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THE TWENTY EIGHTH PLENARY SESSION OF THE PABSEC GENERAL ASSEMBLY

Economic, Commercial, Technological and Environmental Affairs Committee

REPORT*

"Alternative energy sources and their possible application in the Black Sea region"

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I. INTRODUCTION

1. During the Twenty Sixth Meeting of the Economic, Commercial, Technological and Environmental Affairs Committee held in Bucharest on 22-23 March 2006 it was proposed to take up subject "Alternative energy sources and their possible application in the Black Sea region" for the Twenty Seventh Meeting as a main item of agenda.
2. Contemporary world has entered into a new era, which is characterized with increased energy demand. Energy production and energy consumption are both crucial to the BSEC member states. The Black Sea region is a region with huge traditional energy sources. Taking into consideration the increased use of these energy sources and their exhaustion in future perspective the Black Sea countries should improve their strategy in the field of the application of the alternative energy sources.
3. In 2003 the PABSEC adopted Report and Recommendation 68/03 on "Cooperation in the field of energy", in which the Assembly calls on the National Parliaments and Governments to "focus in their general research effort on the development of clean and renewable energies with the view of ensuring safe, sustainable and efficient energy supply".
4. In 12-13 October 2005 the PABSEC with cooperation of the National Assembly of the French Republic held a seminar "Energy and Environment". During the seminar PABSEC national delegations discussed such topics as "Nuclear wastes and ecological safety", "Alternative energies and energy savings" and "Renewable energies: issues and obstacles". It was concluded that the present oil crisis is imposing international community to take measures on development of the solar energy, wind energy, hydraulic energy; to make choices in the investments and technological fields.
5. The Report is based on the contributions received from the national delegations of Azerbaijan, Greece, Romania, Turkey and Ukraine, presentations of the Assembly members, as well as relevant internet resources, including documents of the European Union and its related bodies.

II. ALTERNATIVE ENERGY SOURCES AS A CRUCIAL ASPECT ON THE WORLD AGENDA

6. Reducing poverty and global warming are two of the world's challenges. The urgent need to address these challenges has led to various international initiatives to promote the use of renewable energies. Over two billion people in the developing world, mostly in rural areas, have no access to modern energy services. At the same time, the world could face climatic catastrophe if present fossil fuel trends continue.
7. Responsible use of energy and security of supply issues, the implications of nuclear power and the consequences of greenhouse gas emissions have been on the agenda of the industrialized world for many years.
8. The Kyoto and subsequent climate conferences have substantially influenced on the energy policies in many countries. During the last years several major events such as the electricity blackouts in the USA, Canada, and also in Europe, the heat records in Europe, events in the Middle East and the increasing oil prices brought the whole range of energy issues even more to the attention of the public.

9. Energy will stay at the top of the agenda as worldwide consumption is expected to grow substantially over the next decades. The main reason of this tendency is a rapid growth of world population in perspective and impetuous economic growth of China, India and major developing countries.
10. Consequently, it will be of utmost importance for policy makers in their countries to achieve a balance of various key objectives. They will have to secure an ongoing energy supply at reasonable cost as well as achieve an energy mix, which assures that the ecological objectives are met and ensure that energy production is economically motivated.
11. Renewable energy sources (RES), as a part of the alternative energy sources, have gained wide support for being environmentally friendly. They are also seen to have a valuable part to play in ensuring diversity of supply.
12. Presently there are various new renewable technologies, which can provide clean and affordable energy to the world's poorest countries, helping to reduce poverty without environmental damages. Realization of the potential of these renewable sources is vital for achieving the UN's Millennium Development Goals on halving extreme poverty and hunger by 2015, reversing environmental degradation of energy production and consumption and enhancing energy security.
13. Access to clean and affordable energy services is an essential element of sustainable development. A key advantage of most renewable energy sources is that they can be built as "distributed power" – small, geographically dispersed units built close to the end consumer. This minimizes transmission costs, power losses and grid reliability concerns, and ensures local development benefits as jobs are widely dispersed. This is the best option for providing power to low-income rural people in developing countries, where 80 % of those without access to modern energy services live.
14. The issue of the application of alternative energy sources in the context of the global energy security is on the agenda of the international community. Indicative moment is the document **"Global Energy Challenges"** adopted by the G-8 Summit held on 15-17 July in Saint-Petersburg.
15. Thus, under the document "Global Energy Challenges" G-8 states undertook commitment to pursue energy security through a comprehensive and concerted approach consistent with our common environmental goals. Moreover, G-8 states agreed to enhance their work over the Plan of Action for Climate Change, Clean Energy and Sustainable Development and resolved to take forward the dialogue on these issues whose results will be reported at the 2008 G8 Summit in Japan reaffirming a commitment to the United Nations Framework Convention on Climate Change (UNFCCC).
16. Furthermore G-8 states agreed to take measures both nationally and internationally to facilitate investments into a sustainable global energy value chain to promote wider use of renewable and alternative energy sources.
17. The **"Final Implementation Plan"** of the World Summit on Sustainable Development, agreed on 2 September 2002, committed the signatory countries to making efforts to:
- increase substantially the global share of renewable energy sources in the energy mix;
- create a level playing field for renewable energy sources with respect to other energy sources;

- promote increased research and development in renewable energy sources, energy efficiency and cleaner conventional fuel technologies;
- provide developing countries with financial resources to develop energy expertise, including renewable energy sources, energy efficiency and cleaner conventional technologies;
with the aim of achieving sustainable development.

18. The **Central European Initiative**(CEI) **Plan of Action 2004-2006** states that energy production and know-how transfer as well as research and development of renewable energy sources are a top priority in Central and Eastern Europe. In this regard, the CEI plans to implement ad-hoc programs and activities in order to develop these sectors through the elaboration of specific projects.

19. **The Concept on establishing common electricity market of the Commonwealth of Independent States** (CIS) adopted in November 2005 aimed at the optimization of using energy fuel, hydro energy resources and other renewable energy sources, as well as improvement of the environmental conditions in the CIS member-states

20. Resolutions of the **Baltic Sea Parliamentary Conference of 8 September 1999 and 4-5 September 2000** call on their own parliaments and governments to: take measures aiming at energy-saving and to encourage the governments to set up a common goal for increased energy efficiency, to take measures designed to make greater use of renewable energy sources; to intensify cooperation in the field of energy, not least concerning renewable energy sources, and improving the environment by using the flexible mechanism introduced in the Kyoto Protocol to avoid environmental dumping as well as ensuring nuclear and radiation safety.

21. In 25 October 2005 a **Treaty Establishing Energy Community** between the European Union and Stability Pact for South Eastern Europe was signed in Athens. As it was stated afterwards the implementation of this treaty would have far-reaching political, economic and social consequences, among them is the development of a stable and efficient energy supply in South Eastern Europe. At the moment six BSEC member-states – Albania, Bulgaria, Greece, Moldova, Romania and Serbia – are parts of this treaty.

22. The original **European Energy Charter** was signed in Hague on 17 December 1991, containing a declaration of principles for international energy including trade, transit and investment. The treaty itself was signed in Lisbon in December 1994 together with **Protocol on energy efficiency and related environmental aspects**. The **Energy Charter Conference**, an inter-governmental organization, is the governing and decision-making body for the Energy Charter process and was established in 1994. Presently ten BSEC member-states have ratified Energy Charter Treaty, Serbia has an observer status in the Conference, and ratification of the Treaty by the Russian Federation is still pending. It should be noted that the BSEC Organization has an observer status in the Energy Charter Conference.

III. POLICY OF THE EUROPEAN UNION IN THE FIELD OF RES

23. The external dependence for energy of the European Union is constantly increasing. The EU imports 50% of its energy requirements and within the next 20-30 years this figure will rise to 70%. This external dependence has economic, social, and ecological risks for the EU. Energy imports represent 6% of total imports, (45% of oil imports come from the Middle East and 40% comes from Russia).

24. Development of renewable energy – particularly energy from wind, water, solar power and biomass – is a central aim of the EU's energy policy. There are several reasons for this:
- Renewable energy has an important role to play in reducing Carbon Dioxide (CO_2) emissions - a major Community objective.
- Increasing the share of renewable energy in the energy balance enhances sustainability. It also helps to improve the security of energy supply by reducing the Community's growing dependence on imported energy sources.
- Renewable energy sources are expected to be economically competitive with conventional energy sources in the medium to long term.

25. The need for the European Union support for renewable energy is clear. Several of the technologies, especially **wind energy**, but also **small-scale hydro power**, energy from **biomass**, and **solar thermal** applications, are economically viable and competitive. The others, especially **photovoltaic** (silicon module panels directly generating electricity from the sun's light rather than heat), depend only on (how rapidly) increasing demand and thus production volume to achieve the economy of scale necessary for competitiveness with central generation.
26. *Biomass (including biogas, solid bio-fuels, etc.)***.** Given that it makes a major contribution to the security of supplies, biomass has become a major factor in energy, environmental and agricultural policies.
27. *Wind-power*. Wind power has made impressive progress in the EU. It has been growing during the last decade.
28. *Photovoltaic solar power (PV)***.** This sector has grown at an annual rate of 29 % in Europe. Its potential is enormous and it is highly popular source of power. The programme on the involvement of the public services and the municipalities for solution of the technical and administrative problems in the application of PV has already been started.
29. *Thermal solar energy (solar heating)***.** The solar heating of water offers major potential in the building industry, which represents 40 % of the EU's energy consumption and which is increasing rapidly.
30. *Hydroelectricity***.** This technology has been fully developed. The major hydroelectric schemes are in general competitive and do not need any particular assistance. Now a policy on the building of small hydroelectric power stations is successfully developing.
31. *Geothermal energy.* During recent years more than one million homes were heated by geothermal energy and new stations have been completed.

Electricity sector

32. Electricity produced by renewable energy sources (RES-E) in the EU amounted to 393 THz in 2003, corresponding to a share of 12.8 % of gross electricity consumption. Based on EUROSTAT data of 2003, the historical development of RES-E for the European Union for the period 1990 to 2003 that hydropower is the dominant sources, but new RES-E such as biomass or wind are starting to play a role.
33. Wind energy is the RES-E source with the highest early growth rates of about 35% in electricity production over the last decade. Especially in 15 countries of the EU wind energy is predominant in recent portfolios of new RES-E, whilst biomass dominates in the new member states.

34. The capital intensiveness of many RES-E technologies has been an impediment to broad market penetration. Since market introduction, investment costs have decreased substantially for most RES-E technologies. The main drivers for cost reductions have been research, economies of scale and the gradually declining interest rates over the past two decades.

Heat sector

35. Heat production from renewable energy sources (RES-H) in the EU amounted to 47.8 Mtoe in 2001, corresponding to a share of 11 % of total heat consumption. It is important to note that the statistical data for the RES-H sector at EU-25 member states level and in particular for the new member states are of limited reliability. This is especially valid for non-grid connected wood-heating systems in households because of the decentralized and often non-commercial nature of the activity. In contrast the data on grid-connected systems, as well as on woodchip and pellet systems, are more reliable due to the fact that relevant fuels of generated heat are traded as commercial products.
36. Heat production is currently dominated by biomass resources, outweighing geothermal and solar thermal heat technologies. Particularly, heat production from non-grid connected biomass systems is predominant in almost all member states except the Scandinavian countries and the UK, where heat production from biomass in grid connected systems is primary. There is only a minor contribution from solar thermal (1,2 %) and geothermal heat production (2,4 %), while the overriding share of heat production (96,4%) comes from various biomass resources.

Transport sector

37. Bio-diesel has the largest share of bio-fuels production, reaching more 1,2 Mtoe in 2003. During the last decade, bio-diesel production increased by about a factor of ten. The growth in bio-ethanol production has been more modest at about a factor of five compared to 1993 values. Such countries as Germany, France, Austria, Italy, Sweden and Spain have set the pace for the bio-fuel sector in recent years.
38. In general, within the new member states the development was less dynamic. A significant increase of bio-ethanol production was observed in last two years.

Mechanisms of the EU in the field of application of RES

39. Looking at the various sector markets, it can be concluded that remaining market resistance to RES penetration relates to factors other than economic viability. This should be seen against the rapidly improving fiscal and economic environment being created in the EU both by European legislation itself swinging into full implementation and the Member States' own programmes. These developments are of course also the translation into reality of the Action Programme for Renewables contained in the **1997 White Paper.**
40. The European Commission's **White Paper for a Community Strategy** sets out a strategy to double the share of renewable energies in gross domestic energy consumption in the European Union by 2010 (from the present 6% to 12%) including a timetable of actions to achieve this objective in the form of an Action Plan.
41. The main features of the Action Plan include internal market measures in the regulatory and fiscal spheres; reinforcement of those Community policies which have

a bearing on increased penetration by renewable energies; proposals for strengthening co-operation between Member States; and support measures to facilitate investment and enhance dissemination and information in the renewables field.

42. An important part of the Action Programme is the **Campaign for Take-Off for Renewables**, which forms an integral part of the Community Strategy and Action Plan for Renewable Energy Sources by 2010. Focusing on certain key sectors, the Campaign for Take-Off sets out a framework for action to highlight investment opportunities and attract the necessary private funding which is expected to make up the lion's share of the capital required. The Campaign also seeks to encourage public spending to focus on the key sectors, and, in the process, to complement a trigger private investment. The Campaign is a highly visible vehicle, involving key sectors (solar, wind energy and biomass), for the drive towards a significant increase in renewables use and penetration.

43. Along with White Paper the **Green Paper on Energy Efficiency** point to the fact that the EU could have at least 20 % of its present energy consumption in a cost effective manner that will contribute to: security of supply, competitiveness, environmental protection and EU's Kyoto obligations.

44. According to the Green Paper the main objective of an energy strategy should be to ensure for the well-being of its citizens and for the proper functioning of the economy, the uninterrupted physical availability of energy products on the market at an affordable price for all consumers, whilst respecting environmental concerns and looking towards sustainable development.

45. The Green Paper outlines a long-term energy strategy in which the EU must:

- rebalance its supply policy by clear action in favour of demand. With regard to supply, priority should be given to the action to combat global warming, notably by promoting new renewable energy sources.

- undertake an analysis of the contribution of nuclear energy in the middle term. Whilst examining nuclear energy in terms of its future contribution, issues of global warming, security of supply and lasting development should be debated; the conclusions of this reflection, research in the area of security of nuclear waste management must be actively pursued.

46. Another significant activity in this field is establishment of the ALTENER programme, which is non-technological EU programme aimed at promoting the use of renewable energy sources. The overall aim of the ALTENER programme is to make an essential contribution to increasing use and market share of renewable energy sources;

47. The European Commission's efforts concentrate at the same time on removing barriers to an efficiently functioning market. This is done with the help of Community technology research and demonstration programmes, such as the **RTD Framework Programmes** and with pro-active support programmes as **Intelligent Energy – Europe Programme**.

48. Besides, the following important documents have been adopted in this field: Directive of the European Parliament and of the Council "On energy end-use efficiency and energy services which are to increase efficiency of providing energy services"(COM, 2003), Directive 2003/30/EC of the European Parliament and of the

Council of 8 may 2003 "On the promotion of the use of bio-fuels or other renewable fuels for transport", Directive of the European Parliament and of the Council "On the energy performance of buildings" (16 December 2002), Directive of the European Parliament and of the Council "On the promotion of electricity from renewable energy sources in the internal electricity market" (September 2001).

IV. REGIONAL COOPERATION AND PERSPECTIVES OF THE BSEC MEMBER STATES IN THE APPLICATION OF RES

49. **The BSEC Economic Agenda for the Future** defines certain priorities for cooperation in the energy sector. The growing role of the BSEC potential in the world energy market, particularly taking into account the promising oil and natural gas discoveries in the Caspian Sea basin and the development of prospective projects require the coordination of activities in the energy sector among the BSEC Member States and, whenever possible, the formulation of common strategies. Such coordination should take into account the possibilities to achieve better utilization of energy sources.

50. Optimization and efficiency in the use of energy sources can be achieved through the full integration of both producers and consumers of the region to the international energy markets. In this respect, while coordinating the activities in the energy sector, it should be taken into account that environmental factors, among which the prevention of marine pollution, are of paramount importance.

51. According to the BSEC Economic Agenda the strengthening of regional collaboration and intensification of business contacts among energy organizations and companies of the BSEC Member States would facilitate integration to world markets and generate economic efficiency. Bridging the imbalance between the production and consumption of energy, reduction of energy production costs, decreasing of ecological impact by electric power entities is the foundation of a regional energy market. Higher energy efficiency in the Member States, and wider introduction of energy saving technologies equipment must be an important part of the BSEC energy policy.

52. Synchronization of the energy systems of the Black Sea region. Chairmanship of the Russian Federation in the BSEC offered to make use of cooperation within the framework of organization for speeding up the process of synchronization the energy systems of the Western and Eastern Europe, to continue consistently advancing the proposals on improving interconnection between BSEC states' electric networks with the prospect to create the Black Sea Electro-energy Ring and regional energy market.

53. **The Baku Declaration on Energy Cooperation in the BSEC region** adopted in 3 October 2003 determines that member-states have agreed to promote policies focused on environmental protection in order to manage the environmental problems arising from exploitation and transportation of energy sources, by integrating environmental issues and sustainability into the energy policies and by supporting the development of renewable energy sources.

54. The first regional institution on the cooperation in energy sector is the **Black Sea Regional Energy Centre** (BSREC) established in February 1995 at the initiative of the European Commission, under its SYNERGY programme, by the BSEC member states. The Center's core activity is targeted to promote the development and implementation of market oriented energy policy and support energy efficiency projects.

55. The main objectives of the Centre are aimed at promotion of up-to-date energy policy and market reforms, with reference to EU Directives on electricity, gas and renewable energy sources, the European Energy Charter and the world-wide restructuring process.

56. Each BSEC member-state has own specific potential and experience in the application of the alternative energy sources. In spite of fact that several countries are exporters of the traditional energy sources, their governments during last decades have been elaborating certain programs and projects in the field of application of the renewable energy sources.

57. In **Albania** electricity generation is dominated by large hydroelectric facilities, contributing to over 85 percent of total electric capacity. Although Albania has been a net exporter of electricity in the past, over the last 5 or 6 years the country has relied on imports. There is a state-wide effort to reduce electricity shortages and excessive demand by implementing strong penalties against theft and defaults by consumers. Due to in-country know-how and available resources, hydro appears to be the most promising resource for renewable energy project development. There is however, a concern to increase reliability in dry years when hydro power output is significantly reduced. Privatization is considered as the main driver behind small hydro rehabilitation and development.

58. Although Albania is in a somewhat favorable climate for solar development, it does not seem likely that there will be an emphasis on solar development in the near future due to its relatively high costs. There are numerous locations of low to medium enthalpy geothermal wells identified in Albania, but there are no known high enthalpy locations identified for electricity production. Albania is rich with hydro resources. At present, only 35 % of them are used to generate electricity. Numerous new hydro-power stations ranging from hundreds of KW to 350 MW can be built as well as several thermo-stations in the central and southern Albania.

59. The legal framework is in place in **Armenia** for the development of renewable sources. The urgent and obligatory nature of the bulk purchase of energy by the market obtained from renewable sources is anticipated within fifteen years starting from the day of receiving the licence. Fixed tariffs attractive for the investors are established for fifteen years. Recently amendments were made to the RA legislation allowing applying tax and customs privileges for the import of wind energy equipment. The strategy of Armenia's development envisages maximum involvement of the republic's own sources of renewable energy into the energy balance of Armenia. The economically substantiated wind energy potential makes up no less than 450 MW, and the development of hydro power plants will enable to achieve not less than a twenty-five per cent recovery of the country's total energy output in a long-term perspective. With the support of WB, EBRD and USAID a Fund for energy saving and renewable energy operates, and with the support of the KFW German bank a Fund for the development of small HPPs was established.

60. The solar energy has a great future in Armenia, since the medium annual level of direct solar radiation in the country's entire territory significantly surpasses the medium European indicator. At present there are many installed water collectors and photoelectric converters in Armenia. However the growth rates of the capacities are not satisfactory, and for these reasons additional legislative acts are being developed aimed at creating favourable conditions for attracting investments and acceleration of the growth rates of solar energy. With the assistance of the World Bank research is

conducted in southern Armenia with the view of implementing a geothermal power plant construction project.

61. **Azerbaijan** is one of the leading oil and gas exporter countries in the region. This acts as a disincentive for the promotion and development of the potentially significant renewable energy resources. Nevertheless country has a large potential for renewable energy power generation in the areas of wind, hydro and biomass. Total wind power technical potential is estimated to be 1,500 MW. Biomass and hydro also have substantial potential for power production. The Nakhchivan Autonomous Republic is particularly suited to renewable energy development due to its separation from common state network and the fact that it has a power deficit.

62. In Azerbaijan according to the statistical data of 2004 a capacity of hydro-energy composes 11 % of common production structure of the fuel energy balance. Azerbaijan traditionally has been applying wind energy. There are some developments in the field of application of bio-gas settings in rural areas.

63. In **Bulgaria** currently, there is about 12,668 MW of installed capacity, including thermal, nuclear, and hydroelectric resources. Despite the current excess of capacity, Bulgaria is actively seeking outside investment to expand. Bulgaria also imports over 70 percent of the fuel required for energy production and is interested in developing indigenous sources. On January 1, 2002, Bulgaria passed the Ordinance on Setting and Applying Prices and Rates of Electric Energy. This is a significant incentive that requires transmission and distribution enterprises to purchase renewable power at preferential rates. A system of Green Certificates combined with base tariffs is planned to replace the current system in 2007. As part of their obligation to the European Union, Bulgaria will have 11 percent of their gross electricity consumption generated from renewable energy sources by 2010.

64. Except for solar, Bulgaria has very promising renewable development opportunities. Bulgaria is one of the top countries identified for wind energy development (3,400 MW mid term potential). Bulgaria has tremendous wind energy potential and state-of-the-art wind data supporting development. Country also has a sizable reserve of geothermal energy and is rich in low enthalpy geothermal waters used for space heating, greenhouses, drinking water, and balneology.

65. The most promising renewable energy sources in **Georgia** are geothermal, wind, and hydro power. The geothermal resource is of high quality with minimal amounts of dissolved salts and consequently reduced scaling during utilization. Currently, 350 MWh of capacity is being used with 465 MWh of proven reserves. Resource use to date has not widely utilized re-injection of the waste water and has resulted in depletion of some of the resources. There are good prospects for further development of 15 MWe of multiple small geothermal power plants exist in Western Georgia and in Tbilisi (mainly for multistage heat supply systems).

66. Wind power potential in Georgia is estimated to be at least 2,000 MW. Country takes one of the first places by its hydro potential both per head and per territory unit. Nevertheless only 6 % of hydro potential coming from rivers is in use, and hydro power provides approximately 55 percent of the country's generating electricity capacity. Hydro power will continue to play a major role in Georgia's electricity mix due to positive hydrological conditions and limited fuel supply.

67. In **Greece** the introduction of hydrogen is expected to be proved as an exceptionally important forward step for environment, economic and energy sustainability. The main sector, which may usher in the hydrogen area, is the field of transportation. For the time being the government tries to keep up with the

technological developments in the fields of production, storage, transportation and end use of hydrogen. The Centre for Renewable Energy Sources being an organization overseen by the Ministry of Development has put into operation a system at real scale for the production of hydrogen from water electrolysis using wind energy farms and a system of fuel cells.

68. The Greek parliament on 6 June 2006 adopted law on renewable electricity. Among numerous breakthrough provisions of the new law the following may be outlined: enabling the installation of offshore wind farms following the successful precedent of the implementation of corresponding projects in the North Sea.

69. Today, **Moldova** is a net importer of energy, with only 3 percent of its primary energy demand covered by domestic sources. Hence, the use of renewable energy is a high priority. A National Energy Regulatory Agency (NERA) has been set up to regulate the restructured electricity sector, and Moldova is continuing with its privatization program. An estimated 1,000 MW of wind energy potential exists in the northeast, southeast and western parts of the country. Hydro power accounts for only 2 percent of the country's generating capacity, even so, there is potential for development.

70. The geographical location and climate of Moldova are favorable for agriculture and a considerable amount of agricultural residues are generated annually. The primary barrier to the deployment of biomass plants is the relatively high capital cost.

71. **Romania** has the advantage of using diversified range of primary resources, which gives the possibility of choosing various options if supply shortcoming arise. The energy conservation policy is a priority of the Romanian energy policy. The use of renewable sources is of the greatest importance taking into account the need to reduce the import dependency. State strategy for the capitalization of RES has been adopted and is to be implemented on medium and long-term. According to the legislation in force, in 2010 the share of electricity consumption from RES will represent 33 % of the gross electricity consumption.

72. The most promising RES appear to be wind, biomass, and hydro. Despite lower energy prices, Romania is considered as a strong candidate for wind power development. There are well-documented wind resources, including a large off-shore potential. Total estimated mid term wind potential is 3,000 MW. There are also good opportunities for biomass development, building off a very large base of existing capacity (over 4,000 MWth). Assuming an available biomass energy supply, district heating systems represent the most immediate and low-cost biomass application – especially CHP plants.

73. **Russia** is unique due to its unified power system that connects 70 localized energy systems and allows the transfer of power across the country. This is a unique situation that could allow the sitting of renewable energy projects in some remote locations with access to transmission facilities which can deliver power to more densely populated areas. The overwhelming size of Russia also implies a strong development potential for all renewable energy sources.

74. Russia has excellent potential for wind power generation. An attempt to utilize just 25 percent of its total potential would yield some 175,000 MW of power. The highest wind energy potential is concentrated along seacoasts, in the vast territories of steppes and in the mountains. The overall technical potential of biomass is estimated as 35 million toe, which, if converted to electrical power, could generate nearly 15,000 MWe. This includes sewage sludge, cattle manure, and lumber waste.

With the reconstruction of pulp and paper plants, the use of wood waste is also becoming more prevalent. Similarly, hydro potential is quite large with 9 percent of the world's hydro resources concentrated on Russian soil. Hydropower makes up 21 percent of total generating capacity and there is a large potential for small to medium hydro power projects. Geothermal potential is also high, with theoretical resource estimates of high temperature (>90 C) steam, water and brine at greater than 3,000 MWe. Solar potential is reasonable despite the country's location in the northern latitudes. The highest solar potential is in the southern regions.

75. The energy sector in **Serbia** remains damaged after the conflicts. Infrastructure remains in a state of disrepair, thus leading to frequent and prolonged blackouts, especially over the winter months. In response, emergency grants are planned to help rebuild the damaged systems and restore power. Immediate and medium-term priority will be to reconstruct the country's electricity infrastructure. As a result, renewable energy development will not be a high priority, except for reconstruction of damaged hydro facilities.

76. The solar insolation in Serbia is relatively high, but the typical cost barriers will limit solar applications to niche markets. Although there are many sources of low enthalpy geothermal resource, high enthalpy geothermal resources supporting electricity production are absent in Serbia.

77. **Turkey** is unique amongst other European countries in having an abundant endowment of renewable energy sources with more that 8000 km of coastline and many of its coastal regions enjoying constant breezes. Unexploited hydro resources alone could provide an equivalent amount of electricity capacity as installed today. Now both the private and state-owned banking sectors are to make loans available to qualified private sponsors of renewable energy generation projects. Country has also good potential for wind generated power.

78. In Turkey a law on renewable energy sources aimed at their application in electricity sector was adopted on 18 May 2005. Law embraces possible areas of application of the RES, including such aspects, as exposure and protection of the RES, determination of the stable price policy concerning energy sector in terms of the RES application etc. Besides huge hydro resources, Turkey has a perspective potential fro the development of the wind energy, geothermal energy and biomass. Investments to these types of the RES have already been started.

79. **Ukraine** has a program of state support for the development of nontraditional and renewable energy sources and small hydro power plants. The target set for renewables is 10 percent of generation by 2010. In 1996 the government of Ukraine declared wind generation as a national priority and established a target of 200 MW by 2010. This has resulted in 40 MW of installed wind capacity in Ukraine. It is estimated that Ukraine has 5,000 MW of mid term potential for wind generation in over 40 percent of its territory.

80. Ukraine has a moderate technical potential for solar energy. An emphasis has been put on the development of solar hot water heating. Hydro power currently meets 7 percent of the Ukrainian demand for electricity. Some 327 MW of potential new hydro projects exist, with 220 MW of that on the Tisa River alone. Country has considerable geothermal resources that are used primarily for heat supply. Total installed capacity of thermal systems is 13 MWth. Plans are in place to increase the thermal water utilization up to 250 MWth by 2010. There are prospects for binary geothermal plants using existing wells at abandoned oil and gas fields, and a 1.5 MWe pilot binary geothermal is scheduled for Poltava. The biomass potential is 4.0

million toe, which includes livestock manure, straw, and lumber mill waste. There is strong interest in the use of livestock manure for biogas power generation as well as straw and wood combustion for district heating plants and combined heat and power facilities.

V. NUCLEAR ENERGY IN THE BSEC REGION

81. The second part of XX century was characterized by initiating the process of utilization of the nuclear energy, as one of the most important alternative energy sources. The world experience in the field of the production and exploitation of nuclear energy demonstrates that the functioning of electric-nuclear power plants and nuclear installations, in normal conditions and in full observance of the regulations on nuclear security, have a relatively low impact on the health of population and on the environment.

82. In a number of the BSEC member states existing nuclear plants and installations have a potential to be operated at a high level of safety and radioactive waste. However in each member-country situation in this field is very individual having specific historical background and current state of affairs.

Armenia

83. Armenia has one nuclear power plant, at **Medzamor** in Armavir about 28 kilometers west of Yerevan and 16 kilometers from the Turkish border. The nuclear power plant includes two power units with reactors VVER-440 /project V 270/ in its structure. The project 3-rd power unit of Novovoronezh nuclear power plant with reactors V-230 has been taken for a basis, which has been modified in view of seismic features of the venue of the Armenian platform of the nuclear power plant. Basic changes of project V-230 have been carried out not only in a construction site, but also in the design reactor installation, and conjunction with this project has received a new designation-V-270. Design service life of the power unit is 30 years. The first power unit was put into operation in December, 1976, and the second - in January 1980.

84. During 1988 earthquake the power units of nuclear plant were functioning. In spite of the fact that all equipment control systems and protection of power units of plant continued functioning steadily and reliably, Ministers' Soviet of the USSR made a decision on closing the nuclear power plant, and power units were stopped in spring 1989. In April, 1993 the Government of Armenia made a decision on repeated start-up of second block of the Armenian nuclear power plant due to the energy crisis resulting from the blockade of transport communications. Since November, 5, 1995 the operation of the second block of the nuclear power plant, with a level of safety has been renewed, stipulated by "the Concept of start-up " and even exceeding the design. The second block produces more than 40 % of electric energy of Armenia. It allows providing stability of rates of economic and social rise.

85. In order to provide safe operation of the nuclear energy block "The list of technical arrangements on the increase of safety of energy blocks 2 of the Armenian nuclear power plant", this was presented to different international organizations and donor countries with the aim of receiving financial means, was developed. The realization of the arrangements according to the List is carried out at financial support of the US Government, Russian Federation, France, United Kingdom and the European Community. The price of technical arrangements aimed at safety improvements of the Nuclear Power Plant of this type is estimated at $ 100 million.

86. The power engineering policy of Armenia is based on the concept of ensuring the required level of power safety. As a result of consistent steps directed to its realization, it can be stated that Armenia completely meets the raising demand of the local market and is the electric power exporter in the whole South Caucasus region. In the sphere of nuclear power engineering the Government of Armenia implements all the envisaged arrangements aimed at the continuous upgrading of safety systems for the operation of the acting reactor of the Armenian Nuclear Power Plant till the day of its shutting-down. Currently, the Government of Armenia considers the question of further shutdown of the Armenian Nuclear Power Plant. In the beginning of 2007 the special fund for the shutdown of the Armenian Nuclear Power Plant will be launched. Financial resources have been provided by the State budget of the Republic of Armenia for the construction of the second line of the dry-cask storage of spent nuclear fuel of the plant. Regulating and normative documents on shutting-down the Armenian Nuclear Power Plant are being developed in the framework of EU and USA technical assistance. The development of the nuclear energy on the basis of contemporary reactors with increased indices of security and reliability is considered as the most preferable option for the construction of new basic power units in the power engineering development programme for the period till 2025.

Bulgaria

87. Nuclear power plants in Bulgaria provide a considerable proportion of the country's electricity and nuclear energy is still an important issue in Bulgaria. Nuclear power provided a way of easing its dependence on imported fuels and increasingly made nuclear sector the center of its energy policy in the 1980s. In 1974 the first nuclear power plant was opened at **Kozloduy** north of Sofia on the Danube River. After completing the original four-reactor complex in 1982, Kozloduy added a fifth unit in late 1987 and sixth unit was installed in 1989. This was the first 1.000-megawatt reactor in Eastern Europe outside the Soviet Union. At that some, Bulgaria ranked third in the world in per capita nuclear power generation.

88. In mid-1991 the International Atomic Energy Agency (IAEA) declared the Kozloduy reactors unsafe. Two reactors were shut down. Meanwhile, the planned activation of the two newest reactors at Kozloduy raised the problem of nuclear waste disposal in 1991. In 1991 Bulgaria requested European Economic Community (EEC) aid to build its first permanent domestic repository for nuclear waste. The Bulgarian power transmission network was supplemented in 1988 when a high-capacity transmission line from the South Ukraine Nuclear Power Station reached the northeastern port city of Varna.

89. Following the agreement signed with the European Commission in 1999, which provided for the early closure of the non-upgradeable units (reactors 1 to 4) of the **Kozloduy** power station, reactors 1 and 2 were shut down for decommissioning in December 2002. Reactors 3 and 4 were supposed to be closed in 2006. In addition the Commission has instigated a program of funding from the TACIS Program and Euratom loans, amongst other sources. Given the social and economic impact the closure of the power plant will have, this financial aid will be directed at other sectors as well as the nuclear sector.

90. Since 2000 Bulgaria has launched various projects to fulfill its commitments regarding closing the four non-upgradeable units at the Kozloduy nuclear power station. Measures include setting up a special unit in the power plant to oversee the process of decommissioning reactors 1 and 2 and constructing a new dry-storage

spent-fuel facility on the site. The Bulgarian authorities have also strengthened the legislative framework in this area. Bulgaria has concluded a grant framework agreement with the European Bank for Reconstruction and Development (EBRD) for the decommissioning of Kozloduy, and a meeting of contributors has been held to approve the first work plan. The modernization of the two reactors that are to remain operational (units 5 and 6) started in June 2001. In June 2001 the Council of the European Union adopted a Report on Nuclear Safety in the Context of Enlargement, which reflects the importance attached to this subject in the accession negotiations. This report contains general recommendations for all the EU candidate countries as well as recommendations specific to individual countries. It has also signed an additional protocol to its nuclear safeguards agreement with the International Atomic Energy Agency (IAEA) which entered into force in October 2000. In September 1998, Bulgaria became a signatory to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. A national strategy on this subject has been presented. In 2003, the nuclear regulatory authority (NRA) became a member of the Western European Nuclear Regulators' Association.

Romania

91. In the late 1970s a five-unit nuclear power plant was planned at **Cernavoda**, on the Danube River. After considering several projects it was decided to adopt the Canadian CANDU technology. Cernavoda was based on technology transfer from Canada (AECL), Italy and the USA, with Candu-6 heavy-water reactors. Construction of the first unit started in 1980, and of units 2-5 in 1982. In 1991 work on the latter four was suspended in order to focus on unit 1, responsibility for which was handed to an AECL-Ansaldo (Canadian-Italian) consortium. Unit 1 was connected to the grid in mid 1996 and entered commercial operation in December 1996.

92. One of the major conclusions of the recent economic assessments conducted recently at the request of the Romanian Government is the necessity to continue the setting-up of new nuclear units into the National Energy System. In this context, Unit nr. 2 of the Cernavoda Nuclear Electric Power Plant will be put into commercial operation in 2007. The decisive step in the promotion of new nuclear units consists in the setting-up of a joint commercial society with private capital, with the task to restart and finalize the works at Units 3 and 4 of the Cernavoda Nuclear Plant.

93. The feasibility study made to this end has indicated as optimal solution, in terms of both investments and economic profitability, the setting up of the two units simultaneously. The estimated costs for the construction of the two reactors reach 2,2 billions Euro (including the costs for the decommissioning of nuclear wastes), and the cost of the produced energy is estimated between 30 and 35 €/MWh.

94. For the financing of the project works, the Ministry of Economy and Commerce has initiated a series of procedures in order to attract potential investors. 13 companies have been selected for finalizing, putting into function and operating of Units 3 and 4 of the Cernavoda Nuclear-Power Station, including companies from Turkey and South Korea.

Russia

95. Russia's first nuclear power plant, and the first in the world to produce electricity, was the 5 MWe **Obninsk** reactor, in 1954. Russia's first two commercial-scale nuclear power plants started up in 1963-64, then in 1971-73 the first of today's production

models were commissioned. By the mid 1980s Russia had 25 power reactors in operation.
96. Nuclear electricity output in Russia is rising strongly due to better performance of the nuclear plants, with capacity factors leaping from 56 % to 76% in 1998-2003 and 143 billion kWh being supplied in 2004 (15,4 % of total). In gross terms, output is optimistically projected to grow to 200 in 2010, and 300 billion kWh in 2020 (2025).
97. Following proposals worked out over several years, a government order consolidating the country's nuclear utilities in 2001. Rosenergoatom took over all civil reactors including those under construction and related infrastructure. Rosenergoatom operates within the context of 2003 state energy policy, and of state funding for new plants to meet policy goals.
98. In 2006 Rosenergoatom announced a target of nuclear providing 23% of electricity by 2020, involving commissioning two 1000-1100 MWe plants per year from 2007.

Turkey
99. The Turkish government, namely Turkish Atomic Energy Authority (TAEA) has initiated a project to revise the nuclear policy of the country. This project includes applications of nuclear energy in various sectors, including nuclear power and programs associated with each sector.
100. One of the sectors that are to be considered is 'Research and Development', which also includes innovative designs and small- and medium-sized reactors (SMRs). Cooperation with international/ national groups on theoretical and experimental projects concerning SMRs and innovative technologies will lead to an increase in staff capabilities and experience in nuclear technology in Turkey. To achieve this goal, the TAEA decided to participate in the 'International Project on Innovative Nuclear Reactor Technologies and Fuel Cycles', which is coordinated by the IAEA.
101. Recently the Turkish government confirmed that the country's first nuclear plant will be built in the Black Sea province of **Sinop**. The facility is expected to help meet the country's energy demand over the next 15 years. A 1.000 MW reactor will be constructed by 2012-2013, followed by other power plants with a total capacity of 5,000 MW, expected to be in service by 2015. Turkey has uranium reserves totaling around 10,000 tonnes, according to the authorities.

Ukraine
102. Nuclear energy development started in 1970 with construction of the **Chernobyl** power plant, the first unit being commissioned in 1977. This had the only RBMK type reactors in the country. Unit 4 was destroyed in the 1986 accident, unit 2 was shut down after a turbine hall fire in 1991, unit 1 was closed in 1997 and unit 3 closed at the end of 2000 due to international pressure.
103. The nuclear industry remained relatively stable during the many changes that occurred when the country became independent. During that period and since, there have been continuing improvements in the operational safety and output levels of Ukraine's nuclear reactors. Ukraine's 15 nuclear power units at four nuclear power plants are operated by Energoatom, the country's nuclear power utility. The country's nuclear production increased to 87 billion kWh in 2004, which accounted for 48% of total domestic electricity production. The capacity increased from 11 268 MWe net in 2003 to 13 168 in 2005 which was 26.3% of the country's total installed capacity. This increase was due to addition of two new VVER-1000 reactors.

104. At the end of 1995 **Zaporozhe** unit 6 was connected to the grid making plant the largest nuclear power station in Europe, with a net capacity of 5718 MWe. (The second largest station operating is Gravelines, near Dunkerque in France, with a net capacity of 5460 MWe.)

105. A nuclear power strategy involving building and commissioning 11 new reactors by 2030 is under consideration in Ukraine to enhance its energy independence. It is expected that an international tender will open up the choice of technology.

106. This project will be funded by the International Chernobyl Shelter Fund facilitated by the EBRD. The cost of building the arch-shaped confinement shelter is estimated at more than US$ 1 billion. The start of the first evaluation phase - the technical phase - of bids to build the shelter was announced in November 2004, and the financial evaluation phase is to follow. In May 2005, international donors made new pledges worth approximately US$ 200 million towards the new confinement shelter. The largest contribution, worth more than US$ 185 million, came from the G8 and the EU. Russia contributed to the fund for the first time and other fund members, which include the US, increased their contributions, with the Ukrainian government pledging the equivalent of US$ 22 million.

VI. CONCLUSIONS

107. The Black Sea region offers a very important cooperation possibility in the field for the development of the alternative energy sources. Only two of the BSEC member-states – Russia and Azerbaijan are self-sufficient in view of fossil resources. All of the remaining member-countries are externally dependent in view of oil and natural gas by varying but critical proportions. This dependency creates certain impediments for the sustainable development and for this reason necessity for developing alternative energy sources and increasing their share in the general volume of energy consumption is clear.

108. Renewable energy sources have the potential to play a much larger role in the Black Sea region than they presently do. Undoubtedly, there has been certain progress in some BSEC member states during last years. But taking into consideration the application of RES there is a lack of effective policy in this field. In order to guarantee security, stability and prosperity in the Black Sea region, an ambitious and coherent policy in the filed of RES is a crucial requirement for the BSEC organization.

109. Such an energy policy should rely on a common political will and respond to security of energy supply, economic growth, sustainable development, climate change, employment and technological development. Renewable energy technologies in combination with energy efficiency have a positive effect on all these goals. The BSEC member-states should give significant importance to the exchange of data base and existed experience in the field of the alternative energy sources, and this would allow coordinating efforts on more priority aspects in this direction.

110. The technical potential of renewable energy sources (i.e. the amount of energy that can be derived from the natural supply of renewables using current technologies) is far higher than total global energy consumption. Solar radiation on Earth is roughly 7,000 times greater than current global energy consumption. If calculated on a purely arithmetical basis, current global energy consumption could be met through the installation of photovoltaic cells across an area of 700 km * 700 km. However, technical potential does not correlate to the real available potential once

economic and environmental factors are taken into account. Exploiting the available potential is also a process that takes time: production capacities and appropriate infrastructure must be created and developed in the Black Sea region.

111. The Black Sea region has not yet developed fully competitive internal energy markets. In perspective effective system of security of supply and stable prices should be established. To achieve this aim, interconnections should be developed, effective legislative and regulatory frameworks must be in place and be fully applied in practice. In its turn it will contribute to the development of the alternative energy sources in the region.

112. For renewable energy to fulfill its potentials, the policy framework needs to be supportive and in particular to stimulate increasing competitiveness of such energy sources. Strengthening cooperation and long-term common energetic strategy of the BSEC member-states are necessary for the full realization of the RES potential with the view to provide energy supply over entire region.