changes in stocks. It corresponds to the addition of consumption, distribution, and transformation losses. Data for EU27 are almost identical to EU25.

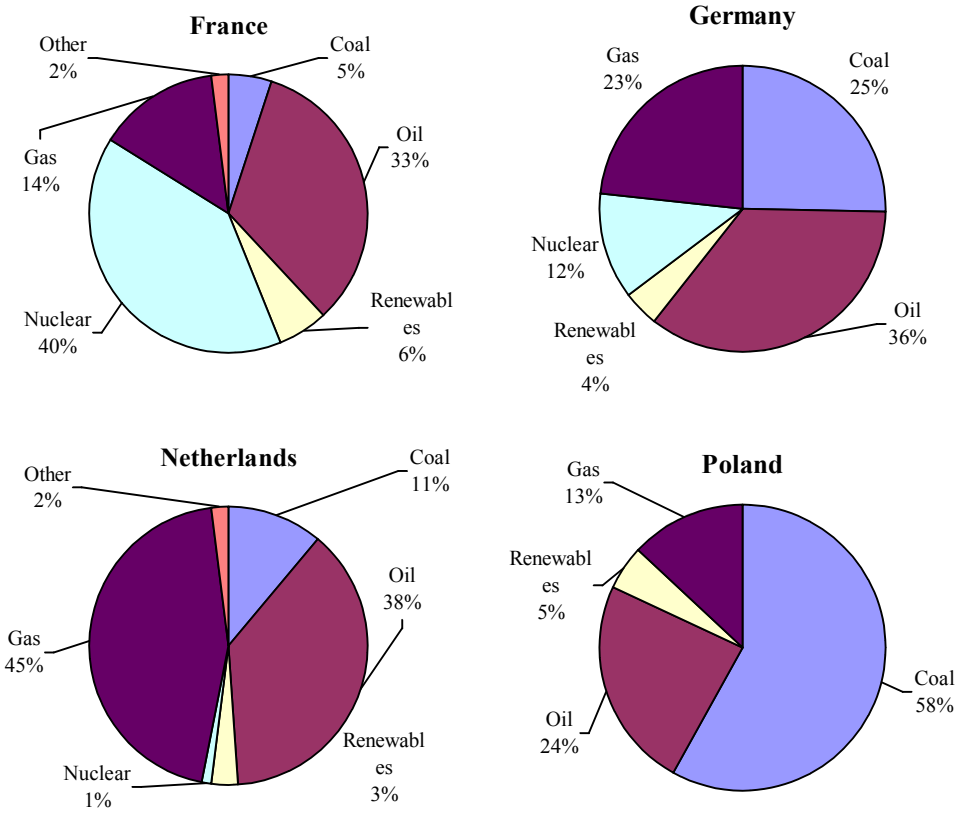
Source: Eurostat.

Energy mix in some FSU countries, notably Russia and Ukraine differs from the EU average in that natural gas plays a larger role. For example in Russia, gas accounted for 54% of the

[4] Unless indicated, data presented in this section come from the Eurostat database or European Commission documents based on Eurostat data.

2004 energy mix. Within the EU there is also substantial divergence in the relative importance of particular energy resources. To illustrate the scale of differences one can compare Netherlands mostly relying on natural gas - 45% of total energy consumption and oil – 38% with France where nuclear sources dominate with a 40% share (and oil accounts for 33%) and Poland where solid fuels account for as much as 58% of total energy mix, with small role of gas (13%) and no nuclear sources (Figure 1.4). In some smaller member states the proportions diverge even further from the EU average, e.g. Malta and Cyprus are almost entirely oil economies (100% and 94%, respectively).

Diagram 1.2. Energy Consumption by Fuel in Selected EU Member States, 2004 (% shares)

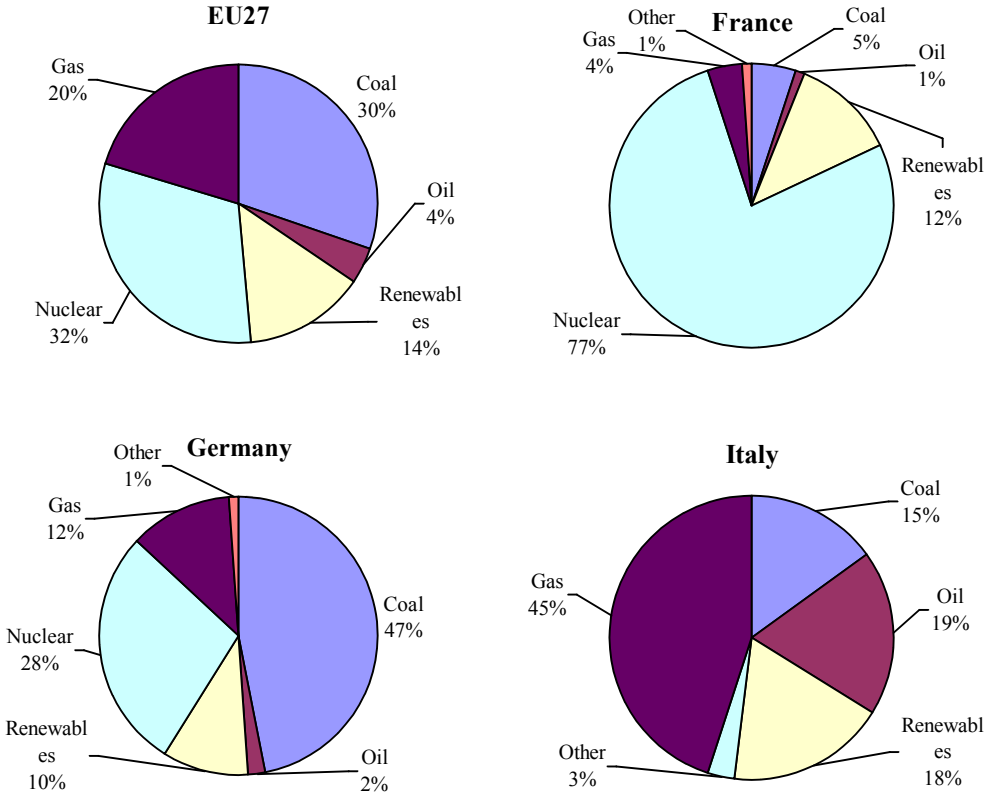


Source: European Commission Staff Working Document, EU Energy Policy Data SEC (2007) 12.

Such major differences in fuel intensity in total energy consumption are primarily related to very different patterns of electricity generation. It is illustrative to point out that while in France more than three fourth of electricity is produces in nuclear power plants, they do not exist in a number of other EU member states. Solid fuels account for almost half of German

and above 90% of Polish electricity generation while playing hardly any role in France for example. 63% of electricity in the Netherlands is produces from natural gas which accounts for less than 5% of electricity mix in the Czech Republic and Bulgaria. Renewables account for almost half of electricity mix in Sweden but just 4% in the UK (see also Figure 1.5).

Diagram 1.3. EU27 and Selected Member States' Electricity Mix, 2004 (% shares)



Source: European Commission Staff Working Document, EU Energy Policy Data SEC (2007) 12.

Between 1993 and 2004, most of the increase in electricity generation capacity in the EU25 came from natural gas-fired plants. Their electricity production more than tripled between 1993 and 2004, compared to almost flat generation from solid fuels-fired stations and hydro power plants, a minor increase in output of nuclear power stations, and a substantial decline in output of oil-fired stations. Output of power plants based on renewable resources (other than hydro energy), particularly wind and biomass increased sharply over the analyzed period (25 times and 3.4 times increase, respectively), although their share in total electricity production is still relatively small.

The data presented so far indicate that while patterns of natural gas consumption differ vastly between countries, the differences in the relative role of oil in total energy mix, while substantial, are of much smaller magnitude. This is explained by patters of use of oil and natural gas. The use of gas is diversified with electricity and heat generation accounting for close to 30%, residential consumption also close to 30%, industry accounting for close to 25% and the rest spread between other uses[5]. It is therefore clear that different industrial and electricity and heat generation patterns in European countries lead to major differences in the role of gas in the total energy mix.

The situation with oil is somewhat different due to the fact that its main use (roughly half of total consumption in the EU or more when maritime bunker is added) is currently in the transport sector. Oil is also used in the industrial sector, by households, in electricity generation plants and in agriculture, but these uses play a relatively small role[6]. From the perspective of oil demand trend an important observation is that so far there are hardly any economically significant alternatives for oil products in the transportation sector. In 2005, bio-fuels accounted for below 0.5% of total fuel consumption in most of the EU member states with only a few countries with slightly higher shares (around 3.5% in Germany) (European Commission Staff, 2007). The share of bio-fuels as an alternative energy, is expected to increase in the EU, possibly reaching around 5% by 2010. Recently, European Commission (2007) mentioned the 10% target by 2020, but it is uncertain whether this is realistic without causing major troubles for the agricultural sector.

While the role of oil products in the transport sector is unlikely to change substantially in the coming years or even decades substantial changes in the mix of fuels is already talking place. The key process is the rising relative demand for diesel and corresponding falling relative demand for gasoline. This results from fast growing popularity of diesel fuelled cars which currently account for around half of new car registration in Western Europe, up from below 20% in early 1990s (IEA, 2006a).

[5] IEA data pertaining to EU25 2004 consumption patterns.
[6] Oil is a very versatile energy resource and can also be used e.g. for electricity generation. This explains while some very small countries (e.g. islands of Cyprus and Malta) may rely almost entirely on oil. This does not contradict the main message from this paragraph which applies to countries with a somewhat diversified economic base.

1.2. Forecast of Oil and Gas Demand

1.2.1. Oil

This report presents the results of demand modeling exercise carried with an updated version of the CASE Advisors (2000) oil demand model. Interpretation of the forecast results requires understanding of the methodology and assumptions guiding the modeling. Their brief description is included below followed by presentation and discussion of results.

In the current version of the model we only present one 'baseline' scenario. Broadly speaking it assumes continuation and relative stability of relationships between aggregate economic activity measures, prices, and oil demand in European countries. In other words, in the forecast horizon, no major technological breakthrough is foreseen that could significantly limit the role of oil as a major fuel for the transport sector. Also, no major change in taxation and other policies is foreseen that could significantly impact the patterns of demand for transport services (e.g. by increasing the prices of fuels relative to public transport to significantly change patterns of passenger transport in Europe). Brief discussion on the impact of other sets of assumptions is included later in this section.

Forecast horizon is up till 2030, in line with the practice of the International Energy Agency and US Energy Information Administration. Database on historical annual oil demand is taken from the BP (2006).

The model comprises three main blocks: structural, trend and expert. The structural block models the demand for oil at country level with measures of aggregate economic activity (proxied by GDP), oil intensity, and international price levels. Following the typical findings from the literature (see e.g. Krichene, 2005), the structural model assumes very low price elasticity and significant income elasticity of oil demand. Future GDP growth path are based on assumptions concerning the speed of convergence within the non-FSU European economies and past performance in case of FSU countries.

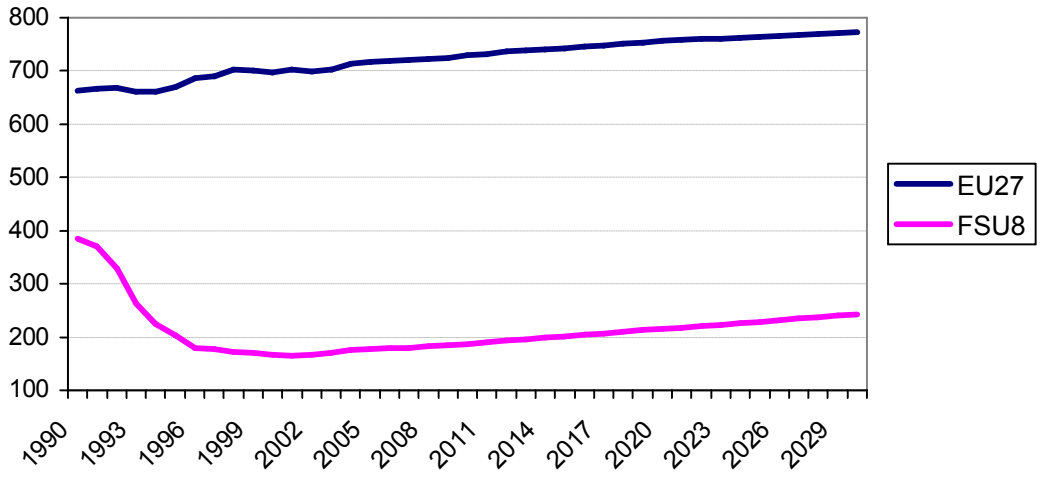
The trend block relies on a simple autoregressive model (estimated using the automated procedure of Neumaier and Schneider, 2001) to describe oil demand as functions of past data. The expert module uses the information from several large international models used at

major institutions, such as International Energy Agency, Energy Information Administration and European Commission (EIA, 2006; European Commission, 2006; IEA, 2005, 2006). 2006 figures are primarily based on preliminary monthly demand data published by International Energy Agency.

The forecasts are obtained as weighted averages from the results suggested by three model blocks with their relative importance differing at different forecast horizons (e.g. weights on the results from trend block concentrated on the short term forecast – up to 5 years).

Figure 1.6 and Table 1.1. present the key results of the forecast exercise. Total demand in Europe and FSU region is expected to increase at an average annual rate of 0.5% over the 2005-2030 period, with broadly similar dynamics over the whole forecast horizon. EU27 demand growth is expected to slightly slow down from the levels observed in the decade 1996-2005 (0.7% annually on average) to 0.3% annually over 2005-2030. FSU countries will see much stronger demand growth, at 1.2% annually during 2005-2030, although this still represents a significant decline in oil intensity of their economies compared to the period up till late 1990.

Figure 1.3. Oil Demand in EU27 and FSU8 – 1990-2030 (million tones per annum)



Note: EU27 comprises 27 EU member states as of 2007. FSU8 comprises the 8 largest oil consumers among CIS countries: Russia, Ukraine, Kazakhstan, Belarus, Belarus, Uzbekistan, Turkmenistan, Azerbaijan.
Source: BP (2006) and oil demand model.

Table 1.1. Average Annual Growth of Oil Demand – 1995-2030 (% per annum)

	Total Europe & Eurasia	EU27	FSU8
1995-2005	0.28	0.67	-1.31
2005-2010	0.5	0.3	1.0
2010-2020	0.6	0.4	1.4
2020-2030	0.5	0.2	1.2
2005-2030	0.5	0.3	1.2

Note: EU27 comprises 27 EU member states as of 2007. FSU8 comprises the 8 largest oil consumers among CIS countries: Russia, Ukraine, Kazakhstan, Belarus, Belarus, Uzbekistan, Turkmenistan, Azerbaijan. Total Europe & Eurasia comprises EU27, all CIS countries plus Albania, Bosnia-Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Gibraltar, Serbia and Montengro.
Source: BP (2006) and oil demand model.

The results of the baseline demand scenario presented above indicate that oil demand in Europe will grow at much lower pace than in other parts of the world. Europe's share in global consumption is set to decline. It is worth recalling that oil market is global in nature, i.e. oil price developments will be shaped by global demand / supply balance rather than developments in Europe.

In the above scenario (which produces similar results to some other larger forecasting projects carried e.g. by the IEA) Europe is characterized by relatively low oil demand growth compared to other economic centers. Still, the global oil (and more generally energy) demand path emerging from these models is widely described as unsustainable from the environmental perspective (and possibly also due to supply capacity/security issues). Rising global energy consumption and related CO_2 emissions are with all likelihood among the primary factors beyond the climate changes observed in recent decades (IPCC, 2007). This acts as a stimulus for governments and in particular the European Commission to introduce policy initiatives that could (1) limit the energy demand and (2) shift it towards cleaner energy sources. This in particular implies lower consumption of oil. In January 2007, the European Commission proposed "an integrated energy and climate change package" of

actions and targets that could achieve these two goals[7]. The coming month and years will likely see the hot debates between various stakeholders and will eventually lead to policy changes effectively reducing consumption of oil relative to the reference scenario. To get the flavor of the possible energy savings one could note that IEA (2005) Alternative Policy Scenario assumes 10% lower global oil demand in 2030 compared to the baseline. Most of the savings come from measures affecting transport sector. Europe is expected to play quite an important role with fostering improvements in efficiency of new vehicles, increasing the role of bio-fuels, and changes in patterns of passenger and freight transport.

2.2.1. Gas

Predicting future natural gas demand requires quite another approach from the one used in modeling oil demand. This is because gas use is diversified across sectors and in all these sectors there are substitutes for gas (unlike in case of oil in the transport sector). Second, gas consumed in Europe mostly comes from pipelines (despite growing role of LNG), indicating the very different character of the European gas market. Unlike oil, gas can only reach a particular destination provided there is sufficient capacity in the pipeline infrastructure. Gas demand is therefore loosely linked to economic developments that can be forecast with some degree of certainty (such as GDP growth) and more with government and private sector policies, and in particular investments in the transport infrastructure. For these reasons the discussion of likely future demand trends below is not based on the modeling exercise but it draws from existing analyses by other sources which are based on careful examination of announced and likely to be announced government policies and other factors determining availability and cost effectiveness of natural gas. The sources include IEA (2005), EIA (2006), Eurogas (2006), Honoré (2006), European Commission (2006) and European Commission Staff (2006).

According to all these sources, between now and 2030, gas demand in the EU is expected to increase significantly faster than oil demand. The expected average annual growth is in the range of 1.5%-2%, with somewhat faster growth between now and 2015 followed by more

[7] See http://ec.europa.eu/energy/energy_policy/index_en.htm for details.

muted gains between 2015 and 2030[8]. FSU region is also expected to see further increases in domestic demand (from already high current levels), but the dynamics may be slightly lower than in the EU/OECD economies – to the tune of 1.3%-2% annually, depending on the source.

Most of the demand gains is expected to come from the power generation sector. Also, among EU countries most of the gains (at least in the period until 2015) is in fact concentrated on just a few markets: Spain, Italy and the UK. Therefore, actual future path of gas demand will be to a large extent ultimately determined by the perceived economic viability of new gas-fired power plants in these and other European countries. For obvious reasons forecasted gas prices are playing an important role in this. The current practice is that gas prices are quite strongly related to oil prices, despite the fact that the two natural resources are no longer substitutes to any significant extent. In the environment of high global oil prices (and therefore also high gas prices in Europe) the viability of several new investment projects in gas-fired power generation may become less clear to investors, leading to delays in the project implementation.

Honoré (2006) carried an interesting bottom-up accounting exercise looking at particular gas-fired power generation projects in major EU gas consumers. The conclusions from this work are that up till 2015 a scenario with slightly slower increase in gas demand is more likely than suggested by most other sources. This is because of the delays or abandoning of some investment projects in the gas-based power generation. The most likely range of average annual growth in (non-FSU) European demand for gas is between 0.8% and 1.7% annually[9]. Assuming a stabilisation or even deceleration over the subsequent 15 years this would likely lead to the average of close to 1.3% or so over the whole 2005-2030 period, i.e. the bottom of the projection range.

We are inclined to believe that conservative growth forecasts for the EU are indeed more plausible. Apart from sustained high oil and gas prices, considerations related to supply

[8] Different sources present forecasts for somewhat differently defined groupings of countries. However, given the high concentration of gas demand on a few largest consumers in the EU and OECD, the results for dynamics of demand growth are hardly affected by changes of the region boundaries. Consequently, the results presented for the EU25 or EU27 can also be apply to all non-FSU European countries (among which only the OECD member country Turkey consumes significant amounts of natural gas).

[9] Preliminary and incomplete IEA data for 2006 gas demand in several EU markets suggest a rather slow demand gains compared to 2005.

security may be an additional factor increasing the risk of investments in gas-dependent projects and thus limiting their attractiveness relative e.g. to projects based on clear coal technologies[10]. In our view a scenario with some 1.5-2% annual growth up till 2015 slowing down to around 0.8% over 2015-2030 is most likely. This would add up to some 35% increase in gas demand in Europe between 2005 and 2030, or 1.2% average annual growth over the period.

Future gas demand trends in the FSU countries are clouded by even higher uncertainty that is primarily related to gas price developments. Policies of particular FSU countries will have a major impact on this, and thus on relative competitiveness of various modes of electricity production. There may be substantial differences in developments in countries that are major gas producers (Russia, some Central Asian and Caucasus countries) and countries relying on imported gas.

2. Energy in Russia: Current and Future Trends. Focus on Oil and Gas

Russia is a global supplier of energy commodities with its exports ensuring global energy balance and stability. Russia accounts for more than 12% of global oil production, about 22% of global natural gas production and more than 5% of global coal production. It produces about 10.3% of world's primary energy (about 1.2 bln TOE in 2004 by IEA estimates) of which 45% is exported and 55% is consumed are domestically. In 2006, primary energy supply of all type resources almost reached 1990 levels with a slight increase of gas supply over oil and coal supply.

Russia is the largest energy producer and supplier of energy resources in Europe, therefore playing an important role in oil and gas markets of several EU countries. For the last few years exports of Russian energy resources have expanded, strengthening the position of Russia in European and global energy markets and stronger linking the country to its main trading partners, especially the EU.

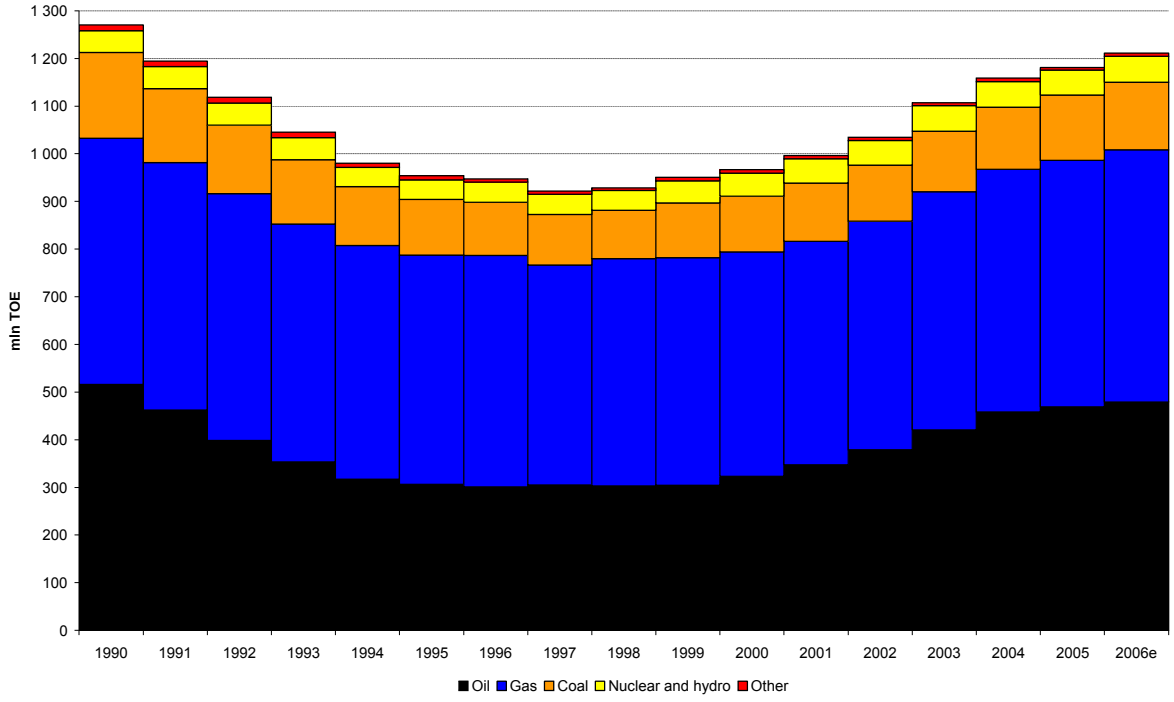
[10] Some authors view coal as a promising alternative to oil and gas – provided the technological improvements significantly limiting the CO_2 emissions. See, e.g. Auer (2007).

At the present Russia needs to find harmonized way to develop energy sector to satisfy both external and domestic demand for energy. Future decades inevitably will bring massive investments in the energy sector that are needed to maintain and increase production and transportation capacity.

2.1. Production of Oil and Gas

During the 1990s demand for Russia's energy resources both internal and external was driven by major changes in domestic economy and fundamental trends in global energy markets. Supply of energy resources was formed by the interplay of forces of economic rationality on corporate level, uncertainty of government regulation and changes in taxation. Overall economic crisis, structural changes in economy and energy sector and low world prices on energy were the main causes of declining production of energy commodities. Primary energy supply decreased constantly for the first 8 years of transition – from 1989 to 1997 (See Figure 2.1.).

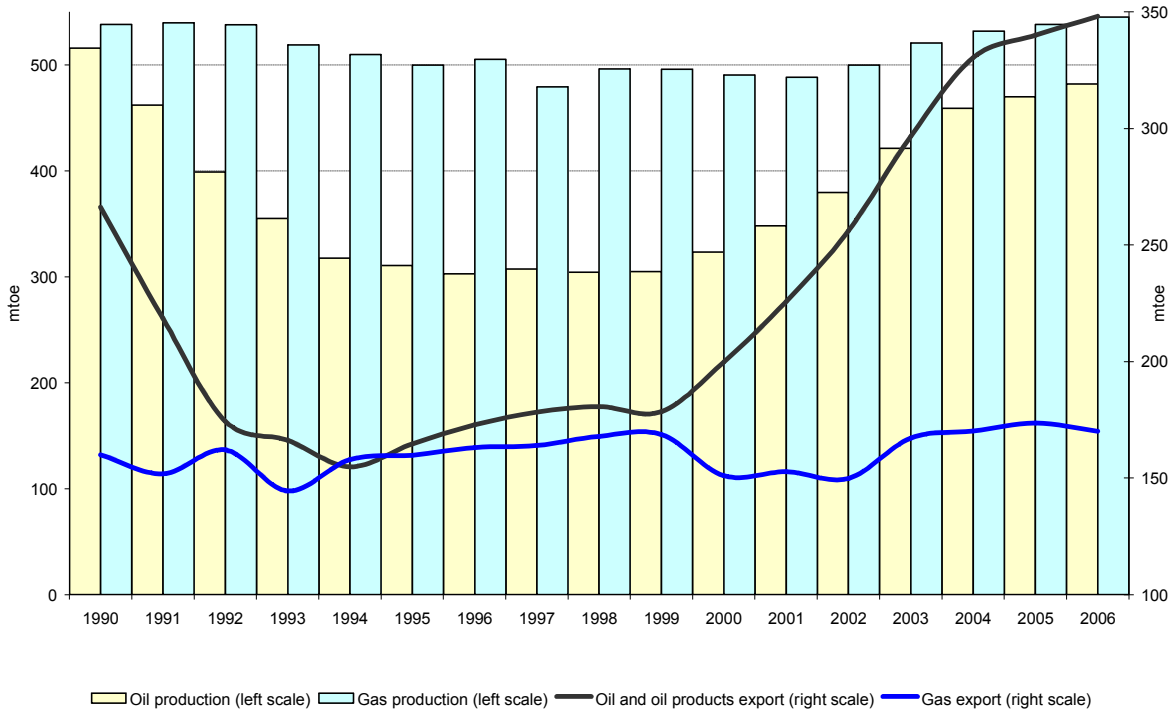
Diagram 2.1 Primary Energy Supply, million TOE by Source Fuel (1990-2006)



Source: Rosstat, IEA, Minpromenergo

Overall minimum of primary supply was reached in 1997 when energy production was at 73% of the 1990 level. Oil production experienced the largest decline. In 1994 it dropped to 56% of the historical highs of 1987, to stay only minimally above this level till 1999 (Figure 2.1). Since 2000 Russia experienced huge growth in production of oil due to reconditioning old fields and implementing new improved technologies. Oil production reached 480 million tons in 2006 but it was still 16% smaller than 1987 high. Since 2005 one could observe a major slowdown in oil output growth despite all-time-high oil prices. Changes in taxation, property rights conflicts and lagged effect of lack of investments in exploring new fields were the main reasons of decelerating growth.

Diagram 2.2 Russia: Net Export and Production of Oil and Gas



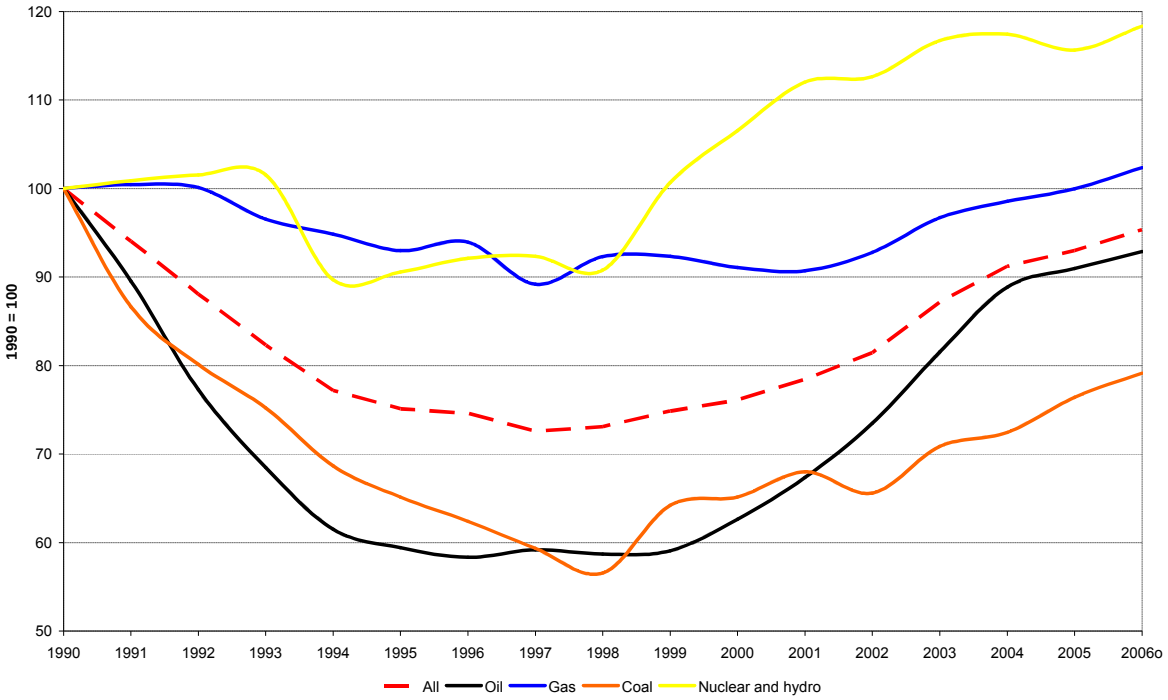
Source: BP (2006), Rosstat.

Changes in production were coupled with changes in main sources of demand. In the early 1990s more than a half of produced oil was domestically consumed. In 2006, 70% of production was exported. This means that the oil sector becomes more sensitive to external demand and developments of export transport infrastructure.

Compared to oil, natural gas production saw a much less volatility in the last 15 years. At the lowest point in 1997 gas production was only 10% lower than in 1990. During 1997-2002 production was fairly constant at about 580-590 billion cubic meters (bcm) annually. Since

2003 gas production has been increasing constantly at around 2% annually with a bulk of additionally supplied gas going for export (See Figure 2.2). In 2006, gas production in Russia grew by 2.4% with a help of independent gas suppliers and oil companies, while Gazprom did not expand production. In contrast to oil, 30% of produced gas is exported and 70% is consumed domestically.

Diagram 2.3 Primary Energy Supply (1990-2006)



Source: IEA, Rosstat, Minpromenergo

Since Soviet times energy prices have been heavily subsidized in Russia. During economic crisis of 1990s low energy prices and tolerance to massive arrears for energy bills *de facto* implied soft budget constraints for households and enterprises. To put it simply, low energy prices helped to survive households and companies during difficult times. But opportunity cost of such subsidies has been rising with a growth of export prices. Low prices also stimulated wasteful consumption and lack of progress in energy efficiency. Relatively low cost of energy resources, heavy industry bias in the industrial structure of the economy, harsh economic conditions, soft budget constraints and lack of incentives for improving energy efficiency are the main determinants of relatively high level of energy intensity (See Table 2.1)

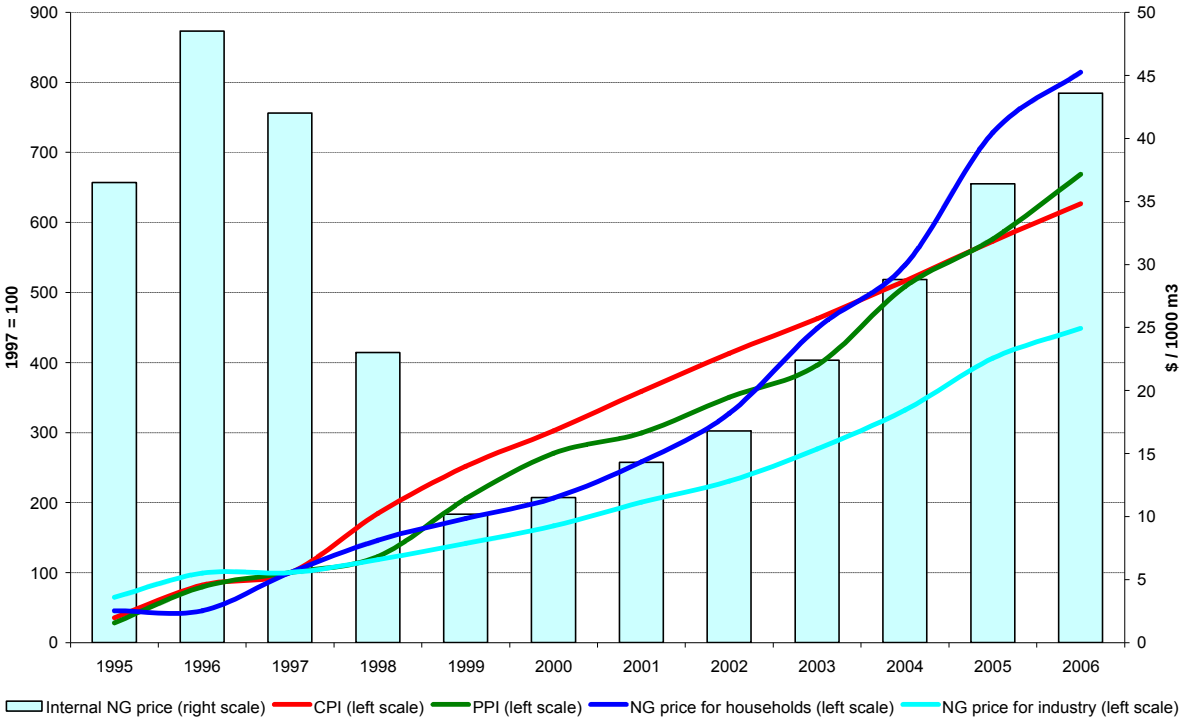
Table 2.1 Total Primary Energy Consumption per Dollar of Gross Domestic Product Using PPP (Btu per 2000 US Dollars) of some CIS and EU countries

Country	Btu per dollar GDP (2004)
Tajikistan	21 176
Ukraine	18 443
Turkmenistan	16 072
Russia	15 763
Azerbaijan	15 360
Kazakhstan	12 726
Moldova	10 205
Estonia	9 881
Armenia	9 853
Lithuania	8 432
Hungary	8 264
Poland	8 087
France	7 209
Spain	7 207
Germany	7 175
Latvia	6 043

Source: EIA (2006) (http://www.eia.doe.gov/pub/international/iealf/tablee1p.xls)

Since 2003 natural gas tariffs have been rising faster than CPI and PPI (See Figure 2.2.). However, aluminum, chemical, fertilizers and other energy intensive industries that export to global market generally resist "too fast" growth of energy tariffs "too fast".

Diagram 2.4 Russia's Domestic Natural Gas (NG) Price



Source: FST, IEF

At the end of 2006 the Russian government declared the increase of domestic prices for natural gas 2.5 times over the 5 year period. According to Russia's Industry and Energy Minister Viktor Kristenko, by 2010 domestic gas price will conform to export price less export duties and transport expenses (Valetminsky I. 2006). According to the government, this should bring prices to levels comparable to those in EU countries.

If this price increase become true that means that attractiveness of export markets will be diminished compared to domestic one. So it will be indifferent at least theoretically for Gasprom whether to supply gas domestically or for export so price increase will boost negotiation power of Gasprom on European market. Domestic price increase will be a factor of major importance to develop any meaningful of gas sector development long-term forecast as processes of energy saving and improving energy efficiency will be become more important. A reaction of households and industry to price increases and price elasticity of gas demand is largely uncertain.

2.2. Energy Trends Forecasts

It is a difficult task to forecast energy trends as energy sector faces lots of uncertainty. Energy production is generally forecast based on reserves and resources estimates. Compared to Soviet times, modern Russia witnessed a significant decrease in investment in new field exploration. Besides, official information on reserves is still classified and not in the public domain. These factors largely complicate building production forecasts as information on production potential substantially vary among different source.

According to some estimations 26.7% of the world proved reserves of gas are concentrated in Russia (Lukovkina, 2006). This volume considerably exceeds reserves of any other country. According to estimation of some experts (Lukovkina, 2006), at today's level of production these reserves will be enough for Russia for 78 years. Production growth will cut down this term, but possible discovery of new fields will increase it. Besides, 17.3% of the proved world reserves of coal, 6.2% of oil and 4.5% of uranium fall on Russia, as well (Lukovkina, 2006 p.10).

Latest official long term forecast for energy was developed in 2003 as the Energy Strategy. It was built on rather conservative assumptions and became obsolete by 2004. 2006 actual production figures were closer to forecasts for 2010 in the optimistic scenario of the Strategy 2003 (See Table 2.1.).

Table 2.2 Russia's Energy Output: Actual Data and Energy Strategy 2003 Forecasts (Optimistic Scenario)

	2005	2006	Russia Energy Strategy – Optimistic Scenario		
			2005	2010	2020
Oil, mln t	470	480	445	490	520
Gas, bcm	641	656	615	665	730
Coal, mln t	298	309	280	330	430
Electricity, TWh	952	991	935	1 070	1 365

Source: Minpromenergo, Rosstat

In the Energy Strategy of Russia for the period to 2020, forecast volumes of gas production differ considerably between scenarios assuming different socio-economic developments in Russia. Under an optimistic scenario, gas production may amount to approximately 665 bcm in 2010, increasing to 730 bcm in 2020. Under the moderate version, gas production is expected to reach 635 bcm in 2010 and up-to 680 bcm by 2020. In case, situation develops under the "pessimistic scenario", Russian gas production will start declining in the near future to later stabilize at the level of 555-560 bcm annually by 2010.

Gas production growth will start only in the second decade reaching the level of 1990s (610 bln.c.m.) by the year of 2020.

Russia is experiencing domestic debate over its future course of development and reconstruction of the energy sector. After 17 years of using the fixed assets of the former Soviet Union, it is time for reinvestment of financial resources into infrastructure, exploration and upstream, and especially into downstream and electricity sector. Next decade will play a crucial role in this respect. Naturally, global oil prices and export proceeds will be a background for the development in the energy sector. The Energy Strategy of 2003 is set for the major revision (planned for late 2007) and extension till 2030.

3. Caspian Oil and Gas Resources: Current Trends and Forecasts

The Caspian basin is the major energy producer supplying both Europe and Asia with oil-products and natural gas. The ancient Great Silk Road linking China and India with Europe was passing through the countries of Central Asia and the Caucasus. Today, discovery and prospecting of immense reserves of hydrocarbons in the Caspian region have defined geopolitical and geo-economical importance of the Central Asian states.

Oil and gas take up an important place in the contemporary world economy and this defines the nature of the relations of many states toward the South Caucasus and Caspian region. Based on this, the Caspian Sea resources and their transportation routes, which are of immense geo-strategic importance, conditioned the interest both for the EU and for the entire region from the very beginning.

EU and other countries are interested in opening alternative sources of oil and gas. Therefore from the very beginning, they have been extremely interested in "getting access to" Caspian sea energy resources and creating alternative pipelines for their transportation. And this, in turn, has ensured a large inflow of foreign direct investments into countries producing oil and gas or serving as transporting the resources through their territories via pipelines.

3.1. Current Trends of Gas and Oil Production and Demand

During 1990-2005 oil extraction increased in all the Caspian basin countries. Increase made up 79 per cent in Azerbaijan, 66 per cent in Turkmenistan and Kazakhstan had 2.4 - fold growth. In 2005 oil extraction cinsisted only 90,1 per cent of 1990 level, despite of high growth since 2000 in Russain.) However, there was recession in oil extraction, especially significant in 1990-95. Oil extraction was reduced at 25 per cent in Azerbaijan, Kazakhstan and Turkmenistan, together. Only Uzbekistan increased oil extraction almost four-fold before 1998, but after 1998 extraction was reduced at 33 per cent by 2005 (BP, 2006).

Upon the whole, during 1990-2005 oil production increased almost two-fold in the Caspian basin countries (Russia, excluded).

In the same period (1990-2005) gas extraction increased only in Kazakhstan (3.5 times) and in Uzbekistan (by 46 per cent). Gas production declined in Azerbaijan (by 43 per cent), in Turkmenistan (by 29 per cent). In Russia gas production remained approximately at the previous level (see Chapter 2). Turkmenistan witnessed particularly volatile production patterns with rapid declines of production between 1993 and 1994, then again between 1996 and 1997-1998, followed by sharp increases until 2003 and stabilization thereafter (at the level some 20% below that from early 1990s).

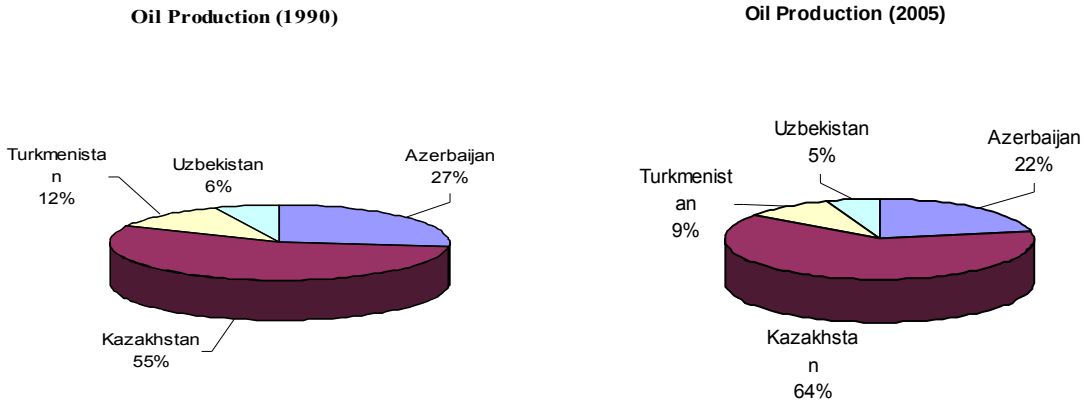
Oil and gas production decline in 1990s can be explained by the hardships of the transition period, mostly by investment difficulties in extraction of energy commodities. Only in the end of 1990s solid foreign investments and start of new international projects enabled Caspian basin countries to considerably increase extraction of both oil and gas. Overall, oil and gas production increased at 77 per cent in the countries of Central Asia and Azerbaijan between 1990 and 2005.

At the same time, aggregate consumption of oil in these countries declined by 31 per cent, while gas consumption increased by 22 per cent.

It should be mentioned that gas consumption increased by 42.4 per cent in Kazakhstan, 19.6 per cent – in Uzbekistan, 69.4 per cent – in Turkmenistan while it declined by some 44 per cent in Azerbaijan.

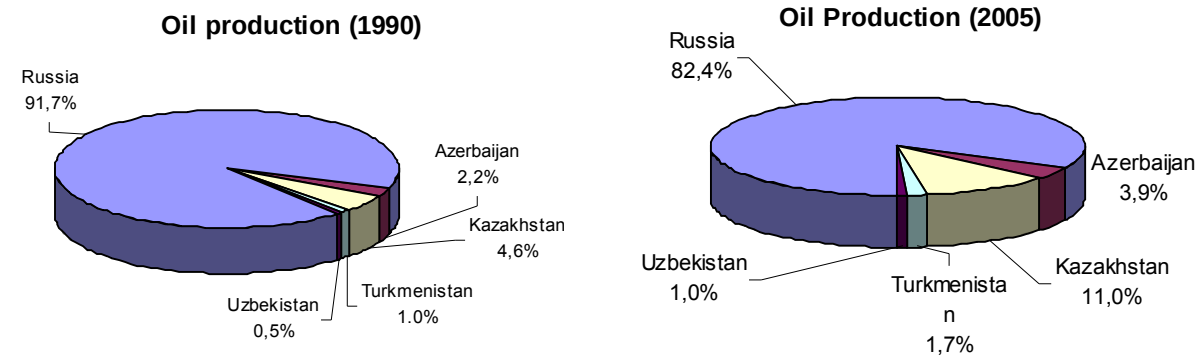
Taken together these trends indicate a much faster growth of oil and production than domestic demand increases, increasing the export potential of the region. This has been possible thanks to foreign investments in the sector and establishment of new relations between the countries importing and exporting energy commodities. Thus, the share of the Caspian countries in global oil and gas output has been on the rise over the recent years. Between 1990 and 2005 the share of Azerbaijan in oil production increased from 2.2 to 3.5 per cent, of Kazakhstan – from 4.6 to 11 per cent while the share of Russia reduced from 91.7 per cent to 82.4 per cent in the total production of the countries of the Caspian basin, Russia included.

Figure 3.1. Oil Production in Caspian Sea Countries (1990 & 2005)



Source: BP (2006)

Figure 3.2. Oil Production in Caspian Sea Countries and Russia (1990 & 2005)



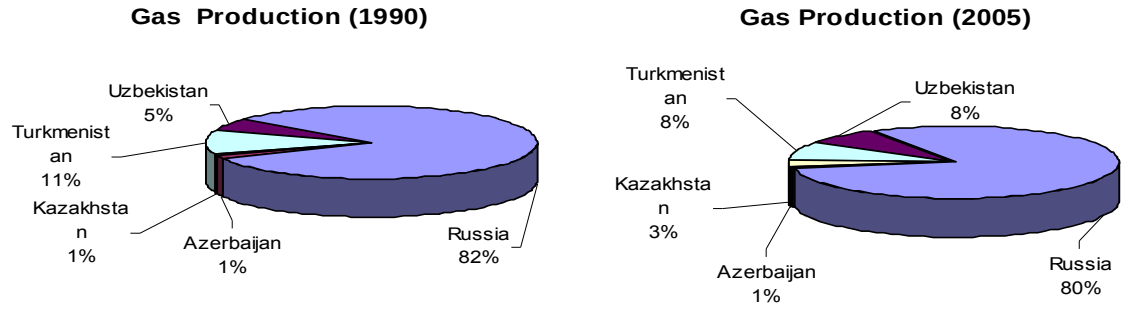
Source: BP (2006)

In gas production the share of Uzbekistan increased from 5 to 8 per cent, of Kazakhstan from 1 to 3 per cent, share of Turkmenistan reduced from 11 to 8 per cent. Share of Russia remained at the level of 82-80 per cent.

In oil production referring to the Caspian basin countries (Russia, excluded), share of Kazakhstan increased from 55 to 64 per cent, while share of Azerbaijan reduced from 27 to 22 per cent.

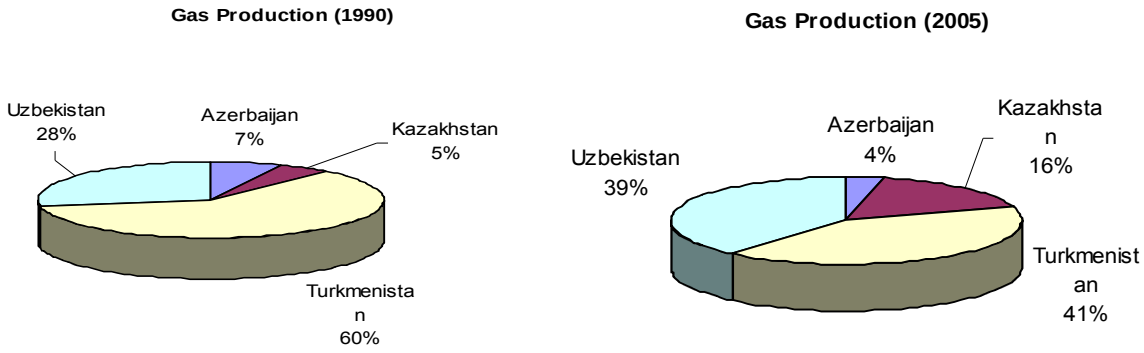
As for gas production, share of Turkmenistan was reduced from 60 to 41 per cent, still it is the major source of gas production and it is expected to keep the leading role thanks to large reserves. Uzbekistan comes next as major gas producer. Its share increased from 28 to 39 per cent. However, while in Uzbekistan internal consumption absorbs 80 per cent of gas production, Turkmenistan exports three quarters of its gas production. The share of Kazakhstan in joint gas production increased from 5 to 16 per cent.

Figure 3.3. Gas Production in Caspian Sea Countries and Russia (1990, 2005



Source: BP (2006)

Figure 3.4. Gas Production in Caspian Sea Countries (1990, 2005)



Source: BP (2006)

Oil consumption reduced almost at half against production in Kazakhstan, Azerbaijan and Russia together. It increased insignificantly only in Turkmenistan at 11 per cent.

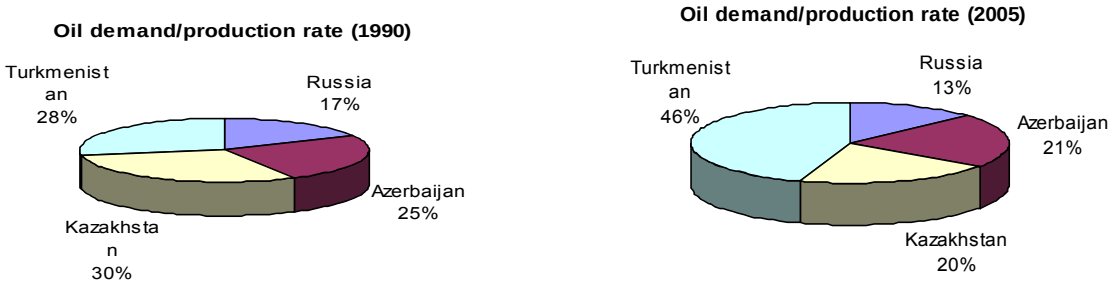
Uzbekistan still imports exports oil to meet its internal needs, but thanks to growth of its internal resources share of imported oil reduced almost two-fold, share of gas export

increased. If, in 1990 Uzbekistan was consuming 96.6 per cent of gas internally produced in 2005, rate of consumption dramatically reduced against production due to growth of gas extraction.

Share of consumption considerably reduced in Kazakhstan. In 1990 it made up 189.4 per cent of gas production, in 2005 it was 75.7 per cent.

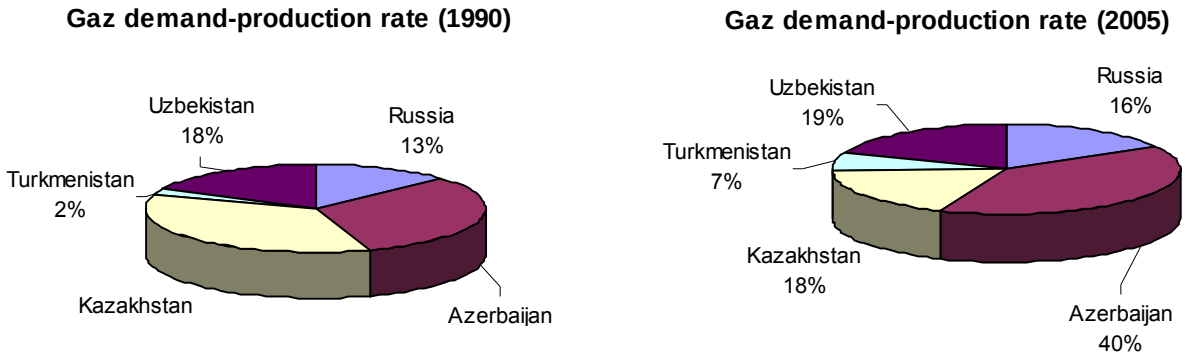
Gas consumption share in production of Russia decreased from 70.3 per cent in 1990 to 67.7 per cent in 2005.

Figure 3.5. Oil Demand/Production Ratio in Caspian Sea Countries and Russia



Source: BP Statistical Review of World Energy June 2006. http://www.bp.com/statisticalreview

Figure 3.6. Gas Demand/Production Ratio in Caspian Sea countries (without Russia)



Source: BP Statistical Review of World Energy, June2006. http://www.bp.com/statisticalreview

These tendencies illustrate production growth in the main oil and gas producing countries of the Caspian basin against the growth of consumption, which determine their capacity to increase exports. Taking into consideration the potential resources and production capacity of energy commodities, we may conclude that this tendency will continue in the coming future.

3.2 Caspian Oil and Gas Resources Forecast

Prospective reserves of the Caspian oil are concentrated mainly at the sea-shore of Azerbaijan and Kazakhstan, gas reserves at the sea-shore of Turkmenistan.[11]

3.2.1. Azerbaijan

Evaluations show that in Azerbaijan the volume of residual extractable reserves is: oil and condensate amounts to 1130 mln tons, of natural gas – 820 bn c. m**.** The main proven oil reserves are concentrated in the Azeri-Chirag-Guneshli deposit while natural gas reserves in the Shah Daniz deposit. According to BP, the proved reserves of gas amount to 1.37 trln c.m and of oil to 1 bln TOE (BP, 2006). However, some very optimistic estimations increase oil reserves at the Azerbaijani sector of the Caspian up to 5.6 bln TOE (39 bln. b) and of natural gas up to 1.85trln c.m. (65 trln, c.f.) (Cohen, Ariel, 2006).

3.2.2. Kazakhstan

Kazakhstan is a country with substantial reserves of hydrocarbons. On the whole, up to 3.3 percent of the explored and proved reserves in the world falls to the share of Kazakhstan. Proved reserves of the country at the end of 2005 were assessed at roughly 5.4 bln TOE of oil (BP, 2006). According to US Department of Energy, Energy information Agency, possible reserves in Kasakhstan reaches about 13.4 bln t (92 bln b) of oil. (EIA, 2006, July).

Added to that stock should be the reserves beneath the bottom of Kazakhstan's share of the Caspian Sea. This area contains around 120 prospects with the combined reserves of 25

[11] At the sea-shore of Russia reserves are not so significant.

billion tons of standard fuel; of the total, up to 8 billion tons of standard fuel are evaluated as recoverable reserves (Essentugelov, 2006).

Natural gas has been found at less than two dozens of deposits – those known as Amangalgy and Shagirli-Shomyshty, and the Imashevskoye gas-liquids field are the best known accumulations of the blue fuel (Smirnov, 2006). The proved reserves of natural gas in Kazakhstan total at around 3 trillion cubic meters (BP, 2006), while probable reserves, including those beneath the Caspian Sea, are running in the range of 8 to 8.5 trillion cubic meters. It must be taken into consideration that over 70 percent of the total gas fall to the share of casing-head gas (accompanying gas, oil-well gas, well head gas), which is extracted out of the hydrocarbon deposits known as Tengiz, Kashagan and Karachaganak. Instead of processing "casing-head gas" into a commercial commodity, it is more profitable to inject the extracted casing-head gas (accompanying gas, oil-well gas, well head gas) back into the wells, thereby increasing the rate of reservoir recovery. Therefore, the real reserves of gas are smaller as compared to the officially announced combined reserves (stock) (Glumskov, 2006).

Consequently, making generalization on the basis of the above-mentioned figures and the data, which have been included in the corresponding reports EIA, the combined recoverable hydrocarbon reserves, both onshore and offshore, varies in the range of 14,7-19.2 billion tons (101-132 bln b.) of crude oil and 4,3 trillion cubic meters (153 trln f.) of natural gas. (EIA, 2006, July).

3.2.3. Turkmenistan

According to the Energy Information Administration of the US (EIA, 2005), Turkmenistan sits on 1.7 billion barrels (248 mln TOE) of recoverable oil reserves, while the prospective accumulation can run as high as more than 80 billion barrels (11.2 bln TOE).

Other sources largely agree on these estimates. According to the results of the corresponding studies, probable reserves of crude oil might reach 12 billion TOE. The proven reserves of gas are running at 3 trillion cubic meters, thereby ranking Turkmenistan the eight country in the world (Vatsganov, and Michailov, 2005).

More optimistic statements come from representatives of Turkmengeology, the state-owned geological exploration corporation, who put the combined initial hydrocarbon reserves of Turkmenistan at 45 billion TOE, with the recoverable equivalent evaluated at 30 billion TOE (Oil and Gas Reserves of Turkmenistan, 2006).

Meanwhile, some experts are skeptical over the above-mentioned estimates. According to those experts, the proved gas reserves of Turkmenistan made up 2.9 trillion cubic meters during the Soviet times. Of the total, some 700 billion cubic meters were extracted in 16 past years, and as a matter of fact, no exploration work was carried out properly, while the reservoir structure was likely severely damaged following operating problems and failures in the middle of the 1990s (Trillions of Unknown Origin, 2007).

Auditors have confirmed 4,500bn c.m. of gas in the largest gas field Dovletabad. DeGolyer & MacNaughton (USA) and Gaffney, Cline & Associates Ltd (UK) have certified the Turkmen gas condensates (Tursunbaev, 2006).

In his recent interview, Mr. Nazar Suyunov, the ex-vice president of Turkmenistan, stated that economically recoverable gas reserves of the country were running in the range of 2.6 and 2.8 trillion cubic meters (Suyunov, 2006). According to last estimation of EIA possible reserves of oil and gas are respectively 4.5 trl cub.m (159 trln cub. f) and 5,5 bln TOE (38 bln b.) (EIA, 2006, July).

3.2.4.Uzbekistan

The proved reserves of natural gas of Uzbekistan have totaled at around 1.86 trillion cubic meters as of the end of 2004 (Ziadullaev, 2006). Probable reserves of hydrocarbons have amounted to 5.903 trillion cubic meters of natural gas, 817.7 million tons of oil, and 360 million tons of gas liquids as of the outset of 2006 (Uzbekistan has Calculated its Natural Gas Reserves, 2006).

The corresponding forecast for 2004-2020 looks as follows: an annual increase in hydrocarbon reserves will make up 75 – 112 million tons of standard fuel, while the

commercially viable combined accumulation of natural gas is set to grow by 60 – 85 billion cubic meters per year (Asrorov, 2006).

Oil reserves of Uzbekistan are evaluated at 600 million barrels (82 million tones) (Conference Focuses on Renewable Power Resources Use in Uzbekistan, 2006). This amount is similar to the predictive estimate of BP (BP, 2006).

3.2.5. Consolidated Oil Reserves of Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan

A review of different government and non-government sources of the corresponding information, including the data provided by international sources, reveals inconsistency in the estimates of Caspian hydrocarbon wealth. As a general rule, government estimates are more optimistic against downbeat forecasts of the others. This can be explained by governments' desire to attract foreign investments as well as draw attention from outside, particularly, from leading economic powerhouses.

Since the analyzed countries regained their independence from the Soviet Union, the Caspian hydrocarbon reserves have been a topic the oil companies are capitalizing upon by intentionally overestimating the amount of reserves they have been given access to, following the signing of the corresponding agreements with local authorities. Such a behavior move is common and intends to increase the price of their shares and pursue other commercial interests. Overestimation of reserves also helps some countries to provide an explanation for their presence in the Caspian region.

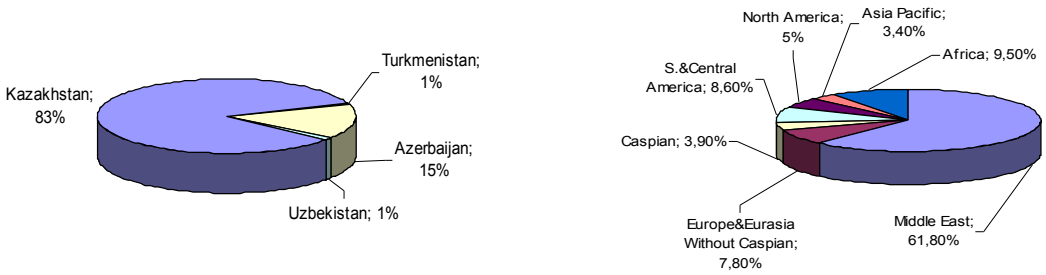
Poor drilling results support the above overestimation hypothesis. For example, exploratory drilling at six contract sites in Azerbaijan failed to encounter commercially viable hydrocarbons, thereby leading to termination of the corresponding agreements with multinational oil companies. Therefore, any forecast of the prospective reserves in the Caspian Sea region should be treated with a big caution. The best way to correct these estimates is to conduct exploratory drilling at the sites, thereby getting a better picture of the entire oil & gas potential of the Caspian region.

In addition, the ongoing dispute on the legal status of the Caspian Sea (between the Caspian countries) slows down further exploration-prospecting works in this region. Depending on various possible outcomes of this dispute, the volume of hydrocarbon resources assigned to each individual country may vary significantly.

In total, the proved recoverable oil reserves of the region constitute around 4 billion tons, which is an equivalent to just 2.6 percent of the global crude oil stock. In the global scale, that is comparable with the consolidated reserves in the Northern Sea, but 25-50 times less the aggregate reserves of the Middle East, a home to two thirds of the proved hydrocarbon wealth in the world (Vatsganov, and Michailov, 2005).

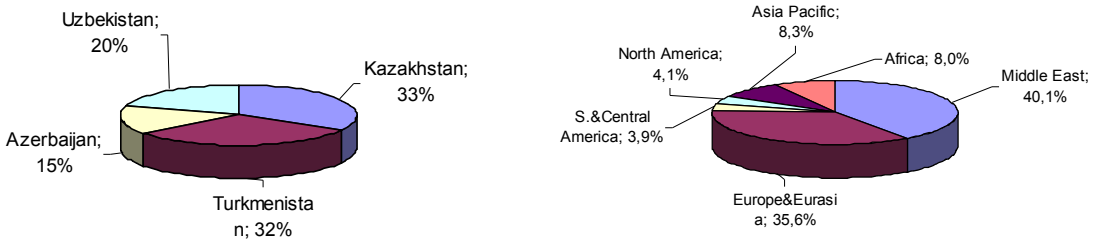
According to the statistical review by BP, the total volume of confirmed oil reserves of Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan as of the end of 2005 was 47.7bn barrels (6.7 bln tons) and the total volume of confirmed reserves of natural gas was 9.12 trillion c. m. (BP, 2006), which are 3.9 percent of oil and 5.1 percent of gas global share.

Figure 3.7. The Global Oil Reserves by Geographical Distribution.



Source: (BP, 2006)

Figure 3.8. The Global Gas Reserves by Geographical Distribution



Source: (BP, 2006)

Thus, on can conclude that the confirmed oil reserves in the analyzed region are sufficient to continue extraction at the level of 2005 for the next 75 years, and natural gas reserves - for the next 63 years. However, taking into account large-scale international contracts on development of the hydrocarbon deposits (with duration of 25-30 years) already signed by the Caspian sea countries, and rapid growth of domestic consumption, one can assume that the analyzed region will be an important supplier of hydrocarbon resources to world markets in the next 35-40 years.

Table 3.1. Confirmed Reserves of Oil and Natural Gas and Own Consumption of these Resources in 2005.

Country	Confirmed oil reserves at end 2005, bn barrels	Confirmed natural gas reserves at end 2005, trillion c. m.	Own annual consumption of oil, million barrels	Oil production in 2005, m tons	Own gas consumption, bln c. m.	Gas production in 2005, bln c. m.
Azerbaijan	7.0	1.37	37.6	22.4	8.8	5.3
Kazakhstan	39.6	3.00	75.9	63.0	17.8	23.5
Turkmenistan	0.5	2.90	40.1	9.5	16.6	58.8
Uzbekistan	0.6	1.85	58.8	5.5	44.0	55.7
Total:	**47.7**	**9.12**	**212.4**	**100.4**	**87.2**	**143.3**

Source: BP (2006).

Estimates show that the total volume of exports, with the account on the confirmed reserves and the current level of domestic consumption and its expected growth, may amount to 35 bln barrels (4.9 bln. tons) of oil and 5.5 trillion c. m. of natural gas in the next 40 years.

How will the histogram of exports of the hydrocarbon resources look like in these years? Estimates show that the export potential of the Caspian region (the four analyzed countries) may reach the level of 150-170 million tons of oil and 120-140 bn c. m. of gas in 2015. These volumes may be even higher in 2020. However, everything will depend on the size of investment into oil and gas projects and pipelines, the economic and political situation in the region and individual countries and on a number of other factors.

In the meantime, Azerbaijan and Kazakhstan are boosting oil exports. In 2006 alone, Azerbaijan exported 22.1 million tons of oil, while Kazakhstan - 57.1 million tons.

4. Transportation Choices and Alternative Pipelines

While importing countries tend to diversify their supply sources, the exporting nations try to do the same in respect to export markets of their hydrocarbon products – crude oil, natural gas and petroleum products. In both cases, the diversification policies are driven by the existing geopolitical paradigms.

Europe is interested in alternative sources of energy commodities. Governments of Turkmenistan, Kazakhstan, Uzbekistan and Azerbaijan have responded with the strategy of multiple export routes for Caspian hydrocarbons, which could provide supply for the world markets (Akhmedov, 2004). Such a tendency can be explained by the fact that Russia has occupied so far a very important place on the market of hydrocarbon resources in Europe, and the alternative transportation routes of oil and gas from Turkmenistan, Kazakhstan, Uzbekistan and Azerbaijan to Europe may reduce monopolistic position of Russian companies and stabilize supply of energy resources.

There are different projects for Caspian oil and gas conveyance to Europe. One route goes via Russia, another – via Azerbaijan, Georgia and Turkey.

At present the following main transportation routes are in operation:

Oil Pilelines

	Total capacity, '000 bpd	Length, km
Baku (Azerbaijan) – Tbilisi (Georgia) – Ceyhan (Turkey);	1000	1768
Baku (Azerbaijan) – Novorossiysk (Russia);	115	1475
Baku (Azerbaijan) – Supsa (Georgia);	115	837
Atirau (Kazakhstan) – Samara (Russia);	300	697
Tengiz (Kazakhstan) – Novorossiysk (Russia);	560 (1st line)	1510
Shimkent (Kazakhstan) – Chardzhou (Turkmenistan through Uzbekistan);	140	n/a
Atasu (North-West Kazakhstan) – Alashkanou (Xinjiang, China);	200 (initial), 400 (budgeted)	960
Neka (Iran) – Tehran (Iran).	175	350
Turkmenistan – Afghanistan – Pakistan (Gvadar)	n/a	n/a

Source: EIA, BP, Cohen, Ariel, 2006.

Since the Caspian is a land-locked sea, oil delivered to the ports of Azerbaijan and Russia is then transported to the Black Sea ports of Batumi, Poti and Kulevi either by the existing oil pipelines Baku-Tbilisi-Ceyhan (Papava, 2005), Baku-Supsa, Baku-Novorossiysk and Makhachkala-Novorossiysk or by Azerbaijan's and Georgia's railway systems. Oil products from Kazakhstan and Turkmenistan are also transported to the same ports on the Black Sea by railway.

On January 24, 2007, Kazmunaygaz and the contractors in charge of development of Kashagan and Tengiz oil fields signed a Memorandum of Understanding on building the Kazakhstan Caspian Transportation System aimed to ensure transportation of the growing amounts of oil exports through the Caspian Sea. Oil will be transported through the route of Eskene – Kurik – Baku – Tbilisi – Ceyhan. This implies building the Eskene – Kurik oil pipeline. The Trans-Caspian Transportation System will include oil discharge terminals

along the Caspian coast of Kazakhstan, a tanker fleet, oil-loading terminals at the Caspian coast of Azerbaijan, and integration with the Baku-Ceyhan pipeline infrastructure. According to this project, the Kazakh system will be able to ship 25 million tons of crude oil per year, with possible future expansion up to 38 million tons. The project is expected to be completed by 2010-2011.

On March 15, 2007 Russia, Bulgaria, and Greece signed an intergovernmental agreement to build the Trans-Balkan Oil Pipeline, Burgas-Alexandropolis (B-A), which would begin in the Bulgarian Black Sea port of Burgas and end at Alexandroupolis on the Greek Aegean coast. The pipeline is intended to carry 35 million tons of oil annually in the first phase, with expansion to 50 million tons in the second phase.

The pipeline would carry oil mainly from Russian Black Sea ports to the Aegean Sea for shipment from there by tankers. This pipeline is a prolongation of the Caspian Pipeline Consortium's (CPC) line from Kazakhstan to Russia's Black Sea port of Novorossiysk, in direct rivalry to the Trans-Caspian oil transport projects from Kazakhstan westward, such as the Baku-Tbilisi-Ceyhan (Turkey) pipeline. The Burgas-Alexandropolis line would also divert Caspian oil volumes necessary to supply the Odessa-Brody pipeline in Ukraine and its possible extension into Plock (Poland) Poland, which is the EU-supported project.

The existing gas pipelines:

	Total capacity, bln c.m.	Length, km
Central Asia - Centre (CAC);	45	existing route [12]
Baku-Tbilisi-Erzurum (BTE) or the South Caucasus Pipeline (SCP).	20	1070
Buchara – Ural	5	4500
Korpeje-Kort-Kuy (KKK) (Turkmen-Iranian)	13	200
Tashkent-Bishkek-Almaty (TBA)	22	371

Sources: EIA, BP, kaztransgas, Cohen, Ariel, 2006.

The gas-pipeline network Central Asia – Center (CAC) is the most important route of gas transportation the Caspian basin to Europe. The construction of this pipeline started in the

[12] The total length of the route on the territory of Turkmenistan is 3,940 km.

late 1960s and was completed in the early 1980s. Now the CAC is a web whose threads are located on the territory of Kazakhstan, Uzbekistan and Turkmenistan. The end point of the CAC is the "Aleksandrov Gay" compressor station on the border with Russia. Through the Central Asia – Centre, Central Asian gas enters the Gazprom system of pipelines. The transport capacity of this pipeline is 45bn cubic meters per year, and there are plans to increase it in the future (2009) (Expert report of the Strategic Research Foundation of the Central Asian Region, 2006).

Gazprom's cooperation with gas producers in Central Asia started in 2001 (Foreign Projects, 2006). In line with the intergovernmental Russia-Kazakhstan agreement on cooperation in the gas industry dated 28 November 2001, Gazprom and Kazmunaygas buy crude gas of the Karachaganak gas condensate field, process it at the Orenburg gas processing plant and supplies the processed dry gas to Gazprom system for sale in individual CIS and Western European countries.

Gazprom signed a series of agreements on strategic cooperation in transportation of natural gas with Central Asian governments and state gas companies:

- The contract with Uzbekneftegaz of 2002 envisages long-term purchase of Uzbek gas in 2003-12 with bringing its annual volume up to 10bn c.m. by 2005.
- The agreement with the Government of Uzbekistan on the handover of a function of the Uzbek gas export operator to Gazprom signed in 2003.
- The contract with the Intergaz Tsentralnaya Aziya (gas transport organization of the national company KazMunayGaz) signed in 2005 on the transportation of Russian and Central Asian gas through the territory of Kazakhstan for 2006-10, using the gas transport systems of Central Asia – Centre (CAC) and Bukhara-Ural, which pass through the territory of Kazakhstan (Foreign Projects, 2006).
- The agreement between the Gazprom and joint-stock company Uztransgaz (a subsidiary of the national holding company Uzbekneftegaz) on the transportation of natural gas via the territory of the Republic of Uzbekistan for 2006-10 signed in 2005. The agreement was concluded with the aim of organizing transportation of a Turkmen gas via the CAC and Bukhara-Ural gas transport systems, which pass through the territory of Uzbekistan (Foreign Projects, 2006).
- The long-term Russia-Turkmenistan agreement on cooperation in gas industry– from 1 January 2004 to 31 December 2028 signed in 2003; this agreement relates to purchase and sale of Turkmen natural gas. (Foreign Projects, 2006). The gas monopolies of both

countries - Gazprom and Turkmenneftgaz - were designated as the authorized organizations to reconstruct the CAC and Gazprom started this project already in January 2004.

In 2005, Gazprom ensured transit of about 54.5bn c.m. of natural gas from Central Asia.

In August 2003, a decision was taken at the inter-government level to increase transit of Central Asian gas (the Central Asia - Centre gas pipeline) and Russian gas (the Orenburg-Novopskov gas pipeline) via Kazakhstan to Russia respectively up to 38.7 bn c.m. and 60 bn c.m. In particular, within the inter-state program of CAC reconstruction, the overall transit capacity of this system was increased from 31bn to 54.6bn c.m. At the same time, the Russian side is actively involved in the upgrading of the Uzbek section of the gas pipeline. In the long-term, the parties of this agreement also plan to reconstruct the Bukhara-Ural gas pipeline (Expert report of the Strategic Research Foundation of the Central Asian Region, 2006).

According to Kaztransgaz, upgrading of the CAC main gas pipeline on the territory of Kazakhstan will be completed in 2008 (Kaztransgaz. The Energy of Peace and Well-being). After reconstruction of the CAC pipeline, Gazprom intends to increase the imports of Central Asian gas to Russia up to 100bn c.m. per year, with the aim of supplying it to Western markets (Akhmedov, 2004).

For the time being gas is transported from Central Asia mainly via Russia due to the relationships of the Central Asian countries with Russia, formed historically in the Soviet times and existence of Gazprom pipeline infrastructure. Today attempts are made to transport part of gas to Europe via South Caucasus. One of the recently completed projects of diversification of the transport routes is the Baku-Tbilisi-Erzrum (BTE) pipeline, designed to transport natural gas from Azerbaijan's Shah Deniz off-shore field. The diameter of this gas pipeline is 106.6 cm with a transport capacity of 20bn c.m. annually (Baku-Tbilisi-Erzrum, 2005). The length of the Azerbaijani section is 442 km, the length of the Georgian section - 248 km, and the length of the Turkish section - 280 km. It is planned that the BTE will be

also used to supply gas via Turkey to Greece, and that it will be subsequently connected to Nabucco (see below).[13]

The planned gas pipelines (including those discussed at inter-government level):

- **Trans-Caspian Gas Pipeline (TCGP**); Gas transportation via South Caucasus is planned to be conducted using the Transcaspian gas-pipe-line . This pipeline will be constructed on the bottom of the Caspian Sea and go via Azerbaijan, and Georgia to Turkey. [14] Total capacity is 15.9 bn c.m (565 Bcf.) in first stage, eventually rising to 31.1 bn.c.m (1.1Tcf). year. Total length - 1642 km (1,020 miles). (EIA, 2002).
- **Trans-Afghan route (TAF);** It is planned to lay this gas pipeline via the route Dovletabad (Turkmenistan) - Kandagar (Afghanistan) - Multan (Pakistan).[15] The gas pipeline of 1680-km-long route and with a diameter of 1,420 mm (56 inches) is designed for a throughput capacity of 33bn cu.m. of gas a year. (The Steering Commitee on Realization of the Project Transafganistan Gas Pipeline will Consider the Report on Certification of Stocks of Gas Deposit of Turkmenistan "Dovletabad", 2006). However, the unstable situation in Afghanistan and issues relating to the commercial viability of the project have for postponed its implementation for a long time (Expert Report of the Strategic Research Foundationof the Central Asian Region, 2006).
- **Atasu (Kazakhstan) - Alashankou (China);** The gas pipeline's throughput capacity will be 30bn cu.m. a year. (Technical Projecion of Construction of a Gas Pipeline from Kazakhstan to China is Planned to Prepare already in this Year. 2007).
- **Turkmenistan - Ukraine**; The project envisages the laying of pipes through the Caspian Sea, Azerbaijan and Georgia, and then along the bottom of the Black Sea to Feodosiya.
- **The Turkmenistan – China gas pipeline with** throughout capacity of 30bn cu.m . annually starting from 2009. At the same time, however, the following questions arise: a) along what route will the pipe go because third countries cannot be bypassed while it is laid (Uzbekistan and Tajikistan); b) how will this impact the scales of gas supplies for Gazprom.(Expert Report of the Strategic Research Foundationof the Central Asian

[13] In accordance with a recent statement of the prime minister of the Republic of Kazakhstan, Danial Akhmetov, Kazakhstan is considering to use the BTE for exporting natural gas to Europe. (Kazakhstan is Considering Using the BTE for Exporting Natural Gas, 2006).

[14] Moreover, in May 2000, S. Niyazov and Turkish Energy and Natural Resources Minister Ziya Aktas signed in Ashkhabad a contract on the supply of Turkmen gas to Turkey. The total volume of gas supplies via the pipeline is 30 bn c.m., of which 14bn c.m. are planned to be exported to Europe.

[15] The governments of Turkmenistan, Afghanistan and Pakistan signed a memorandum of intent in February 2006 to start the construction of the pipeline, in which India is interested too.

Region, 2006). The agreement with China also creates tension in ensuring future supplies to Europe.

- **Turkmenistan – EU.** This is the route of so called Nabucco pipeline: Turkey-Bulgaria-Romania-Hungary-Austria. It is expected that the project will be implemented by the year 2012. The maximum throughput capacity of Nabucco will be 31bn cu.m. (Ukraine is Ready to Participate in Construction of a Gas Pipeline " Nabucco", 2007). The length of the pipeline is 3,300 km,

The "Nabucco" pipeline is intended to diversify gas delivery and transit to the EU, from Turkey to Austria. The route is planned to go from Turkey through Bulgaria, Romania, Hungary to Austria. The "Nabucco" project is oriented at the Caspian region gas resources, namely, at the Central Asian and Azerbaijani gas. The project is expected to be completed by 2012.[16]

Along with "Nabucco" there are two other projects proposed to convey Caspian gas to European markets. The first concerns the Turkey-Greece-Italy (TGI) pipeline. The Turkey-Greece section will be completed in 2007. The second project is the so called Georgia-**Ukraine-European Union (GUEU**) pipeline project, connecting Georgia and Ukraine via the pipeline beneath the Black Sea.

The **Turkey-Greece-Italy (TGI)** gas pipeline is a win-win project between Turkey and Greece that will deliver Azeri gas to the EU markets. TGI is already making real progress, and by the end of 2007 Azerbaijan will already start sending small volumes of much-needed gas to Greece via TGI. In nine years Azerbaijan could export one-third of what Russia currently sends to Europe (Baran, and Apokis, 2007)

All these new projects are illustration of the EU strategy called to provide energy security by means of multi-pipelines; this means adding new pipelines to the existing ones.

[16] An international consortium led by the Austrian oil and gas company OMV will construct and operate the Nabucco gas pipeline. The maximum throughput capacity of Nabucco will be 31 bn c.m. The length of the pipeline will be 3,300 km, and the expected cost will be 5.8 bn US dollars. Ukraine is also ready to take part in construction of the "Nabucco" gas pipeline.

Conclusions

1. Consumption of energy resources has increased in the European countries for last 15 years. Consumption growth was rather modest in the developed countries. Oil consumption declined in the post-communist and especially in the former Soviet Union countries. This was conditioned by the transition period in 1990s and related major changes in their economic structures.

2. Gas consumption increased more rapidly both in Europe and in the post-communist countries. Although, in general, oil consumption in European countries was going on slower growth path than in the world, a growth rate of gas consumption in EU was a bit faster. In 1990-2005 world gas consumption increased by 25%, in EU-25 by 35% and in FSU – by 7%. (BP, 2006). As a result, the share of Europe and FSU countries in the world consumption was reduced.

3. Along with reduction of the internal energy resource base in European countries, they became increasingly dependent on imported energy resources.

4. As a result of low consumption level (except Russia) CIS region is expected to have rise of energy resources consumption. Russia becausue of climate provisions will maintain high consumption of gas. In European countries significant function will fall on gas consumption in the upcoming future.

5. Production of energy resources and prospected reserves are more outstanding in the Russain as well as in Caspian see basin. European countries may improve use of their energy - saving technologies and increase energy efficiency. They are also expected to increase consumption of alternative energy resources. In the following years energy supply will depend on the investments made in the gas and oil production and transportation and on formation of alternative sources of supply; this will be the main factor for formation of ”reasonable and rational” prices.

6. European countries, which are major importers of energy resources, are interested in stability and diversification of energy supply. Energy exporting countries (Russia, the Caspian countries) posses huge reserves of energy resources but their export infrastructure is weak and their dependence is high on foreign investments in transportation (except Russia). These countries are also greatly interested in diversifying their export markets.

7. Transit countries face the problem of severe competition between the alternative transportation routes, competition which is subject of global political games in the energy field. Today, Russia occupies the dominant position on an European energy market as the main producer of energy resources and owner of the transit network.

8. In the recent period, the potential importance of Caspian energy resources for Europe has considerably increased. Export potential has increased in the Central Asian countries and Azerbaijan, while Russia's production capacity has recently stabilized. This implies a gradually growing importance of South Caucasus and Turkey as an energy transit region.

9. Further development and implementation of alternative transportation routes of energy resources supply require stable support and cooperation of the EU.

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