SCIENCE AND TECHNOLOGY

224 STCEES 10 E rev.1
Original: French/English

NATO Parliamentary Assembly

SUB-COMMITTEE ON ENERGY AND ENVIRONMENTAL SECURITY

A SUSTAINABLE ENERGY STRATEGY FOR THE ALLIANCE

REPORT

PHILIPPE VITEL (FRANCE)
RAPPORTEUR

International Secretariat 14 November 2010

TABLE OF CONTENTS

I. IS THERE A ROLE FOR NATO IN ENERGY SECURITY?

1. Energy security has never been such a dominant economic, environmental and geopolitical issue in international relations. The essence of the problem lies in the fact that petroleum and gas – the pillars of the dominant energy paradigm – are distributed very unevenly over our planet. Paradoxically, most of these resources are found in regions that are historically less industrialised. This, added to the fact that world energy consumption is increasing substantially, creates a series of vulnerabilities and tensions. The growth is impressive: the United States, for example, is consuming three times more fossil fuel than 60 years ago. Domestic production has been unable to sustain such an increase, and the country, which was formerly self-sufficient, now has to import over a quarter of its energy requirements. The resulting vulnerabilities cannot fail to have profound implications for security.

2. Since the end of the Cold War, NATO has constantly reviewed and extended its definition of security, beyond the purely military domain. NATO, like other actors in international relations, has seen energy take its place at the centre of its political agenda. On 30 July 2007, a NATO fleet including ships from six Alliance member countries[1] embarked upon an historic mission, sailing all round the African continent to safeguard commercial shipping and to protect the transport of energy resources[2]. A few months earlier the Riga Summit had suggested that energy should be integrated into the tasks of NATO; this, however, has not failed to create disagreements among the Allies. References to energy security were also made later, in official documents produced at the NATO Summits in Bucharest and Strasbourg-Kehl.

3. Should NATO concern itself with energy security? Some within the Alliance, like Jaap de Hoop Scheffer, the former Secretary General, consider that energy should form part of NATO's missions, referring to paragraph 24 of the 1999 Strategic Concept[3]:

> *"(…) Alliance security must also take account of the global context. Alliance security interests can be affected by other risks of a wider nature, including acts of terrorism, sabotage and organised crime, and* ***by the disruption of the flow of vital resources****".*

4. Others take the view that energy security has no place in the tasks of NATO and should remain a matter for other organisations such as the EU, and for States themselves. The present discussions on redefining the Alliance's Strategic Concept have revealed arguments from both viewpoints. Mrs Albright's Group of Experts report did not identify energy security as one of the three major unconventional threats to the Alliance, although further on several paragraphs dedicated to energy security suggest that "(t)he potential for major energy supply disruptions should figure prominently in NATO's strategic assessment and contingency planning activities". The future basic official document should clarify the slightly ambiguous position.

5. In this paper, Your Rapporteur wishes to stress the de facto central place of energy within the Alliance. The linkage between energy and security is undeniable, as most recently demonstrated by the agreement between the Russian Federation and Ukraine which included gas prices and the extension of the Russian naval presence in Crimea in the same package. Also, the energy vulnerability of some of the Allies, whether genuine or imagined, has very real implications on their foreign and security policies as well as on broader geopolitical climate NATO finds itself in. Decreasing energy-related tensions would substantially enhance Europe's security landscape.

---

1 Canada, Denmark, Germany, the Netherlands, Portugal and the United States.

2 "NATO News: NATO Naval Force Sets Sail for Africa'', July 30, 2007, http://www.nato.int/docu/update/2007/07-july/e0730a.html

3 Robert G. Bell, "NATO's Grapple with Energy Security", in Gal Luft and Anne Korin, *Energy Security Challenges for the 21st Century*, Prager Security international, Santa Barbara, CA, US, 2008, pp.263-266.

6. The key question is whether NATO with its limited resources and specific mandate is capable of contributing to addressing these vulnerabilities? The prevailing approach is that NATO should play a secondary role and "add value" in specific areas, particularly in terms of critical infrastructure protection. Although this is essentially a national responsibility, the Alliance could provide assistance, on request, in protecting certain infrastructures. In particular, NATO's Maritime Situational Awareness and Active Endeavour operations or anti-piracy capabilities might be used to protect shipping such as tankers carrying oil or Liquefied Natural Gas (LNG) against terrorists or pirates. To illustrate this problem, reference can be made to the capture by pirates of the Saudi supertanker Sirius Star, which was carrying nearly a quarter of the country's daily oil exports[4]. The potential for NATO's role in critical infrastructure protection was thoroughly discussed in an excellent report of the Assembly's Committee on Civil Dimension of Security by Lord Jopling (UK) [207 CDS 10 E]. Other suggestions for NATO to "add value" include the establishment of a centre of excellence to promote the exchange of best practice and information (similar to the centre for cybersecurity established in Estonia) as well as coordinating policies in the High North with its considerable energy potential.

7. However, Your Rapporteur would argue in favour of a more comprehensive approach: while the Alliance should by no means be involved in energy supply negotiations, it could serve as an important venue to promote the principle of solidarity which could translate into specific actions on a national or the EU level. The discussion, exchange of views and joint statements within NATO on energy security are extremely valuable, even if they do not lead to specific NATO policies. The Alliance has the unique characteristic of being able to bring together European and non-European energy producers – the United States, Canada and Norway, as well as Turkey, a vital transit country. NATO partnership programmes extend to several key countries and regions, such as Russia, Ukraine, the Caucasus and the Persian Gulf. NATO's geographical range and its network of partners can potentially add value to the drive for energy security by organisations like the EU or the OECD.

8. That said, NATO and its member states must be careful to avoid too much direct involvement in the energy diplomacy, particularly in sensitive regions such as the Caucasus or Central Asia where references to NATO may prove counter-productive. Energy diplomacy in Europe should remain the responsibility of the European Union.

9. A common energy policy has been widely debated. Up to now, EU member states themselves have been almost solely responsible for meeting their energy needs. They negotiate bilaterally with energy suppliers, without enough co-ordination among themselves. When some countries had to face cuts in energy supplies, no European aid mechanism was called in. However, the EU's role in the energy security of its members is clearly and steadily increasing. Firstly, measures have been taken to create a common energy market in Europe. This would enable countries affected by disruptions in energy supply to purchase energy from other sources. However, for this market to operate efficiently throughout the EU, a substantial number of expensive infrastructure projects have to be completed, i.e. national electricity interconnectors and gas networks. Secondly, the entry into force of the Lisbon Treaty in December 2007 has given fresh impetus to the EU's common foreign policy, laying the foundations for the EU's more active diplomatic involvement in future conflicts and negotiations on energy.

10. Apart from discussing 'traditional' energy security challenges relating to diversification of fossil fuel supply, this report emphasises that this discussion cannot ignore the implications of climate change. Climate change and the necessity of meeting growing world needs and reducing current dependencies show that a fundamental change of direction is essential, towards a green economy, comparable to the transition from an agricultural to an industrial society. This transition

4 NATO and Energy Security after the Strasbourg-Kehl Summit. Report by Andrew Monaghan. NATO Defense College. June 2009.

requires strong political will and resolve as it is a costly one: the UK government, for instance, assesses that implementation of 'green' policies would increase domestic gas prices in 2020 by 18% and electricity prices by 33%.[5] The new technological solutions as well as energy efficiency measures are therefore critical for the acceptability of these policies.

11. Low-carbon or zero-carbon technology solutions are key factors in this process as they help to address both energy security and climate change challenges. Denmark, for instance, suffered considerably from the oil crisis in the 1970s, but its subsequent focused and robust policy to promote renewable energy made the country essentially energy independent. Nevertheless, European countries still lag behind the US in terms of green technology development (venture-capital investments in clean technology in the United States in 2008 were almost $6 billion, compared with less than $2 billion in all of Europe[6]), and need to step up their efforts both in terms of direct support and through tax incentives. The role of NATO in promoting 'green' policies is even more questionable than in case of traditional energy supply challenges, but it should not be completely ruled out. NATO's Science for Peace and Security programme offers opportunities to contribute to development of green technologies through the system of grants and workshops. Also, the Alliance may have an influence reducing the carbon footprint of armed forces – after all, the US defence sector is the single largest energy consumer in the US.

12. States in the transatlantic community could and should take the lead in promoting a sustainable energy future for our planet. This community of States should develop a framework (the Center for Strategic and International Studies, an influential American think-tank, suggests the name "Transatlantic Forum for Energy Cooperation"), which would include NATO, the EU and their member states, to co-ordinate long-term energy policies, to reach agreement on common energy standards, to support research and development for new low CO_2-emission technologies and to address the issue of nuclear power development. It is regrettable, however, that at this stage there is no consensus among the Allied nations on joint climate stabilisation strategy: the United States government's efforts to introduce ambitious emissions reduction legislation are unlikely to succeed, while the European Union is clearly a global leader in this regard with its "20-20-20" strategy and ongoing discussions on increasing the emission reduction target to 30% by 2020. As a result, the transatlantic community was unable to emerge as a single actor at the 2009 Copenhagen Summit, nor is it likely to have a unified position at the follow-up gathering in nov-dec 2010 in Cancun, Mexico.

13. Energy security is not a novel issue for the NATO Parliamentary Assembly. The Rapporteur would like to stress the work done by Mario Tagarinski in 2008 for the Sub-Committee on Energy and Environmental Security. The present report is part of a long-term debate round this subject, which today is a central concern of the Assembly. Other NATO Parliamentary Assembly committees, in particular the Economics and Security Committee, have also made a substantial contribution to the debate on energy security for the Euro-Atlantic community.

14. The following chapters are intended to provide a more detailed background for the discussion on the exact scope of NATO's role in promoting sustainable energy security for its member states.

---

5 Efficiency Drive. The Economist. 29 July 2010.

6 The Elusive Green Economy. By Joshua Green. The Atlantic. July 2009.

II. ENERGY DEPENDENCE IN THE COUNTRIES OF THE ALLIANCE

A. THE OVERALL SITUATION

15. Although our report concentrates essentially on the countries of the Alliance, 23 of which are members of the OECD, it is nevertheless essential to analyse the present situation and trends outside the Alliance, because these have a significant impact on the supply available to the Allies. This is all the more true because countries outside the OECD, the great majority of which are regarded as emerging or developing, will account for 59% of world energy consumption in 2030, compared to only 41% today. According to forecasts by the International Energy Agency (IEA) submitted in World Energy Outlook 2009, world demand for energy is likely to increase by 40% between now and 2030, mainly because of the predicted rise in countries outside the OECD, in particular the Asian countries[7].

16. Forecasts for global energy demand are declining slightly relative to those made in 2008, due in large measure to the economic crisis, which has clearly held down production of goods and services and world demand for energy. However, this downward trend is probably temporary.

17. The consumption of **liquid fuels and other oils**[8] should only increase at an annual rate of 1% between 2006 and 2030. Even if it is predicted that liquid fuels will remain the greatest source of energy, their share in world energy consumption is likely to decline slightly[9]. At the same time, daily production, which was 84.6 million barrels in 2006, is likely to increase by a quarter between now and 2030, thus covering the rise in consumption[10]. An increase in production is expected to come mostly from regions outside OPEC[11].

18. Early in 2009 world oil reserves were estimated by the Oil and Gas Journal at 1,342 billion barrels[12]. Four-fifths of these reserves are concentrated in eight countries, only two of which (Russia and Canada) are outside OPEC[13]. The three countries with the largest oil reserves are Saudi Arabia, Canada and Iran[14].

19. **Natural gas**, which is more efficient and has a lower carbon content, is still an important fuel for electricity production in the world. It should benefit both from the high prices of other fossil fuels and from government projects aiming to reduce greenhouse gases, as a fuel less polluting than coal or oil. Natural gas production will have to increase by 48 trillion m^3 between 2006 and 2030, to meet the increase in consumption[15]. It is predicted that countries outside the OECD will account for over 80% of the increase in world production.

---

7 International Energy Agency, *World Energy Outlook 2009,* Executive Summary, p. 42, energy consumption is likely to increase by 73% in countries outside the OECD and by 15% in the OECD countries between now and 2030, a worldwide increase of 44% : Energy Information Administration, *International Energy Outlook 2009*, US Department of Energy, Washington DC, May 2009, p. 7.

8 This category includes a vast range of liquid reserves, conventional (e.g. crude, heavy hydrocarbons, butane, propane, kerosene, refinery products) and non-conventional (e.g. biofuels, liquid fuels obtained by conversion of coal or gas, and non-conventional petroleum products). However, it does not include natural gas for vehicles (NGV), liquefied natural gas (LNG) or hydrogen.

9 The IEA predicts that the share of liquid fuels in world consumption is likely to drop from 36% to 32% between 2006 and 2030 - Energy Information Administration, *International Energy Outlook 2009*, p. 9.

10 Twenty-two million barrels between 2006 and 2030: Energy Information Administration, *International Energy Outlook 2009*, p.22.

11 59% : Energy Information Administration, *International Energy Outlook 2009*, p. 25.

12 "Worldwide Look at Reserves and Production", *Oil & Gas Journal*, Vol. 106, No. 48 (December 22, 2008), pp.23-24.

13 Fifty-six per cent is in the Middle East, as against only 16% in North America, which is nevertheless the second richest region in oil.

14 With 266, 178 and 136 billion barrels respectively: Energy Information Administration, *International Energy Outlook 2009*, p.31.

15 An increase of 1.6% per year on average.

20. World natural gas reserves have stagnated since 2004, despite growing demand. Iran and the United States have recorded the greatest increases in their natural gas reserves[16], thanks to a better knowledge of where these reserves are located and to improved exploration techniques. The greatest reductions affect Germany and the United Kingdom[17]. Nearly three-quarters of world natural gas reserves are in the Middle East and Eurasia. Early in 2009 three states, Russia, Iran and Qatar, accounted for 57% of world reserves[18].

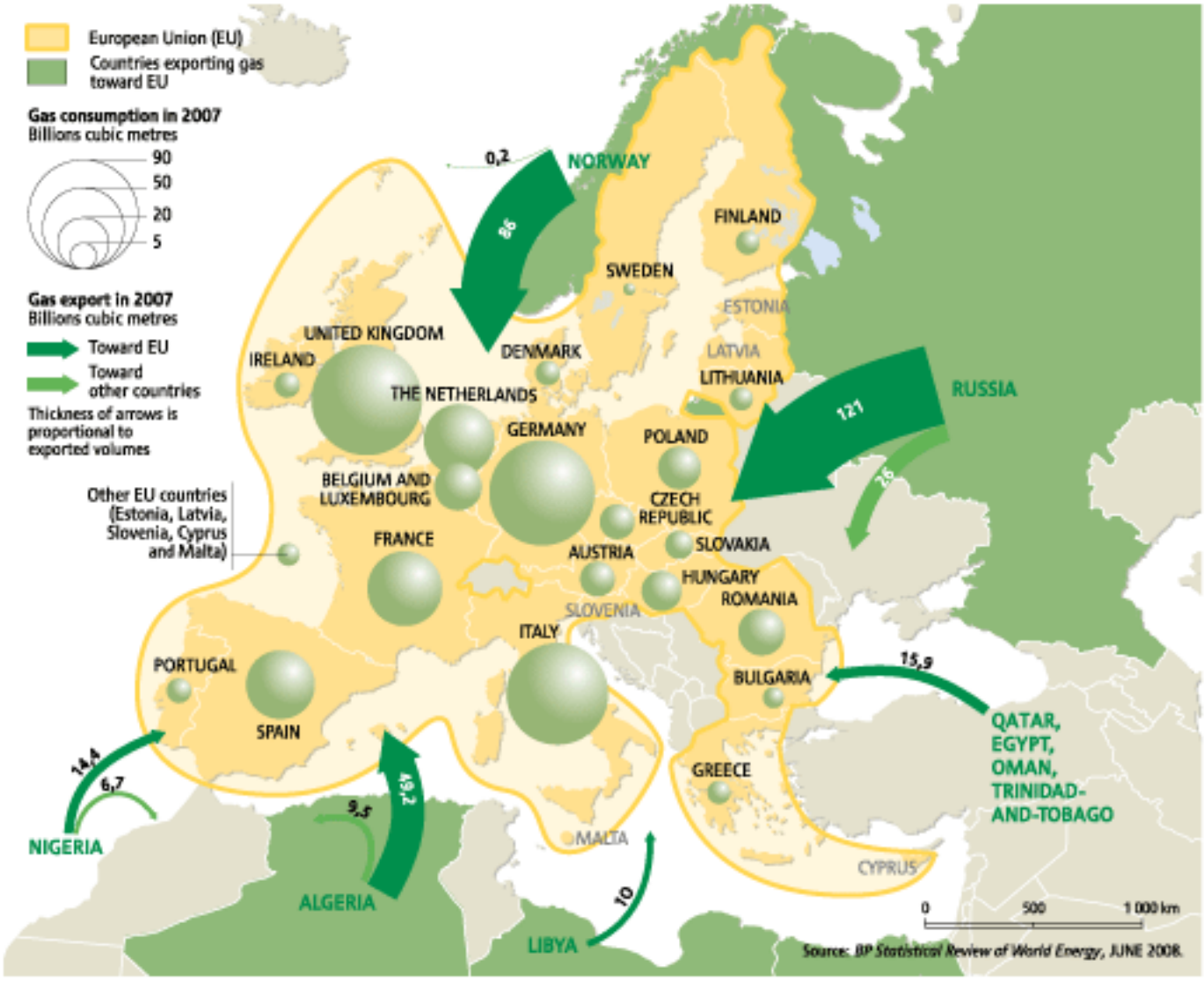

Figure 1. Natural gas supply and demand in Europe. Source: Philippe Rekacewicz, Le Monde diplomatique, 2007

21. The share of **coal** in world consumption is likely to increase slightly between now and 2030[19]. In the absence of regulations that would limit its increased use, the United States, China and India are likely to turn to coal in preference to more expensive fuels, unlike other European countries,

16 Increases of 5% and 13% since 2008.
17 Reductions of 31% and 17% in their proven reserves.
18 Energy Information Administration, *International Energy Outlook 2009*, p. 44.
19 To 28% of world energy consumption in 2030, as against 26% in 2007 - International Energy Agency, *Key world energy stats 2007*, p.6.

where renewable energy sources, natural gas and nuclear energy will probably be preferred for electricity production in future years. Forecasts of high rates of economic growth support large increases in the demand for electricity in developing regions.

22. The production of **electricity** is likely to increase by 77% between now and 2030, mainly because of trends in developing countries. Since 1990, growth in electricity production (2.9% annually) has been greater than the growth in energy consumption as a whole (1.9%)[20].

23. It must be noted that the rapid development of unconventional oil and gas resources such as tar sands and shale gas is a potential game-changer. The impact of the ongoing "shale revolution" has yet to be fully assessed but it has already made significant differences to world reserves.

B. THE SITUATION COUNTRY BY COUNTRY

24. Energy dependence varies widely from one country to another. In this part we will study various scenarios within the Alliance, from the countries most self-sufficient in terms of energy to the most dependent. To assess the degree of dependence of Alliance countries we have used the rate of energy dependence (imports/gross consumption), supplemented by other indicators such as the origin of the energy, the number of suppliers and the existence of alternative energy options.

1. The least dependent countries: Canada, Denmark, Norway, the Netherlands and the United Kingdom

25. The energy situation in several countries in the Alliance comes close to self-sufficiency, with an energy dependence rate of less than 40%, and even a negative value in the case of Denmark, which is a net exporter of energy. This independence in energy terms is the result of substantial domestic reserves, a domestic policy based on diversified electricity production, many importers of energy, energy saving or substantial use of renewable energy.

26. Norway provides an example of a consistent and viable energy policy. Although the country has considerable resources of natural gas and crude oil[21], it invests widely in sustainable energy technologies, in particular hydroelectric power, energy from the seas and wind energy, as we will see later in a part devoted to green technologies. Today, hydropower accounts for nearly 99% of electricity production in Norway[22]. Canada is third in the world as a natural gas producer, seventh as an oil producer and third as an exporter of electricity[23], but hydropower produces 58% of its domestic electricity[24]. The United Kingdom has an energy dependence rate of only 21%, in particular due to indigenous gas production of 98% and to reserves of crude unique in the EU: 4 billion barrels in 2006[25].

2. The United States: a special case

27. The United States is a special case. The alleged energy dependence of the United States, especially as regards the Middle East, is often exaggerated. Although the United States is the

---

20 *Ibid.*, p. 63.

21 Norway ranks sixth in the world as an exporter of oil and second as an exporter of natural gas : International Energy Agency, 'Key World Energy Statistics 2009', http://iea.org/textbase/nppdf/free/2009/key_stats_2009.pdf.

22 'Norway, a producer country that thinks of future generations', *Arte*, March 2006, http://www.arte.tv/fr/Regards-croises-n_C2_B03/1163586.html.

23 IEA, 'Key World Energy Statistics 2009', http://iea.org/textbase/nppdf/free/2009/key_stats_2009.pdf, pp. 11-19.

24 *Ibid.*, p.19.

25 US Department of Energy, Energy Information Administration, 'Country Analysis Brief: UK', April 2007 http://www.eia.doe.gov/emeu/cabs/United_Kingdom/Oil.html

world's greatest importer of oil, it is also largely self-sufficient with regard to natural gas[26], and several factors call into question its dependence on imports of oil: extensive energy reserves, large-scale production[27], stable main suppliers[28] and a revival of interest in renewable energy.

28. According to IEA figures, the United States is the world's third largest producer of crude, its second largest producer of natural gas, its second largest producer of coal and its leading producer of nuclear energy[29]. The growing production of unconventional gas already provides roughly one fifth of the nation's needs[30]. In short, the energy position of the United States is clearly different from that of its European partners, in terms of volume of supply, demand and energy relations with other world players.

3. Intermediate countries: France, Germany, Slovenia, Belgium, Italy, Portugal, Spain, the Czech Republic, Poland, Romania, Iceland and Albania

29. France is the largest producer of nuclear energy in the world after the United States, which enables it to produce 80% of its electricity from this source, a rate unique in the world, and to compensate in part for its low reserves of other types of energy. Germany is more dependent on Russian supplies than its Western neighbours (35.3% of the gas imported by Germany comes from Russia, compared to 15.9% in the case of France). What is more, the characteristics of gas transport (mainly by pipeline, recourse to liquefied natural gas still being limited), are not conducive to flexibility in supplies and increase dependence. However, this dependence is reduced in Germany by substantial investments in renewable energy (solar and wind) and policies in support of energy efficiency established by the government.

30. Italy, Portugal, and Spain have energy dependence rates of over 70%. For example, Italy is the fourth importer of natural gas in the world, and the seventh importer of crude[31]. However, these countries have several sources of energy supply available, which reduces their dependence on one country or one region in particular. Although Russia exports large quantities of gas to certain countries, Algeria, Egypt, Nigeria and Libya are also major suppliers of gas to this region[32]. Two gas pipelines link Italy and Spain to Algeria, and two other projects are on the way (the Medgaz and Galsi pipelines)[33]. Algeria, ranked fifth in the world as a gas exporter, supplies mainly Italy, Spain, Portugal and Slovenia by pipeline and France, Spain, Turkey, Belgium and Italy with LNG[34].

31. The Czech Republic, Poland and Romania are special cases in Central and Eastern Europe. The energy dependence rate of the Czech Republic is 28%, which means that its imports are low compared with its consumption, but 70% of the gas consumed in the country comes from Russia.[35]. Nonetheless, in 1997 the Czech company Transgas managed to conclude long-term

---

26 For example, in 2006 natural gas imports by the United States amounted to only 2% of total consumption. The figures for Canada and Mexico are similar.

27 The United States is the third largest producer in the world (8.3 million barrels per day), behind Saudi Arabia (10.66 million) and Russia (9.6 million).

28 Canada is the United States' principal oil supplier (2,066 million barrels per day, 20.4% of total imports), ahead of Saudi Arabia (14.2%), Mexico (12.4%), Venezuela (10.16%) and Nigeria (9.3%). Four Arab countries account for 22.2% of imports:, Associated Press, 15 January 2009, data from an *American Petroleum Institute* Report.

29 IEA, 'Key World Energy Statistics 2009', http://iea.org/textbase/nppdf/free/2009/key_stats_2009.pdf, pp. 11-19.

30 Unconventional Gas: Cheap Gas Coming? By Paul Stevens. The World Today. August 2010.

31 *Ibid*.

32 Spain's principal suppliers of gas are Algeria, Egypt and Nigeria, and Italy's are Algeria, Libya, Russia and Norway:
BP Statistical Review 2008.

33 Gaz naturel: L'Algérie un fournisseur fiable pour l'Union Européenne. City DZ magazine. 13 August 2009. http://www.city-dz.com/gaz-naturel-l%E2%80%99algerie-un-fournisseur-fiable-pour-l%E2%80%99union-europeenne/

34 The European Gas Market. 11 December 2007. http://www.theoildrum.com/node/3283

35 British Petroleum Company, *BP Statistical Review of World Energy*, London, June 2008, http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2008/STAGING/local_assets/downloads/pdf/statistical_review_of_world_energy_full_review_2008.pdf

contract with Norwegian gas suppliers for supply of 53 billion cubic meters (bcm) of natural gas for 20 years. The Czech government has given its support to the construction of the Nabucco Pipeline, but there are also plans to build pipeline that will connect the Czech Republic to the planned German pipeline OPAL, and thus be connected to the Nord Stream pipeline.[36] Regarding the oil sector, until the mid-90s the Czech Republic was fully dependant on Russian oil flowing through the pipeline Druzba. In order to overcome this high energy-dependency by 1996 the Czech government built the IKL pipeline, which is connected to the Trans-Alpian Pipeline TAL that runs from the Italian oil terminal in Trieste. The capacity of this pipeline is approximately the same as Druzba's but since the 2008 oil supply disruptions from Russia, the Czech Republic has been trying to increase the capacity of TAL pipeline. Additionally, in 2009 the Czech government announced a public tender for the construction of two reactors for Temelin nuclear power plant[37].

32. Russian Yamal I and Brotherhood pipelines provide Poland with Russian gas, and in case of a cut off or reduced supply of gas Poland does not have other alternative solutions but to rely to its own gas storage[38]. To rectify this dependency, several projects have been undertaken in the energy sector. One of them is the Baltic Pipe that aims to connect the Norwegian Continental Shelf to Poland[39]. More recent development is also the Polish-Lithuanian agreement for building the Amber gas pipeline that was supposed to be build by Russian energy company Gazprom, a project that was later abandoned in favour of the Nord Stream gas pipeline[40]. Another similar project is the building of the LNG terminal on the border between Poland and Germany, which will allow import of liquefied natural gas to Poland from different suppliers.

33. Romania is one of the largest producers of natural gas in central and Eastern Europe. Its production rate, however, has fallen significantly in the past years and most of the gas but also oil supply for Romania is delivered via pipelines from Russia.[41] [42]

34. In order to ease this dependency on Russia, there has been strong interest in Romania for nuclear energy. Currently, around 20% of the electricity in Romania is generated from two nuclear reactors. The first one was opened in 1996 and the second one in 2007. The Government strongly supports nuclear energy and there are plans for completing two additional nuclear units.[43] The future diversification plans of Romania include direct procurement of Azerbaijani natural gas, which will be transported from Azerbaijan to Georgia and from there transferred by tankers in liquefied form to the new terminals in Romania [44]. Also, Romania has expressed a great interest in the Russian South Stream pipeline and is one of the participating countries in the Nabucco pipeline project.

35. In Albania, low domestic energy consumption and substantial hydropower resources compensate in part for low fossil fuel reserves and the necessity for importing Russian gas. Albania, however, is also among the South-eastern European countries with the most underdeveloped gas networks. Therefore, the highest future priority project in Albania will inevitably include modernisation and extension of the existing pipelines, but also completion of

---

36 Ibid.

37 Nosko, Andreaj. Lessons from Prague: How the Czech Republic Has Enhanced Its Energy Security, http://www.ensec.org/index.php?option=com_content&view=article&id=258:how-the-czech-republic-has-enhanced-its-energy-security&catid=108:energysecuritycontent&Itemid=365

38 Naimski, Piotr "Energy diversification strategy for Poland". September 2007.

39 All Obstacles Cleared for Undersea Baltic Pipe. EuroActiv. 12 February 2010. http://www.euractiv.com/en/energy/all-obstacles- cleared-sub-sea-baltic-pipe

40 Poland and Lithuania Discuss Gas Pipeline. UPI. 4 August 2010. http://www.upi.com/Science_News/Resource-Wars/2010/08/04/Poland-and-Lithuania-discuss-gas-pipeline/UPI-24751280942072/

41 Natural Gas Liquid Extraction in Romania – Overview. http://www.mbendi.com/indy/oilg/gas_/eu/ro/p0005.htm

42 Secure Gas Supplies Will Empower Balkan Integration, http://www.balkaninsight.com/en/main/analysis/26896/

43 Nuclear Power in Romania, July 2010. http://www.world-nuclear.org/info/inf93.html

44 A Floating Alternative to Nabucco Undercuts Potential Disruptions to EU Energy Supplies, 07/04/2010 http://www.safehaven.com/article/16351/a-floating-alternative-to-nabucco-undercuts-potential-disruptions-to-eu-energy-supplies

underground gas storage, which do not exist at the moment. There are some possibilities for connecting with the neighbouring pipelines as the Ionian-Adriatic Pipeline (IAP) and the Trans-Adriatic Pipeline (TAP) or even Interconnector Greece-Italy (IGI)[45].

36. The production of oil and gas in Slovenia is very limited and most of the energy imports are coming from Russia. In 2007 half of the gas imports were from Russia, 30% Algeria and 19 % from Austria. The geographical position of Slovenia is a big advantage as the country is easily connected to the pipelines in the neighbouring countries- Italy, Austria and Croatia, which in turn provides for continuous gas supplies. Slovenia will participate in the Nabucco pipeline project, which will link the country to the Caspian basin and also in the South Stream pipeline project. In addition to this, Slovenia has a shared nuclear power with Croatia since 1981. Another nuclear unit is under construction and is expected to be built from 2020-2025, and fully owned by Slovenia[46].

37. Iceland has been reducing its dependence on oil for several years. It is one of the first countries wishing to eliminate domestic petrol consumption, thanks to its substantial geothermal resources drawn from volcanoes, geysers and hot springs across the country. This heat is used to produce electricity and to supply homes, infrastructure, and more recently hydrogen-powered vehicles[47]. Iceland is participating in the Intelligent Energy Europe (IEE) programme, a specific sub-programme of the Competitiveness and Innovation Framework Programme. There are some, like Gijs Graafland of the Planck Foundation, who suggest that Iceland's debt resulting from the 2008 economic crisis could be repaid by supplying geothermal energy – the Energy for Debt Initiative[48].

4. The most heavily dependent countries: Slovakia, Estonia, Latvia, Lithuania, Bulgaria, Hungary, Greece, Luxembourg, Croatia and Turkey

38. A large number of countries in Central, Eastern and South-Eastern Europe are heavily dependent on Russia for their energy. Russian gas accounts for 70-100% of domestic gas consumption in the Baltic States, Slovakia, Bulgaria, Greece and Turkey. In addition, the Baltic States are also not connected to the Western electricity grid system. The countries of this category pursue a number of projects designed to reduce this dependency through construction of new pipelines, transnational grid interconnectors as well as development of nuclear and renewable energy.

39. Of the Baltic States, Estonia is the least dependant on energy imports as it has its own oil shale production. In 2008 around 94% of the total electricity production in Estonia was from oil shale [49]. Nevertheless, the strict environmental standards on emissions, which are set out in the EU Climate and Energy Package, require Estonia to substantially reduce its emission. This would entail in phasing out the use of oil shale and the argument has been put forward that this can turn Estonia from self-sufficient to country dependent on oil and gas imports from Russia mostly [50].

40. Latvia, on the other hand, is fully dependant on oil and gas coming from Russia. Its gas dependency has enormously increased after the closing of the Soviet- built Ignalina Nuclear Power Plant in Lithuania, which provided the Baltic States with most of the electricity supply. Latvia, on the other hand, has large underground storage capacity and there have been plans for further

---

45 Albania Gas System. 5 March 2010. http://www.marketresearch.com/product/display.asp?productid=2613332

46 Nuclear Power in Slovenia. World Nuclear Association. 30 January 2010. http://www.world-nuclear.org/info/inf114_nuclearslovenia.html

47 Iceland phasing out fossil fuels for energy', CNN.com, September 20, 2007. http://edition.cnn.com/2007/TECH/science/09/18/driving.iceland/index.html

48 'Iceland EU accession inspires exotic ideas for debt', *Euractiv*, 25 February 2010, http://www.euractiv.com/en/enlargement/iceland-eu-accession-inspires-exotic-ideas-news-283619

49 Maigre, Merle, 'Energy Security Concerns of the Baltic States' March 2010, http://www.icds.ee/fileadmin/failid/Merle_Maigre-Energy_Security_Concers_of_the_Baltic_States.pdf

50 Ibid.

extension of it. The counter-argument for the extension of the storage capacity is that it will serve for nothing, as currently Latvian pipelines are not connected to EU systems, thus these storage capacities cannot be used for EU strategic reserves [51].

41. Similar to Latvia, Lithuania also imports large quantities of oil and gas from Russia. Until December 2009, the Ignalina Nuclear Plant accounted for more than 70% of Lithuania's total electricity production, but after the closing down of the plant, to comply with the EU accession treaty requirements, Lithuania had to increase its gas and electricity imports from Russia. At the moment, the country has no infrastructural capability to import gas from anywhere but Russia, and very limited options for electricity imports. In the longer term, Lithuania plans to build a new modern nuclear power plant, to construct an LNG terminal and to increase the use of wind and other renewable energy sources. In the meantime, Vilnius focuses on strengthening the common Baltic electricity market and constructing interconnectors with Poland and Sweden.

42. In Hungary, 62.5% of national energy requirements are imported[52]. Hungary is quite poor in energy resources, despite a few gas fields in the Hajduszoboszlo region near the Romanian frontier. The country has a single nuclear power station, at Paks in the South, which reached peak production in 2007. At the time its reactors had succeeded in producing 36.8% of electricity consumption requirements. But the Paks station is now giving cause for concern: inaugurated in 1982, there have already been two serious accidents, in April 2003 and May 2009. In this context of energy poverty, Hungary is importing coal, oil and gas on a massive scale. Imports of the latter cover 72% of national gas requirements, which makes securing supplies a structural problem[53]. The Nabucco pipeline project can potentially rectify the problem of energy supply diversification. In early 2010 Gazprom and the Hungarian MFB bank agreed on setting up a joint venture to build the South Stream gas pipeline in Hungary. The double-pipeline politics will certainly make Hungary the key player in Central and Eastern Europe[54].

43. Slovakia is also entirely dependant both on oil and gas supply from Russia. Slovakia and the countries of the South-East Europe are keen to diversify their energy resources and participate in all pipeline projects planned for the region. EU's Southern Gas Corridor strategy (Nabucco and the Turkey-Greece-Italy Pipeline), but also the Trans-Adriatic Pipeline, could greatly alleviate the energy insecurity in the region. In addition, a number of interconnectors are planned (for instance, between Croatia and Hungary, Greece and Bulgaria, Bulgaria and Romania and between Romania and Hungary). These interconnectors will have a reverse-flow capacity, thus ensuring effective and timely delivery of gas in cases of supply disruptions. This system will obtain supplies either from Arab LNG and/or Caspian pipeline gas imports via the ITGI (Turkey-Greece-Italy Pipeline) as well as through the present LNG terminals in Greece [55].

44. Turkey is located close to world's richest oil and gas regions, but its own fossil fuel resources are very limited: Turkey has some coal and lignite resources but has to import almost all of its oil and gas. Oil is coming from various countries, including Iran, Libya and Saudi Arabia, but around two-thirds of gas is imported from Russia[56]. Turkey is hoping to enhance its energy security through construction of nuclear power plants, and through exploiting the country's strategic position within a double strategic corridor (Baku-Tbilisi-Ceyhan for oil, Baku-Tbilisi-Erzurum for gas)[57].

---

51 Ibid.

52 Eurostat study, June 2009, www.ec.europa.eu/eurostat

53 Sébastien Gobert, 'Hongrie: vers un renforcement de la dépendance énergétique ?', *Regard sur l'Est,* 1 October 2009, http://www.regard-est.com/home/breve_contenu.php?id=994

54 Gazprom, Hungary to set up South Stream pipeline's Hungarian leg http://en.rian.ru/business/20100129/157715900.html

55 Ibid.

56 Energy Security of Turkey. Speech by Prof. Havva Caha, Fatih University. International Conference on Human and Economic Resources, Izmir, 2006.

57 'Turkey on the nuclear path', Conference on 2 March 2010 organised by the European Movement Belgium and the MEDEA Institute, http://www.medea.be/files/Midimed_FDebrouwer.pdf

III. NATO AND RUSSIA: PARTNERSHIP OR POLITICAL DEPENDENCE?

Figure 2. Russia as Europe's gas supplier. Source: Philippe Rekacewicz, Le Monde diplomatique, 2007.

45. The above overview reaffirms the central role Russia plays in Europe's energy security. Russian gas is projected to meet more than 50% of Europe's gas demand by 2020, compared to roughly 25% today. However, one should not forget that Russia itself is heavily dependent on the European market: it is estimated that around 90% of Russia's gas and 60% of its oil export goes to Europe; roughly 40% of Russia's public money and 75-80% of Russia's total export revenues are generated in the EU's energy market. It is estimated that Russia's GDP rose from around $200 billion in 1999, to $1.3 trillion in 2007 mostly due to production of fossil fuels. Due to high prices for oil and gas, Russia was able to increase its gold and currency reserves rose from $12.7 billion in 1999 to nearly $500 billion in 2007 and to accumulate the Stabilization Fund of over $150 billion [58]. The greater solidarity among NATO and European countries would ensure a much more balanced energy relationship between Europe and Russia. The lack of solidarity of consumer nations encourages a supplier to abuse its monopolist position: the cases of energy cut offs for political reasons as well as non-transparent and arbitrary pricing polices towards different nations are abundant. The Lithuanian energy minister recently disclosed that his country pays roughly $300 for 1000 cubic meters of the Russian gas, compared with around $200 for Germany, although Lithuania is geographically closer to Russia.

46. Russia also regularly tries to buy major national undertakings connected with the energy sector – pipelines, refineries, electricity networks and ports – from surrounding countries[59]. However, in July 2007 the EU brought in new regulations on the energy market in order to prevent

58 Rethinking Russia: Russia and Europe's Mutual Energy Dependence. By Christophe-Alexandre Paillard. Journal of International Affairs. Spring-summer 2010.

59 For example, in 2002 a Russian public company tried to gain control of the Mazeikiu Nafta refinery in Lithuania and the Ventspils oil export terminal in Latvia. When the Lithuanian and Latvian governments refused to sell their shares to the Russian firm, Moscow reduced oil deliveries substantially, forcing Mazeikiu Nafta to have oil delivered by rail. http://www.eoearth.org/article/Energy_profile_of_the_Baltic_Sea_region

energy producers from controlling European distribution networks. Following severe criticism by Gazprom, a reciprocity clause was added in September 2007 to give foreign firms an opportunity to purchase shares in Europe, provided that their countries of origin did the same in return. Apart from a fear of being bullied by Russia, there is also an issue of continuity of Russian supply. It would appear that oil production peaked in 2007, and uncertainty regarding gas is even greater. Gas extraction in Western Siberia, which is the largest Russian reserve, falls by 6 to 7% each year, and Russia has not invested enough in new reserves to make up for this fall. The quality of Russian infrastructure is another major problem. Javier Solana, the former EU High Representative, already said in 2006 that "due to Russia's outdated oil and gas pipelines, the equivalent of a quarter of Russia's total gas exports to Europe was being lost in transport". Renewal costs are estimated at several tens of billions of euros. To this must be added the fact that demand among the Russian population is rising – Russia with its 140 million population is the world's second largest gas consumer. Secondly, Russia is also turning to Asian markets for the sale of its energy resources – Russia intends to sell 30% of its oil and 15% of its natural gas to Asia before 2020[60].

47. Lastly, energy co-operation between Russia and the EU is hampered by protectionist tendencies in Russia. Thus the EU has tried to involve Russia in an energy co-operation structure based on the European Energy Charter, designed to promote energy security by way of greater transparency and competition on energy markets, while respecting the principles of sovereignty over energy resources. Since 1994, when this international treaty was signed, Moscow has refused to ratify, on the ground that this would mean a loss of sovereignty for the country. Earlier this year, Russia rejected the Charter altogether.

48. We have to admit that the EU and Russia have different strategic views about energy. Moscow, like other great energy-producing regions and countries, uses its energy policy as an instrument of foreign policy. However, relations between Russia and the Alliance, at their lowest ebb during the August 2008 crisis in Georgia, have improved appreciably lately, around several areas of co-operation: Afghanistan, anti-terrorism and anti-piracy policies, as well as nuclear policy. One can reasonably hope that Europe and Russia are seizing this opportunity of an improved political climate to resume energy relations that are less conflictual and less politicised. On the one hand, European countries need Russia's energy resources because their domestic production is limited. On the other, Russia needs financial and technological support from the EU in order to exploit its vast resources to the full and to enhance energy efficiency, as well as European consumption in order to sell its hydrocarbon production.

49. Despite their differences on the international scene, it is clear that Russia would prefer co-operation to conflict with the countries of the European Union. Russia certainly has a need for capital, but an even greater need for technology, to improve energy efficiency in its economy. It has agreed to close co-operation with two countries in Europe in this area: Germany and France. The RUDEA (Russisch-Deutsche Energie-Agentur) Agency was created in 2009. With a grant of 3 million euros from the German Government, it offers its expertise to Russian national and local authorities in installing projects improving energy use. Of course, the Agency promotes German technologies, but that is no surprise. France and Russia have just created a Franco-Russian Energy Efficiency Centre (in June 2010) with the same purpose, enabling major French companies to compete in calls for bids or in private contracts offered by the Russian authorities.

60 Ariel Cohen, "Russia: The Flawed Energy Superpower", p. 103.

IV. TECHNOLOGICAL SOLUTIONS TO REDUCE ENERGY DEPENDENCE

A. THE REPERCUSSIONS OF CLIMATE CHANGE

50. The present debate on combating global warming has considerable implications for energy strategies. In 2007 the famous report by the Intergovernmental Panel on Climate Change (IPCC) the most respected world scientific forum and joint winner of the Nobel Peace Prize, demonstrated unequivocally that climate change was a reality, that it was caused mainly by human factors, and that if we did not control it, it would have profound adverse effects on the world economy and on human and international security.

51. Scientific evidence shows that the concentration of CO_2 in the atmosphere has increased by about one-third relative to its pre-industrial level, reaching nearly 400 parts per million by volume (ppmv) today. The average world temperature rose 0.7°C over the last century. According to the experts, a rise in emissions above the 450 ppmv threshold and a rise in temperature of over 2° C relative to its pre-industrial level would have devastating consequences for our planet. However, with the present way of working, and if nothing is done to mitigate global warming, the average temperature is likely to rise by 6°C between now and the end of the century.

52. To prevent this distressing but perfectly credible scenario from becoming a reality, our energy policy paradigm must change considerably. Some take the view that emissions will have to be reduced before the end of the century by 60-80% relative to the 1990 level in order to reach these goals. This is an enormous challenge, given the rapid increase in world population[61]. The energy sector is mainly responsible for the increase in greenhouse gas emissions: about 60% of world emissions (80% in the developed countries)[62] come from burning fossil fuels for electricity generation, heating, transport, industry and housing.

53. Alternative technological solutions with low CO_2 emissions are therefore essential to a long-term response to the energy security challenge. This report will give a general briefing on the most promising options, particularly those involving low CO_2 emissions, such as nuclear energy, renewable energy sources and energy efficiency. In the medium term, however, our societies will continue to rely on fossil fuels. The next chapter deals with the most urgent challenges to energy security arising from meeting the demand for oil and gas within the Euro-Atlantic region.

B. MEETING THE IMMEDIATE DEMAND FOR FOSSIL FUEL

1. Sustaining production within the Alliance

54. As suggested in the first part of this report, production of natural gas and conventional oil is in decline in the countries of the Alliance. World natural gas reserves have stagnated since 2004, despite increasing demand. The greatest reductions affect Germany and the United Kingdom[63]. Oil production in the OECD countries is decreasing slightly but steadily, after reaching a peak in 1997[64].

55. Some insist that in order to overcome this problem, it is necessary to turn to non-conventional fossil fuels, which have considerable potential – in 2007, the National Petroleum Council estimated that the global reserves of unconventional gas (tight gas, coal bed methane and

---

61 The Challenge of Climate Protection. By Kevin A. Baumert. In Energy and Security: Toward A New Foreign Policy Strategy. Ed. by Jan H. Kalicki and David. L. Goldwyn. pp. 486-487.

62 Energy Security and Climate Change: Assessing Interactions. International Energy Agency. 2007. p. 28.

63 Reductions of 31% and 17% in their proven reserves.

64 Crude oil production – *Swivel,* http://www.swivel.com/workbooks/19972-Production-of-crude-oil

shale gas) were about five times greater than the conventional reserves[65]. The increased interest in these resources is sometimes even described as a real energy revolution. In general, non-conventional fossil fuels are oil or natural gas imprisoned in sand or rock. Extraction of this type of fuel often calls for more energy and water, a process which therefore proves to be costly and polluting. However, with the development of extraction techniques and the rise in conventional oil and gas prices, these fuels are becoming more and more attractive. The price factor also needs to be considered: according to RAND Corporation estimates, production of shale oil is not economically viable if oil price falls below $75 per barrel.[66]

56. Development of non-conventional fuels is making Canada a major power in energy. The province of Alberta is home to the second largest world oil reserve – not less than 170 billion barrels. Alberta produces about 1.7 million barrels a day. Production is likely to almost double between now and the end of the decade. In addition, Alberta has 40 trillions cubic feet (about 4,400 billion m³) of natural gas and accounts for nearly half of American natural gas imports.

57. In Poland, the first shale gas extraction site is on the point of opening, in Gdansk. According to the experts, Northern and Central Poland might contain impressive reserves of non-conventional gas, potentially capable of making Poland self-sufficient, increasing the EU's natural gas reserves by 47% and so substantially reducing the dependence on Russian gas analysed above. However, the conditions for shale gas production are less favourable in Europe than in North America: European reserves are smaller, located deeper in the ground and have a high content of clay which hinders the extraction of gas[67]. However, if oil prices reach extreme heights, the general trend to move away from fossil fuels might also discourage investments in unconventional fossil fuel production.

58. In order to reach the goals of sustainability, the development of non-conventional (and traditional) resources in the Euro-Atlantic zone must go hand in hand with advances in carbon capture and storage technology.

59. Carbon capture[68] and storage[69] (CCS) consists of another set of transitional technologies, which can be used to reduce carbon dioxide emissions pending the transition to less polluting sources of energy. There are a wide range of CCS procedures which make it possible to reduce CO_2 emissions by up to 90%. Potentially these technologies provide a quick and effective way of reducing world carbon dioxide emissions, given that many countries will still be using coal extensively in the years to come.

60. About ten carbon storage sites are operational today in the world, while there are a substantial number of projects (particularly in the United States, Canada, Australia, China, the United Kingdom, France and Germany). Norway is already especially active, with two operational sites since 1996 and 2007, due to incentive policies and a high carbon tax[70].

61. Of course, CCS techniques really only offer one solution, realistic today but partial and temporary, to the worldwide increase in CO_2 emissions and must form part of a wider political process of energy saving and renewable energy development.

---

65 Unconventional Gas: Cheap Gas Coming? By Paul Stevens. The World Today. August 2010.

66 Oil Shale Development in the United States. Prospects and Policy Issues. James T. Bartis, Tom LaTourrette, Lloyd Dixon, D.J. Peterson and Gary Cecchine. RAND Corporation. 2005.

67 Unconventional Gas: Cheap Gas Coming? By Paul Stevens. The World Today. August 2010.

68 Or trapping.

69 Or sequestration.

70 Ariel Cohen, "Russia: The Flawed Energy Superpower", p. 103.

2. Diversifying fossil fuel imports

62. As shown above, Central and Eastern Europe is the Alliance region with the highest energy dependence, and diversification of primary energy imports is the highest strategic priority for these countries. The Caspian Sea region is one of the most realistic options for reducing dependence on Russia. Oil reserves in this region are comparable to Venezuela's, and the potential in terms of gas is even greater – and comparable to Canada's.

63. A distinction must be drawn between oil and gas sectors. It is much easier to transport oil: by pipeline, by sea and land in tankers, by train or as petrol. When oil supplies were disrupted (in the Czech Republic in 2008 and in Lithuania in 2006), the countries concerned were able to find other options, although these proved to be more costly. In addition, Caspian Sea oil is already transported via the Baku-Tbilisi-Ceyhan and Baku-Supsa pipeline systems, which bypass Russia. Moreover, some of the oil from Kazakhstan is transported to Europe via pipelines (then by tanker) which, although they pass through Russian territory and are under the control of Transneft, the monopolistic Russian oil transport undertaking, are also partly under international control.

64. The situation with regard to gas is more complicated. Natural gas is mostly transported by pipeline. Attempts by the EU to build the Nabucco gas pipeline extending from Azerbaijan and Georgia to Turkey and Central Europe have run into substantial difficulties. Firstly, it is not certain that Azerbaijan alone is capable of supplying enough gas for this pipeline (Azerbaijan is above all an oil power). A trans-Caspian pipeline bringing in Turkmenistan, a gas giant, might be necessary, but this option is hindered by the unresolved issue of Caspian Sea delimitation and by Russia's considerable financial efforts (being ready to pay well over the market price for Turkmen gas) to ensure that all Turkmenistan's gas is sold to Gazprom. Using Iranian gas for Nabucco also raises obvious political problems but this option should not be dismissed altogether. While trying to discourage Tehran's nuclear ambitions, the US and its West European allies are clearly reluctant to diminish Iran's role as major oil and gas supplier: the extensive UN sanctions do not cover the country's oil and gas exports. Moreover, even if the Euro-Atlantic community were to sanction Iran's oil and gas sector, the rising demand for fossil fuels in the developing world would be likely to offset the effect of these sanctions on Iran's economy.

65. Secondly, unresolved regional conflicts and tensions between Russia and Georgia are putting investors off. The progress of Nabucco has been slowed, because Baku is annoyed about Turkey's decision to improve relations with Armenia. Azerbaijan is obviously in the process of increasing its co-operation, and in particular its co-operation in energy, with Russia. In addition, France has ceased to participate in Nabucco because of tensions arising from the issue of Turkey's accession to the EU.

66. Thirdly, Nabucco is under serious threat from the competing South Stream project, a joint undertaking by Gazprom and several Western energy firms which follows a similar route to Nabucco and has twice its capacity (63 billion m^3, compared to only 31 in the case of Nabucco). Russian diplomatic efforts have taken the form of actively seeking support from countries in Southern and South-Eastern Europe for South Stream, and a considerable number of countries, including Italy, Slovenia, Bulgaria, Serbia, Hungary, Greece and Austria, have supported this initiative. Although some of these countries are also part of the Nabucco project, it is not certain that building two parallel gas pipelines can be justified in practice. Some (including ENI, the Italian energy giant) have suggested merging the two projects, but this proposal has been rejected by Russia.

67. Despite some problems, the Nabucco project is advancing. There Has been several positive developments regarding the project since 2009. The signing of the Intergovernmental Agreement (IGA) in Ankara on 13 July 2009 has been an important step forward towards the realisation of this project. Following the ratification by the parliaments of all the state parties the Nabucco IGA

entered into force as of 1 August 2010. The EU, the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) have taken important decisions in terms of funding, and the parties to the Nabucco consortium are actively seeking additional gas suppliers. The negotiations over the Project Support Agreements (PSAs), the second phase of the legal framework of the project, were also successful, and are expected to be signed in the near future. Once the principal problems that remain have been solved pipeline construction can begin, as early as next year.

68. The EU is also supporting the White Stream gas pipeline project, which will link the Caucasus to Central Europe via the Southern Black Sea. The project is supported in particular by Ukraine, Romania, Poland and Lithuania. It is likely to be financed entirely by private funds. If new private investment comes in, building should start in 2013.

69. In terms of a non-Caspian gas supply for Central Europe, there is no alternative other than the Russian gas pipeline network that supplies the EU via Ukraine and Belarus. In addition, the Russian Nord Stream project, designed to carry Russian gas via a pipeline across the Baltic Sea, has recently moved into the construction phase. Although the Nord Stream project offers practical Russian gas supplies at a reasonable price for the older EU member states, Central and East European countries, which are not affected by the project, fear that their energy vulnerability may increase. Moreover, the Nord Stream project is criticised for its harmful effect on the Baltic Sea, where a substantial quantity of chemical weapons dating from the Second World War are still buried.

70. The Mediterranean countries generally feel less vulnerable as regards energy supply, due in particular to the growing role of Algeria as a supplier of gas in the region. The export potential of Algerian gas is twice the projected capacity of Nabucco. Algeria is also in the process of establishing a partnership with Niger and Nigeria to build a trans-Sahara gas pipeline and thereby develop its exports to Europe. However, some challenges persist, including the fact that the Movement for the Emancipation of the Niger Delta opposes the trans-Sahara project. In addition, Russia is seeking to exploit African resources: thus Gazprom has signed a strategic partnership agreement with the Nigerian National Petroleum Company.

71. LNG is a very promising option in support of gas security. For decades, gas has been transported regionally, via a dense network of pipelines. Although this has been quite an efficient method for transporting gas, the flexibility of this market is severely restricted by the necessity for major infrastructure between suppliers and consumers, as well as long-term contracts between them. LNG is natural gas in liquid form, obtained by bringing natural gas down to a very low temperature (-256°F = -160°C). The liquid produced in this way takes up 600 times less space than the gas, which makes transporting it in tanker trucks or ships economically viable. When it reaches its destination, the liquid is reconverted to gas in re-gasification terminals prior to distribution within the country in question by pipeline[71]. LNG provides the opportunity to convert a regional market into a world market. In 2006 LNG accounted for about 7% of world natural gas consumption, and this share is likely to be 12% in 2030[72].

72. Japan, Europe and South Korea are the world's greatest consumers of LNG. Europe, which has a substantial flow from pipelines from Russia, Algeria and Norway, is turning little by little to LNG to reduce its dependence on Russia. In 2005, 11% of Europe's gas imports were in LNG, particularly from Algeria and Nigeria[73]. The United States is also resorting more and more to LNG, because of declining production in North America. In 2006, LNG accounted for only 3% of the

---

71 Cindy Hurst, "Liquefied Natural Gas: The Next Prize?", in Gal Luft and Anne Korin (2008), *Energy Security Challenges for the 21st Century*, Prager Security international, Santa Barbara, CA, US, p. 271.

72 Energy Information Administration, *International Energy Outlook 2008.*

73 Energy Information Administration, "World's Imports by Origin, 2005", October 10, 2006.

natural gas consumed in the country, but this is likely to reach 13% in 2030[74]. This trend might change, however, due to the "shale revolution" – investors in LNG technology might want to explore the potential of the unconventional gas before committing to costly LNG projects.

73. Thanks to the LNG system, countries are less likely to be subjected to coercion or to economic or political blackmail. On the other hand, LNG cannot solve all the problems related to energy security. Firstly, while most importers of LNG are OECD democracies, the majority of exporting countries are not necessarily democratic and do not abide by the same democratic and economic principles as their customers. Secondly, LNG tankers are vulnerable to attack. Thirdly, building and running LNG terminals is highly technical and therefore very costly, and they are unpopular because of potential terrorist threats[75]. Last but not least, LNG transportation through narrow passages such as the Turkish Straits also poses a substantial threat to the human security and environment.

C. SUSTAINABLE SOLUTIONS

1. Nuclear power

74. Nuclear power supplies about 15% of world electricity, and nearly a quarter of the electricity in OECD countries[76]. Electricity production using nuclear power is likely to increase significantly between now and 2030, while uncertainties regarding the increase in prices of fossil fuels, energy security and greenhouse gas emissions encourage this "nuclear renaissance", analysed in detail in the report submitted by Mario Tagarinski to the 2009 NATO Parliamentary Assembly Session [183 STCEES 09 E]. While there is still much uncertainty as to the future of nuclear power, several factors might hold up the development of new plants (security, radioactive waste, and proliferation of nuclear weapons). However, forecasts are clearly upward, mainly because of promising new technologies.

75. Recent surveys indicate broad support for nuclear power. Of more than 10,000 persons questioned in 20 countries, two-thirds thought that their country should start using nuclear power or should increase its use[77]. However, these figures cannot conceal differences between countries. It would therefore be premature to think that opposition to nuclear power has disappeared in Europe and in Alliance countries in general[78].

76. Most nuclear reactors are second-generation. Even though they are in general operational, there is still anxiety as to their cost, nuclear security and radioactive waste.

77. Third-generation reactors have been created, in order to overcome these problems. The first of these are already in being. Japan was the first to order this type of reactor, in 1996, while the United States, France, Russia, Canada, the United Kingdom and several other countries will bring in these third-generation reactors in the near future. The advantage of these is that they are more efficient, less polluting, smaller in size and have a life expectancy of 60 years, compared to 30 years for second-generation reactors. In addition, these reactors can respond more flexibly to fluctuations in demand. Lastly, safety mechanisms have been optimised.

78. Fourth-generation reactors are very promising, in that they offer a multitasking feature: for example, they can produce electricity and destroy waste. There are six types of fourth-generation reactor, at the research stage at present, which might be marketed as from 2030. Fast neutron

---

74 EIA Annual Energy Outlook 2008.
75 *Ibid.*, pp. 277-279.
76 "World Energy Needs and Nuclear Power", http://www.world-nuclear.org/info/inf16.html
77 NEI (Nuclear Energy Institute), *Nuclear Energy Insight*, May 2009.
78 A. Adamantiades, I. Kessides, "Nuclear power for sustainable development: Current status and future prospects", *Energy Policy,* 37 (2009), p. 5152.

reactors have two very interesting advantages: firstly, they make it possible to preserve uranium resources for future generations, and secondly to destroy waste in the reactor by promoting fission[79]. These fourth-generation reactors do have some drawbacks: they use highly enriched uranium (HEU), while the international community is trying to eliminate HEU from the civil sector, and are very expensive for the time being. A few fast neutron reactors are now operating in the world, particularly in Russia, but are not economically and commercially viable because of their very high construction and operating costs. However, new types of reactor are at the project stage.

79. Nuclear fusion is another technological option of interest for the future. Nuclear fusion makes very little radioactive waste, and produces no plutonium that could be used to make atomic weapons. However, the technological challenge is enormous, because nuclear fusion is possible only in an extraordinarily hot environment, several million degrees. In addition, very sophisticated electromagnetic systems are necessary to contain the plasma during fusion. Scientists are hoping to overcome these problems and to make nuclear fusion economically viable. In 2006 China, the EU, India, Japan, Russia, South Korea and the United States launched the **ITER** (International Thermonuclear Experimental Reactor) project. ITER is located on the Cadarache site, in the commune of St-Paul-lès-Durance 60 km from Marseille, and might be a real triumph of technology and give substance to hopes for the nuclear renaissance. The delegation of the Science and Technology Committee visited ITER in September 2010 and was impressed by the immense promise of this cutting-edge technology.

2. Renewable energy sources

80. A new political momentum has emerged in Europe and the United States in favour of the development of renewable energy sources. In March 2007 the EU adopted a new approach on climate and energy, seeking to combat climate change and to increase energy security for the EU while strengthening its competitiveness. The EU heads of state and government therefore set a series of goals to be reached between now and 2020, which were approved by the European Parliament and by the EU Council in June 2008: to reduce EU greenhouse gas emissions by at least 20% below 1990 levels; to ensure that 20% of EU energy consumption comes from renewable resources, and to reduce primary energy use by 20% by improving energy efficiency[80].

81. Barack Obama has announced that the United States was ready to lead to world campaign against global warming, and has set up a plan linking economic revival and environmental policy. The American Recovery and Reinvestment Act dedicates over $787 billion of investment to relaunch the economy and create the green energy jobs of tomorrow.

82. Today, renewable energy sources are those for which demand is increasing fastest (3% per year) and are regarded as the energy sources of the future. Hydropower and wind power respectively account for 33% and 17% of the estimated increase in renewable energy production over the period 2006-2030. The forecasts in terms of crude oil prices, growing anxieties about the environmental impacts of using fossil fuels and policies to encourage recourse to renewable energy are considerably improving the prospects for development of these energy resources. For the time being, renewable energy sources, apart from hydroelectric power, do not yet have the means to compete with fossil fuels. However, investments are expected in OECD countries, especially in wind energy and biomass, because most hydroelectric systems are already well developed. On the other hand, outside the OECD, the largest investment projects are in the hydropower sector, in particular in China, India, Brazil, Vietnam and Laos. Wind power is also at the heart of new investments in renewable energy, especially in China (by 2030 China's wind power production is expected to be 150 times greater than in 2006; however this remains less than half of the forecasted hydroelectric production [in 2030]).

---

79 Conversion into lighter nuclei.

80 The EU Climate and Energy Package. European Commission Climate Action. http://ec.europa.eu/environment/climat/climate_action.htm

83. Today, **hydropower** is the most widely used source of renewable energy and the best known. In 2009, it supplied 16% of world energy (99% in Norway, 58% in Canada and 7% in the United States)[81]. About two-thirds of the economically exploitable hydroelectric potential is not yet being used. There are still abundant unused hydroelectric resources in Latin America, Central Africa, India and China. Exploiting half the economically usable hydroelectric potential might reduce greenhouse gas emissions by about 13%.

84. An advantage of hydroelectric systems is that they are able to manage peaks of energy consumption. However, increased demand for irrigation, coming during peaks in electricity demand, may make the use of stored water difficult[82]. Another problem with this type of energy is that building dams may involve displacing local populations and damage to ecosystems, as construction of the Three Gorges Dam in China has shown. The problems of dams breaking are also often mentioned.

85. Political solutions exist, linked to town and country planning that respects the environment and implemented in collaboration with the various elements in civil society. In addition, small-scale hydroelectric plants provide a good solution, especially in isolated areas where other sources of energy are not viable. These little plants can be built on small rivers or currents with very little effect on, for example, the ecosystem and fish migration, giving preference to watermills rather than dams[83].

86. **Energy from the seas**. While dams and mills are the best-known types of water power, others linked to the oceans are sources of hope[84].

87. *Tidal power* is energy created by the tides in the oceans, caused by the moon and the sun in combination with the rotation of the earth. Variations in sea level (potential energy) or tidal currents (kinetic energy) can be exploited. The former is the basic principle of the tidal power station in the estuary of the Rance, the first electricity-generating installation of this type in the world[85]. It is also important to mention the smaller-scale undersea installations designed in Norway, a pioneer in this field. The cost of the systems being studied, a major concern of research workers, is comparable to that of wind power, and so suggests substantial development in future decades.

88. For the time being, tidal currents are the preferred area because of their predictability, proximity to the coasts and their considerable strength. However, general *marine currents* like the Gulf Stream are also exploited by water turbines that use their kinetic energy, like wind turbines, which use the kinetic energy of the air. Marine currents have greater potential because they could be exploited everywhere in the world. At present, France has 20% of the European potential.

89. *Wave energy* can also be exploited and converted into electricity via columns installed in the sea, or more often by devices floating on the surface or just below it. The energy produced is used most often in desalination plants, generating stations and hydraulic pumps. Although the process is generally still at the experimental stage, a first wave farm has been designed in Portugal to harness energy from the waves[86]. Current problems in wave energy are operating costs, which are

---

81 BP Statistical Review of World Energy 2009, http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622

82 Renewable Energy and Electricity, http://www.world-nuclear.org/info/inf10.html

83 Igor Winkler, 'Small hydropower resources and prospects of small hydropower electric plants in the near-border regions of Ukraine', in *Energy and Environmental Challenges to Security*, NATO Science for Peace and Security Series, Springer (2009), pp. 371-378.

84 Renewable Ocean Energy: Tides, Currents and Waves. Alternative Energy. 23 October 2006. http://www.alternative-energy-news.info/renewable-ocean-energy-tides-currents-and-waves/

85 Tidal Power. Alternative Energy. http://www.alternative-energy-news.info/technology/hydro/tidal-power/

86 Aguçadoura Wave Farm, created by the Scottish company Pelamis Wave Power: http://www.alternative-energy-news.info/agucadoura-generating-power-1500-homes/

still high, effects on marine fauna and harnessing the energy[87], but current techniques are only at the experimental stage and there should be substantial technological progress in the years to come.

90. Two other procedures linked to the energy of the seas and oceans are worth mentioning: thermal energy from the seas or *ocean thermal energy*, produced by exploiting the temperature difference between surface water and deep water in the oceans, and *osmotic energy*[88], which makes it possible to convert the difference in salinity between fresh water and sea water into energy, currently being developed by the Norwegian company Statkraft.

91. **Biomass**. Burning biomass emits carbon, but this effect is balanced by the absorption of CO_2 by the plants grown to produce biofuels. Between 2001 and 2006, ethanol and biodiesel production increased six-fold, due in particular to sharp rises in maize production in the United States and Brazil (52% of world bioethanol in 2006). However, these advances cannot hide the reality: biofuels account for only 1% of world liquid fuel consumption.

92. First-generation biofuels gave rise to great anxiety regarding their adverse effects on the environment. Biofuel production calls for heavy use of fossil fuels. In addition, crops essential to biofuel production mean less land for growing food crops[89], and may constitute a real threat to soil diversity, in particular increasing deforestation as shown by oil palm growing in Indonesia and Malaysia. Sixty per cent of Indonesian forests have been sacrificed to large-scale oil palm cultivation between 1985 and 1997[90].

93. Second-generation biofuels are obtained from non-food and more diversified resources. They can be used to produce larger amounts sustainably and viably, without using agricultural land, and with more environmental benefits. There are two processes for utilising plant lignocellulose, present in all plant cells. Firstly, fermentation makes it possible to produce ethanol. Lignocellulose ethanol is manufactured by freeing the sugar molecules locked in the cellulose, using enzymes, steam heating and other pre-treatments. The by-product of this process is lignin, which can be burnt as a non-polluting fuel. Secondly, the Fischer-Tropsch process, a GTL (gas-to-liquid) process, yields synthetic petrol.

94. Other technologies, sometimes regarded as third-generation biofuels, also offer worthwhile solutions. Microalgae use photosynthesis to manufacture their reduced carbon material at chloroplast level. Fuel production by microalgae is much more efficient than production from the crops mentioned previously. This renewable energy resource is regarded as the only one capable of replacing the productivity of oilfields[91]. In 2009, the first car running partly on algae fuel travelled across the United States using only 25 gallons of fuel. However, extraction of oil from algal cells is a considerable technological challenge and has to be further developed to be commercially viable[92].

95. **Wind power** production capacity increased by 12 times between 1995 and 2005. The present world leader in wind energy is Germany, and China is now building the largest wind farm in

---

87 On average only 25% of the energy produced by the waves is captured by current technologies.

88 L'énergie osmotique, une énergie d'avenir ? France2. 25 November 2009. http://info.france2.fr/environnement/L-%E9nergie-osmotique,-une-%E9nergie-d-avenir--59142248.html

89 In fact, to match the 49.35 million tonnes of oil consumed by transport annually in France it would be necessary to grow sunflowers on 118 % of the total surface of the country. The same applies to production of biofuels from plant alcohols (bioethanol), calling for 120% of the total surface of the country. Guillaume Calu (2006), 'Biodiesel et microalgues', S*pectrosciences,* 1 February 2006.

90 Deron Lovaas, Balancing Energy Security and the Environment (2008), *Energy Security Challenges for the 21st Century*, Prager Security international, Santa Barbara, CA, US, p. 326.

91 ISIS, 'Energie – Green algae for carbon capture and biodiesel', 10/04/2006, http://www.i-sis.org.uk/pdf/GAFCCABFR.pdf

92 Biofuels: A Controversial Option. By Luca Marazzi. www.rtcc.org/2010/html/ht-biofuels.html

the world. The US Department of Energy has just published a future scenario in which 20% of electricity would be produced by wind power in 2030, and which would save 7.6 million tonnes of CO_2 and four trillion gallons of water[93]. This scenario is based on new incentive measures, such as the Renewable Portfolio Standards (RPS)[94] already in place in most American States.

96. Wind turbines have been criticised because they are a danger to migratory birds. In addition, noise problems have been reported on many occasions, while turbines have increased in size since the 1980s, for the sake of improved performance. These two issues must be considered when choosing the type of wind turbine and the location of its installation. Indeed, recently installed wind turbines in the North Sea have demonstrated many advantages in power generation potential without the adverse affects on residents of land-based turbines[95]. Thus the Norwegian firm Sway is going to build a floating wind turbine very soon; it will be the world's largest wind turbine, with a height of 163m, and will be installed in the North Sea[96]. The Danish island of Samsø, with 4,000 inhabitants, uses only renewable energy for all its energy requirements[97].

97. Although wind turbine machinery has been generally improved, due in particular to larger turbines or changing direction according to wind direction, new technologies should make it possible for wind power to pass a milestone. Experts estimate that total wind energy in the world is more than 100 times the requirements of the planet. The main problem is due to the fact that the wind blows particularly hard at high altitude, where it is difficult to build traditional wind turbines. Scientists have therefore perfected new technologies, smaller and more adaptable to these extreme conditions. The fact remain that if compared with other power sources the wind energy creates no waste, it does not use water and unlike solar panels it does not take up much space.[98]

98. **Solar energy**. Today Japan and Germany account for 69% of the world market in photovoltaics (PV)[99]. Thanks to the leadership of these two countries, the world PV market has increased tenfold between 1995 and 2005, an annual rise of 29%. High cost and storage are the two most important problems for solar energy. In addition, solar panel production in China discharges a large amount of toxic waste into the environment. Moreover, according to the French National Electricity Users' Safety Committee (Consuel), more than one photovoltaic installation in three in France does not conform to safety standards, giving rise to a risk of electrocution or fire[100]. So the technological solutions now being designed, linked with stricter monitoring of the production process as a whole, seem indispensable today.

99. Although countries in the Northern hemisphere such as Germany have been very dynamic in their approach to solar energy, it must be admitted that most of the potential lies in sunnier regions. In the Middle East and North Africa, the EU has set up a programme to implement the concentrated solar power process[101], via the Euro-Mediterranean Dialogue and the Barcelona

---

93 US Department of Energy, '20% wind energy by 2030: increasing wind energy contribution to US electricity', July 2008, http://www.nrel.gov/docs/fy08osti/41869.pdf

94 The RPS specify a percentage of electricity that has to be produced by renewable energy before a certain date.

95 Jacques de Jong and Louise Van Schaik, 'EU Renewable Energy Policies: What can be done nationally, what should be done supranationally?', *Clingendael Seminar Overview Paper for the Seminar on EU Renewable Energy Policies*, The Hague, 22-23 October 2009, pp.5-7 www.clingendael.nl/publications/2009/20091023_cesp_paper_dejong.pdf

96 Norwegian Company Develops World's Largest Wind Turbine, *Alternative Energy News*, March 1, 2010, http://www.alternative- energy-news.info/worlds-largest-wind-turbine/

97 'Is It Possible To Convert To 100% Wind Power?', *Alternative Energy News*, February 1, 2010, http://www.alternative-energy-news.info/convert-to-100-wind-power/

98 Wind energy and politics: Not on my beach, please, 19/08/2010 The Economist: http://www.economist.com/node/16846774

99 Photovoltaic cells and panels and thermal methods are the two major solar technologies.

100 'Un tiers des installations photovoltaïques à risque', *Le Monde*, 19 mars 2010 http://www.lemonde.fr/economie/article/2010/03/19/un-tiers-des-installations-photovoltaiques-sont-arisque_1321546_3234.html

101 English abbreviation CSP.

Process, as well as the German Desertec Foundation. This concept uses a set of mirrors to capture the reflection of the sun to produce steam for electricity generation. It is increasing in popularity, because unlike photovoltaic processes it can store energy and operate almost permanently. There are already 30 projects in the United States, Spain and France, but regions in North Africa and the Middle East offer even more exciting prospects. Sunshine there is 50% higher (30% relative to southern Europe) and it is estimated that enough electricity could be produced to meet all the requirements of the EU, North Africa and the Middle East by covering about 0.3% of the surface of the deserts in these regions[102].

100. **Geothermal energy** comes from heat taken from below the earth's crust, particularly in the Western United States, as well as in Central and Western Europe, Iceland, Asia and New Zealand. This type of energy has been traditionally used in areas that are volcanically active. However, the modern techniques – namely the Engineered Geothermal Systems (EGS) – allow exploitation of geothermal energy practically in any geographic location. EGS technology involves drilling several thousand meters into the Earth's crust to reach layers of hot rock. Water is then being injected into the wells. When extracted, the resulting heat is used either for electricity generation or for heating buildings.

101. Geothermal power has the advantage over other renewable energy sources that it is independent of atmospheric conditions (sun, rain, wind) or even the availability of a substrate, as is the case with biomass. According to a report issued by the Massachusetts Institute of Technology, the America's geothermal energy potential is nearly 140,000 times greater than its annual energy consumption. Although only 2% of that energy could be tapped by EGS in practice, the potential is still formidable. However, challenges to be overcome include high upfront investment costs and high cost of deep drilling, More effective technological solutions are being developed, including a method called spallation, which uses superheated steam for drilling rock.

3. Energy efficiency

102. Since the Kyoto process, energy efficiency is no longer a purely national issue, but is now a matter for international negotiation under the aegis of the United Nations. With its Climate and Energy package, the European Union has made a commitment to reduce greenhouse gas emissions, which steers its policy towards renewable energies and a low-carbon economy. The United States is unable to make specific commitments, for reasons of domestic policy. China for its part refuses to put its economy at a disadvantage, but is quickly building up a solar energy industry which is already generating exports.

103. Improving energy efficiency is undoubtedly the cheapest and quickest way of meeting the challenges of energy security and climate change. Applications that involve more efficient use of fuel and electricity in buildings, industry and transport reduce the need for importing energy, while reducing greenhouse gas emissions. Today, about 30 gigatonnes of CO_2 are discharged into the atmosphere every year, as a result of human activity. The IEA predicts that if all energy efficiency measures were implemented, this amount could be reduced by eight gigatonnes[103]. Energy efficiency is thus seen as the most effective tool in reducing emissions.

104. Although a vast number of programmes and action plans (binding and voluntary) in the field of energy efficiency are already in place at local, regional, national and international levels, substantial efforts still have to be made. About two-thirds of the fossil fuels burned in producing

---

102 Jacques de Jong and Louise Van Schaik, 'EU Renewable Energy Policies: What can be done nationally, what should be done supranationally?', *Clingendael Seminar Overview Paper for the Seminar on EU Renewable Energy Policies*, The Hague, 22-23 October 2009, pp.7-9 www.clingendael.nl/publications/2009/20091023_cesp_paper_dejong.pdf

103 'IEA says that G8 call for increased investment in energy supply, energy efficiency and low-carbon technology is timely and urgent', 9 July 2009, http://www.iea.org/press/pressdetail.asp?PRESS_REL_ID=286

energy or for transport are wasted, as merely useless heat[104]. The IEA estimates that the best figure achieved in applying recommendations in terms of energy efficiency in OECD countries today is 57%[105]. On the other hand, some countries have implemented only 10% of the measures recommended.

105. Improving energy efficiency is an ongoing process, led both by private initiatives and by centralised planning such as the EU's 20-20-20 plan. It is important to note that energy savings do not necessarily involve lower rates of economic growth or reductions in the standard of living: the Danish economy, for example, has grown by about 80% since 1980, while its energy consumption has remained stable, thanks to more efficient energy use[106]. Technological innovations reducing energy used by domestic electrical appliances and for heating water are constantly being introduced. In order to sustain and speed up this process, national programmes must introduce new incentives for industry and must advise individuals. Thus, in France, Info-Energy projects (EIE) give free, objective and unbiased information and advice on energy efficiency to individuals and small businesses. In 2008, CO_2 emissions were reduced by 140,000 tonnes as a result of this programme. More than 6 million people have used services suggested by EIEs since 2003[107].

106. The lowest level of progress is apparent in the transport sector[108]. This sector is still wedded to systems based on fossil fuels, a trend which seems difficult to counter. Nevertheless, concerted action at governmental and supranational levels is essential in order to reverse this trend and facilitate conditions for the mass production of other types of vehicle – electric, hybrid, running on biofuels or compressed gas (GTL), and ultimately hydrogen-powered vehicles.

V. PRESENT POSITION AND PROSPECTS: INTEGRATING ENERGY INTO THE ALLIANCE'S STRATEGIC CONCEPT

107. The analysis just submitted reveals that the situation with regard to energy supplies in the NATO countries varies widely. The Alliance brings together countries which are almost self-sufficient and those totally dependent on imports. It is not the function of the present report to analyse the resulting economic advantages or disadvantages for each country. On the other hand, it aims to consider the possible consequences at a strategic level.

108. The NATO countries share principles of individual and public freedom. They are open societies, devoted to freedom of conscience and of communication, but also to freedom to initiate. One of the features of the numerous energy markets in North America and the European Union is that they are driven by private entities, firms following their commercial and financial principles such as oil and gas companies, but also energy brokers, some of the world leaders in which are major banks. It is difficult in this context for states to impose supply strategies on these firms in the short term.

109. On the other hand, in the long term States retain the capability to direct the methods of consumption – and consequently production – of energy, by way of taxation or technical and environmental standards.

---

104 American Energy: The Renewable Path to Energy Security. Worldwatch Institute. 2006. p. 21.

105 Implementing energy efficiency policies 2009 - Are IEA members on track?, IEA, October 2009, http://www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2139

106 The Danish example – the way to an energy efficient and energy friendly economy. Ministry of Climate and Energy, Denmark. http://www.kemin.dk/Documents/Publikationer%20HTML/The%20Danish%20Example/html/kap01.html

107 Innovations in Multi-Level Governance For Energy Efficiency. Information Paper. International Energy Agency. http://www.iea.org/papers/2009/mlg_final_web.pdf

108 Implementing Energy Efficiency Policies: are IEA member countries on track? IEA/OECD 2009. http://www.iea.org/Textbase/npsum/implementingEE2009SUM.pdf

110. The question before the NATO countries is a simple one: in the event of a prolonged military conflict, what is the extent of the Alliance's autonomy in energy resources for its civil and military requirements? The answer is often at a national level, with the strategic reserves which each State forms, but we have to admit that there is no answer at Alliance level.

111. Security of supply gives rise to a similar debate. It is vital to ensure security of supply in time of war, and also in time of peace, particularly if the energy sector were to become a target for terrorists. While the strategy is defined as the combination of resources that makes it possible to achieve an objective, protection of the Alliance's energy resources is a central issue.

112. Your Rapporteur is accordingly hoping and praying for the adoption of a European energy policy - but this depends upon a positive attitude by the European Union - and the adoption by the countries of North America of economic models embodying lower greenhouse gas emissions – but quite obviously this is within the sovereign jurisdiction of Canada and the United States. The issue for Europe, as it is for North America, is reduced dependence on fossil energy.

113. Your Rapporteur is also in favour of consideration of energy issues in the next NATO Strategic Concept. Protecting resources as well as supplies, making industrial establishments working on energy secure, assessing needs in the event of short or long conflicts, with or without force projection, seems essential, in order to enhance our security.