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The Wind of Change

The Role of the
Renewable Energy in
the European Energy
Security

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The topic of energy security it is not new. On the contrary– it has always been highly attractive for politicians, economists, analysts, physicians, environmentalists. The reasons could be easily guessed. A main one is related to the energy in general, thanks to which the societies are developing and their day to day life continues smoothly. All this continues until the moment when the energy suddenly stops, the oil prices sharply increase, producers decide to cut the supplies or extreme weather destructs the infrastructure; and then, the world starts to worry.

The inconvenience of the traditional energy sources is that they are unequally distributed on the earth, which makes a lot of countries highly dependant on external supplies. That is why the definition of energy security – reliable and adequate to the demand supply of energy at reasonable price – is facing serious challenges today. Some of them are: 1) the suppliers are not always reliable (Venezuela, Iraq, Iran, Bolivia, Nigeria), 2) the demand is expecting to exceed the production in the near future and 3) now the prices are closer than ever to the prices of the recession period in 1970 and there is no perspective for future decrease.

After a short study of several national energy strategies, the analysis will put the emphasis on a completely new global energy tendency – moving from energy dependency toward energy independency, where independency can have different meanings – from fossil fuels to external supplies. This tendency is opposite to the globalization process, because it provides a given country with energy autonomy.

European Union does not differ from the global trends. The Union is equally affected like the other countries by the high oil prices, slow population and economic growth, new environmental and climate change worries, energy access uncertainties, energy concurrence from the East, increasing energy dependence, sluggish alternative energy growth rate. But besides that, EU has its own energy problems: 1) the oil and gas imports are from concentrated regions, like Russia or the Middle East; 2) the main EU “unity in diversity” principle is seriously challenged, meaning that a consensus between the member states is impossible, because the different regions in the Union experience different energy problems; 3) the existence of hard (frozen conflicts) and soft (organized crime, migration) security challenges in the EU`s neighboring countries, which often are transit or supply countries.

It would be unrealistic if one states that European Union does not make efforts to face its energy problems. The principal policy guidelines used by

the EU when meeting its energy security challenges are the bilateral, multilateral/regional dialogues and the Green/White Papers. After a short summary of them one can conclude that neither the dialogues, nor the Papers have made a significant progress in resolving EU`s energy problems. The efforts for assuring less energy dependency for the Union are formulated in a triad: external security by assuring the security of supplies, internal security by completing the single energy market and energy efficiency.

The first aspect is highly contestable, because of the several factors. The external security is a multilateral process in which assuring the behavior of the consumer does not mean security of supplies from the exporter, especially when the suppliers are problematic regions and countries, and one is highly dependent on them. Furthermore, the proven reserves have decreased and if they would be enough for this generation, for the next one it is already unsure. This means that all energy strategies made over the traditional fuels are short-term and without any perspective for the future. In this context, the EU security of supply policy, expressed in building new pipelines for resources which are limited, pollutant and expensive, does not provide energy security in long-term.

The second aspect is more or less affordable in near future. The integration of the national energy markets is the best way to start a process for further "communitization" of the national priorities and goals on the energy policies.

The third aspect concerns the most appropriate tools in order to achieve energy security for the future. The energy efficiency is the best way to reduce the external supply dependence, to reduce the internal energy intensity, to save the environment and to reduce the consequences of the climate change. One can consider the energy efficiency like a means, with help of which the transition from energy dependency to energy independency will be reached. In this perspective, the renewable energies constitute the essential part of the process. They have the real chance to replace the old fossil fuels, to make the countries energy independent, to meet the environmental problems in the cleanest possible way, to balance the climate mitigation for long-term, to provide a real sustainable development for the poor countries and to improve the quality of life. Furthermore, all of this will be achieved by the forces of nature.

EU has prioritized the renewable energy sources (RES) for a long time, as it could be seen from the energy strategies until now. This renewable "kick-start" surprises by several reasons – all Member states have settled,

workable, traditional energy infrastructure (including supply) in which RES do not play a central role. The arguments for this sound convincing, because for the moment the renewables cannot achieve desirable reliability, accessibility and affordability. Furthermore, their direct impact on the environment is sometimes contestable. Nevertheless, long enumeration of disadvantages like this one can be completely inadequate if we look at the situation objectively. The choices for overcoming the future energy situation are limited: continuation of the search for available fossil fuels, nuclear energy, clean technologies and renewables. Among them the RES possess the real chance to answer all future energy challenges, assuring the sustainability of this very future.



World Overview

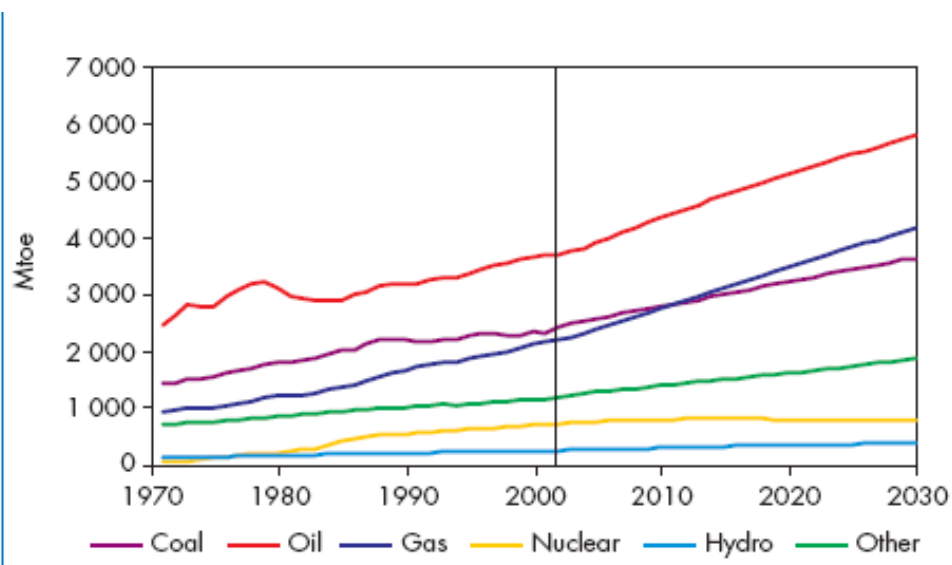
- What the numbers are saying
- Future scenarios
- Energy security

a. What the numbers are saying

The current population on the Earth is 6,5 bn. people. In 2000 we were 6,1 bn. people. For 2030 the trends are nearing 8 bn. and for 2050 – 9 bn. The population will increase most rapidly in the developing countries (Africa and Asia) - from 76% today to 80% in 2030. Despite these positive demographic trends, some negative perspectives are predictable too: the ageing population will prevail, even in the developing countries and the income growth will slowly decrease (3, 5% yearly in average)¹.

The picture in the energy field is a lot similar². For the last year, the consumption of all fuels increased by 4,3 % of which coal - 6,3%, hydroelectric - 5%, nuclear - 4,4%, oil - 3,4% and natural gas rose with 3,3%. At the same time the world proven reserves gradually disappear. They are foreseen to meet growth twice then the actual one. For the last years, the energy consumption increased three times as expected, and some of the future scenarios predict growth for the next 20 years with 54% from the present levels. From the figure below, the world energy consumption by fuel could be followed.

Figure 1 | World Primary Energy Demand by Fuel



Source: World Energy Outlook 2004, IEA, OECD

The oil has reached a price of \$72 per barrel (p/b)³ in 2006 and the situation is not expected to change in the near future. In 2004 for the first

¹ The data is taken from IEA (International Energy Agency) (2004) *World Energy Outlook 2004*. OECD/IEA

² The data is taken from BP (British Petroleum) (2005) *Statistical Review of World Energy 2004*. BP p.l.c., London

³ Daily forecast for 11.05.2006 <http://www.mosnews.com/>

time, the global oil production exceeded 80 mln. b/d (barrel per day) and in April 2006 it reached 85,1 mln. b/d⁴. Saudi Arabia set a record reaching an output from 10 mln. b/d. Natural gas trade rose by 9%, of which pipeline shipment grew with 10% and liquefied natural gas (LNG) – with 5,4%. For 2004, the production rose up to 2691,6 billion cubic meters. Coal consumption, discouraged from the higher prices, declined slowly in Europe and North America, while China is responsible for 75% of the entire growth during the last year. Nuclear power consumption is strongly supported from Japan's recovery, which accounts for 50% of the growth.

The next problem is related to the way in which the energy is consumed globally. In 2002, the total number of people without access to electricity was 1,6 bn. (IEA, 2002): in Asia - 1 bn., in Africa – 536 mln., in Latin America and the Middle East – 60 mln. One third of the population does not have access to modern energy sources and 80 % of the population (transition and developing countries) now consume only 40 % from the energy in general. The poor countries, the countries in transition and the developing countries represent 80 % of the world population, produce 65% of the world energy, possess 80% of the proven energy reserves and consume 34% from the energy in general. The present structures of energy usage create severe environmental risks and rise major barriers to the development in many countries. 35% of the energy consumed in developing countries derives from biomass (firewood, charcoal or dung); in parts of Africa this share reaches 90% (**Appendix A**). According to the World Health Organization, emissions from the burning of biomass and coal indoors cause the death of 1,6 mln. people every year.⁵

The last problem is related to all the issues mentioned beforehand. All the forecasts from the last year show strong growth in energy consumption among the nations with an expected significant rise in population – meaning all but the industrialized ones. The fastest growth is projected for the nations of developing Asia, including China and India, where the rising population and the economic growth (5,1% in comparison with 3,5% generally) will support the increase in energy consumption (**Appendix B**). With such strong growth in GDP, demand for energy in developing Asia doubles over the forecast, accounting for 40 percent of the total projected increment in world energy consumption and 70 percent of the increment for the developing world alone. In contrast to the developing world, slower growth in energy demand is projected for the industrialized world, averaging 1.2 percent per year over the forecast period.

⁴ IEA: Добыча нефти в мире в апреле достигла 85,1 млн барр./день (12/05/2006)
<http://www.oilcapital.ru/news>

⁵ WBGU (German Advisory Council on Global Change) (2004) *Towards a sustainable energy systems*. Earthscan, UK and USA

There is another reason why the world is so worried about energy. Last September, the oil price reached \$70 per barrel and has stood at the same level until now. In real terms, \$80 per barrel is equivalent to the price level which triggered the stagflation of the 1970s.⁶ For the moment, these record prices do not have such a serious impact, which will be anyway completely different for each country. The industrialized economies will have to deal with economic slowdown, inflation and budget deficit, as opposed to the post-communist counties which continue to import energy from Russia at preferential prices. The oil shock will affect most seriously the poor economies, relying on the oil import in two ways: first, by increasing considerably the energy price and second – increasing at the same time the price of the industrial products.

Tacking into account these economic observations, several macroeconomic questions logically arise:

- is it possible for the rest of the reserves (proven, possible and potential) to cover the future demand (**Appendix C**)? In other words - is the data reliable, do the exporting counties (OPEC particularly) possess a capacity to produce more, do the importing countries have enough refining and distributive ability, do we have technologies and investments to meet the challenge?

- and if not, can we rely on the alternative sources of energy, energy efficiency and conservation? On the other hand, are they sufficiently developed, are they enough to replace the old ones and are they affordable?

But is there anything else beyond the numbers? The energy price is as well influenced by geopolitics. Since the very beginning of the import-export energy relations, several geopolitical problems have existed almost permanently and have influenced consistently the price of the energy production: political instability in the oil exporting nations; proliferation of weapons of mass destruction (WMD); embargos and sanctions; ethnic conflicts, resource conflicts and wars. In our days, the problems are the same, and we have even succeeded to add another one – terrorism (**Appendix D**).

Strikes in Venezuela (77 bn. barrels proven reserves), leftist nationalism in Latin America (especially in Mexico – 15 bn. barrels proven reserves), war in Iraq (115 bn. barrels proven reserves), instability in Angola (9 bn. barrels

⁶ Daianu, Daniel (03/01/2006) *Oil price, emerging economies reshape global picture*. Southeast European Times

http://www.setimes.com/cocoon/setimes/xhtml/en_GB/features/setimes/articles/2006/01/03/REPORTAGE-0

proven reserves), ongoing conflict in Niger Delta (35 bn. barrels proven reserves), Iran's nuclear program (132 bn. barrels proven reserves) strongly influence the price of energy. The most dangerous threat is that of attacking and destroying the infrastructure. But there are danger points, such as the Saudi oil-shipment terminal at Ras Tanura, which handles some 4-5 mln. b/d or Abquiq, the world's largest oil-processing complex which treats something like 7 mln. b/d. Were these to fall victim to a dirty bomb or some other devastating weapon, the damage to the world would be incalculable.⁷

Concerning infrastructure, we can point out another issue influencing the price of energy – namely, the current inadequate refining capacity. The downstream sector is incapable of meeting the increasing demand and the product effectiveness, especially related to the recent environmental concerns (cleaner and lighter products). Part of this problem is that the supply sector is experiencing a lack of investments.

Beyond the economical and geopolitical uncertainties which have raised the energy price over \$70 per barrel this year, there is another issue, comparatively new – environment and climate change. The ecological concerns have little influence so far, but in the near future it is expected to increase. The main factors which directly influence the energy prices for the moment are Kyoto protocol targets (primarily in the developed countries), natural disasters (hurricanes, tsunamis, earthquakes, connected or not with the climate change process) and local taxes (if they exist).

As energy importers, most of the G8 members are alarmed by the way oil and gas prices have been sent rocketing ... (although) ... energy exports helped Russia's economy grow by more than 6% last year.⁸ The actual energy situation prompts several questions – what are the prospects for the future, how are the exporting countries using the additional revenues, and will the environment be taken into consideration. In order to foresee the future scenarios the international organizations, states and private enterprises periodically prepare outlooks with different types of outcomes. In the next part I will summarize some of them, showing their common patterns.

⁷ The Economist (07/01/2006) *Nervous energy, Special report: Energy Security*. The Economist, London

⁸ BBC News (17/22/2006) *Energy prices "Threaten growth"*. BBC, <http://news.bbc.co.uk/2/hi/business/4703984.stm>

b. What is the international community saying about the future?

Although every outlook pretends to be different and to propose a different point of view (from one to five scenarios), in general all scenarios present two level outcomes.

- no matter the concrete name, the first considers the current policies unchanged and creates a forecast in which the world economy continues to develop in the same way, if the environmental/climate change issues are not taken into account;
- the second scenario reflects the environmental targets (Kyoto Protocol), which influence the sustainable development policies.

The scenarios can be difficult to classify in a table because they use different approaches and methodology, and a number of different scenarios. That is why I will present only several cases and I will arrange the outcomes in the way the authors have done it.

Table 1 | Future energy scenarios: a view from different actors

| Scenario I | Scenario II |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| European Union (2003): World energy, technology, and climate policy outlook 2030 (WETO) ⁹ | |
| <p>“Reference Scenario” - Business as usual</p> <ul style="list-style-type: none"> - world energy demand will increase with 1,9% per year - industrialized countries will experience a slowdown in the demand, but developing countries will start to consume rapidly - fossil fuels will continue to dominate the world energy system (in 2030 they will represent 90% of the total energy supply). | <p>“Carbon Abatement”</p> <ul style="list-style-type: none"> - world energy demand will be 1,3% pr year - the global energy mix: the carbon value will affect coal (-42%, -61% for EU) and oil (- 8%, -13% for EU) based fuels - globally this will be compensate by nuclear energy (+ 36%, +35% for EU) and renewables (+ 35%, +56% for EU), which will increase twenty fold - global CO2 emissions would still be higher in 2030 - EU emissions` level will decrease with 15%. |
| OPEC (2004): Oil Outlook to 2025 ¹⁰ | |
| <p>“Reference Case”</p> <ul style="list-style-type: none"> - grow in energy demand driven by the transport sector (Appendix E): increase with 12 mln b/d to 89 mln b/d from 2002 to 2010, 17 mln b/d to 106 mln b/d by 2020, and then by another 9 mln b/d to 115 mln b/d by 2025. Almost three-quarters of the increase in demand over the period 2002–25 come from developing countries; - consumption of fossil fuels will continue to prevail (accounting 90% of the primary demand): oil (36,9%), gas (29,9%), solids (25,2%) and hydro/nuclear/renewables (8%) in 2025; - oil resource base is sufficiently abundant to satisfy this demand growth; - Latin America, Africa, Russia and the Caspian will be the key non-OPEC suppliers. | |
| <p>“Low economic growth scenario”- potential weaknesses of the economy such as financial market instability, possible overheating, geopolitical risks and structural problems. If the economic growth falls with 1% the loss will be 4 mln b/d till 2010; 17,3 mln b/d till 2025.</p> | <p>“Vehicle efficiency scenario” – different improvements in vehicle efficiency driven by the rate of penetration of existing technologies and by the development and introduction of new ones, in order to reduce oil use. 0,5% efficiency improvement will decrease world demand with 5,6 mln. b/d by 2025.</p> |

⁹ http://europa.eu.int/comm/research/energy/pdf/weto_final_report.pdf

¹⁰ <http://www.opec.org/library/OPEC%20Review/OWEM04.pdf>

ExxonMobil (2004): The Outlook for Energy – a 2030 view ¹¹

- world energy demand will increase by 50% (1,7% per year) till 2030 primarily in developing countries;
- oil and gas will be the primary energy sources (60% of the total demand) – fastest grow in Asia Pacific, because of the increase sale of personal vehicles ; North America and Europe will compensate the growth with higher vehicle efficiency;
- because of the growth in the use of vehicles (in Asia Pacific particularly), carbon emissions will increase;
- although renewables will grow quickly, they will account for a little part of the energy supply;
- nuclear energy will grow with 0.8% per year and new plants will be constructed in the developed countries (due to environmental and security supply concerns).

(OECD) International Energy Agency (2005): World Energy Outlook (WEO)¹²

“Reference Scenario”

- global energy demand will rise by over 50% (of which oil and gas will account 81%, renewables, which will grow fastest only 2%);
 - global dependence on Middle East and North Africa exports and generally from non OECD countries;
 - CO2 emissions will rise by 52% (developing countries will account 73% of it).
- All this will need enormous investments in infrastructure (\$ 17 trillion). If it has a delay:
1. sharp rise in energy prices;
 2. slowdown in the global GDP growth;
 3. slowdown in energy demand like an answer.

“Alternative scenario”

- in this case global energy demand will rise with 10% less than in the Reference scenario (37%), thanks to the policies that promote more efficient use of energy and switching away from fossil fuels;
- although the imports of fossil fuels from Middle East and North Africa decline and drive down the prices, the region remains highly important;
- CO2 emissions will fall to 5.8 gigatonnes (30% rise).

¹¹ <http://www.exxonmobil.com/Corporate/Citizenship/Imports/EnergyOutlook05/index.html>

¹² <http://www.worldenergyoutlook.org/2005.asp>

From this table it becomes clear that the future forecasts, although with some common patterns, vary and depend on the starting point (producer, consumer, state, organization). We have problems with the energy prices, with the energy accessibility and reliability, with the energy affordability, with the energy dependence (namely of fossil fuels), with the environment. The present world energy situation is more than unstable – it is insecure. The only way to make it secure is to answer these problems or to get used to living in insecurity.

The next part will aim at creating a general definition for energy security. In order to do this I will do through different existing ones (USA, EU, OPEC, Russia, CIS, China) and I will try to find the common points.

c. What is the international community saying about the energy security?

The international community has reached a consensus when discussing the importance of the energy security. The current G8 Summit proves it undoubtedly, namely choosing the energy security topic for its main theme. Like the future scenarios, the definitions of energy security vary according to the concrete position of the actor – importer, exporter, government, private enterprise. As Centre for Security and International Studies (CSIS) points out, we can distinguish three levels of energy security priorities:

- for Producers – consistency and predictability of demand requirements;
- for Consumers – available, reliable, affordable and secure sources of supply;
- for Governments – secure supplies at predictable and stable prices to support economic growth, preserve national security interests, and meet consumer needs.¹³

As we saw earlier in the outlooks above, the forecasts are:

- future producers – Middle East (OPEC particularly), Russia, Caspian Region, Africa and Latin America;
- future consumers – OECD countries, developing countries from Asia Pacific (especially China, India and Japan).

I will present the security strategies of two producing countries (OPEC and Russia) and four consumers: two developed (USA and EU) and two

¹³ Verrasto, Frank (20/03/2006) *Energy Security in a Changing Global Marketplace, Power Point Presentation*. CSIS (Center for Strategic and International Studies), Washington DC

developing (China and India) in order to see where are the common features and the areas the countries have focused on.

In its Statute¹⁴, OPEC speaks about security of supply: "Due regard shall be given at all times to the interests of the producing nations and to the necessity of securing: a steady income to the producing countries; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on their capital to those investing in the petroleum industry." OPEC develops its entire conception about energy security like a two-way process – supply and demand. The latter shows producers' uncertainties over the amount of oil they need to deliver. In this context the OPEC countries suggest creation of a "<road map> for oil demand reflecting the need for security of demand as a legitimate concern for producers"¹⁵.

The Russian Government sees its energy security as "the reliable and effective provision of traditional hydrocarbon energy resources to the global economy; energy diversification through the use of new energy sources and technologies; and more efficient use of energy resources."¹⁶ Russia's definition relies on the country's double position. As a supplier, it will assure security of its supplies and as a consumer Russia will seek energy efficiency. Behind the Government's official definition we can find a second side: state control over the strategic resources and their infrastructure (e.g. Gazprom, Tatneft). The Russian Federation does not identify officially its energy security like a part of the National Security Concept.¹⁷

The current USA energy security strategy is basically formulated in their "National Security Strategy", issued on March 2006.¹⁸ George W. Bush determines two prerogatives: "diversity in the regions from which energy resources come and in the types of energy resources on which we rely". In order to achieve reduced reliance from foreign energy sources, the priorities are: 1) work with resource-rich countries to increase their openness, transparency, and rule of law; 2) opening, integrating, and

¹⁴ OPEC (Organization of the Petroleum Exporting Countries) (2001) *Statute*. OPEC, Vienna <http://www.opec.org/library/opec%20statute/pdf/os.pdf>

¹⁵ Barkindo, Mohammed (15-16/02/2006) *Energy Supply and Demand Security, Speech at EUROPIA Conference*. London, England <http://www.opec.org/opecna/speeches/2006/europia.htm>

¹⁶ CS ED Unit (G8 Research Group Civil Society and Expanded Dialogue Unit) (07/02/2006) *G8 and Russian Initiatives: Energy Security, Global Health and Education*. University of Toronto, Toronto <http://www.g8.utoronto.ca/evaluations/csed/csedupdate060207.html>

¹⁷ ИПМБ РАН (Институт проблем международной безопасности) (2000) *Концепция национальной безопасности Российской Федерации, Утверждена Указом Президента Российской Федерации № 24 от 10.01. 2000*. Москва http://www.ipmb.ru/1_1.html

¹⁸ The White House (03/2006) *The National Security Strategy of the United States of America*. Washington www.whitehouse.gov/nsc/nss/2006/

diversifying energy markets; 3) developing and deploying of advanced nuclear recycling and reactor technologies; 4) investing in zero-emission coal-fired plants; revolutionary solar and wind technologies; clean, safe nuclear energy; and cutting-edge methods of producing ethanol. Central Asia is put in focus like a priority region for the foreign policy. Energy efficiency policies are only partly present, because they are not entirely under the responsibility of the federal government.

The latest EU energy strategy - "A European Strategy for Sustainable, Competitive and Secure Energy"¹⁹ - issued also in March this year is a separate document from the EU Security Strategy - "A Secure Europe in a Better World"²⁰, where it is only mentioned that EU has problems with its energy dependency from the Gulf, Russia and Northern Africa. The Green Paper for energy security sets six priority areas, three main objectives and six concrete proposals, which makes it difficult to summarize it. Nevertheless, the Europe's energy policy is concentrating on: 1) sustainability - energy efficiency, climate change policies; 2) competitiveness - single, liberalized, competitive European energy market, technologies research and 3) supply security (to make Europe less dependent on imported energy) - reducing demand, diversifying internally the energy mix and externally, the sources. EU puts a priority over several regions - Caspian, North Africa and Middle East.

The newly emerged economies of China and India fully realize that increase in the price of energy will have direct impact over their budgets. So in the strategies of both countries we can see two common elements: 1) efficient use of energy (energy management) and 2) decreasing the foreign energy dependence.

From 1980 to 2000, the Chinese government formulated a strategy of "paying equal attention to energy development and conservation, and giving energy conservation preference in the near future."²¹ The latest (March this year) action plans for the Chinese economy, as passed by the People's Congress, set new policy priorities on energy security²²: 1) "scientific development concept" for environmental friendly approach (greener GDP with renewable and alternative energy) and energy

¹⁹ European Commission COM(2006) 105 final (08/03/2006) *A European Strategy for Sustainable, Competitive and Secure Energy*. European Commission, Brussels
http://ec.europa.eu/energy/green-paper-energy/doc/2006_03_08_gp_document_en.pdf

²⁰ European Council (12/12/2003) *European Security Strategy, A Secure Europe in a Better World*. European Union, Brussels <http://ue.eu.int/uedocs/cmsUpload/78367.pdf>

²¹ Development Research Center of the State Council (11/2003) *China Development Forum 2003, China's National Energy Strategy and Reform*. Diaoyutai State Guesthouse, Beijing, <http://www.efchina.org/resources.cfm>

²² Jiang, Wenran (12/04/2006) *China Brief, Beijing's 'new thinking' on energy security*. The Jamestown Foundation, Washington DC

conservation, 2) self-reliance strategy for more exploration of domestic energy reserves. China's energy security is mainly related with its economic security, but recently China has formed military ties with the government of Sudan, which is one of its major suppliers in Africa.

In order to understand India's energy policy we must know that from 1,6 bn. people which don't have access to electricity, 800 mln. live in India (IEA, 2002). Most of the energy needs in these areas are met by non-commercial renewable resources and biomass (40 % of the total primary energy supply - 114 mln tones yearly). The energy demand generated by rural industrialization will require more commercial energy, which must be imported²³. That is why the annual speech of India's president Dr. Kalam, devoted to India's energy security, combines two totally different principles: 1) focusing on the efficiency *mantra* for cutting down losses and taking a more synergistic approach to consumption and 2) tapping all the energy sources at the local, regional, and global level, which include "coal, oil, and gas supplies, until the end of the fossil fuel era, which is fast approaching.²⁴ In the President's speech, energy security is not presented like a part of India's national security.

The aim of this short overview was to show that the priorities in the national energy strategies are quite similar, although the countries are so different. The energy security is still strongly dependent on external supplies, "oil addicted" and in the priority of the state power. Nevertheless, in the examples above we can distinguish a common tendency: energy independence. Each country emphasizes different scenarios – own resources, energy efficiency, energy mix, green energy, nuclear energy. The old and well-known definition for energy security - reliable and adequate to the demand supply of energy at reasonable price is at the heart of the debate, because today each part of it is problematic: 1) the suppliers are not every time reliable (Venezuela, Iraq, Iran, Bolivia, Nigeria), 2) the demand is expected to exceed the production in the near future and 3) now the prices are more closer than ever to the prices of the recession period in 1970 and there is no perspective for future decrease. Can we say that the world is moving from energy dependency toward energy independency in each sense – independency (or more correctly less dependency) from fossil fuel and/or independency from external supplies?

In the different countries' overviews, I explicitly mentioned if energy security is part of the national security strategy or not, in order to focus on

²³ Dhaka, Ambrish (28/02/2006) *India's Energy Security and Central Asia's Energy Resources. Central Asia and the Caucasus*

²⁴ Kalam, Dr. APJ **Abdul** (14/08/2005) *Speech on 59th Independence Day anniversary, New Delhi* <http://presidentofindia.nic.in/scripts/independencedetail.jsp?id=6#>

the ongoing debate about the energy security and the “dependency dilemma”²⁵. First, we can notice that the nature is not recognized from the international relations' theories like a determining factor for human action and social outcome²⁶ and consequently the idea of a “resource war” is quite abstract for the theorists. Nevertheless, the energy (mainly the oil) is prioritized like a strategic commodity for the state. This is the reason why so many countries consider the energy issue a matter of their national security – what this means is that these countries are prepared to use military force in order to protect their energy interests. In the heart of the recent debate is the meeting point between the instability of the states that the world is coming to rely on (let's say depend on) and the future forecasts for growth in the energy demand. This meeting point will make the one side more instable and the other - more insecure.

Related to this debate over the global energy security is the recent proposal of the Polish Deputy Minister of Economy Piotr Naimski for the creation of new alliance between NATO and EU members to act together “in the face of any energy threat provoked by either a cut or a diminution of supply sources that may occur because of natural disaster, disruption of wide distribution and supply systems, or political decisions by suppliers”²⁷. The debated option for NATO to ensure energy security is to protect the infrastructure (pipelines, facilities, tankers, oil platforms) from terrorist attacks or in periods of conflict. But most of the EU members consider that market forces have a greater potential to ensure the access to energy. For now, the debate remains open.

This chapter aimed to show several tendencies:

- we have and we will have even more serious problems trying to ensure our energy security, because the problems are too diverse to be resolved quickly, separately and without mutual efforts;
- the national energy security strategies prioritized in long term perspective one common feature – energy independence, which I can distinguish as a completely new tendency in the energy field and a completely opposite tendency to the globalization.

Continuing in this context the next chapter will focus on the European energy security, its own problems, priorities and on energy independence.

²⁵ For further reading Klare, Michael (09/2004) *Blood and Oil: The Dangers and Consequences of America's Growing Dependency on Imported Petroleum*. Metropolitan Books, New York

²⁶ Peters, Susanne (2003) *EUI Working Papers, Building Up the Potential for Future Resource Conflict: the shortcomings of Western response strategies to new energy vulnerabilities*. Robert Schumann Centre for Advanced Studies, Florence

²⁷ RFE/RL (Radio Free Europe/Radio Liberty) (24/02/2006) *Energy, NATO considers role in increasing energy security* <http://www.rferl.org/>



European Union's Energy Security

- What about EU?
- European Union's answers
- Remaining problems

a. What about EU?

Let's start from the beginning. The energy theme has always been central for the European Union, because this is one of the reasons for its existence. The founding fathers considered the energy sector essential for the countries in the post-war period: 1) the economies were totally ruined, 2) peace had to be established and 3) prevention of another war had to be ensured. On this basis a process of reconstruction started and it began from the easiest thing – economic cooperation. In 1951 the European Coal and Steel Community was established and six years later – in 1957 – the European Atomic Energy Community (EURATOM). But like nowadays, this sector did not enjoy a common approach. Taking part of the “high politics” field, the energy was and is recognized like a matter of the national policy, related to the sovereignty. At the end of 1992 the Single market entered into force, but once again this sector stayed untouched. The European Commission's attempts continued and in 1999 the energy and transport policies were combined in one Directorate-General (e.g. one Commissioner). Unfortunately the debate if these fields are a national or a community priority still remains.

George W. Bush described the current energy situation in his annual speech as “beyond a petroleum-based economy”²⁸, but no matter the label this situation calls for wise and fast adaptation. The recent development over the European energy policy shows once again the lack of common approach and the lack of will to take the long-awaited decision. But the economy, the environment, the time and the question about their own energy security seriously presses the Union and its Member States, and prompts them to find a solution.

What exactly makes the current energy situation different, concerning the European Union? The past decades are considered as the “Golden 1990's”²⁹ of the European Union energy system, which was really sustainable, secure and environmentally friendly. This means that all targets (concretely from the Amsterdam treaty, 1997) were achieved: 1) access to energy resources; 2) low energy import dependence (below 50%); 3) decreasing energy prices; 4) 25% economic growth; 5) successes in the reforms in the internal, electricity and gas markets; 6) high energy efficiency in all sectors and technological advances in energy production and 7) the emissions of sulphur dioxide (SO₂),

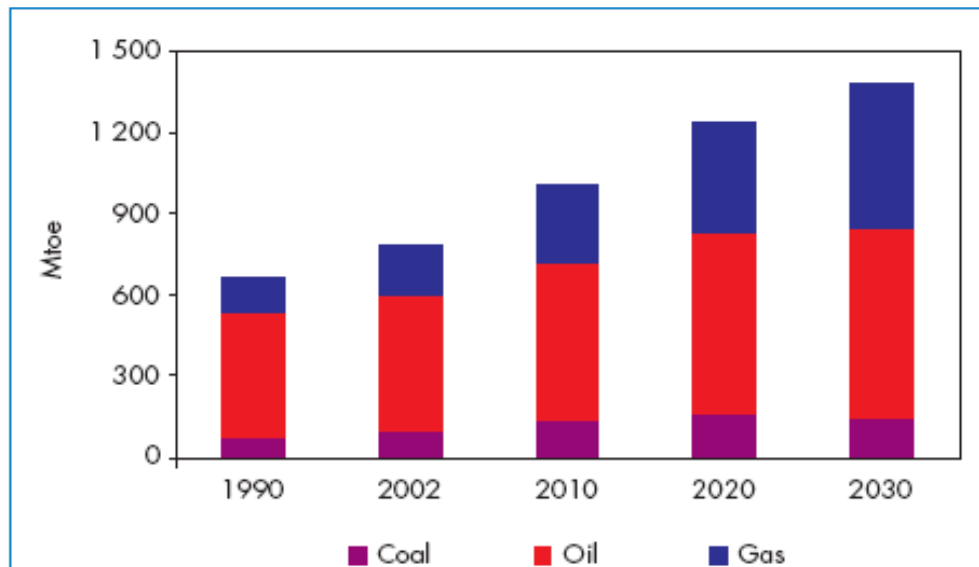
²⁸ Bush, George W (31/01/2006) *Annual State of Union address*. Washington

²⁹ European Commission (1999) *Energy in Europe, Economic foundations for Energy Policy*. Brussels

hydrocarbon and nitrogen oxide (NO_x) declined and carbon dioxide (CO₂) emissions were stabilized.

Now the energy reality is far away from its golden moments. In the previous chapter, I observed the global energy development, international energy security and some trends for the future. The conclusions were that home production declines (the production in general), the economic and population growth will challenge the energy production capacity, the energy imports will increase considerably, energy prices will remain very high, the environment is already seriously damaged, global competition for energy resources is emerging, the access to energy resources is problematic and although renewable energy is prioritized, the market conditions are not favorable. The Union is one of the major participants in the global energy transition.

Figure 2 | Fossil Fuel Net Imports in the European Union



Source: World Energy Outlook 2005, IEA

EU members possess approximately 0.6% of the world's proven oil reserves, 2.0% of the world's proven gas reserves, 4.0% of the world's proven coal reserves and 18.0% of the world's electric generating capacity.³⁰ Despite these insufficient reserves the Union consumes 17% of the world total energy consumption (in 2003 USA consumed 23%). The prominent fuel is oil, which accounts for more than 40% of the total energy consumption, gas – 24%, nuclear power – 15%, coal – 13 % (the

³⁰ In this part is used data from: 1) EIA (Energy Information Administration) (2005) Country Analysis Brief, EU. <http://www.eia.doe.gov/>, 2) BP (2005) Statistical Review 2005 and 3) IEA (2005) WEO 2005

coal consumption is reduced because of the environmental concerns) and renewables – 6%.

Table 2 | European Union's energy resources

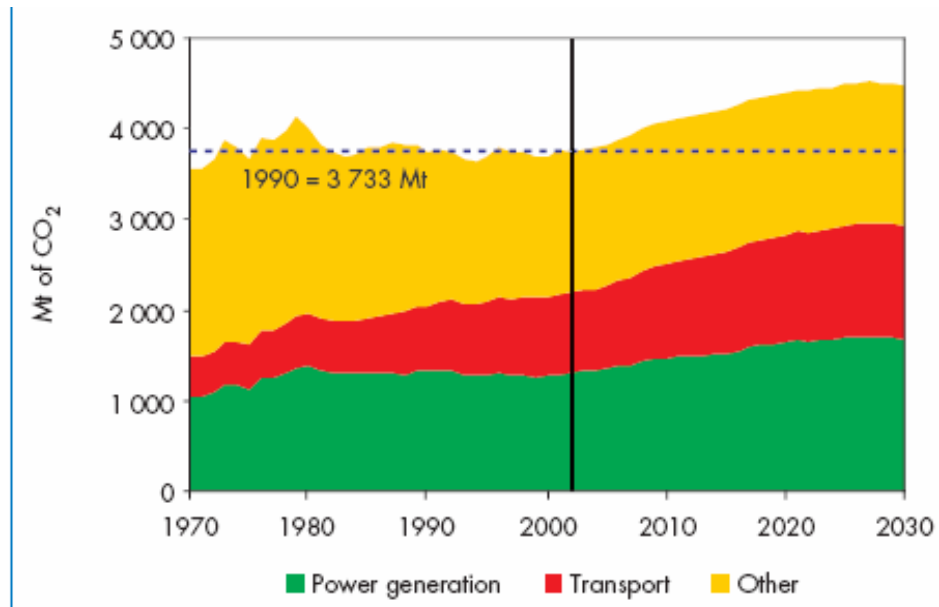
| | Proven reserves | % of the total EU consumption | % of the total world consumption |
|------------|-----------------|-------------------------------|----------------------------------|
| oil | 0.6 | 40 | 18,4 |
| gas | 2.0 | 24 | 17,4 |
| coal | 5.5 | 15 | 11 |
| nuclear | - | 13 | 35,8 |
| renewables | - | 6 | - |

EU is a net importer of energy. Now the dependence of external energy sources is more than 50%, and the Commission's forecasts are for 70% imports at 2030. Imports already meet 76% of EU primary oil demand and this share will grow to 94% to 2030; gas import dependence will increase from 49% now, to which 81%, will be met considerably by liquefied natural gas (LNG). Coal imports are projected to grow too, because of closures of unprofitable mines in some countries: Czech Republic, Germany, Greece, Poland, Spain and United Kingdom.

The growth for 2005 is above 2,6% and it is projected to slow down in the period 2010 – 2030 till 1,7%. Because the population will remain relatively unchanged, the GDP per capita will be 75% higher in 2030 than in 2002.

The CO2 emissions in EU will rise with the growth in the energy demand. In 2030 they will reach 20% above the 2002 level. Power generations (35% now, 37% in 2030) and transport (24% now, 28% in 2030) will stay the biggest CO2 emitting sectors.

Figure 3 | Energy-Related CO2 Emissions in the European Union



Source: World Energy Outlook, 2005, IEA

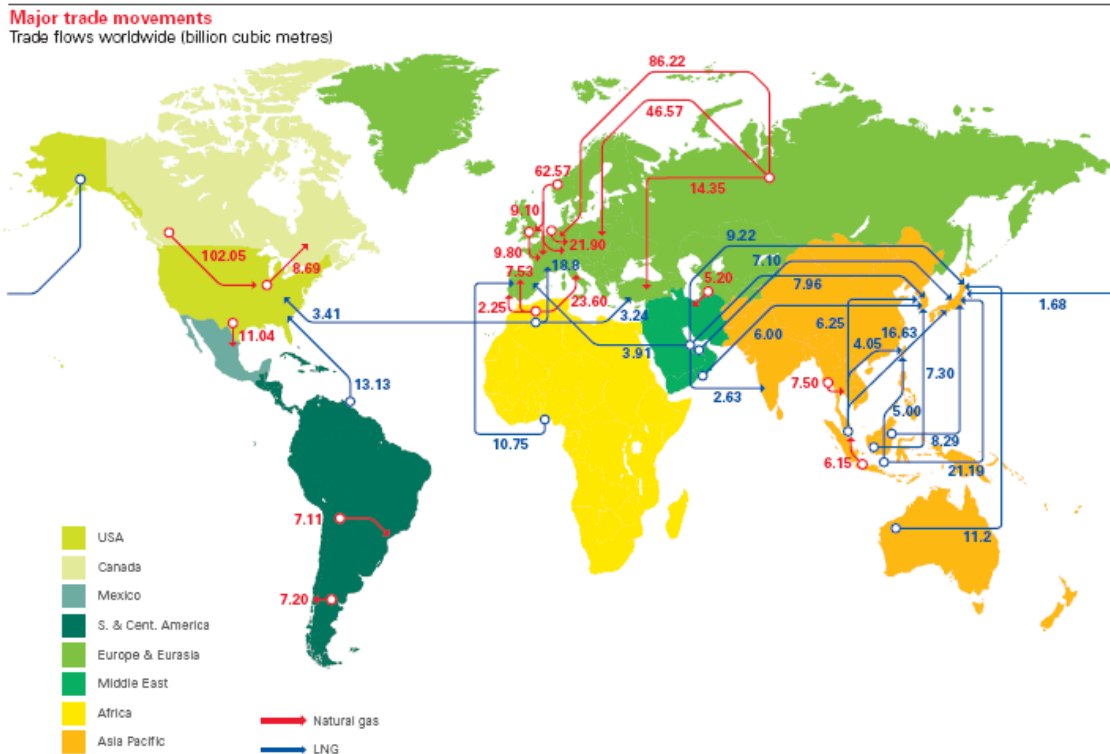
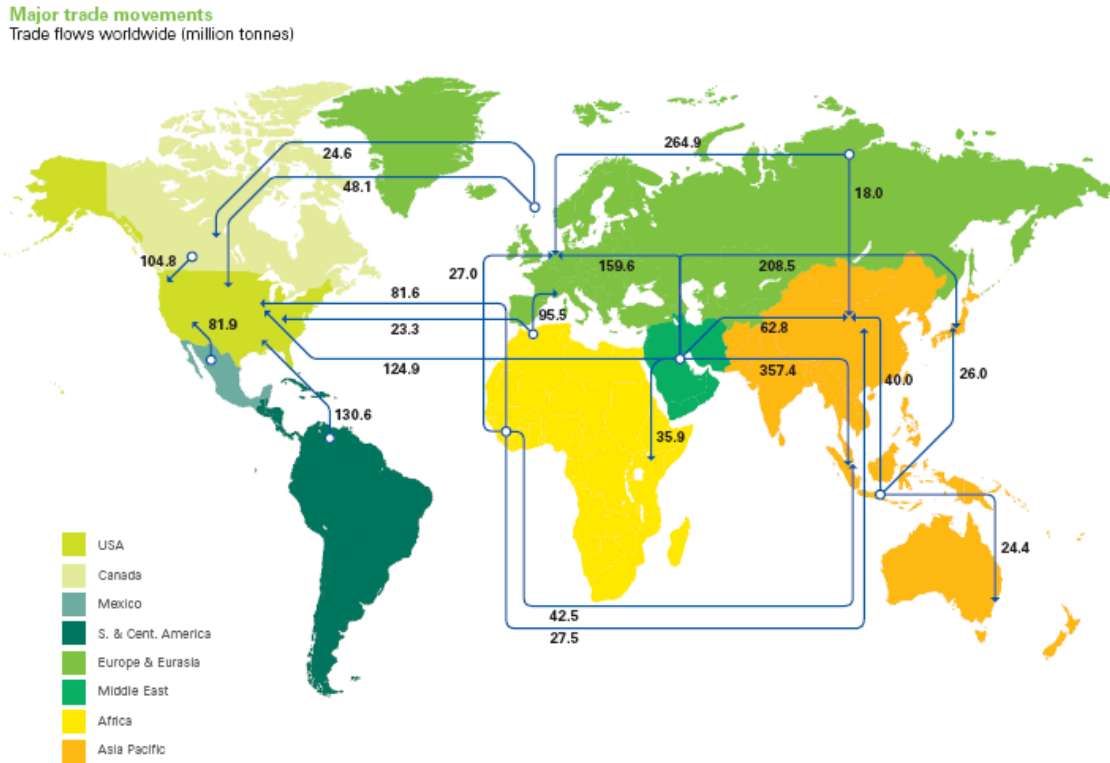
After all the statistics we can easily assemble the whole picture of the European energy situation and this will clearly show us what the challenges ahead look like. The EU does not stay apart from the global energy instability; on the contrary – it actively participates and it is highly affected. The Union is equally affected as the other countries from OECD by the high oil prices, slow population and economic growth, new environmental and climate change worries, energy access uncertainties, energy concurrence from East, increasing energy dependence, and sluggish alternative energy growth rate. But besides that, EU has its own energy problems.

The oil and gas imports come from concentrated regions, which refer directly to the energy security issues. Currently, EU imports gas via pipelines mainly from Russia (131 bcm), Norway (62.6 bcm) and North Africa (34 bcm): of which Algeria (33.5 bcm) and Libya (0.5 bcm), and in the form of LNG from Africa (Algeria – 18.8 bcm and Nigeria – 10.75 bcm) and the Middle East (5.4 bcm). Although the gas market tends to be regional (with exception of LNG exports) the Union depends highly only on three regions and first of all – considerably from Russia. This uncomfortable situation currently appeared when Russia suddenly stopped the exports for the EU via Ukraine.³¹ Even on a global scale, the

³¹ BBC News (04/01/2006) Lessons' for EU from gas crisis. BBC <http://news.bbc.co.uk/go/pr/fr/-/1/hi/world/europe/4582652.stm>

oil market gives the same result for the EU – Russia (264.9 mln.t), Middle East (159.6 mln.t) and North Africa (95.5 mln.t)

Figure 4 | Major Trade Oil and Gas Movements



Source: BP Statistical Review 2005

The Union started to work on these problems ever since the last decade, but the results are not encouraging. Because of the high external dependence, it is difficult to separate the external from the internal aspects of the energy security. The inevitability of increased energy imports for the moment is obvious. For this reason, EU started to work had on its energy efficiency in order to meet the new tendency towards energy independence (it is more correctly to say, European energy less-dependence). In this context, Brussels launched different initiatives to face the challenges – bilateral and multilateral dialogs, Green and White Papers, Carbon Emission Trading Program, alternative pipelines projects, directives and regulations for liberalization of the energy and gas market, R&D programs for new technologies, alternative energy, renewables, biofuels. Along with this, the EU participates in various international forums (International Energy Forum), programs, meetings (G8), organizations (ECT), regimes (Kyoto Protocol) in order to discuss, influence and if possible, to change the global energy environment.

Amongst all the initiatives those related to external relations are the most controversial, because, as I mentioned earlier, they remain in the Member States' foreign policy and are part of the national sovereignty issues. Nevertheless, this discussion is still open exactly because of the EU (in this case we can say Europe) energy import dependence, particularly from one major supplier, which affects not only the Community, but also the individual member states' energy security. Facing the reality needs a stable position, which is difficult with 27³² or more national strategies. And we must not forget that achieving energy less-dependence at this moment requires security of supplies (external security), internal security (market) and energy efficiency (energy mix, alternative energy, renewables, biofuels), and all three of them deserve equal attention.

The principal policy guidelines used by EU when meeting its energy security challenges are the bilateral, multilateral/regional dialogues and the Green/White Papers. The Union tried to legalize the energy issue in the Treaty Establishing the Constitution, too. All other initiatives and official documents are consequent to them, trying to implement the subsequent actions. In the next part I will go through these initiatives in order to see the recent progress on the way to achieve energy security.

³² After Bulgaria and Rumania

b. European Union's answers

The global energy situation is entering into a period of transition. In Chapter I, I described this tendency like this – from energy dependence to energy independence. In the first part of this Chapter II we understood that in the case of EU the most appropriate expression is energy less-dependence. Brussels has worked for a long time to prepare the Union for this moment, but unfortunately we cannot call all initiatives successful. One of the mentioned reasons is that energy issues are too of a “national problem” to be decided at community level. But now when the situation is urgent from economical, political, social, and environmental point of view, a solution must be found soon. In this particular situation, when even the future of the planet is at stake, it is not the process which is important, but the outcome (not if we finish it, but the way in which we finish it is crucial).

One of the main policies through which the EU provides its priorities about energy security are the energy dialogues. They can be bilateral (EU – third country), multilateral (EU – third countries) and regional (EU – region or regional organization). Recently we saw a fourth type of energy relations in the logic of the debate if the energy is national or a community priority – bilateral dialogue between one Member State (e.g. Germany) and third country (e.g. Russia).³³

In the newly issued Green Paper, the EU not for first time prioritized the regions of Caspian Sea, Middle East and North Africa as essential for its energy security, but for now the Union did not develop the framework of energy dialogue with them. Furthermore, like the former energy commissioner Loyola De Palacio pointed³⁴, a strategic partnership or energy dialogue must be build with key suppliers – Algeria, transit countries – Turkey, Ukraine, other energy consumers – USA, China and I will add – the whole region of Caspian Sea (for which already the competition is growing – USA and Russia). In this context, even now in the frameworks of the existing dialogues, the progress is not considerable (on Russia, for instance).

In this part I will summarize the development of the relations between the EU and this key countries or regions and will observe which existing or future projects make them so important. Under key actors, I understand

³³ Spongenberg, Helena (09/05/2006) *EU queries state aid in German-Russian gas deal*. EUobserver <http://euobserver.com/9/21540>

³⁴ Palacio Loyola De (2004) *Policies For A Dependent Europe*. European Commission, Brussels www.worldenergy.org/wec-geis/global/downloads/first/19congress/palacio.pdf

future or existing major suppliers for EU, major transit countries and major competitors on the global energy market.

Bilateral Dialogues | Suppliers | Russia

The bilateral energy dialogue was launched in 2000 and a joint declaration was adopted in 2001.³⁵ The principal idea of the dialogue was to secure the energy interdependence (secure supplies for EU and secure markets for Russia). The problems start from the different priorities for the both sides:

For EU:³⁶

- improvement of the Russian business environment, investments in the domestic energy market (which is monopolized – Gazprom, Transneft)
- climate change issues and Kyoto protocol (Russia already ratified it);
- nuclear safety and energy efficiency projects

For Russia:³⁷

- harmonizing the Russian and EU energy systems and construction of a new energy transportation system;
- settling the situation around Gazprom's long-term contracts.

The energy dialogue is not developing considerably for several reasons: 1) EU insists over the ratification of ECT (European Charter Treaty) while Russia sees the situation differently, 2) the so-called “four spaces” – security, economic, legal, research on which EU bases its relations with Russia are not equally cherished by the two sides. Currently problematic issues are: 1) the shortage of gas supply for EU via Ukraine caused by economic reasons, 2) the launch of the new project North European Gas Pipeline (NEGP) by Russia and Germany; the pipeline will bypass Poland and Ukraine, which will compromise their own energy security.

It is important to notice that the Russian natural gas is imported to the EU by pipelines (Russia does not export by LNG) and the oil has two ways; first is through Droujba pipeline and second – tankers from the Baltic ports in Germany and Latvia. The projects of common interest are (Appendix F):

1. NEGP and its concurrent Yamal Europe gas pipeline
3. Bourgas-Alexandroupolis oil pipeline (concurrent to the AMBO Project, (Albania-Macedonia-Bulgaria Oil) which is without Russian participation);
4. Droujba-Adria oil pipelines
5. Shtokman field

³⁵ For more information www.europe.int

³⁶ EurActive (23/03/2006) *Energy, Geopolitics of EU energy supply.*

<http://www.euractiv.com/en/energy/geopolitics-eu-energy-supply/article-142665>

³⁷ Khristenko, Viktor (25/04/2006) *Possibilities for energy dialogue.* RIA Novosti

<http://en.rian.ru/analysis/20060425/46902706.html>

Bilateral Dialogues | Suppliers | Norway

In 6 July 2005, the Energy Commissioner Andris Piebalgs and the Norwegian Minister of Petroleum and Energy signed an energy dialogue.³⁸ The areas of common interest are: energy efficiency, renewable energy and security of energy supply, exploration and production activities in the Arctic area.

Brussels communicates with Norway in two other energy dialogues, which I will discuss later – Baltic Sea Region Energy Cooperation (BASREC) and Arctic Energy Agenda. But at the moment this is everything which can be said about the energy communication between the two actors, although EU is dependent of oil and gas imports from Norway.

Recently, geologists found in the Norwegian part of Arctic sea oil field in area of 27.7 mln. km², worth EUR 250 bn.³⁹

Bilateral Dialogues | Suppliers | Algeria

European Union does not have an energy dialogue with Algeria.⁴⁰ The energy issue is part of their institutional cooperation, in the context of the association agreement. 16 May 2006 in Brussels the two actors agreed on a future “strategic energy partnership” and “high level” dialogue. Subject to this discussion were as well: 1) the creation of Free Trade Area between the two parties, 2) modernization of the existing energy infrastructure, 3) prioritization of the LNG trade. At this moment, Algeria exports gas via two gas pipelines: Maghreb-Europe (via Marco for Spain and Portugal) and Trans-Mediterranean (via Tunis for Italy) and LNG terminals (France, Belgium, Spain, Turkey, Italy and Greece) (Appendix G). Two ongoing projects will have the potential to strengthen even more the current energy cooperation:

- 1) Medgas
- 2) Galsi

Algeria will participate in a new project part of the New Partnership for Africa’s Development (NEPAD)⁴¹ for gas pipeline TransAfrican, which will

³⁸ European Commission, DG TREN (06/07/2005) *Joint Press Release, EU-Norway Energy Dialogue*. Oslo http://www.dep.no/odinarkiv/english/bondevik_II/oed/026031-070371/dok-bn.html

³⁹ Kuchler, Teresa (24.4.2006) EU should look north for energy. EUobserver

⁴⁰ Rebah, M'hamed (18.05.2006) *Un protocole d'accord sera signé fin mai*. La Nouvelle République, Alger

www.lanouvellerepublique.com/actualite/lire.php?idc=38410&idc=4&refresh=1%2B%2B

⁴¹ Nouveau Partenariat pour le Développement de l'Afrique (NEPAD)
<http://www.nepad.org/2005/fr/home.php>

connect Nigeria and Europe via the Mediterranean Sea. Another dialogue, in which Algeria participates, is the dialogue Euro-Mediterranean Partnership, which includes Turkey, Middle East and North Africa.

Bilateral Dialogues | Suppliers | Azerbaijan

Discussions on energy cooperation between the European Union and Azerbaijan have started in the framework of the PCA, in addition to energy related technical assistance performed under TACIS. For the first time the energy cooperation between the EU and Azerbaijan in the form of a dialogue took place during the third meeting of the EU-Azerbaijan Sub-committee on Trade and Economic Issues in Baku on 14-15 March 2003.⁴²

The priorities as they are formulated in the dialogue are following: 1) facilitating the transportation of oil and gas from Azerbaijan, 2) security of transportation of hydrocarbons, 3) creation of common rules and standards for the transportation of Azerbaijani oil and gas to Europe, 4) improvement of investment conditions for the EU companies in Azerbaijan, 5) harmonization of Azerbaijani legislation with rules of the internal market for electricity and gas of the EU and 6) continuation of reforms in the oil and gas production.

Azerbaijan is one of the countries, which will be extremely important for the European energy security. In the new Green Paper, the EU mentioned that the whole region of Caspian Sea is important for the future European energy security, because it is one of the ways to ensure energy less dependence. The concrete projects for now are (Appendix H):

- 1) TRACECA
- 2) INOGATE
- 3) AMBO – Albania – Macedonia – Bulgaria Oil
- 4) BTG – Baku – Tbilisi - Ceyhan
- 5) BTE – Baku – Tbilisi – Erzurum, but Russia boosted the project with the construction of Blue Stream gas pipeline under Black Sea.

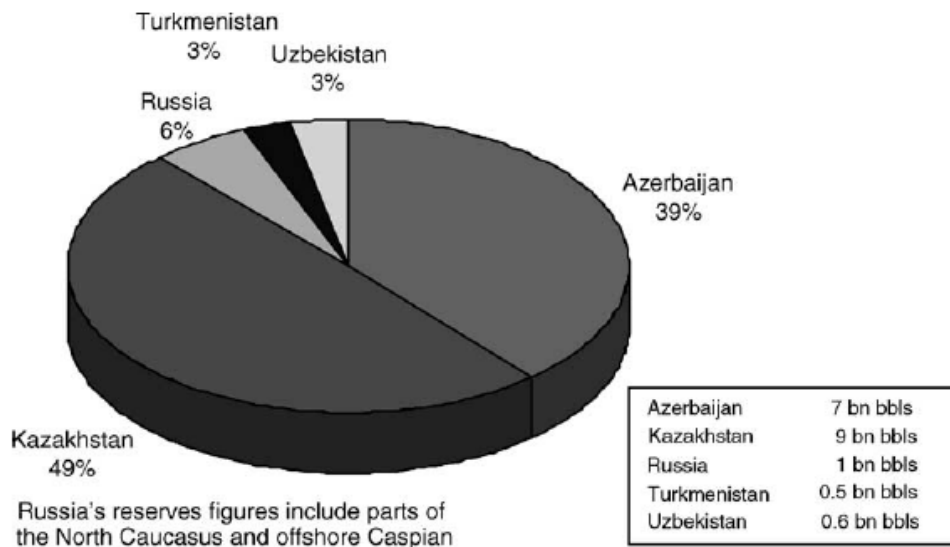
Bilateral Dialogues | Suppliers | Kazakhstan

In 1995 between the EU and Kazakhstan a Partnership and Cooperation Agreement (PCA) was signed, which even now is the legal framework for their energy relations. Separately from the PCA, specific energy issues are

⁴² Mission of Azerbaijan to the European Union <http://www.azerbaijan-eu.com/energy.php>

being discussed under bilateral agreements: 1) Steel Agreement, 2) Nuclear Safety, 3) Nuclear Fusion and 4) Peaceful use of nuclear energy. In 4 may 2006 Commissioner Piebalgs visited Kazakhstan in order to explore the future perspectives for energy cooperation⁴³. This was the first official visit of an Energy Commissioner ever in this country. He is joined by representatives of the European oil and gas industry and met with numerous high level officials. Kazakhstan has the capacity to be a major player in the oil rich Caspian Region. The country accounts for 49% of the proven reserves in the Region (Afghanistan is the second with 39%).

Figure 5 | Shares of proven oil reserves in the Caspian region



Source: BP & CGES, 2004

“Strengthening discussions with Kazakhstan in the energy sector is of great importance for improving the security of energy supplies to the EU” underlined the Commissioner. Discussions with senior Kazakh representatives involved the modalities of enhancing energy cooperation and new export routes from the Caspian region to the EU.

Bilateral Dialogues I Transit countries

After the shortage of the Russian gas to EU via Ukraine, the Union understood the importance of the transit countries. After the collapse of the Soviet Union, the transit chain became too long – in some cases the transit countries can be 14. The major transit country for gas is Ukraine, for oil is Belarus, and in the near future for fossils fuels in general - Turkey.

⁴³ European Commission, IP/06/573 (04/05/2006) *Commissioner Piebalgs Enhances Bilateral, Energy Cooperation with Kazakhstan*. European Commission, Brussels
<http://europa.eu.int/rapid/pressReleasesAction.do?reference=IP/06/573&format=HTML&aged=0&language=EN&guiLanguage=en>

Bilateral Dialogues | *Transit countries* | Ukraine

The energy fiasco passed quickly, but EU has yet not reacted with some special proposals toward Ukraine. Their energy relations were and are in the framework of the Neighborhood Action Plan. The priorities are: 1) liberalization of Ukraine's energy markets, 2) renewable energy, 3) nuclear safety and 4) co-operation in energy infrastructure projects.

In a conference on 28 February 2006 in Brussels, the Energy Commissioner stressed that "Re-enforced co-operation with Ukraine is a key element of our considerations in this respect. The Memorandum of Understanding on co-operation in the field of energy which was signed on 1 December 2005 constitutes a good basis for working together."⁴⁴

The Memorandum establishes a joint strategy towards the progressive integration of the Ukrainian and the EU energy market. It consists of road maps covering four specific areas: nuclear safety, integration of electricity and gas markets, enhancing security of supplies and the transit of hydrocarbons and improving the functioning of the Ukrainian coal sector. It also foresees the development of a roadmap on energy efficiency, renewables and measures to tackle climate change.

Bilateral Dialogues | *Transit countries* | Belarus

EU and Belarus have no energy relations, which is logical having in mind the lack of cooperation in any field. It is even more correct to say that Brussels refuses to communicate with Lukashenko. In 1995 both sides negotiated a PCA, but it never came into force.⁴⁵ In 2003 the Commission launched the European Neighborhood Policy (ENP), but still there is no movement towards a signing of an Action Plan. EU is dependent on Belarus, and it will be in the interest of both sides if the existent legal framework develops and spreads in other fields.

Bilateral Dialogues | *Transit countries* | Turkey

The relations between Turkey and EU started a long time ago. In 1959 Ankara applied for EEC (European Economic Community). EEC answered

⁴⁴ Piebalgs, Andris (28/02/2006), *Conference on "Electricity Sector of Ukraine – Status and Plans ahead"*, EU – Ukraine Common Energy Challenges. Brussels
<http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/06/132&format=HTML&aged=0&language=EN&guiLanguage=en>

⁴⁵ European Commission, DG External Relations (03/2005) *Overview of the EU's relations with Belarus*. European Commission, Brussels
http://ec.europa.eu/comm/external_relations/belarus/intro/index.htm

with the progressive establishment of a customs union and abolition of tariffs and quotas for goods' circulation.⁴⁶ In 1987 Turkey applied for full membership and in 1990 EU confirmed its eligibility. In 1999 Brussels officially recognized Turkey like a candidate country. In 2003 the Council adopted a revised Accession Partnership and National Program for the Adoption of the Acquis. In November 2005 the EU opened accession negotiations with Turkey.

Turkey is expected to be a crucial player in the future European Energy Security, because of its geographical proximity to the key supplying regions of Middle East, North Africa, Caspian Sea, and even Russia. Another point is Turkey's possibility to bypass Russian monopoly on the European energy market. All the projects which are already reality, or are waiting to become a reality, transfer Turkey from a country non-producer into a third largest gas exporter (120 bn m³⁴⁷) to Europe after Russia and Algeria. Turkey can be seen neither as a producer, nor like a pure consumer, but as a main energy route in the world, which gives Ankara completely new role in the energy scene.

The existing projects:

- 1) Blue Stream – though the Bosphorus strait, which faces serious environmental problems⁴⁸
- 2) Baku-Tbilisi-Ceyhan. Together with South Caucasus Pipeline, BTC is a part from East-West Energy Corridor;⁴⁹
- 3) The South Caucasus Pipeline (Baku-Tbilisi-Erzurum)

Potential pipelines (Appendix I):

- 1) Turkey-Greece-Italy - 0.75bn m³, long term capacity 3-11 bn m³, due to open 2006. The project is also a sign that relations between the two bitter historical rivals are warming up.
- 2) Greece - Italy Interconnector - 22 bn m³, under study with possible opening in 2008. Together with Turkey-Greece pipeline, the two projects are part from the EU's South Europe Gas Ring project;
- 3) Turkey-Austria (Nabucco) - 3-5 bn m³, long term capacity 20-25 bn m³, under study with possible opening in 2009.

⁴⁶ European Commission, DG Enlargement *EU-Turkey relations*.

http://ec.europa.eu/comm/enlargement/turkey/eu_relations.htm

⁴⁷ Estrada, Aurelia Mane (2005) *European Energy Security: Towards the Creation of the Geo-Energy Space*. Energy Policy

⁴⁸ There are several projects bypassing the Straits and because this is not the main purpose of the text, I will only enumerate them here: **1)** Odessa-Brody, **2)** Adria-Druzhba integration, **3)** Constanza-Pancevo-Omisalj-Trieste (CPOT), **4)** Albania-Macedonia-Bulgaria Oil (AMBO) Pipeline, **5)** Bourgas-Alexandroupolis (Trans-Balkan Oil Pipeline), **6)** Kiyikoy-Ibrikbaba, **7)** Samsun-Ceyhan, **8)** Agva-Izmit: The Tupras refinery bypass.

⁴⁹ Turkish Embassy in USA *Energy Issues, Turkey's Energy Policy*

http://www.turkishembassy.org/index.php?option=com_content&task=view&id=65&Itemid=265

4) Greece-Western Balkans-Austria or The West Balkans Pipeline Proposal - 10-20 bn m3 (preliminary proposal).

But Turkey's energy relations are much more diverse:

Table 3 | Potential Eurasian gas suppliers to the EU market (by pipeline)

a. Supply potential as of 2010

| Country | Volume | Transit country | Potential by 2015 | Existing system |
|--------------|-----------|-----------------|-------------------|------------------|
| Iran | 10 bcm | Turkey | 20-30bcm | 3-10 bcm |
| Turkmenistan | 13 bcm | Iran/Turkey | 30 bcm | 13 bcm |
| Turkmenistan | 34-80 bcm | Russia | 80 bcm | 50 bcm |
| Turkmenistan | 10-36 bcm | Russia/Ukraine | 36 bcm | 36 bcm |
| Azerbaijan | 7 bcm | Turkey | 20 bcm | 6-20 bcm* |
| Iraq | 10 bcm | Turkey | 10 bcm | none |
| Egypt | 4 bcm | Jordan/Syria | 10-12 bcm | Link to Jordan** |

* SCP system under construction, due to open 2006.

** Egypt-Jordan gasline has reached Syrian border.

b. Additional supply potential post-2015

| Country | Volume | Transit country | Existing system |
|--------------|-----------|--------------------------|-----------------------|
| Qatar | 20-30 bcm | Kuwait/Iraq/Turkey | None |
| Egypt | 10-12 bcm | Jordan/Syria | Link to Syria* |
| Saudi Arabia | 10-20 bcm | Jordan/Syria/Turkey | None |
| Kazakhstan | 10-20 bcm | Azerbaijan/Turkey | None |
| Turkmenistan | 20-30 bcm | Azerbaijan/Turkey | None |
| Turkmenistan | 30-36 bcm | Iran/Turkey | Limited connections** |
| Uzbekistan | 5-10 bcm | Turkmenistan/Azer/Turkey | None |

* This would be additional to the 10-12 bcm potential delivery before 2015.

** Turkmenistan's Caspian shore gasfields are already linked into the Iranian network via the 12 bcm/y capacity line from Korpedzhe to Kurt-Kui, but there are no significant connections to Iran from Turkmenistan's main central and southeastern gasfields.

Source: CEPS, The Turkish Gate, Energy Transit and Security Issues, John Roberts, EU-Turkey Working Papers, No 11/October 2004,

So like this, the number of future projects increase considerably⁵⁰: Iran is important energy supplier. Tehran has already been discussing eventual deliveries of gas to Greece via Turkey, whilst EU officials have spoken of Iran as a long-term gas supplier to EU member states. The current political situation in Iran has frozen the projects for the moment.

Turkish officials also continue to discuss with their Iraqi counterparts what they call the 'Iraq Integrated Natural Gas Pipeline Project', for developing gas fields in northern Iraq and bring some 10 bcm/y into the Turkish system, again with a view to forwarding some of this gas to other European markets. Now the project depends on the security conditions in Iraq.

⁵⁰ Roberts, John (10/2004) *EU-Turkey Working Papers No 11, The Turkish Gate, Energy Transit and Security Issues*. CEPS, Brussels

Egypt-Jordan-Syria line can be easily able to affect deliveries to southern Turkey or Iskenderun. Egypt has a desire for new export markets. For the moment the feasible alternatives are: pipeline deliveries to Europe via a proposed connection to Libya and the Libya- Italy "Green Stream" line, and development of LNG export facilities.

Bilateral Dialogues | Concurrent countries | USA

The energy issues have taken part in the EU – USA relations after the negotiations of the New Transatlantic Agenda in 1995.⁵¹ The main priorities in the energy agenda are: 1) transportation security (aviation, maritime), 2) environment, climate change issues and chemical safety legislation (Kyoto Protocol). In the latest visit of the Commission President Barroso in USA this year⁵² he underlined several other problems:

- setting up a Strategic Energy Dialogue between EU and US;
- improve energy security and foster economic growth and development;
- cooperation ("where it is possible") in development of new fields;
- Increasing the role of the market rule in the energy sector;
- tackling together not only the energy supply, but the energy demand too: diversifying the energy sources, developing renewable energy, improving the energy efficiency;

"It would help us to shape the post petroleum economy together" finished one speech Mr. Barroso, but is cooperation in a field of national vital resources really possible, when accessibility is questionable and availability is decreasing? And especially when the county you want to cooperate with has the same level of development and the same priorities (and priority areas) like yours...

Bilateral Dialogues | Concurrent countries | China

The 6th EU-China Energy Conference took place in Shanghai on 20 and 21 February 2006.⁵³ Due to its increasing role on the global energy market because of the existing and anticipated energy demand, China is becoming an important partner for energy dialogue. The priority areas are: 1) reinforcing the security of energy supply, 2) promoting renewable

⁵¹ Delegation of the European Commission to the USA, Transportation/Energy/Environment Policy, <http://eurunion.org/legislat/TEE/TEEhome.htm>

⁵² Barroso, José Manuel Durao (09/02/2006) *Speech in Georgetown University, Speaking with a Common Voice: Energy Policy In The 21st Century*. Washington
http://europa.eu.int/comm/commission_barroso/president/pdf/speech_20060209_en.pdf

⁵³ European Commission, DG Energy and Transport (17/05/2006) *Enlargement and International Relations*. Brussels

energy, 3) increasing energy efficiency, 4) straightening nuclear safety and security, 5) interactions between energy policy and research and environmental policies.

The recent initiatives are:

- action plan on clean oil (China is one of the biggest oil consumers);
- action plan on energy efficiency and renewable energy;
- strategic dialogue on energy and transport;
- joint declaration on climate change – energy efficiency, renewables, clean coal, methane recovery and use, carbon capture and storage, hydrogen and fuel cells, power generation and transmission.

Additionally, Memorandum of Understanding (MoU) on “Co-operation on Near-Zero Emissions Power Generation Technology through Carbon Capture and Storage” has been signed. Furthermore China now is building the biggest hydroplant in the world – the so-called “Three Dams”.

Bilateral Dialogues | Concurrent countries | India

In October 2004, the EU and India established a Strategic Partnership in the field of energy.⁵⁴ The Energy and Transport Commissioner Andris Piebalgs identified several concrete areas of cooperation:

- energy efficiency, in particular standards for energy using products and building standards;
- exploration the possibilities for joint research and development projects in the areas of solar photo-voltaic, solar thermal, biomass combustion and biomass gasification;
- cooperation in the area of bio-diesel;
- increasing efficiency of coal based power generation;
- developing of clean coal technologies (India is like China highly dependent on coal energy).

After the conference, the EU and India signed a Memorandum of Understanding (MoU) on five concrete studies in the areas of renewable energies, energy efficiency and coal.

Multilateral Dialogues | Organizations | OPEC

The countries in OPEC (Organization of the Petroleum Exporting Countries) account for around 40% of the total oil import of the European Union. The

⁵⁴ Piebalgs, Andris (06/04/2006) *Opening Speech at the EU-India Business Conference on Energy, Energy Cooperation with India*. New Delhi

EU has an Energy Dialogue with OPEC. On the first meeting in 9 June 2005 in Brussels the priority issues were⁵⁵:

- fluctuation in the oil prices and oil market development in short and medium-to-long terms;
- greater data transparency on stocks and investment needs;
- energy policies, energy technologies and energy related multilateral issues.

The second energy meeting was on 1 February this year in Vienna ⁵⁶. The focus was on: 1) carbon capture and storage in conjunction enhanced oil recovery and 2) impact of energy policy on demand and supply.

Multilateral Dialogues | Organizations | Gulf Cooperation Council (GCC)

The Union has two forums for energy discussions with the countries from the Middle East and the Persian Gulf – OPEC and Gulf Cooperation Council (GCC). In 1989 the EU signed bilateral co-operation agreements with the six countries from GCC – Saudi Arabia, Bahrain, Kuwait, Oman, Qatar and United Arab Emirates (Yemen is currently in negotiations for membership and it is expected to join in 2016). All the GCC countries are part of OPEC, except Bahrain and Oman. The objectives of these agreements are to strengthen the stability in a region of strategic importance and to facilitate political and economic relations. In 2001 Free Trade Agreements began to be negotiated and today they already are in their final stage.

GCC is currently the EU's sixth export market (for 2004 – EUR 40 bn) and the EU is GCC first trading partner (for 2004 – EUR 25 bn).⁵⁷ 70% of EU's import from GCC countries is fuels and derivatives (GCC holds 45% of the world's oil reserves).

GCC countries stated many times that they would like to conclude a series of Free Trade Agreements with different partners, including India, China and Turkey for a period of two years. The forecast is that the

⁵⁵ European Commission (09/07/2006) *Joint Press Release, EU-OPEC Energy Dialogue*. Brussels

⁵⁶ OPEC Conference President Dr Daukoru meets Austrian Federal Minister of Economics and Labor, Dr Barenstein in Vienna, Austria in 1 February 2006

<http://www.opec.org/opecna/Press%20Releases/2006/pr042006.htm>

⁵⁷ The Peninsula (13/04.2006) *GCC-EU free trade talks in final stages*. Doha

http://www.thepeninsulaqatar.com/Display_news.asp?section=Business_News&subsection=Local+Business&month=April2006&file=Business_News2006041312628.xml

Region will have a common currency and a single regional central bank, until the end of 2010.⁵⁸

But the Region has a serious problem: despite the enormous oil resources, there is a lack of water. Thus one of the recently expressed priorities for the GCC region is the development of research projects for increasing the water resources and developing solar energy as an alternative "since the hydrocarbon reserves are not going to last for ever".⁵⁹

Regional Dialogues I South Mediterranean

The Partnership is launched in 1995 with the so-called Barcelona Process. The Euro-Mediterranean Partnership is composed by all North African countries, the Middle East countries and Turkey: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, the Palestinian Authority, Syria and Tunisia. Lebanon has an observer status. Nevertheless, the EU communicates separately in the energy field with part of these states (Turkey, Algeria) or in the framework of GCC or OPEC. Brussels recognizes these regions as key partners in its energy security and energy relations in general. The Middle East Peace Process is separated from this dialogue.

The final aim is the formation of a Euro-Mediterranean Free Trade Area (EU-MEFTA) until the end of 2010.⁶⁰ Part of the aim is the creation of Maghreb electricity market, for eventual connection with Europe. For the moment the dialogue with Algeria has a priority.

Regional Dialogues I Africa – Gulf of Guinea

The dialogue started in 2000 in Cairo and is focused on development cooperation (peace, security and good governance) with the Economic Community of West African States - ECOWAS. The energy aspects of these relations are several:

- in the context of EU energy security, these are the dialogues with two oil exporters for the Union – Nigeria and Angola. Related to these dialogues is the initiative New Partnership for Africa's Development (NEPAD)⁶¹ –

⁵⁸ European Commission DG External Relations (01/2006) Overview of the EU and the Gulf Cooperation Council relations. Brussels

http://ec.europa.eu/comm/external_relations/gulf_cooperation/intro/index.htm

⁵⁹ Ibid

⁶⁰ European Commission, DG External Relations (2005) *Overview of the EU's Mediterranean & Middle East Policy*. Brussels

http://ec.europa.eu/comm/external_relations/med_mideast/intro/index.htm

⁶¹ Nouveau Partenariat pour le Développement de l'Afrique (NEPAD)

<http://www.nepad.org/2005/fr/home.php>

trans-African gas pipeline (NIGAL pipeline), which will relate Abuja (Nigeria) with Mediterranean coast via Niger and Algeria, and will contribute for the European gas supplies (Appendix J).

- creation of a European Energy Facility for ACP countries (African Caribbean and Pacific States) for supporting the provision of adequate, affordable, sustainable energy services.⁶² Already completed projects exist with the governments of Republic of Congo, Zambia, Gambia, ongoing project in Mali and projects under preparation in Malawi, Rwanda, Tanzania, Swaziland and more.⁶³

Regional Dialogues I North Europe

The countries from the area of Arctic Sea, Baltic Sea to Iceland and Greenland are organized in one cooperation framework, called Northern dimension. One of the aims of the initiative, although not a primary one, is to focus on energy issues. Thus the countries have launched two other forums, specialized in energy: BASREC and Arctic Energy Agenda plus the bilateral energy dialogues with some of the countries (Russia, Norway, for instance).

Regional Dialogues I Baltic Sea Region Energy Cooperation (BASREC)

The dialogue was started in 1999 by the energy ministers of Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia and the EU Commission. The main priorities for the moment are: replacement of old energy supply systems, improvement in the area of energy consumption, transmission and generation (spatially in district heating), reduction of the environmental impacts of the energy production, use and transmission, development of the wider potential for renewable energy.⁶⁴

Recently BASREC has met one serious problem, namely the Russian-German common joint venture decided to launch the North-European Pipeline Project, which will bypass Poland. It is a serious issue, because before this project the priority was put on Yamal-Europe Pipeline and Amber (via Poland, Belarus, Lithuania and Latvia).

⁶² European Union (29/03/2005) *Taking EU-Africa Dialogue Forward*. Brussels
<http://www.europa.eu/scadplus/leg/en/lvb/r12109.htm>

⁶³ EUEI (European Union Energy Initiative) (10/03/2006) *Partnership and Dialogue Facility*.
http://ec.europa.eu/comm/development/body/theme/energy/initiative/index_en.htm

⁶⁴ <http://www.cbss.st/basrec/>

Regional Dialogues I Arctic Energy Agenda

Norway, Russia, US and EU in July 2005 agreed that the Arctic region remains one of the most important energy regions and it will be crucial for the future energy security. Particular issue for this area is the vulnerable marine environment, so the balance in the co-existence in all the actors there (fisheries, marine transportation, petroleum activities) is highly important. The proved and possible reserves of the region are enormous. The existing fields are (Appendix K): Goliat, Snohvit, Shtokman and several condensate fields in the Norwegian part. ⁶⁵

The problem (like in the case of BASREC) is that these projects and the new projects for pipelines require investments. And in this context the carbon dioxide capture and storage initiatives must find their place too. EU could communicate with the three other arctic players in its bilateral dialogues with them.

Regional Dialogues I South-East European Energy Community (ECSEE)

In 25 October 2005 in Athens the Energy Community Treaty was signed between the EU (represented by Austria, Greece, Hungary, Italy and Slovenia) and ten south-east European partners – Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro⁶⁶, the FYR of Macedonia, Romania, Serbia, Turkey and UNMIK on behalf of Kosovo. ECSEE treaty deals with the countries` electricity and natural gas sectors, aiming the creation of an integrated energy market connected to the EU`s. Its second goal is to help the stabilization and development process in South-East Europe (SE Europe).⁶⁷

In addition, first, the treaty creates a framework for the WB and EBRU support to infrastructure projects. Second, it will serve as an intermediate gas market between Caspian Sea and EU. Third, ECSEE will facilitate the import of Middle East and Caspian oil to the Union. At this point, the EU relies on the treaty for decreasing its dependency on Russian energy.

The subsequent initiatives will affect the sustainable development, environmental challenges and nuclear safety issues of the Region. The biggest energy challenge related to SE Europe is the serious gas

⁶⁵ Widvey, Thorhild (07/07/2005) *Introduction speech "The Arctic Energy Agenda"*. Kirkenes http://www.dep.no/odinarkiv/english/bondevik_II/oed/026031-090146/dok-bn.html

⁶⁶ In 23.05.2006 Montenegro separated through a referendum from a state union with Serbia

⁶⁷ European Union IP/05/1346 (25.10.2005) *The EU and South-East Europe sign a historic treaty to boost energy integration*. Brussels <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/05/1346&format=HTML&aged=0&language=EN&guiLanguage=en>

dependence from Russian exports. After the last enlargement and the accession of Bulgaria and Romania, the EU's dependence on Russian energy increased considerably.

Regional Dialogues I Caspian Region and Central Asia

EU has no relations with the Caspian Region as a whole. The Union maintains bilateral energy cooperation with Russia, Azerbaijan, Kazakhstan, and Turkmenistan. Brussels started recently bilateral relations in Central Asia (Kazakhstan and Turkmenistan). Pointed out like one of the priority regions for the energy security of the Union, this regional dialogue deserves much more attention.

The three gas producers in the region Turkmenistan, Kazakhstan and Uzbekistan remain reliant to the existing Soviet-era pipelines. The Russian gas which enters in Ukraine in \$95 tcm., starts from Turkmenistan at \$29-\$45 per tcm⁶⁸. For both the Caspian and the European Union, one key question is whether the EU will help the Caspian countries as a group by using its near-monopolist position to secure a better deal for Caspian gas transiting the Russian system and to succeed to diversify its own energy supplies. For the moment the principal user of the Caspian gas remains Russia and for changing the present situation enormous investments are required. Moreover, these investments are with very long-lead times and it must be taken into consideration that the Region is not very politically stable, with active conflicts in several countries.

Table 4 | Proven Reserves in The Caspian Region

| | Proven Oil Reserves | | Proven Gas Reserves | |
|--------------|---------------------|-----|---------------------|-----|
| | | | | |
| Azerbaijan | 7 bn bbls | 39% | 1 550 bcm | 13% |
| Iran | - | | 358 bcm | 3% |
| Kazakhstan | 9 bn bbls | 49% | 1 840 bcm | 16% |
| Russia | 1 bn bbls | 6% | 3 168 bcm | 27% |
| Turkmenistan | 0.5 bn bbls | 3% | 2 860 bcm | 25% |
| Uzbekistan | 0.6 bn bbls | 3% | 1 870 bcm | 16% |

For the table is used data from BP&CGES, 2004

After this overview of the first set of EU's policies about energy security, in the next part I will go through the second set of policies, namely – the Green/White Papers⁶⁹:

“Green papers are discussion papers published by the Commission on a specific policy area. Primarily they are documents addressed to

⁶⁸ Roberts, John (10/2004) *EU-Turkey Working Papers No 11, The Turkish Gate, Energy Transit and Security Issues*. CEPS, Brussels

⁶⁹ European Union Documents, European Commission
http://europa.eu.int/documents/comm/index_en.htm

interested parties - organizations and individuals - who are invited to participate in a process of consultation and debate. In some cases they provide an impetus for subsequent legislation."

"White papers are documents containing proposals for Community action in a specific area. They sometimes follow a green paper published to launch a consultation process at European level. While green papers set out a range of ideas presented for public discussion and debate, white papers contain an official set of proposals in specific policy areas and are used as vehicles for their development."

Green Paper 1995 I « An Energy Policy for the European Union»⁷⁰

The aim of this first Green Paper on energy is to satisfy the price expectations of the end users (individual or industrial), taking into account the security of supply and the protection of the environment. It has four main priorities:

- straitening the dialogue and cooperation between the decision-makers and actors in the European Community;
- taking into account the national and community energy policies in the general point of view, which is influenced by transnational actors, and in the necessity to achieve a single market. All this must be addressed to the final aim – protection of consumers, security of supply and protection of the environment;
- identification of the Community's responsibilities (aside from ECSC and Euratom);
- to consider the environmental challenges: 1) classical forms of pollution and 2) climate change risks from gas emissions and greenhouse effect.

White Paper 1995 I « An Energy Policy for the European Union »⁷¹

This White Paper, covering the issues from the previous Green Paper (1995) introduces a five years Action Plan, in the context of the new energy factors - environmental preoccupations, technological development, scope and responsibilities of the European community. The steps are the following:

- establishment of a single energy market ;
- management of the security of supply;

⁷⁰ Bulletin UE 01-1995 , <http://europa.eu.int/abc/doc/off/bull/fr/9501/p103085.htm>

⁷¹ Bulletin UE 12-1995, Energie (7/13), <http://europa.eu/bulletin/fr/9512/p103101.htm>

- promotion of a sustainable development;
- development of advanced technologies and research activities.

Green Paper 1996 I « Energy For The Future: Renewable Sources Of Energy »⁷²

This Green Paper sets the way in which the objectives from the previous one (protection of consumers, security of supply and protection of the environment) must be achieved. The document calls for effective management of the available resources which require:

- well balanced fuel mix, in which all appropriate energy sources play their proper role, is essential to support sustainable economic growth.
- efficient exploitation of renewable sources of energy, because failure to increase the share of renewable energy sources will have negative effects on other important policy objectives, in particular security of supply, economic and social cohesion, environmental issues and - at least in the medium to long term - economic competitiveness. Concretely in the paper four element of the energy strategy are proposed: 1) ambitious, and yet realistic, increase in the contributions of renewables to the Community energy balance should be aimed for at Community level, 2) strengthening the Member State co-operation on renewables, 3) reinforces its policies affecting development of renewable sources of energy, like RD&D, training actions, awareness building, pilot schemes and 4) strengthening assessment and monitoring of the progress.

White Paper 1997 I « Energy For The Future: Renewable Sources Of Energy »⁷³

This paper starts with the general energy picture of the EU, which is not very optimistic – increase in the demand, fossil import dependence, and slow growth in the renewable energy matter. Taking the previous Green Paper's (1996) recommendations for basis, this With Paper sets the main goals:

- indicative target of 12% for the contribution by renewable sources of energy to the European Union's gross inland energy consumption by 2010 (EU15).
- the main responsibility for this target is in the Member States energy policy strategies.

⁷² <http://europa.eu.int/en/record/green/gp9611/enumen.htm>

⁷³ European Commission COM(97) 599 final (26/11/1997), Brussels

- for the moment the hydro power has a priority, so the use of other renewables must be encouraged (like biomass, wind energy, solar thermal collectors, photovoltaics, geothermal energy, heat pumps).

Afterwards the document foresees the costs (ECU 164 bn for the period 1997-2010) and the benefits (jobs, CO2 savings, growth of the EU renewable energy in the international markets, fuel import reduction, increased security of supply, local/regional development) from such a policy.

Green Paper 2000 I « Towards A European Strategy For The Security Of Energy Supply »⁷⁴

This Green Paper successfully extracts the main priorities from all the Papers until this moment and proposes totally different and complete approach. The Paper underlines that the EU's long-term strategy for energy supply security must be geared to ensuring, for the well-being of its citizens and the proper functioning of the economy, the uninterrupted physical availability of energy products on the market, at a price which is affordable for all consumers (private and industrial), while respecting environmental concerns and looking towards sustainable development. The document starts with several statements, already known from the previous ones: 1) European Union has structural weaknesses regarding energy supply, namely Europe's growing dependence on energy, the role of oil as the governing factor in the price of energy and the disappointing results of policies to control consumption, 2) need for investments in energy for replacing of the existing resources and to meet increasing energy demand, 3) the EU's energy options are influenced by the world situation, the Member States individual preferences, the liberalization of the sector and the environmental issues, 4) the climate change concerns (Kyoto commitments), 5) member states are too interdependent to seek individual policy, because every decision has an impact on the other countries.

The Green paper points out that the main way to achieve a long-term energy strategy is:

- concerning the demand – change in the consumer behaviour toward respect to the environment
- concerning the supply – fight against global warming through new and renewable energies (place for discussion about the nuclear energy use).

⁷⁴ European Commission COM(2000) 769 final (29.11.2000), Brussels

The document states that the lack of political consensus on the energy policy on Community level blocks a big part of the possibilities to react in the situation. The future perspectives are: 1) controlling the demand growth – single energy market, taxes, new technologies, efficiency on the transport sector and buildings, 2) managing the supply dependence – less pollutant energy sources, like renewables or nuclear; preserving access to resources; competition on the downstream sector; relations with producing countries and strengthening the supply networks (TRACECA, INOGATE).

Green Paper 2005 I « Energy Efficiency or Doing More with Less »⁷⁵

The Green Paper introduces in the energy efficiency topic by raising the question “Why we should save energy?” if, of course we leave aside the high oil and energy prices like a first explanation. The answers are: 1) because we can re-invest the saved money and create new jobs, which direct consequence is better competitiveness, 2) by improving energy efficiency, we reduce the greenhouse gas emissions, increase the air quality and prepare ourselves to meet the Kyoto commitments and to reduce climate change consequences and 3) by reducing the demand (especially in long term), we influence directly on the security of EU's energy supplies.

Further on, the document prioritizes several actions which should be taken, in order to achieve energy efficiency in local, regional, national and EU level, and key problems related to the global climate change/energy efficiency problem. Some of the measures for European energy efficiency include:

- establishing of an Annual Energy Efficiency Action Plan at national, regional and local level.
- better information for the citizens.
- improving taxation, without increasing overall tax level.
- use of financing instruments to introduce cost-effective improvements.
- speed up the development of a new generation more fuel efficient vehicles (the initiative CARS 21).

The Green Paper continues with the global dimension of the climate change problem and the energy efficiency like an integral part of the answer. In this direction EU can provide two types of policies: 1) with the developing countries (China, India), which will be the biggest polluters in near future and 2) with ACP countries, which are hit the most from the high oil prices, in order to provide a sustainable development.

⁷⁵ European Commission COM(2005) 265 final (22.6.2005), Brussels

Green Paper 2006 I « A European Strategy for Sustainable, Competitive and Secure Energy »⁷⁶

Mr. Barroso has called this approach “Kyoto-Lisbon-Moscow triangle”, which completely explains the essence of the document:⁷⁷

- Kyoto part or EU strategy for sustainable energy – promoting energy efficiency, energy mix, renewable energies, which will contribute not only for achievement of the environmental goals like Kyoto, but will diversify the energy sources. This part has raised the nuclear energy issue too.
- Lisbon part or EU strategy for competitive energy – the integration of the energy markets will make Europe much more competitive.
- Moscow part or EU strategy for secure energy – the Union confesses that there is no mechanism to prevent crisis like the Ukrainian one. According to the Paper closer relations and common external energy policy with Russia are for the moment a step in the right direction.

The document sets six priority areas: 1) development of a fully competitive internal energy markets in Europe, 2) measures in case of internal energy crisis or to prevent such crisis (issue related to the subsidiarity principle), 3) EU's approach for the individual energy mix, concerning the interdependence of Member states and the principle of subsidiarity once again, 4) facing the climate change goals in an integrated manner⁷⁸, 5) encouraging innovation – European energy technology plan and 6) EU must define its energy partners from the both sides – suppliers and consumers, and starts to speak with one voice.

Other I Treaty Establishing the Constitution of the Europe (2004)⁷⁹

The entering into force of this Treaty (TEC) is very unlikely, but I will extract only the most important issues related to energy, showing them as they were officially integrated in the principal guideline of the future EU energy policy.

Section 10, Article III-157, Paragraph 1, 2 and 3 determine the policy like:

- in establishing an Internal Market and with regard to the environment, the EU's energy policy should aim: 1) ensure a functioning energy market, 2) ensure security of energy supply and 3) promote new and renewable forms of energy.

⁷⁶ European Commission COM(2006) 105 final (8/3/2006), Brussels

⁷⁷ Beundermann, Mark (22/03/2006) *Commission paints gloomy picture of future energy use*. EUobserver, Brussels

⁷⁸ Piebalgs, Andris (07/04/2006) *Speech at the EU – India Energy Panel, EU – India: a New Energy Era*. New Delhi

⁷⁹ <http://europa.eu/constitution/>

- laws or framework laws related to energy shall be adopted after consultation of the Committee of the Regions and the Economic and Social Committee. These laws shall not affect the Member states choice of energy source.
- when there are questions of fiscal nature, qualified majority is required.

After this review of initiatives, which the EU used in order to put the general guidelines on its energy security vision, I will enumerate the remaining problems in front of achieving such a policy.

c. Remaining problems

It would be unrealistic if one states that European Union does not make efforts to face its energy problems. The number of initiatives is remarkable, although as I mentioned, the dialogues are not developed enough in some key regions or countries. Concerning the Green/White Papers the observations are not in the same direction. These documents prioritize each time similar challenges and similar ways, in which they could be met. After short summary, one can conclude that neither the dialogues, nor the Papers, nor the TEC made a significant progress in resolving EU's energy problems. Nevertheless it must be stated that the current and future energy challenges concerning all the countries cannot be solved unilaterally. For this reason the analytics often argued that in the way of achieving the energy goals (environmental, economical, political) cooperation is essential factor. Furthermore, cooperation not only between the developed countries, but between them and the rest of the world (developing, poor states) which are expected to be the biggest consumers and polluters in the near future. This process has another important part – active dialogue between consumers and producers, as well as between polluters and countries which already poses the needed knowledge, technologies and finance to deal with these problems.

Aside from this external part of the global energy picture, stays the internal one, which is more important and which cannot be achieved by the EU for the moment. Each country should develop a clear energy strategy taking into account the future individual (for each country) and global trends and the individual and global goals in this direction. In the fast changing world, if this strategy is too long-term this will make its forecasts reliable. Because the energy enters in a completely new era, which will affect all the state policies – economy, environment, social

policy, external relations, transport, in order to be followed this strategy should be accepted by all actors. And exactly here the EU fails.

The Union is a complex actor both on the external and on the internal scene, but this is part of its essence and it can not, and it should not be changed. Now with 25 Member States, later on with 27⁸⁰ or more, this Union exists because of the mutual desire to work in the same direction. The energy issues currently emerged like a serious problem, related even to the future of the Earth. The international community agreed that the goals are common and the cooperation is vital. Unfortunately, for EU is easier to achieve cooperation with US, than between its own Member States, which shows serious weaknesses inside the Union.

In this part the analysis will concentrate exactly on these remaining problems for the Union. The problems will be broadly divided in two groups: internal, on which EU's policies can influence and external – independent from the Union's decisions.

Remaining problems I Internal for EU

1. Unity in diversity problem. As it was mentioned before, one of the major energy problems for EU is the lack of common vision over the energy priorities. The conflict national – community level is not new and it is not out of logic, taking in mind the Union's structure. But concretely concerning energy policy the issue is serious, because it works with definitions like protectionism, sovereignty and national interest. Everything related to high politics is far from the term solidarity, which is directly opposed to the basic principle of the EU. It is true that the more general the energy strategy is the more Member states will accept it. EU's approach is not without logic, because the mechanism is already tested – “let's start from the single market and after we will see”.

Where are the problems in the current situation?

- after the last Green Paper the Member States underlined the necessity of “fully respect member states' sovereignty”⁸¹ on the issues related to their energy mix and preferred energy supplier. In this context the current disputes over the use of nuclear energy and relations with Russia can be examined. The latter emerged after the signing of NEGP between Russia and Germany, bypassing Poland.

⁸⁰ After the accession of Bulgaria and Rumania

⁸¹ Rettman, Andrew (20/03/2006) Sovereignty and protectionism cloud EU energy policy. EUobserver

- the same problem faced the single energy market initiative – the economic nationalism or protectionism of the national energy market and companies for now is the biggest obstacle. The Single Market Commissioner Charlie McGreevy and the Competition Commissioner Neelie Kroes started already legal action against almost all European governments.⁸²

- energy solidarity need – after the polish proposal of “energy NATO”⁸³, which means if one state faces supply crunch, the other Member states should provide energy resources, explodes the European community. UK and Germany have opposed it immediately. The solidarity topic concerns to the NEGP project.

2. Backup plan. The Ukraine situation currently puts EU in uncomfortable homeland position. It became evident that the Union does not possess a plan for an energy crisis. This is a problem related to the ensuring of a short term energy security. This crisis could be caused by different reasons: shortage from suppliers' side, problems with the infrastructure, extreme weather. The consequences after an energy interruption, no matter the duration can be serious – high price, additional supply for the regions, social and economic costs. For the moment this debate consists of two parts: 1) EU must develop an approach for energy crisis management and 2) who is responsible for the safety of the oil and gas facilities and infrastructure (threatened by whether or terrorist for example), and should NATO develop such a capability or not. EU's existent policy in this context is the requirement that each Member State should possess emergency reserves equivalent to 90 days of inland consumption of three types of petroleum products.⁸⁴

3. Problem Regions inside the Union. The countries from Central and East Europe (CEE) are very dependent on Russia's energy (gas mostly) supplies, which increases substantially the total EU energy dependence. Furthermore CEE countries are extremely energy ineffective: 1) with some of the most monolithic fuel mixes in Europe (often nuclear), 2) energy intensive and polluting economies, 3) limited primary energy sources, 4) politically instable regions. Nevertheless, the region has positive sides too. The gas infrastructure, although old, is well developed and now several pipeline projects for diversifying Europe's supplies in the Region are ongoing. Additionally October 2005 EU initiates Energy Community Treaty in the region, which aims to create an integrated energy market and develops the Region as a whole.

⁸² PINR (02/04/2006) Economic Brief: EU Energy Policy.

⁸³ Rettman, Andrew (20/03/2006) Sovereignty and protectionism cloud EU energy policy. EUobserver

⁸⁴ Gault, J(ed in Dannreuther, R.) (2004) European Union Foreign and Security Policy - Towards a Neighbourhood Strategy, EU energy security and the periphery. Routledge, New York

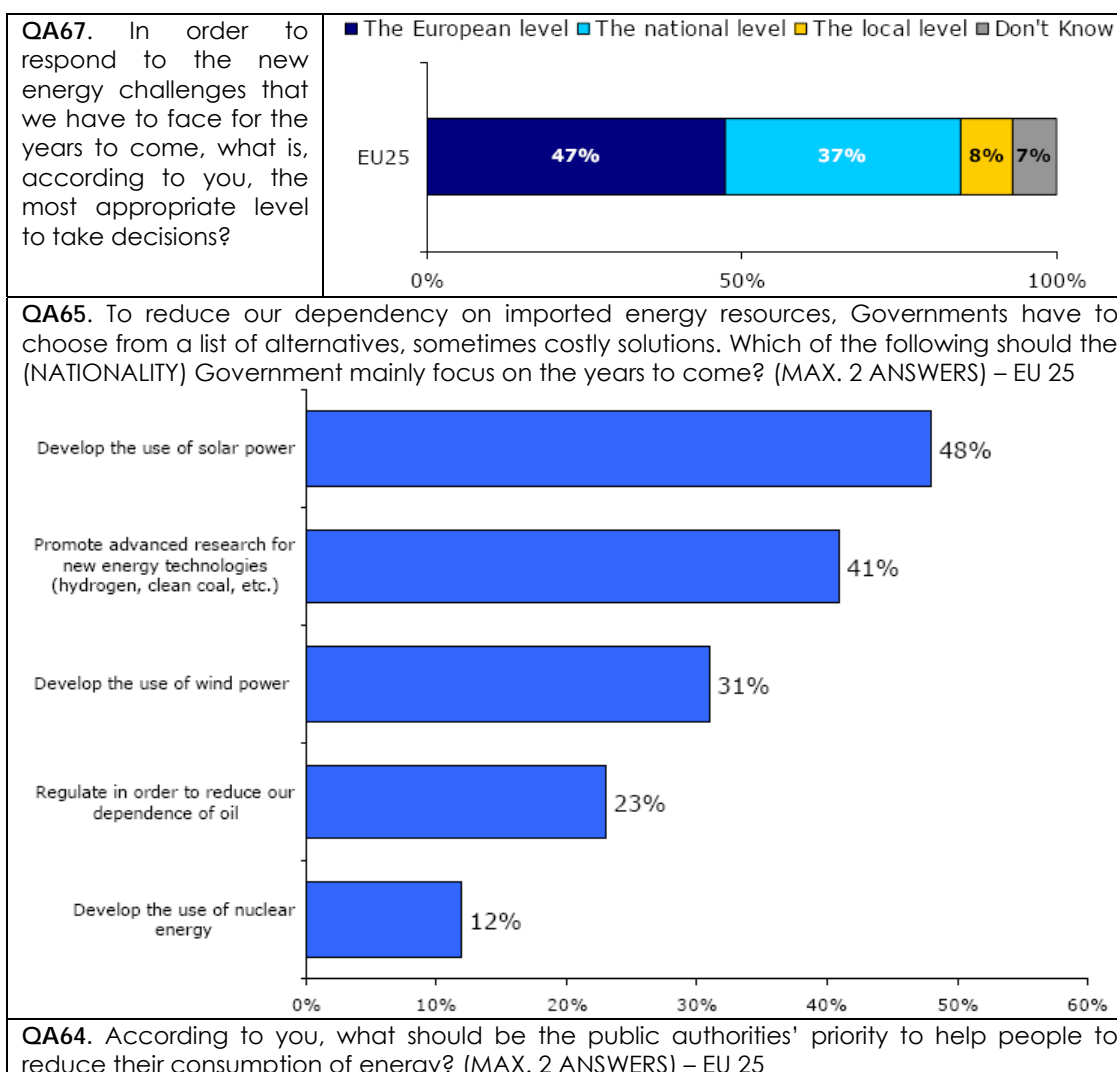
Table 5 | Imports of natural gas from Russia in 2004

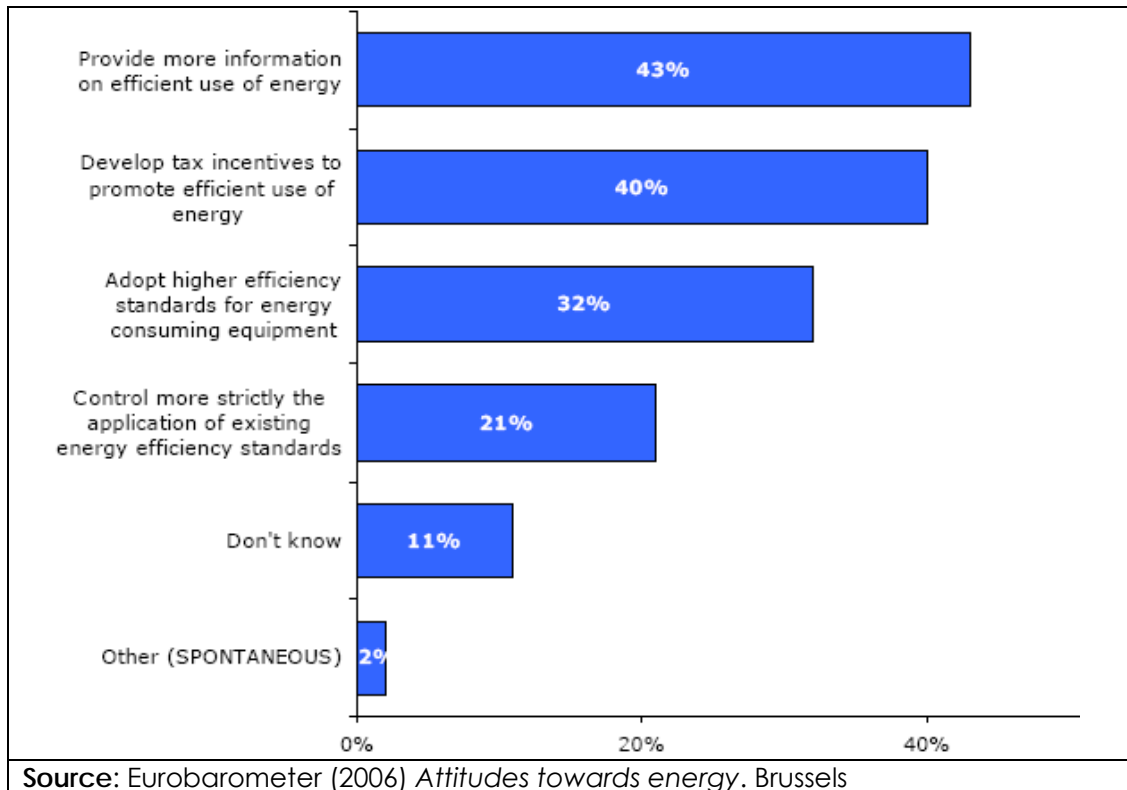
| Country (1) | % of the total export | Country (2) | % of the total export | Country (3) | % of the total export |
|-------------|-----------------------|-------------|-----------------------|-------------|-----------------------|
| Moldova | 100 | Azerbaijan | 89 | Poland | 69 |
| Serbia | 100 | Hungary | 85 | Turkey | 65 |
| Estonia | 100 | Greece | 80 | Belarus | 52 |
| Bulgaria | 100 | Slovakia | 80 | Ukraine | 50 |
| Finland | 100 | Austria | 77 | Germany | 41 |
| Latvia | 94 | Romania | 70 | Italy | 35 |
| Lithuania | 94 | Czech Rep | 69 | France | 30 |

Source: Krashkov, Aleksey (16/12/2005) *Rossiya prekraivaet ekonomicheskuyu kartu mira. Nezavisimaya gazeta*"

4. The general public opinion must have its word too. The citizens of the Union have a clear idea about the answers of the current problems and their point of view should be taken into account.

Figure 6 | Eurobarometer Survey – Attitudes towards energy





5. The energy policy is too complex in order for the countries to deal with the challenges unilaterally. The cooperation is crucial in order to produce an effective energy policy (from economical, political, environmental, social point of view). This means producer – consumer dialogue, between the developed countries, between the main polluters and so on. This principle is equally valid in the community level too, especially when the actor is so complex like the EU. In this context co-operation between different entities, local-regional-national officials, governments, ministries, Directorates-General, community institutions, distributors - end consumers can only improve the European energy policy.

Remaining problems I External for EU

1. Turkey – The Union should create completely new approach toward Ankara, because as the analysis showed earlier, Turkey has the potential to develop itself as a new actor on the energy scene. The country is not a net consumer; it is not a producer too, but it will be the third net exporter for the Union. EU is developing numerous projects for building new and reconstruction and interconnection of the existing pipelines. In this context, Brussels must pay more attention to Turkey in order not to create a new energy monopolist, from which to be dependent.

2. Russia – The analysis already focused itself a lot on Russia. The problems related to EU's energy security and its high dependence on Russian energy imports can not be solved easily and quickly. But in this case one issue remains – if really the EU-Russia cooperation leads to energy security⁸⁵. The main priority of the European energy strategy are the dialogues, but only several months earlier this dialogue did not influence the Russian decision to cut the energy supplies for EU (through Ukraine). Often in the discussions the mutual interdependence is explored like a major factor for the Union's energy security, but in April this year Russia signed a new pipeline project (Taishet - Nahodka route – Appendix L) with China and Japan, which will enable Moscow to deliver oil to Mongolia, China, Japan and USA.

3. Instabilities in the neighbors. EU tries to diversify its energy imports through Africa, Middle East, South Caucasus and Central Asia. One of the transit regions is the Western Balkans and the regions of Turkey inhabited by Kurds. The Union will meet serious hard (frozen conflicts) and soft (organized crime) security challenges achieving its security of supply. Actually this is a major energy security issue in our days, because a big part of the supplying and transit countries have substantial problems with their political stability, transition economies and democratic institutions. These factors and the current tensions in Venezuela, Nigeria, Angola, Iraq, Iran and between USA and Mexico sharply increased the oil prices. Concerning EU, the Union maintains some relations with its suppliers, which unfortunately in time of crisis will not provide enough. Moreover, these regions, although possessing oil reserves, do not have the potential to use them. This means that EU must provide a considerable finance aid before starting to explore these reserves, namely to construct and develop an oil infrastructure and facilities, as well as to engage in long-term projects.

The aim of this chapter was to analyze the process of achieving energy security for EU and the main policies through which this can be done. The Union sees its energy security from three views: external security by assuring the security of supplies, internal security by completing the single energy market process and energy efficiency. The first aspect is highly contestable, because of several factors. The external security is a multilateral process in which assuring the behavior of the consumer does not mean security of supplies from the exporter, especially when the suppliers are problematic regions and counties, and when a given country is highly dependent on them. Furthermore, the proven reserves have decreased and if they would be enough for this generation, for the

⁸⁵ CRS (Congressional Research Service) (2006) *Report for the Congress, NATO and Energy Security* <http://www.usembassy.it/pdf/other/RS22409.pdf>

next one it is already unsure. This means that all energy strategies made on the traditional fuels are short term and without any perspective for the future. In this context the EU security of supply policy, expressed in building new pipelines for resources which are limited, pollutant and expensive does not provide energy security in long term.

The second aspect is more or less affordable in near future. The integration of the national energy markets is the best way to start a process for further "communitization" of the national priorities and goals on the energy policies.

The third aspect concerns the most appropriate tools in order to achieve energy security for the future. The energy efficiency is the best way to reduce the external supply dependence, to reduce the internal energy intensity, to save the environment and to reduce the consequences of the climate change. One can consider the energy efficiency like the means, with the help of which the transition from energy dependency to energy independency will be reached. In this perspective, the renewable energies constitute the essential part of the process. They have the real chance to replace the old fossil fuels, to make the countries energy independent, to meet the environmental problems in the cleanest way, to balance the climate mitigations in long-term, to provide real sustainable development for the poor countries and to improve the quality of life. Furthermore, all of this will be achieved by the forces of nature. In the next chapter I will try to find where is the place of the renewables in the European energy strategy and why they have a major importance for the future.



**Not just more,
but better
energy!⁸⁶**

- What is Renewable Energy
- EU`s Renewable Energy Priorities

⁸⁶ Loyola De Palacio (23/03/2006) *Letter to Financial Times, Ten measures to improve EU energy cooperation*

Why the people, the international community, the politicians, and even the oil companies are so negative when speaking about traditional fuels? Did not the fossil fuels make possible the whole industrial revolution? Did not they help substantially the whole technological, space, communicational and transport progress? The answer is yes, they did, but the real problem is that the price we are paying for the chance to develop our societies turned out to be too high.

In order to make our live easier than ever before, thanks to the fossil fuels during the last century we developed technologies, which made the energy available to much more people and allowed them to rapidly produce, consume and alter the environment. Recently, the humans acquired the ability to change substantially the air, the water, the soil and the animal and plant life. These changes include: loss of crop- and grazing land; depletion of tropical forests; extinction of biological species; rapid population growth; shortage of freshwater resources; over-fishing; habitat destruction and pollution of the marine environment; treats to human health; climate change related to carbon dioxide (greenhouse gas – GHG) concentrations in the atmosphere; acid rain; air pollution; pressure on energy resources⁸⁷.

The fossil fuels⁸⁸ are energy-rich substances, which are petrified and liquefied remains of million years' accumulation of decayed plant life. Chemically, fossil fuels consist of hydrocarbons (hydrogen – H and carbon – C) and smaller amount of other components. As accumulating sediment layers exerted increasing heat and pressure, these organic remains gradually transformed into hydrocarbons. Fossil fuels include coal, natural gas and petroleum (known as oil or crude oil). These substances are extracted from the earth's crust and after (if necessary) refined into gasoline, heating oil, kerosene or processed into plastic, chemicals, and lubricants. Apart from them other types of hydrocarbon-rich deposits exist like oil shale, tar sands and gas hydrates, which can be used as fuels, but they are too costly to extract and refine. After burning, the chemical energy of the fossil fuels becomes heat energy, which is converted into mechanical or electrical energy.

The primary fossil fuel for the last century was the coal. In the 1950s the oil became the industry and transportation fuel. Recently the natural gas started to attract the public attention, mainly because of environmental reasons. Now more than 80% of worldwide energy use is based on fossil energy sources. After a lot of these fuels have been used the forecasts for

⁸⁷ IEA (International Energy Agency) (2003) *Energy to 2050- Scenarios for a Sustainable Future*. OECD/IEA, Paris www.iea.org/textbase/nppdf/free/2000/2050_2003.pdf

⁸⁸ The description of fossil fuels is based on definitions taken from: Microsoft Encarta 2006

the future sound undesirable: loss of the Arctic, with all that implies for the wildlife; worldwide rising seas; losses at the fringes of Greenland and Antarctica (Appendix M); rise in main global temperature between 1.4° and 5.8°C; frequent weather extremes and more.

Another disadvantage of the traditional fuels is the fact that they are unequally distributed over the planet. Thus not every country possesses natural resources or if it does they may be not enough or already not enough to cover its needs. The fossil fuel dependence means dependence on the fossil fuel supplier. Following this logic, as more energy consumes one country, as more dependent it becomes. The problem is that the big consumers are the developed and some of the developing countries and the suppliers come from the developing and poor countries, which often experience political and economic crisis as well as armed conflicts.

When talking about today's energy situation and more precisely about energy consumption, after the fossil age the humanity is challenged by four major issues: 1) the environment is already seriously damaged, 2) the traditional fuels are getting closer to the oil's peak⁸⁹, 3) the population growth will rise substantially and will lead to increase in the energy consumption and 4) an increased dependence between producing and consuming countries.

These four realities require a fast and wise reaction not only because of the actual situation, but because of the future too. The implications for the future make the responsibility of the today's decisions far greater. The fact that the problems are interconnected creates at the same time difficulties and advantages, because every decision applied in some field undoubtedly will influence the others.

The decisive part of this complicated answer is energy efficiency and renewable energy, because they possess the real chance to meet the four issues at the same time. Energy efficiency can reduce the energy consumption, it can affect the intensity fossil fuels are used and like this indirectly decrease the consumer-producer dependence. Simultaneously the renewables can decrease the traditional fuels dependence as well as the supplier dependence, and it can influence positively the environmental concerns. Both, energy efficiency and renewables have the possibility to overcome the consequences from the energy transition period and make us consume "not just more, but better energy".

⁸⁹ Predicting when oil production will stop rising is relatively straightforward once one has a good estimate of how much oil there is left to produce. M King Hubbert in 1956 observed that in any large region, unrestrained extraction of a finite resource rises along a bell-shaped curve that peaks when about half the resource is gone.

a. What is Renewable Energy

Renewable energy⁹⁰ is a type of energy resource that can be replenished rapidly by a natural process (conventional hydroelectric, geothermal, biofuel, solar, and wind) on a time scale appropriate to human use. Conventional hydroelectricity and energy from biofuels are considered mature sources of renewable energy. Coal is produced continually in some geologic formations, but the time scale is on the order of hundreds of thousands of years. Accordingly, coal is considered a nonrenewable energy. In this context nonrenewable energy is a form of energy with limited supply that cannot be replaced or can be replaced only in extremely long periods of time. For sources of non-renewable energy production are considered the fossil fuels, nuclear electric and pumped hydroelectric, which are vast, but not inexhaustible.

Here is the place to clarify that renewable energy it is not a synonym for alternative energy. When one speaks about alternative energy it means an energy produced by non-fossil fuels, including nuclear. The nuclear energy, does not take part of the RES. Recently, another expression pretends to be equal to the renewables – clean technologies. Unfortunately, they include clean coal and nuclear, which substantially differs them from the RES.

The RES do not have positive impact on the environment in a direct way. They influence it indirectly, and are an important part of the way to save the environment by restraining the usage of traditional fuels. Sometimes the renewable resources can damage the environment – for example damming a river to make a hydroelectric power plant could destroy the plant and animal habitat there.

Most use of the renewable form of energy involves the sun, excluding geothermal and tidal energy (using the gravitational force between Earth and Earth's moon). Roughly, 95 percent of all renewable energy is solar in origin. Solar Energy, radiation produced deep in the Sun's core travels to Earth in packets called photons. Only the half of the Sun's energy reaches the Earth's surface and in each point on the ground the amount of light is different.

Renewables can be used directly (water and wind mills, geothermal heating) or indirect (photovoltaic cells – PVC, biofuels).

⁹⁰ For the following description is used Macmillan Encyclopedia of Energy, 2001 Macmillan Reference USA, and Microsoft Encarta Library 2006, 1993-2005 Microsoft Corporation

Solar power⁹¹ | the solar power can be use in several manners:

- direct collection of solar energy – two main types of artificial collectors are designed to directly capture and utilize solar energy converting it into thermal energy: flat plate collectors (used for water and space heating) and concentrating collectors (air conditioning, central power generation, and many industrial heat requirements). Both require large surface areas exposed to the Sun since so little of the Sun's energy reaches Earth's surface.

- passive solar heating - The solar energy that falls naturally on a building can be used to heat the building without special devices to capture or collect sunlight. Passive solar heating makes use of large sun-facing windows and building materials that absorb and slowly release solar heat. A well-insulated building with such construction features can trap the Sun's energy and reduce heating bills as much as 50 percent. Passive solar designs also include natural ventilation for cooling.

- solar cooling - Solar energy can also be used for cooling. An absorption air conditioner or refrigerator uses a large solar collector to provide the heat that drives the cooling process.

- photovoltaic (PV) - Solar cells made from thin slices of crystalline silicon, gallium arsenide, or other semiconductor materials convert solar radiation directly into electricity. Cells with conversion efficiencies greater than 30 percent are now available.

- directly from space - a futuristic proposal to produce power on a large scale envisions placing giant solar modules in geostationary Earth orbit. Energy generated from sunlight would then be converted to microwaves and beamed to antennas on Earth for conversion to electric power. Like this such a collector would gather eight times more light than a similar collector on the ground

Problems with solar energy: 1) the energy is not reliable (intermitted during the night or if it is cloudy) and produces variable voltages, 2) for the moment is expensive for the average citizen. Nevertheless, the solar energy can be stored and use when it is necessary.

Wind energy | due to unequal heating of Earth's surface by the sun. Wind energy can be converted into mechanical energy (for pumping water, grinding grain, and milling lumber) or by connecting to a spinning rotor to an electric generator - into electrical energy. Wind farms or offshore wind parks are the most developing RES industry in this century. Unfortunately the wind energy meets the same problems like the solar one – cannot guarantee continuous power and the station is noisy.

⁹¹ Microsoft Encarta Library 2006

Water power | Different parts from water's behavior can be used in order to create energy. The water is far much heavier than the air, so even a slow move can produce big amount of energy.

- hydroelectric energy - power derived from the fall of water from a higher to a lower level, and extracted by means of waterwheels or hydraulic turbines. It transfers gravitational energy into electricity.

- tidal power – (can be horizontal and vertical). Incoming tide of the river flows through a dam, driving turbines, and then is trapped behind the dam. When the tide ebbs, the trapped water is released and flows back through the dam, again driving the turbines. Such tidal power plants are most efficient if the difference between high and a low tide is great.

- Ocean Thermal Energy Conservation (OTEC) – this process use temperature differences in the ocean (warm surface and cold depths) to create electricity. Capturing the heat differential, the process drives a generator.

Other methods include the power of the waves, deep lake water, currents or blue energy (difference between the salt concentration in sea and river water).

Water energy meets a lot of environmental concerns. The large scale dams are accused in changing the habitat for the whole region's wildlife and producing carbon dioxide and methane from rotting vegetation. Part of the other water power forms is not sufficiently tested on a large scale⁹².

Geothermal energy | geothermal heat, found deep in the earth's crust, can be captured for heating directly or it can be used to generate electric power. In some areas the geothermal energy is closer to the surface than to other. At the beginning of the 21st century, there were some 380 geothermal power plants in 22 countries around the world. The United States, the Philippines, Italy, Mexico, Indonesia, Japan, New Zealand, and Iceland are the largest producers of geothermal energy. The main issue is whether the geothermal energy is renewable, because some of the locations are starting to cool down.

Biomass energy | Biomass energy has its origin in plants grown with the help of solar radiation. The energy that can be derived directly (burned) or indirectly (turned into combustible gases or liquids, such as ethanol) from biological sources like agricultural waste (sugarcane bagasse, rice hulls), wood, crop residues, and dung, which remains the primary source of energy in developing regions. These products are currently used to produce electricity and as a substitute for petroleum. The process does not release net CO₂.

⁹² Graham-Rowe, Duncan (24/02/2005) *Hydroelectric power's dirty secrets revealed*. New Scientist <http://www.newscientist.com/article.ns?id=dn7046>

Biomass energy | *Biofuel and Biogas* | Any solid, liquid, or gaseous fuel produced from biomass. Biofuel is produced either directly from plants or indirectly from industrial, commercial, domestic, or agricultural wastes. There are three main methods for the development of biofuels: the burning of dry organic wastes (such as household refuse, industrial and agricultural wastes, straw, wood, and peat); the fermentation of wet wastes (such as animal dung) in the absence of oxygen to produce biogas (containing up to 60 percent methane), or the fermentation of sugarcane or corn to produce alcohol and esters; and energy forestry (producing fast-growing wood for fuel). Fermentation produces two main types of biofuels: alcohols and esters. These could theoretically be used in place of fossil fuels but, because major changes into existing engines are required, biofuels are usually mixed with fossil fuels. The European Union requires 5.75 percent ethanol, derived from wheat, beet, potatoes, or corn, to be added to fossil fuels by 2010 and 20 percent by 2020.

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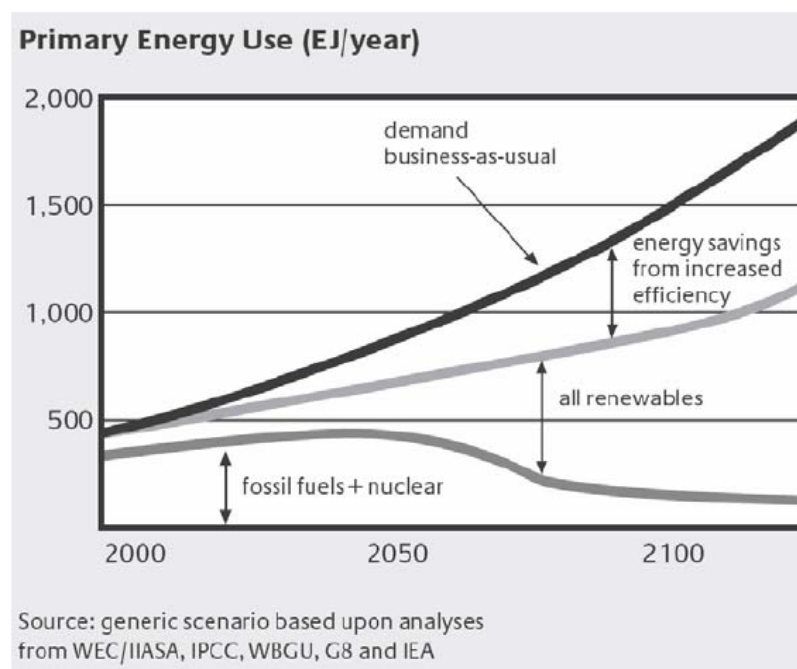
The need of renewable energy sources is prioritized by EU for a long time. The international community has developed numerous strategies for development and mass production of renewables. Despite the initiatives the renewables are not competitive on the energy market and need much more research and investment in order to become reliable and affordable. The RES and energy efficiency deserve a lot of attention, because they really have the potential to overcome the energy crisis, to “green” the energy and to improve the quality of life. This attention means enormous efforts from all the players in the energy scene – from producer to end consumers, via the market networks. These efforts unfortunately demand huge investments in long term perspective, which is not the favorite combination of the politicians and economists. The positive side is that the process has already started and the results are encouraging. The negative side is that besides the RES and energy efficiency, the alternatives are not so much. So, let's think positively!

The analysis will continue discussing how positively the international society thinks about RES, precisely the recent global performance of the renewable energies. After, in the second part the focus will be only on EU renewable energy policies and their importance for the energy security of the Union.

The last two G8 Summits have several common issues. One of them is energy security and the second is renewable energies. The G8 Moscow Summit 2006 stresses primary energy security issues, leaving the RES behind. G8 Gleneagles Summit 2005 discussed too the energy security issue, but far more attention was given to climate change, energy efficiency and renewables. Concerning the RES, the G8 took unanimous position. They stated that the renewable energy “shows great potential

for contributing to the solution of some of today's energy security and environmental challenges" ⁹³. On this Summit the major issue related to RES was their cost-effectiveness. Although considerable steps in this direction were taken, only the cost of some hydro, bioenergy and geothermal energy is comparable with the traditional energies. Like further actions in order to achieve cost-effectiveness can be considered: more funds for RD&D projects, diversification in the sectors the renewable energy is adopted, stable and predictable funding for technologies and planning, different incentives (capital assistance, mandated quotas, premium price for green energy) for mass usage of energy from RES. The priorities for further RES progress according to G8 are to accelerate the technological advancement and achieving their cost-effectiveness.

Figure 7 | Sustainable Energy Development



Source: Renewables 2004 Conference Issue Paper

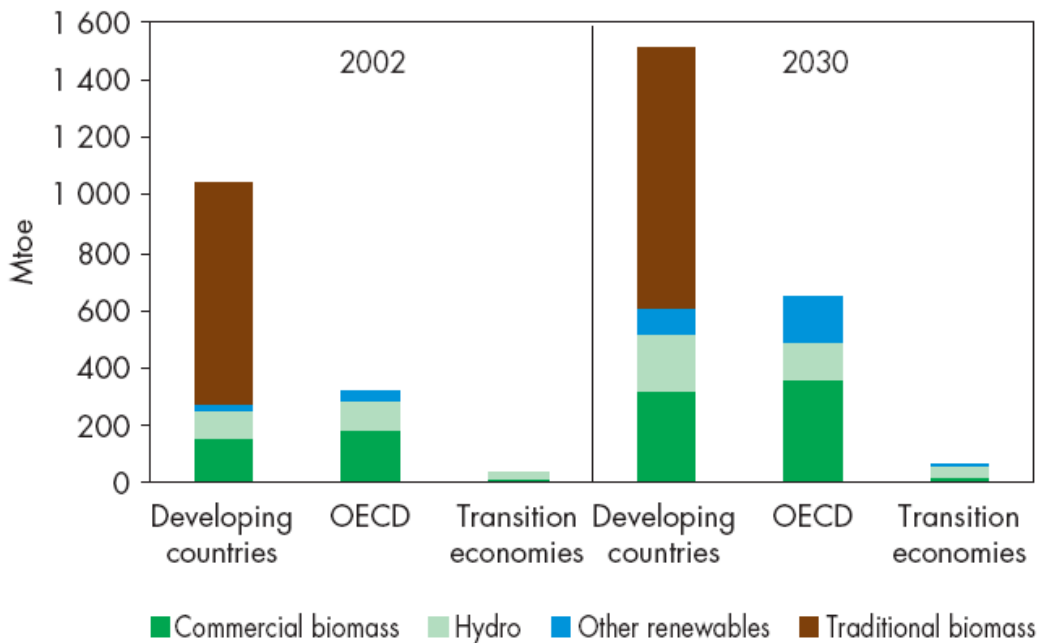
Often when one speaks about renewable energy it is mentioned to energy efficiency. In the most energy security strategies, observed in Chapter II the two processes consisted part of the strategies and were prioritized together. Of course until now these analyses showed many times that the RES and energy efficiency could not achieve the final aim – ensuring energy security, if they are looked at separately. The two issues are complementary and each country decides on its own in which context – through climate change strategy, energy security strategy, sustainable energy strategy. The very fact that each country favors under

⁹³ IEA (International Energy Agency) (2005) Energy Policies in IEA Countries, 2005. OECD/IEA

certain conditions the RES helps them to attract public attention, investments, international interest and like this to continue to increase their potential. In this context Kyoto protocol supports a lot their development and contribution in the future energy consumption.

The countries which did not ratified Kyoto protocol – US, China, Japan, South Korea and Australia (representing the half of the population) created a concurrent fund to promote cleaner energy technologies.⁹⁴ This is good news for RES, because they are one of the first prioritized tasks which will receive backing from this fund. The first is cleaner fossil energy – the six states are the biggest fossil consumers (with EU) and the biggest polluters (with EU). This pact does not put targets or fix periods for GHG emissions reduction (like Kyoto).

Figure 8 | World Renewable Energy Consumption by Region



Source: World Energy Outlook 2004, IEA 2005

Since the last two decades the share of the renewable energies in the world total primary energy supply (TRES) is constantly growing, although for 2002 represents 13.4% from TRES. From these 13.4%: 10.4 – biomass, 2.2% - hydropower and geothermal – 0.4%⁹⁵. The rest – solar, wind and tie energy (new renewables) represent less than 0.1%. Between the counties the differences are substantial. Biomass production is distributed mainly in

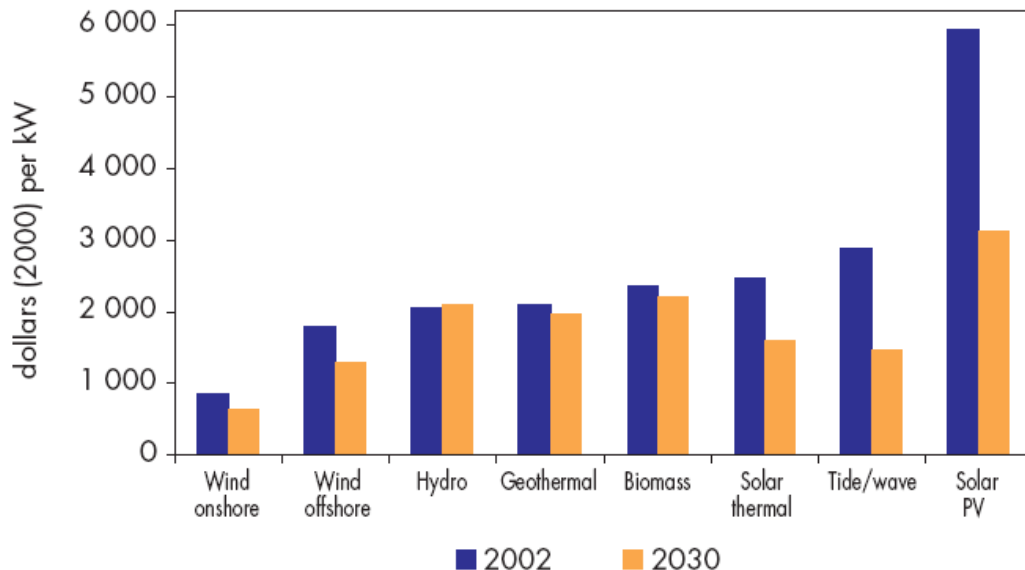
⁹⁴ EurActive (22/03/2006) *Sustainable Development, Six nations launch "clean energy" fund to rival Kyoto*. <http://www.euractiv.com/en/sustainability/nations-launch-clean-energy-fund-rival-kyoto/article-151480>

⁹⁵ ECT (European Charter Treaty) (2005) *Integration of Energy Efficiency and Renewable Energy Policies*. Brussels

the poor and developing countries, while the new renewables are used in developed countries. Most of the countries rely on one or two types of RES: Iceland – 72% geothermal, Georgia – 50% hydro and biomass. Several countries derive more than 50% from their electricity production from renewables: Norway – 99%, New Zealand – 66%, Austria – 63%, Canada – 59%.⁹⁶ The leaders in new RES producing are Japan, Italy, Iceland, in wind installed capacity – Denmark, Germany and Spain and in solar PV – Germany and Japan.⁹⁷

As it was noted, a lot of challenges remain before the RES could be used with their complete performance. It was mentioned that their low cost-efficiency is the major problem. When one speaks about renewables it must be taken into account that this includes not only large scale (dams), but small scale ones, like biomass boilers, individual solar collectors, small wind power. The common problems experienced with renewables are: lack of information, insufficient state grants or limited access to funding, need of RD&D in this domain, institutional barriers – lack of co-operation between the different part of the chain, lack of political attention, in order to prioritize them and rarely – environmental concerns, like with the big dams.

Figure 7 | Capital Costs of Renewable Energy Technologies in 2002, 2030



Source: World Energy Outlook 2004, IEA 2005

⁹⁶ IEA (International Energy Agency) (2006) *Renewable Energy: RD&D Priorities*. OECD/IEA, Paris

⁹⁷ Ibid

b. EU`s Renewable Energy Priorities

Going through all the chapters and subchapters of this analysis one main idea can be found – the current world energy situation is close to its politic, economic, environmental and social crisis. The positive side is that the world has the potential to meet this crisis – RES and energy efficiency. This potential needs a lot of research, investment, public attention and state aid, but nevertheless it can overcome all consequences after the fossil fuel age. The second chapter showed that the Union prioritized the potential of RES and energy efficiency a long time ago in all its official Papers and builds its vision about the energy future leaving the central place for the renewables. On the other hand, as it can be seen from the official EU energy dialogues, the RES are a major issue in the Union's foreign relations.

It would not be for first time in this text to be explained why the renewables play an important role in the energy strategies worldwide and concretely in the EU energy policy. But this time they will be examined from the point of view of the Union's last energy strategy, namely the Green Paper on Sustainable, Competitive and Secure Energy Policy. The conclusions will not be surprising, as it was said one paragraph before, EU placed the RES in its energy strategy since the very first Green Paper. But why the EU pays so much attention to the energy issue? Leaving aside the reason that generally the energy sources are strategic for every country, another reason exists. EU in the way we know it today started from ECSC (European Coal and Steel Community). Several years after this, the Union (then the Community) prioritized the peaceful usage of nuclear energy, creating EURATOM. The last two decades Brussels has placed to the front completely new direction of its energy policy - RES and energy efficiency.

The fact that the current energy problems concern not only the EU has not only positive, but negative sides as well. The positive one is that the international society works together in order to meet the challenges - fighting climate change, running towards energy independency, RES. The negative one is that each country has its own individual problems, which must be answered by themselves. This analysis already enumerated the external and internal European problems, which if not resolved on time, can substantially delay the Union from its main focus and can show weaknesses inside the EU.

EU often uses only "European", when describing its energy policy. This is correct in the areas where the EU policy involves its neighbours, like

pipelines or connection of the energy markets, when the transit countries just cannot be avoided. However, inside the Union there are many individual or regional energy policies – western European energy policy, CEE energy policy, German energy policy, pro nuclear energy policy. At some point this is completely normal, because the energy policy is still a national sovereignty issue, although obstructing one of the main principles of the Union – solidarity. In this context the common energy market is very good step in the right direction – EU has already long experience with the positive effects of the single market.

The fact that exactly the EU emphasizes on RES is surprising, because the land is crucial for the development and the usage of renewables and the Union does not possess a lot of it (2% of the total land area). Nevertheless, Brussels has set out very ambitious targets for the proportion of the used renewable energy, leaving each Member state to decide in which way these targets will be achieved:

- double the share of the renewable energy in the national energy consumption from 6% (1995) to 12% in 2010.⁹⁸ In 2004 the Commission evaluated this target⁹⁹: 1) the real share which can be achieved in 2010 is 10%, 2) an extra efforts required if the 12% target wants to be reached and 3) in 2001 the share of the renewables continued to be 6%.

- increase the share of the electricity, produced by renewables from 14% (1997) to 22% in 2010.¹⁰⁰ This Directive sets an individual target for each country including the new Member States, for which the targets are set in the accession treaties. At the same the Communication from 2004, in which the Commission evaluated the previous target, gave an evaluation for the electricity target too: 1) the real share which can be achieved with the present efforts in 2010 is 18-19%, 2) four countries are on their way to reach the national targets – Germany, Denmark, Spain and Finland and 3) Greece and Portugal are not on their way to reach these targets and for the others the information is not sufficient.

- increase in the share of biofuels added to the fossil fuels to 5.75 % in 2010.¹⁰¹

Exception is envisaged in to cases: 1) if the country has little potential for production of biofuels and 2) if the biomass is used for other purposes.

⁹⁸ European Commission COM(97) 599 final (1997) *White Paper on Renewable energy*. Brussels

⁹⁹ Communication from the Commission COM(2004)366 final, (2004) Brussels

¹⁰⁰ European Commission Directive 2001/77/EC (2001) *Electricity from Renewable Energy Sources*. Brussels

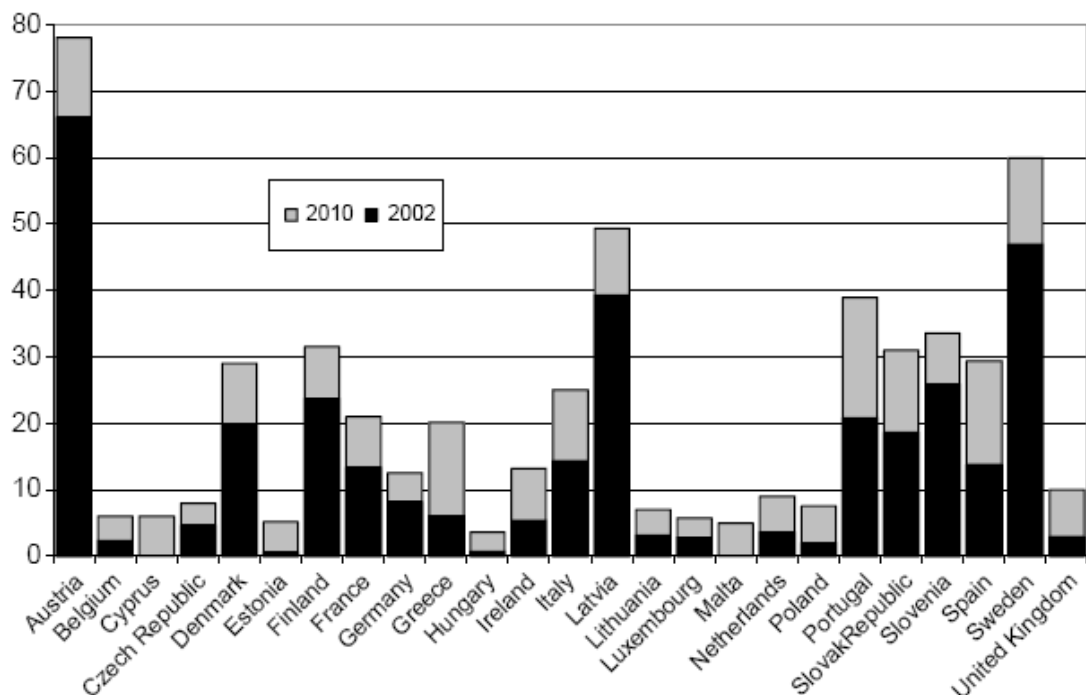
¹⁰¹ European Parliament and European Council Directive 2003/30/EC (08/05/2003) *Promotion Of The Use Of Biofuels Or Other Renewable Fuels For Transport*. Brussels

Table 6 | Share of the Renewable electricity in the Member States in relation to the national targets (%) for 2010

| country | 1997 | 2010 | country | 1997 | 2010 |
|-------------|------|------|----------------|------|------|
| Austria | 70.0 | 78.1 | Sweden | 49.1 | 60.0 |
| Belgium | 1.1 | 6.0 | UK | 1.7 | 10.0 |
| Denmark | 8.7 | 29.0 | EU 15 | 13.9 | 22.0 |
| Finland | 24.7 | 31.5 | Cyprus | 0.0 | 6.0 |
| France | 15.0 | 21.0 | Czech Republic | 3.7 | 8.0 |
| Germany | 4.5 | 12.5 | Estonia | 0.1 | 5.1 |
| Greece | 8.6 | 20.1 | Hungary | 0.7 | 3.8 |
| Ireland | 3.6 | 13.2 | Latvia | 50.1 | 49.3 |
| Italy | 16.0 | 25.0 | Lithuania | 4.0 | 7.0 |
| Luxembourg | 2.1 | 5.7 | Malta | 0.0 | 5.0 |
| Netherlands | 1.8 | 9.0 | Poland | 1.6 | 7.5 |
| Portugal | 38.5 | 39.0 | Slovenia | 31.1 | 33.6 |
| Spain | 19.9 | 29.4 | Slovakia | 15.9 | 31.0 |

Source: Commission staff working paper, SEC (2004) 547.

Figure 8 | Comparison of the share of renewables in the power consumption in 2002 and 2010.



Source: Commission staff working paper, SEC (2004) 547.

In order to achieve these targets the Commission launched different support systems to open the grid for renewables¹⁰²: 1) feed-in tariffs, 2)

¹⁰² For further information: European Commission COM(2005) 627 (07/12/2005) *The Support Of Electricity From Renewable Energy Sources*. Brussels

green certificates, 3) pure tendering procedures and 4) tax incentives. The choice which of these (one or more) regulatory policies to be applied is left to the State. Recently this community supporting system opens a debate on the need of such. The discussions continue, but the opinions in favor of common support for RES prevail¹⁰³. Nevertheless the renewables experience different administrative and finance barriers, like¹⁰⁴:

- bureaucratic problems, lack of co-ordination between the involved entities;
- not enough capacity in the special planning;
- lack of information about the projects and RES themselves;
- not enough public awareness.

The renewable energies constitute a major part of the EU energy policy and this analysis provides numerous reasons for that. But how concretely the RES faces the challenges in the last European energy policy (Green Paper 2006)?

The strategic formulation “sustainable (environmentally friendly), competitive (competitive energy costs) and secure energy (security of energy supply)” does not stress different key areas from the previous documents, EU just prioritizes them in a new order. In the current Green Paper the accent is on sustainable energy (arranged in first place), which means promoting renewable energy, increasing energy efficiency, promoting greater coherence between energy, research and environmental policies.¹⁰⁵

Although all the technical and market difficulties, RES poses feasible chance to cover all the EU energy policy challenges, some of them indirectly, some of them directly. Already most of the advantages were mentioned in the previous chapters, but now I will summarize them concretely in the EU context.

1. In security of supply aspect: help to decrease the overall energy dependency on external supply; being internal (domestic) product they help to achieve energy autonomy; RES insure high energy security for rural or isolated regions; decentralize of the energy system by locating an affordable and accessible source of power near its point of use and in this way avoid all the uncertainties of the supply chain.

¹⁰³ For further information: CEPS (Center for European Policy Studies) (2005) *Market Stimulation for Renewable Electricity in the EU*. CEPS, Brussels

¹⁰⁴ EurActive (21/04/2006) *Support for Renewables does not distort the energy market*. <http://www.euractiv.com/Article?tcaturi=tcm:29-118013-16&type=News>

¹⁰⁵ Piebalgs, Andris (06/04/2006) *Opening Speech at the EU-India Business Conference on Energy, Energy Cooperation with India*. New Delhi

2. In competitive energy cost aspect: in order to find a proof for this statement one must differentiate long from short term perspectives¹⁰⁶. In short term RES need a lot of work for achieving cost effectiveness, but in long run the picture is different. Commission foresees for 2030 70%¹⁰⁷ dependency on external supplies for the Union and at this moment the oil price could be extremely high. So, indirectly the domestic energy resources might contribute to low-price electricity supplies.

3. In environmental, climate change and sustainable development aspect: indirectly together with energy efficiency measures RES can decrease the use of fossil fuels, GHG emissions; improve the quality of live; balance the population growth / energy consumption relation;

These three areas are strongly interrelated and improvements in one of them will affect positively the other spheres. Separately from these three main objectives of each energy strategy, the RES have other advantages, namely in EU context. The first is that RES receive broad support from all European actors – national governments, public opinion, supranational institutions, industry unions, green organizations. Thus the consensus on this policy is more or less achieved. Second – because the renewable energy industry is relatively new, the need for a lot of new working places will complement some EU objectives from the Lisbon strategy. Additionally, prioritizing RES, the Union will have the chance to become really competitive in the renewable energies technology industries worldwide.

This EU renewable “kick-start” surprises by several reasons – all Member states have settled, workable, traditional energy infrastructure (including supply) in which the RES do not play a central role. The arguments for this sound convincing – low cost efficiency; unstable voltage; dependence on weather conditions; different type of transmission, networks and required infrastructure; no direct positive impact on the environment, even sometimes negative – big dams distorting the fish migration or wind turbines endangering flying birds; unavailability in regions in need, due to geographical reasons. A long list with disadvantages like this one can be completely inadequate if we look at the situation objectively. The choices for overcoming the future energy situation are limited, but even limited and imperfect they can still meet the energy challenges.

¹⁰⁶ Ringe, Marc (2005) *Fostering the use of renewable energies in the European Union: the race between feed-in tariffs and green certificates*. Renewable energy N31 1-17

¹⁰⁷ European Union (2003) *World Energy, Policy and Climate Change Outlook 2030 (WETO)*. European Union, Brussels

Conclusion

The theme of the G8 Summit this year is the energy security. This very fact confirms the urgency of the current energy situation worldwide. We have problems with the energy prices (\$ 72 p/b), with the energy accessibility and reliability (strikes in Venezuela, leftist nationalism in Mexico, ongoing conflicts in Angola and Niger Delta, war in Iraq, Iran's nuclear worries), with the energy affordability (1.6 bn people without access to electricity), with the energy dependence (80% of the energy use is based on fossil fuels), with the environment (increase in the ground-level air temperature between 1.4°C and 5.8°C for the next 100 years). The present world energy situation is more than unstable – it is insecure. The only way to make it secure is to answer these problems or to get used to living in insecurity, forgetting about the future.

This analysis has for a final aim to prove that a major part of the answers to the current energy security lies in the Renewable Energy Sources (RES). Particularly, the European Union energy security depends on the way the Union assure its energy independence, for which purpose the RES have a greater potential. Of course alternatives exist – clean technologies, fuel cells, nuclear energy, but among them the renewables can contribute at the same time for sustainable development and secure future.

In order to prove this statement, the study is divided in three chapters: World overview, European Union's energy security and RES.

After going through some national energy strategies, the **Chapter I** concludes that the energy priorities are quite similar, although the countries are quite different. The energy security is still heavily dependent on external supplies, "oil addicted" and in the priority of the state power. Nevertheless, one common feature can be distinguished and formulated as a global tendency: the energy policy is moving towards energy independence. Each country emphasizes different scenarios – own resources, energy efficiency, energy mix, green energy, nuclear energy. The old and well-known definition for energy security - reliable and adequate to the demand supply of energy at reasonable price is at the heart of the debate, because today each part of it is problematic: 1) the suppliers are not always reliable (Venezuela, Iraq, Iran, Bolivia, Nigeria), 2) the demand is expecting to exceed the production in the near future, 3) now the prices are more closer than ever to the prices of the recession period in 1970 and there is no perspective for future decrease and 4) the environmental pressure on the energy policies grows.

If one can say that the world is moving from energy dependency toward energy independency (or more correctly less dependency) in each sense – from fossil fuel, independency from external supplies this means that a completely new tendency, opposite to the process of globalization, appears in the energy field.

This chapter opens for debate several other issues related to the energy security: how the international community sees the future (future scenarios), does the energy security take part of the national security strategy, should NATO contribute for ensuring the energy security.

Chapter II starts stating that the EU energy reality is away from its golden moments during the 1990s. The Union is one of the major participants in the global energy transition being one of the big consumers and contributing substantially for the climate change issues. EU is a net importer of energy and the forecasts for 2030 are 70% external export dependence. The Union does not stay apart from the global energy instability; on the contrary – it actively participates and is highly affected. But besides that, EU has its own energy problems. The international community agreed that the goals are common and the cooperation is vital. Unfortunately, for EU is easier to achieve cooperation with US, than between its own Member States, which shows serious weakness inside the Union. Because the energy enters in a completely new era, which will affect all the state policies – economy, environment, social policy, external relations, transport, in order to be followed this strategy should be accepted by all actors. And exactly here the EU fails.

When one discusses the EU behavior it should be taken into account that the Union is a complex actor both on the external and on the internal scene, which is part of its essence and it cannot, and it should not be changed. Now with 25 Member States, later on with 27¹⁰⁸ or more, this Union exists because of the mutual desire to work in the same direction. This is at the same time advantage and inconvenience, which substantially contributes to the Union energy problems. They are broadly divided in two groups: internal, which the EU's policies could influence and external – independent from the Union's decisions.

- internal problems: 1) “unity in diversity problem” – because the energy field traditionally is part of the national politics, the Member states rarely reach a common vision, despite the urgency of the situation. Part of these disputes is nuclear power, external relations with suppliers, solidarity issues; 2) no back-up plan for energy crisis (recently Ukraine); 3) the regions in the Union differ essentially in their energy needs and policies

¹⁰⁸ After the accession of Bulgaria and Rumania

(Central and East Europe) and 4) need for better co-operation between all the entities responsible for the energy policy of the Union.

- external problems: 1) Turkey's increasing energy role for EU can lead to the creation of another energy monopolist in the region; 2) The question if really the EU-Russia cooperation leads to energy security; 3) the neighbors – transit or supplying countries experience a lot of security problems (organized crime, ethnic conflicts, political instability).

The principal policy guidelines used by EU when meeting its energy security challenges are the bilateral, multilateral/regional dialogues and the Green/White Papers. The Union tried to legalize the energy issue in the Treaty Establishing the Constitution, too. All other initiatives and official documents are consequent to them, trying to implement the subsequent actions. One can conclude that neither the dialogues, nor the Papers, nor the TEC made a significant progress resolving EU's energy problems. The text argues that the dialogues are not enough developed in some key regions or countries. The Green/White Papers since their very beginning have prioritized similar challenges and similar ways, in which they could be met. In this context, the European energy security priorities are: external security by assuring the security of supplies, internal security by completing the single energy market process and energy efficiency.

The last Chapter III shows the possibilities in which these challenges could be met by sustainable and environmentally secure ways – energy efficiency and renewable energy sources. The energy efficiency is the best way to reduce the external supply dependence, to reduce the internal energy intensity, to save the environment and to reduce the consequences of the climate change. One can consider the energy efficiency like the means, with help of which the transition from energy dependency to energy independency will be reached. In this perspective, the renewable energies constitute the essential part of the process. They have the real chance to replace the old fossil fuels, to make the countries energy independent, to meet the environmental problems in the cleanest way, to balance the climate mitigations in long-term, to provide real sustainable development for the poor counties and to improve the quality of live. Furthermore, all of this will be achieved by the forces of nature.

EU prioritized the renewable energy sources since a long time ago, as it can be seen from the energy strategies until now. The latest Green Paper puts the sustainable aspect on the energy security on the first place, which gives the RES a high importance. Form the opposite point of view this renewable “kick-start” surprises because all Member states have settled, workable, traditional energy infrastructure (including supply) in which RES do not play a central role. The arguments for this sound

convincing, because the renewables could not achieve the desirable reliability, accessibility and affordability for the moment. But if we look at the situation objectively the choices for overcoming the future energy situation are really limited: continuation of the search for available fossil fuels, nuclear energy, clean technologies and renewables. Among them the RES possess the real chance to answer all future energy challenges, assuring the sustainability of this future. And isn't exactly this the energy security priority of the European Union?

Energy calculator

Approximate conversion factors

| Crude oil* | To | | | | |
|-----------------|--------------------|------------|---------|------------|-------------|
| | tonnes (metric) | kilolitres | barrels | US gallons | tonnes/year |
| From | Multiply by | | | | |
| Tonnes (metric) | 1 | 1.165 | 7.33 | 307.86 | – |
| Kilolitres | 0.8581 | 1 | 6.2898 | 264.17 | – |
| Barrels | 0.1364 | 0.159 | 1 | 42 | – |
| US gallons | 0.00325 | 0.0038 | 0.0238 | 1 | – |
| Barrels/day | – | – | – | – | 49.8 |

*Based on worldwide average gravity.

| Products | To convert | | | |
|----------------|--------------------|-------------------|----------------------|----------------------|
| | barrels to tonnes | tonnes to barrels | kilolitres to tonnes | tonnes to kilolitres |
| | Multiply by | | | |
| LPG | 0.086 | 11.6 | 0.542 | 1.844 |
| Gasoline | 0.118 | 8.5 | 0.740 | 1.351 |
| Kerosene | 0.128 | 7.8 | 0.806 | 1.240 |
| Gas oil/diesel | 0.133 | 7.5 | 0.839 | 1.192 |
| Fuel oil | 0.149 | 6.7 | 0.939 | 1.065 |

| Natural gas and LNG | To | | | | | |
|----------------------------------|-------------------------|-----------------------|-------------------------------|--------------------|--------------------------------|--------------------------------|
| | billion cubic metres NG | billion cubic feet NG | million tonnes oil equivalent | million tonnes LNG | trillion British thermal units | million barrels oil equivalent |
| From | Multiply by | | | | | |
| 1 billion cubic metres NG | 1 | 35.3 | 0.90 | 0.73 | 36 | 6.29 |
| 1 billion cubic feet NG | 0.028 | 1 | 0.026 | 0.021 | 1.03 | 0.18 |
| 1 million tonnes oil equivalent | 1.111 | 39.2 | 1 | 0.805 | 40.4 | 7.33 |
| 1 million tonnes LNG | 1.38 | 48.7 | 1.23 | 1 | 52.0 | 8.68 |
| 1 trillion British thermal units | 0.028 | 0.98 | 0.025 | 0.02 | 1 | 0.17 |
| 1 million barrels oil equivalent | 0.16 | 5.61 | 0.14 | 0.12 | 5.8 | 1 |

Units

- 1 metric tonne = 2204.62 lb = 1.1023 short tons
- 1 kilolitre = 6.2898 barrels
- 1 kilolitre = 1 cubic metre
- 1 kilocalorie (kcal) = 4.187 kJ = 3.968 Btu
- 1 kilojoule (kJ) = 0.239 kcal = 0.948 Btu
- 1 British thermal unit (Btu) = 0.252 kcal = 1.055 kJ
- 1 kilowatt-hour (kWh) = 860 kcal = 3600 kJ = 3412 Btu

Calorific equivalents

One tonne of oil equivalent equals approximately:

| | |
|---------------|------------------------------------------------------------|
| Heat units | 10 million kilocalories 42 gigajoules 40 million Btu |
| Solid fuels | 1.5 tonnes of hard coal 3 tonnes of lignite |
| Gaseous fuels | see natural gas and LNG table |
| Electricity | 12 megawatt-hours |

One million tonnes of oil produces about 4500 gigawatt-hours (= 4.5 terawatt-hours) of electricity in a modern power station.

Source: BP Statistical Review 2005

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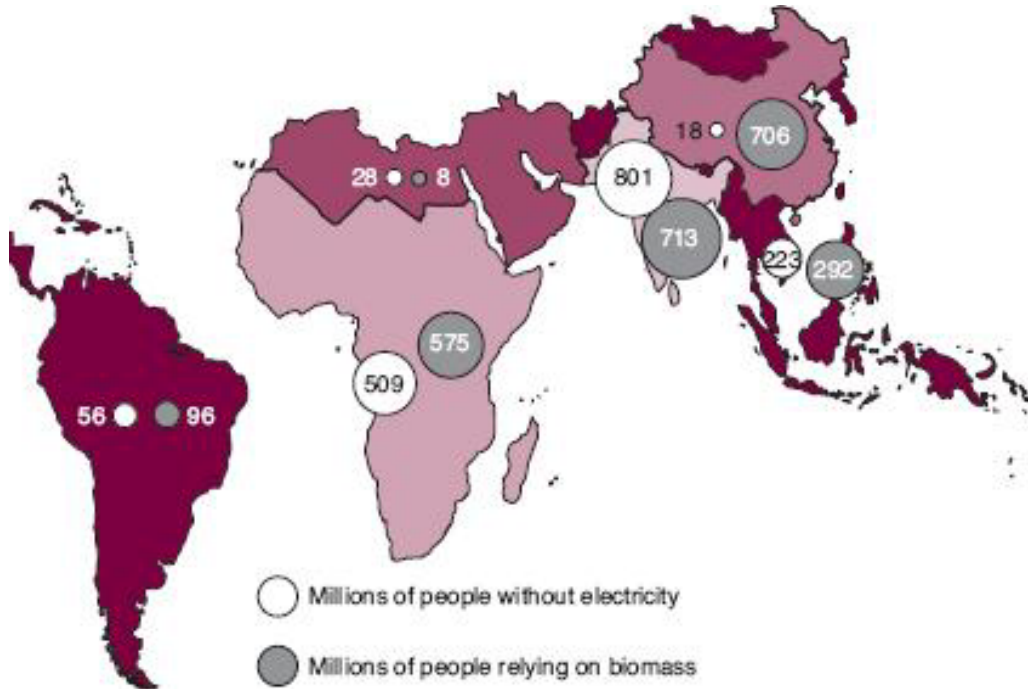
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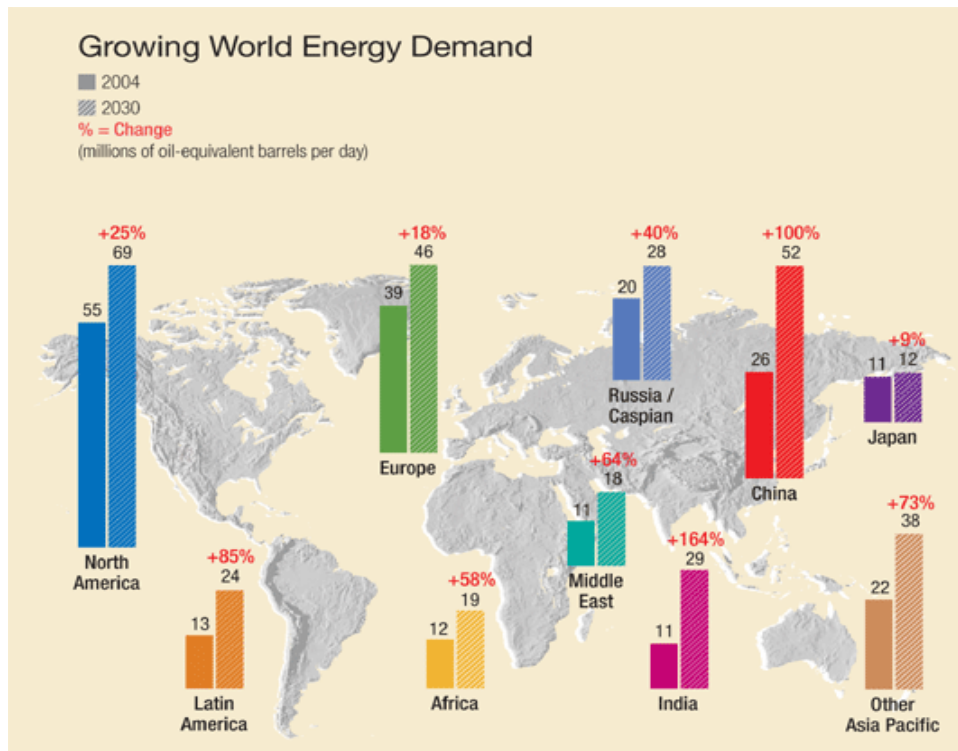
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Appendix A | Regional distribution of people without access to electricity and those dependent on biomass for their energy supply.



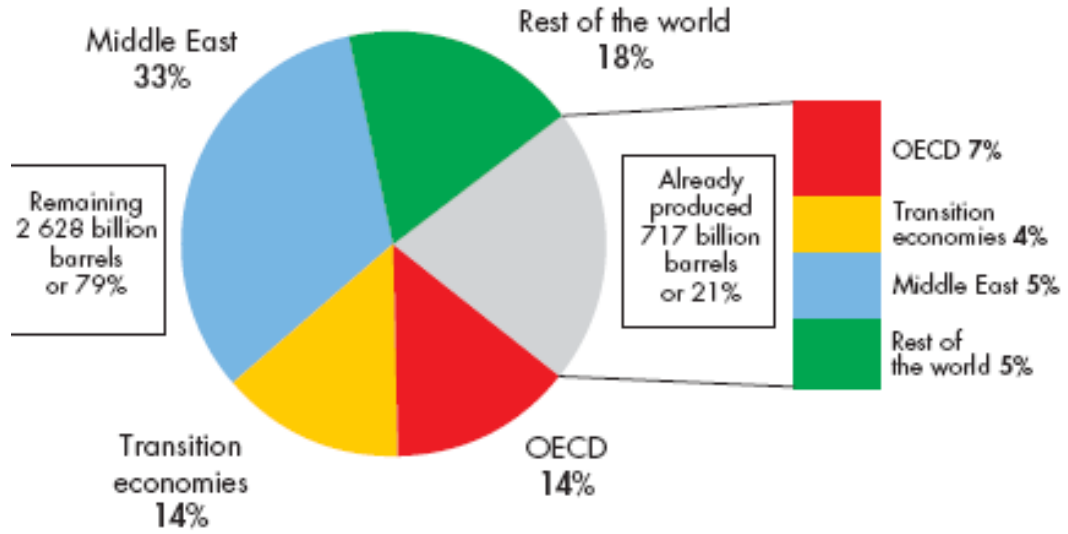
Source: IEA, 2004

Appendix B | Growing World Energy Demand (2004 - 2030)



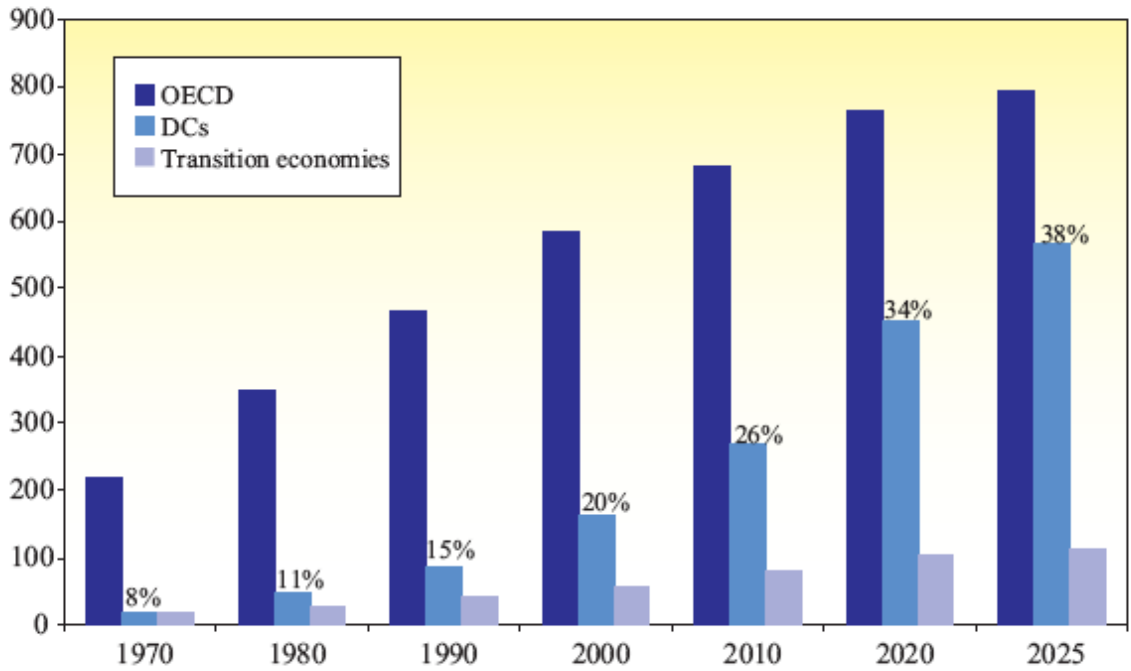
Source: ExxonMobil, 2004

Appendix C | Recoverable Resources of Oil and NGL by Region



Source: IEA, 2004

Appendix E | Number of vehicles, 1970-2025 (million)



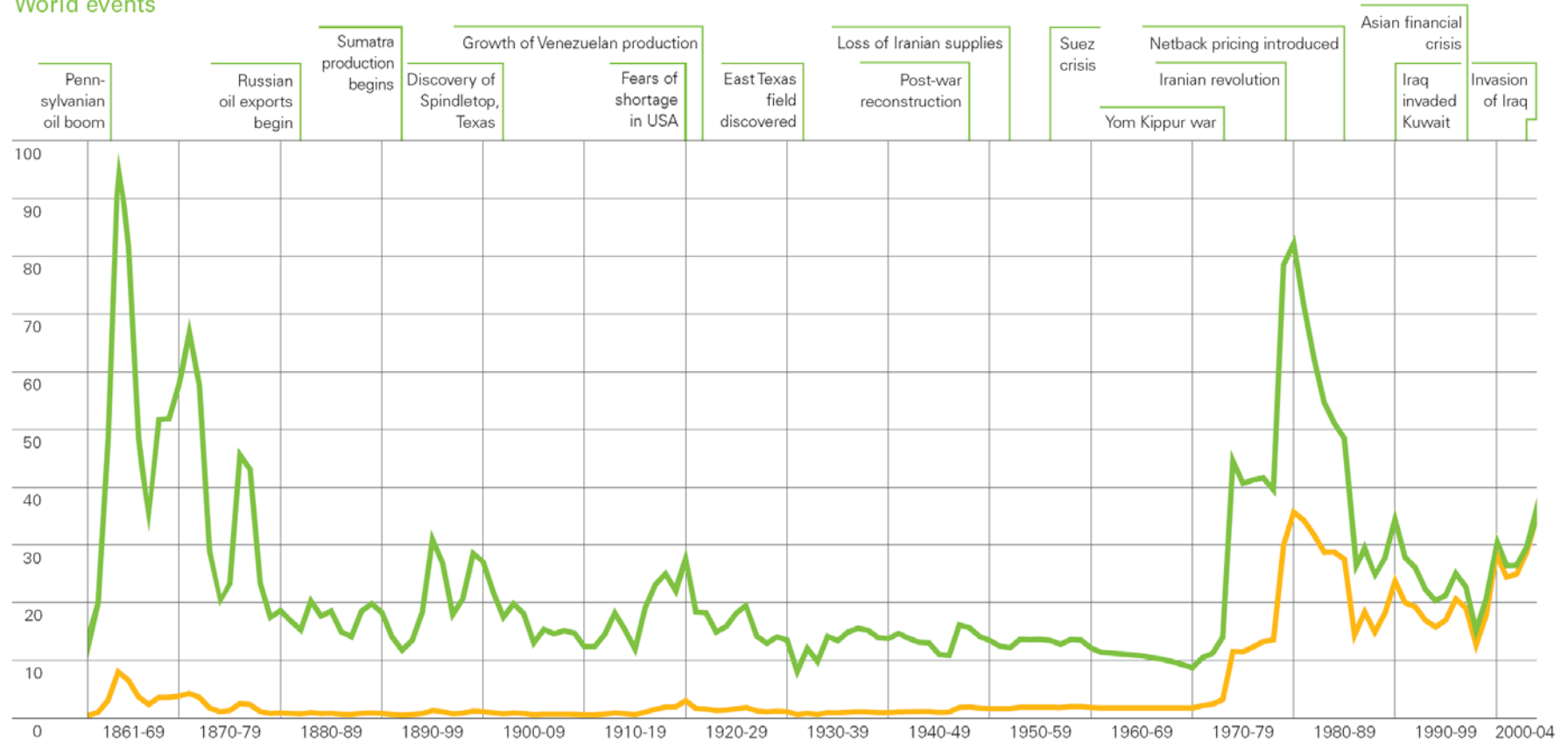
Source: OPEC Oil Outlook to 2025, 2004

Appendix D | Crude oil prices since 1861 / World events

Crude oil prices since 1861

US dollars per barrel

World events



Source: BP Statistical Review, 2005

Appendix F | Projects of common interest EU-Russia

1. **NEGP:** \$ 5 bn., 1200 km, eventually will be connected after with other member states. For now will deliver gas for Germany via (under) the Baltic Sea by 2010. The pipeline will link the Russian port of Wyborg and the town of Greifswald in north-eastern Germany. The capacity is 55 bn m3 per year. The stakeholders are: Gazprom (51%), BASF (24.5%) and E.ON(24.5 %).



2. **Yamal-1Europe gas pipeline:** 4 000 km, comes into EU via Belarus, cross Poland and ends in Germany.



3. **Bourgas-Alexandroupolis oil pipeline:** from Novorosiisk (Russia, Black Sea), via Bugras (Bulgaria) to end in Alexandroupolis (Greece). The 300 km, \$700 million pipeline is envisioned to pump at first 15 million tons a year, moving on to 24 million tons, with a final volume of 35 million tons a year.



4. **Drouzba-Adria oil pipeline:** via Ukraine Slovakia and Czech Republic, were must be connected to reversed Adria system via Hungary and Croatia, to ends in Omisalj port. The main idea is from import pipeline to become an export one. The partners are: Russia, Belarus, Ukraine, Slovakia, Hungary, and Croatia. The capacity is 300 000 b/d.



5. **Shtokman field:** giant gas field located in the Russian Barents Sea, 550 km offshore from the coast of the Kola Peninsula in 330 m water depth. Russia has not yet decided which companies will be its partners: Elf, ConocoPhillips, Chevron, Total, Statoil or Hydro.

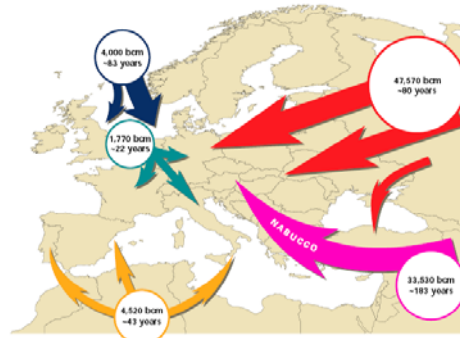


Appendix G | Algerian gas for European Union

Existing pipelines (in yellow):

- Maghreb-Europe (via Marco for Spain and Portugal)
- Trans-Mediterranean (via Tunis for Italy)

Gas Reserves around Europe



MEDGAZ Project: Submarine gas pipeline, which will connect (eventually 2009) Algeria and Spain directly. The capacity will be 8bn m3 per year, and the stakeholders are: Spanish oil company Cepsa (20%), Algeria's Sonatrach (20%), Gaz de France (12%), Total (12%), BP (12%), Endesa (12%) and Iberdrola (12%).



GALSI Project: North Algeria – Italy, via Sardinia. The capacity will be 10 bcm per year and the stakeholders are: Sonatrach (36%) – Algerian and the others are Italian - EDISON Gas (18%), ENELPOWER (13,5%), EOS ENERGIA (9%), SFIRS Spa (5%), PROGEMISA Spa (5%) and WINTERSHALL (13,5%).



Appendix H | Pipelines (existing and projects) via Azerbaijan

TRACECA: Transport Corridor Europe Caucasus Asia was initiated in Brussels in May 1993. The trade and transport ministers from the five Central Asian republics and three Caucasian republics namely Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan decided to run the EU funded Technical assistance program aimed towards the development of the transport corridor from the west across the Black Sea, through the Caucasus and the Caspian Sea to Central Asia. Later Mongolia, Ukraine, Moldova, Bulgaria, Romania and Turkey joined the Traceca.

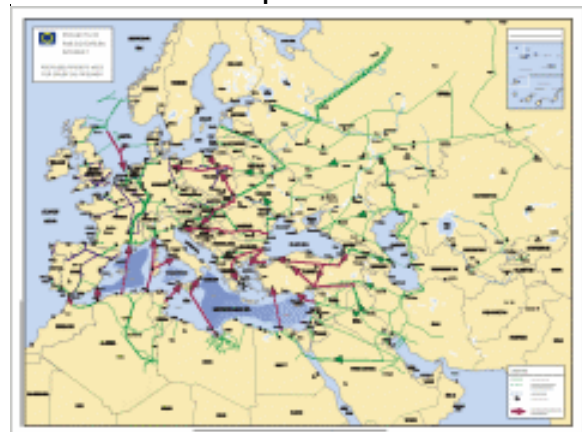


INOGATE: The INOGATE Program's overall objective is to promote integration of the oil and gas pipeline systems and facilitating their transport towards the export markets of Europe and the West in general. To date, it has been signed by 21 states from Central Asia, Caucasus, Eastern Europe and the EU.

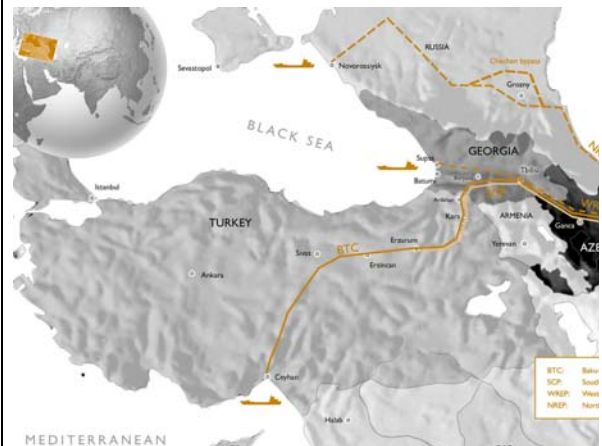
Gas Map



Crude Oil Map



Baku-Tbilisi-Ceyhan (BTC) – the pipeline connects Azerbaijan with Turkey, via Georgia. It opens up a market for Caspian Sea crude oil independent of Russia. With its 1 700 km is the second longest oil pipeline in the world after Droujba. The planned capacity is 1,5 mln b/d. the stakeholders are: BP (30.1%) , SOCAR (Azerbaijan–25%), Unocal (USA–8.9%), Statoil (Norway – 8.71%), TPAO (Turkey-6.53%), Eni/Agip (Italy–5%), Total (France–5%), Itochu (Japan–3.4), Inpex (Japan–2.5%), ConocoPhillips (USA- 2.5%), Amerada Hess (USA-2.36%)



Albania-Macedonia-Bulgaria Oil (AMBO) or Burgas-Vlore Pipeline – 900 km, with capacity of 750 000 b/d. It will connect Caspian Sea oil with Adriatic Sea, via Black Sea, bypassing Turkey's increasingly congested Bosphorus and Dardanelles. The project is estimated to cost \$1.2 billion, of which \$930 million will be provided by international donors: the WB, the EBRD, IMF, the U.S. Export-Import Bank and the U.S. Overseas Private Investment Corporation.

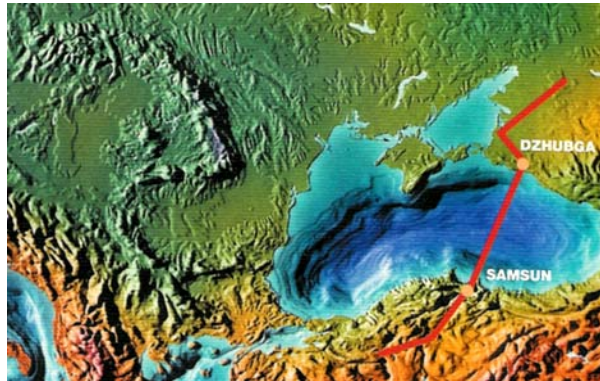


Baku - Tbilisi - Erzurum – gas pipeline (\$ 953 mln), officially called South Caucasus Pipeline. BP leads an international consortium developing the Shah Deniz gas field some 60 km off Azerbaijan's Caspian Sea coast. The 15-year contract will deliver an initial volume of 6.6 bn cmpy from 2007. In order to bring the contract to life, BP, Kvaerner of Norway and Azerigaz have been conducting the engineering study. The Shah-Deniz field - apart from BP also operated by TotalFinaElf, Statoil. Production could reach 16 bn cmpy. under the Black Sea to boost deliveries to Turkey and other European markets. The pipeline, with annual capacity of 16.8 bn cm, is scheduled for completion later this year.



Appendix I | Pipelines (existing and projects) via Turkey

Blue Stream: 1213 km, \$3.2 billion. The capacity now is 6 bcm (2005) and for 2010 -16 bcm. In November 2005 the Blue Stream project has been officially inaugurated by the Russian President Vladimir Putin, Turkish Prime Minister Recep Erdogan, and Italian ex-Prime Minister Silvio Berlusconi.



Turkey – Greece: 300km, starting capacity 0.75 bcm, long term-11.5 bcm. In 03 July 2005 the Turkish and Greek prime ministers - Recep Tayyip Erdogan and Costas Caramanlis launched the project, which will connect rich natural gas fields in the Caspian and Central Asia to energy-hungry markets in Europe via Bursa (Turkey) and Komotini (Greece). Latter will be extended to Italy as part of the Southern Europe Gas Ring Project.

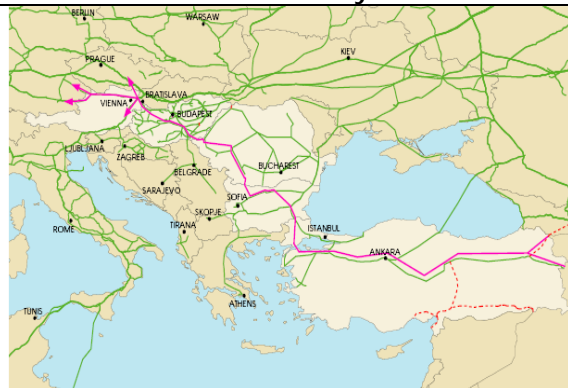


Interconnector Greece-Italy



Interconnector Turkey-Greece

NABUCO gas pipeline - 3 300 km, \$ 5bn, long term capacity 30 bcm/y. From Caspian / Central Asia / Middle East via Turkey to Austria, (Bulgaria, Romania, and Hungary). Construction is expected to begin in 2008 and take until 2011. The company leading the project is OMV from Austria.



Greece – Western Balkans – Austria: Western Balkan Natural Gas Pipeline Development Project. It is planned to connect eight countries and was expected to start in mid-2005. Completion is scheduled for 2008. The European Union is expected to guarantee and finance the project.



Appendix J | Pipelines via Africa-Gulf of Guinea

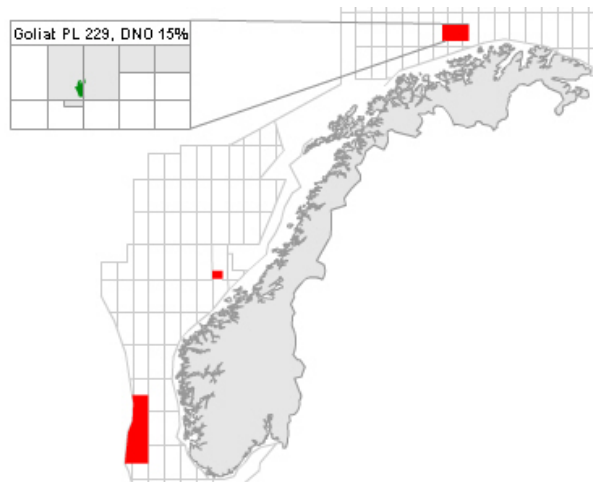
Sonatrach (Algeria) and NNPC (Nigeria) formed the **Trans-Saharan Natural Gas Consortium (NIGEL)** in 2002. The NIGEL consortium aims to construct a 4,550-mile natural gas pipeline from Nigeria to Algeria, via Niger. The NIGEL pipeline would utilize the proposed Medgaz and existing Transmed pipeline to carry Nigerian gas to European markets. The Nigerian and Algerian governments have sought financial assistance for the \$7 billion from the World Bank and the New Project for Africa's Development (NEPAD).



Appendix K | Gas fields in Arctic region

Goliat field: offshore oilfield just northwest of North Cape in the Barents Sea. The estimate indicates approximately 250 million barrels of oil equivalents, made up of approx. 75 percent oil and 25 percent gas. The stakeholders for the field are:

- Eni Norge (operator) 65%
- Statoil 20%
- DNO 15%



Snøhvit field: discovered in 1984, together with its neighboring fields of Askeladd and Albatross, it is estimated to hold around 200bn cubic meters of natural gas (5.7 bcm yearly). Statoil has secured a market for the gas in the US state of Maryland. Because this distance is unfeasible for pipeline via LNG shipment the gas will reach the US terminal.

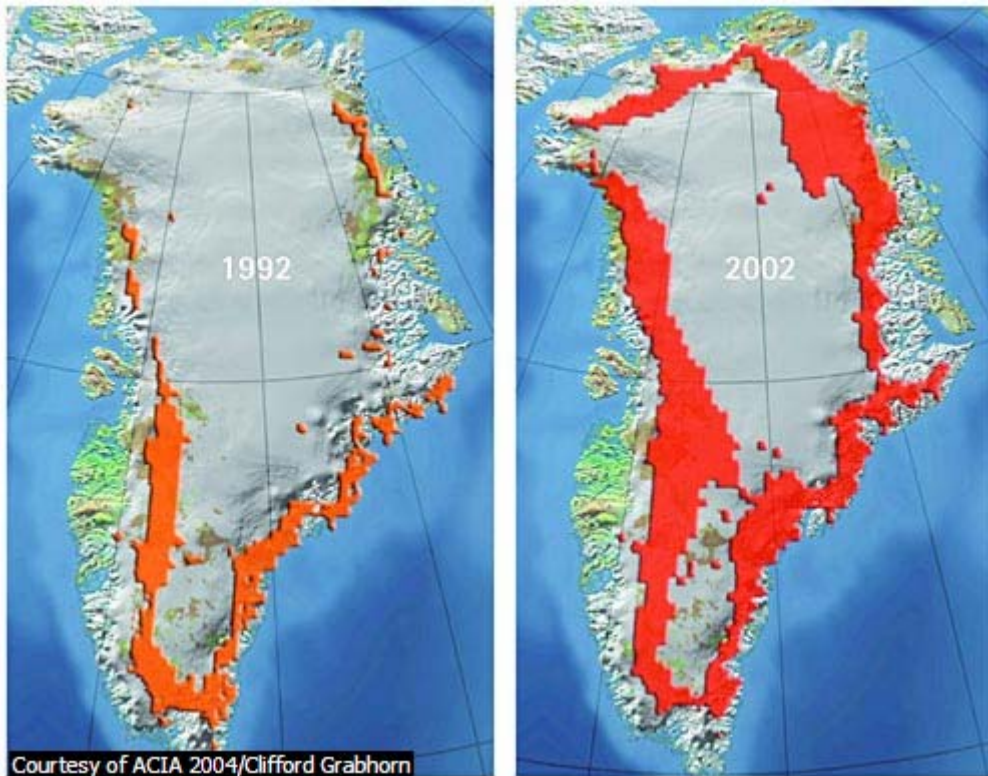


Appendix L | East Siberia – Pacific Ocean Pipeline

Tayshet – Nahodka Pipeline or East Siberia – Pacific Ocean Pipeline. 4 188 km, \$ 11.5 bn. The pipeline pass close to Lake Baikal (40 km), which now raises a strong reaction from environmental organizations.



Appendix M | Shrinking Greenland Ice Sheet (1992 - 2002)



Shrinking Greenland Ice Sheet

The Greenland ice sheet underwent extensive surface melting from 1992 to 2002, according to the Arctic Climate Impact Assessment report released in 2004. Tinted areas in these satellite images show the extent of surface melting in 1992 and in 2002. The report warned that the melting of Greenland's ice sheet and the melting of glaciers in Alaska and Canada are increasingly contributing to a rise in the world's sea level.

Courtesy of ACIA 2004/Clifford Grabhorn

Source: Microsoft Encarta Library 2006