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APROBAT
În şedinţa Biroului permanent al Camerei Deputaţilor
din data de 8.04.2008
Nr. 360

Parlamentul României
Camera Deputaţilor
B.P. Nr. 360 din 7.04.2008

INFORMARE

privind participarea la reuniunea Comisiei pentru mediu agricultură, probleme locale şi regionale, a Adunării Parlamentare a Consiliului Europei (A.P.C.E.) (Paris, 27 martie 2008)

La 27 martie 2008, s-a desfăşurat, la Paris, reuniunea Comisiei pentru mediu, agricultură, probleme locale şi regionale a Adunării Parlamentare a Consiliului Europei (A.P.C.E.), la care, din partea Delegaţiei Parlamentului României la A.P.C.E. (Camera Deputaţilor), au participat domnul deputat Laurenţiu Mironescu, membru al Comisiei şi doamna Nadia Ionescu, secretara Delegaţiei Parlamentului României la A.P.C.E.

La reuniune a fost prezent şi secretarul general al A.P.C.E., domnul Mateo Sorinas.

Pe ordinea de zi a lucrărilor Comisiei au fost înscrise comunicări ale conducerii A.P.C.E., informări privind participarea la diferite evenimente internaţionale şi mai multe proiecte de rapoarte între care menţionăm: „Cultivăm hrană sau combustibil?" raportor parlamentarul britanic Nigel Evans, „Muniţiile chimice îngropate în Marea Baltică", raportor parlamentarul lituanian Gediminas Jakavonis, „Mediul şi energiile refolosibile", raportor parlamentarul german Hermann Scheer „Energia nucleară şi dezvoltarea durabilă" raportor parlamentarul britanic Bill Etherington.

Cele mai aprinse dezbateri s-au înregistrat pe marginea rapoartelor „Cultivăm hrană sau combustibil?" raportor parlamentarul britanic Nigel Evans şi „Energia nucleară şi dezvoltarea durabilă" raportor parlamentarul britanic Bill Etherington. Parlamentarii care au intervenit în discuţii au subliniat imperativul ca, pentru a se evita orice acuză de subiectivism într-o direcţie sau alta, fiecare dintre cele două rapoarte să se bazeze pe evaluări ştiinţifice şi studii care să pună

în evidență atât părțile pozitive cât şi consecințele negative a oricăreia dintre soluțiile propuse. În context a fost, încă o dată subliniată, responsabilitatea factorilor politici în trasarea direcțiilor de dezvoltare globală viitoare şi s-a subliniat necesitatea eliminării sărăciei şi a reducerii gravelor disparități în redistribuirea şi utilizarea resurselor, în acelaşi timp cu reducerea poluării şi menținerea calității factorilor de mediu.

A avut loc de asemenea un schimb de vederi privind obiectivele avute în vedere după adoptarea de către Adunarea P+

arlamentară a raportului referitor la „Încălzirea globală şi dezastrele ecologice".

Plecând de la ideea viitoarei reuniuni în România, programată pentru toamna anului 2008, preşedintele Comisiei, parlamentarul britanic Alan Meale a adresat secretarei delegației Parlamentului României rugămintea ca, folosindu-se această oportunitate, să fie pus în legătură cu responsabili din rândul minorității rrome cu care ar dori să se sfătuiască în legătură cu problemele rromilor emigrați în Marea Britanie. În cadrul viitoarei reuniuni din România ar urma să fie dezbătut şi aprobat, între altele, raportul cu tema „Lupta împotriva amenințărilor asupra mediului în Marea Neagră", elaborat de parlamentarul român Laurențiu Mironescu.

Laurențiu Mironescu, deputat PDL

Red. Nadia Ionescu, director, secretara Delegației Parlamentului României la A.P.C.E.

Parliamentary **Assembly**
Assemblée parlementaire
Committee on the Environment, Agriculture and Local and Regional Affairs
Commission de l'environnement, de l'agriculture et des questions territoriales

Parliamentary Assembly
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AS/ENA (2008) OJ 03 rev.
17 March 2008
AENAOJ_08_03

Committee on the Environment, Agriculture and Local and Regional Affairs

REVISED DRAFT AGENDA

for the meeting to be held in PARIS
at the Council of Europe Office
(55 avenue Kléber, Paris 16ème – *métro station Boissière*)
(tel: +33 (0) 1 44 05 33 60, fax: +33 (0) 1 47 27 36 47)

on Thursday 27 March 2008 (from 9.30 am to approx 5 pm)

1. **Agenda**
   [AS/ENA (2008) OJ 03 rev.]

   Adoption of the draft agenda

2. **Minutes**
   [AS/ENA (2008) PV 02]

   Approval of the draft minutes of the meeting held in Paris on 22 February 2008

3. **Statement by the Chair**

This draft agenda, addressed to members of the Committee and their alternates, is the convocation to the meeting

Copy to Secretaries of national delegations

4. **Growing food or fuel?**
Rapporteur: Mr Evans, United Kingdom, EDG
[AS/ENA (2008) 11]

Presentation by the Rapporteur of a memorandum
Exchange of views

5. **Global warming and ecological disasters**

Exchange of views on follow-up to the Assembly report

6. **Chemical munitions buried in the Baltic Sea**
Rapporteur: Mr Jakavonis, Lithuania, ALDE
[AS/ENA (2008) 12 + 10, Letter Nordic Council]

Consideration of a preliminary draft resolution
Exchange of views

7. **Environment and renewable energies**
Rapporteur: Mr Scheer, Germany, SOC
[AS/ENA (2008) 06]

Presentation by the Rapporteur of an outline report
Exchange of views

8. **Tourism and sustainable development**
Rapporteur for opinion: Mrs Ohlsson, Sweden, SOC
[AS/ENA (2008) 13, AS/EC (2008) 02 rev]

Consideration of a draft opinion
Exchange of views

9. **Nuclear energy and sustainable development**
Rapporteur: Mr Etherington, United Kingdom, SOC
[AS/ENA (2008) 05 rev]

Exchange of views

10. **For a new governance of the oceans – The problem of the North Atlantic**
Rapporteur: Mrs Melo, Portugal, SOC
[AS/ENA (2008) 14]

Presentation by the Rapporteur of an outline report
Exchange of views

11. **Noise pollution**
[Doc. 11444]

Exchange of views

12. Committee's work programme
[AS/ENA (2008) 02 rev 3]

A. Appointment of Rapporteurs
[Doc. 11484]
Biodiversity and climate change

B. Reports on past events

[AS/ENA (2008) 15]
Congress spring session, Malaga, 13-14 March: *Mr Dorić*
Group of Experts on biodiversity and climate change (Bern Convention), Seville, 13-14 March: *Mrs Melo*
Bureau of the Assembly, Paris, 13 March: *Mrs Ohlsson*

C. Forthcoming activities

Exchange of views on a possible Conference on Environment and Health (Strasbourg, November 2008 – to confirm)

13. Other business

14. Future meetings

Strasbourg, 14-18 April 2008 (during the Assembly part-session)
Strasbourg, 27-29 May 2008 : Sub-Committee on Local and Regional Democracy (on the occasion of the plenary session of the Congress) ***(to confirm)***
Paris (CoE Office), 10 June 2008 : plenary Committee ***(to confirm)***
Strasbourg, 23-27 June 2008 (during the Assembly part-session)

Parliamentary Assembly
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Parliamentary **Assembly**
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Committee on the Environment, Agriculture and Local and Regional Affairs
Commission de l'environnement, de l'agriculture et des questions territoriales

AS/ENA (2008) 11
17 March 2008
AENA08_11

Growing food or fuel?

Memorandum
Rapporteur: Mr Nigel EVANS, United Kingdom, EDG

I. Introduction

In a context where fossil energies are limited and access to them is synonymous with national security and given the alarming state of global warming, using agrofuels as substitutes for fossil fuels may appear to be a miracle solution.

The vast majority of specialists agree today that fossil fuel consumption is one of the main causes of global warming and climate change. Among the alternatives to fossil fuels, agriculture is undeniably of specific interest. Some plants may be used to produce fuels, to replace the "classic" oil-based fuels.

It would seem however that the large-scale production of plants to manufacture "agrofuels" (biorganic fuel which may be used in car engines), while helping to cut energy dependence and fossil fuel consumption, poses problems of another kind. For example, the land recently allocated for the production of crops for agrofuels was previously used for the production of foodstuffs, which could slump as a result.

Some maintain that the use of agrofuels contributes to or could even be the cause of a substantial rise in the price of agricultural produce grown for human and animal consumption. This is what has happened in South America where rising prices have jeopardised access to foodstuffs, while maize intended to feed people has been sold for the production of agrofuels. In addition, the fact that farmers are opting to grow maize (now more profitable) instead of wheat has prompted a spectacular increase in the price of the latter foodstuff, which has become a rare commodity.

In Brazil, six million vehicles are already running on a blend of 25% ethanol and petrol. The European Union has set the share of agrofuels within total fuel consumption at 10% by 2020. It has even considered the elimination of fallow land, entailing a potential increase in cereal production from 10 to 17 million tonnes, which should help to slow the general rise in the price of agricultural produce. According to the FAO, world cereal production in 2007 reached 2 095 billion tonnes, an increase of 4.8% compared with 2006 – which is explained at least in part by an increase in the area of farmland used for agrofuel production. Even so, we should also take into account the strong rise in food consumption in the large emerging economies such as China.

Furthermore, the crops grown for agrofuel production may be fertilised with substances not authorised for crops intended for food production. Yet those substances – particularly when used in large quantities – may have harmful effects on the environment. So, paradoxically, agrofuels could have adverse effects on both agriculture and the environment, as well as on water resources and, ultimately, result in deforestation, desertification and famine in certain regions of the world.

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It is important, therefore, from both the environmental and agricultural viewpoints, as well as in a long-term economic perspective, not to excessively develop this new sector which could endanger the traditional role of agriculture – namely feeding humankind - and also damage the world's environment through undesirable effects and impoverish and starve certain populations.

II. Technical overview

There are a great many types of agrofuel - ranging from wood used to cook food to highly sophisticated modern fuels obtained from purpose-grown biomass.

Agricultural residues - such as animal waste products - may also be used as agrofuels. In some European countries such as Germany, France and Holland, animal waste is becoming a problem for the environment. But it can be used for energy production through a fermentation process. In China, this technology has been used for over 20 years and there are now 10 million biogas digesters using animal waste.

The vegetable matter used for agrofuels may come from fast-growing trees, cereals, vegetable oils, agricultural residues or, in the case of Brazil, sugar cane.

Where sugar cane is concerned, for example, either the sugar or the bagasse may be used as a source of energy. Bagasse is the cane-waste that remains once the stems have been pressed, and it is very useful as a fuel, forage-stuff and construction material. Sugar refineries use the bagasse as an energy source to supply the heat required for the sugar production process. Modern technology makes it possible to use bagasse far more efficiently, so that much of it can be exploited to generate electricity through a normal fuel-burning power station. In this way a food industry becomes an energy-generating industry too.

Agrofuels are not a new resource. They were already known about during the early stages of the car industry: when the combustion engine came into being, its inventor, Niklaus Otto, anticipating using ethanol as a fuel. Furthermore, the first diesel engine, named after its inventor, Rudolf Diesel, ran on peanut oil. And Henry Ford had thought of using ethanol to run the famous Ford T, manufactured from 1903 to 1926.

Following the two oil crises in 1973 and 1979, there was growing interest in agrofuels. However, this enthusiasm soon waned when oil prices fell in 1986. There has been a further upsurge in interest in agrofuels since the turn of the century, with the fresh rise in the price of oil, the unstable situation of certain major oil exporters and determination to combat the greenhouse effect.

There are two main families of agrofuels: ethanols (for petrol engines) and agrodiesels (vegetable oil methyl esters (VOME)) for vehicles running on diesel. At present, agrodiesel is used far more than ethanol in Europe in a ratio of 80%:20%. That ratio could change in future, with the appearance of cars with dual-fuel engines (known as "flex-fuel"), using a maximum of 85% ethanol for 15% petrol. Ethanols are derived from sugar beet, wheat, maize or sugar cane. The technique entails extracting the sugar, directly or by starch hydrolysis in the case of wheat, and then fermenting and transforming it into ethanol. Agrodiesels are extracted and transformed from vegetable oils (colza, sunflower, soya and palm) with the resulting esters blended with diesel fuels.

In Europe, France is the leading producer of ethanol alcohol, accounting for 33% of Europe's production. But Spain remains the leading producer of ethanol intended for the manufacture of fuels. In the period 2005-2006 France produced over 9 million hectolitres of alcohol including 7.6 of alcohol of agricultural origin, sourced from beet (81%) and cereals (19%).

The world's main producers of ethanol of agricultural origin are the United States (some 200 million hectolitres in 2006) and Brazil (some 170 million hectolitres in 2006). These two countries are "models" of industrial agriculture, highly mechanised and geared to single-crop farming, intensification and modern biotechnologies. In 2006, the world production of ethanol of agricultural origin was nearly 500 million hectolitres, with Brazil and the United States alone providing around three-quarters of that volume.

III. The effects on the environment

The down-side is that agrofuels may in some cases produce more greenhouse gas emissions than the fossil fuels they are replacing, if we take all the factors in their production chain into account. Deforestation and changes in land use trigger the release of large quantities of previously stored CO2; in addition, there are the

gas emissions resulting from the production, transformation and transportation of agrofuels, much of which is done by machinery and technologies using oil derivatives and other greenhouse gas-producing elements.

According to a study published in Science magazine, the climate would be more effectively protected by conserving or restoring forests and grasslands rather than developing crops for agrofuel production. The study shows that reforestation would make it possible to capture between two and nine times more CO2 over a period of 30 years than would be saved in terms of emissions through the use of agrofuels over that period.

Moreover, the development of agrofuels is highly controversial even from the energy balance point of view. More oil is needed to manufacture agrofuel. In the case of maize-based ethanol, for example, 1.3 kilocalories of oil are needed to produce 1 kilocalorie of bioethanol.

In terms of foodstuffs, the quantity of cereals needed to fill a lorry's tank with agrofuel could feed one person for a whole year.

It would appear that the harmful effects of agrofuels on health are by no means negligible either. A study by Stanford University has shown that the use of ethanol will ultimately cause a considerably greater public health problem than the present pathologies linked to hydrocarbon pollution. Ethanol combustion engines escalate the amounts of ozone toxicity in the air, particularly in cities already affected by smog. Using ethanol instead of petrol is likely to cause 9% more air pollution-related deaths.

IV. The effects on agriculture

Beyond the ecological concerns, there are other major issues, focusing on access to land, food sovereignty and famine on a planetary scale.

The swift increase in demand for agrofuels will mean that thousands of hectares of fertile land will no longer be allocated to food production and instead destined for the production of fuel. This land will be concentrated in the hands of a few large agri-food multinationals and the energy sector, resulting in smallholders being "displaced" towards the misery of over-populated urban centres or converted into landless rural workers.

Similarly, forests will no longer guarantee the subsistence of thousands of people, the water sources of these regions will be contaminated and the soils of these fragile ecosystems will be gradually exhausted by intensive agriculture and the massive use of chemicals (many of them banned for food crops while tolerated for non-food crops but no less harmful to the environment). This has already happened in South America (especially in Colombia and in Amazonia, in Brazil), where the development of single-crop farming of soya, sugar cane or African oil palm has led to massive deforestations. These mechanised monocultures use high doses of fertiliser (such as atrazine, a very harmful herbicide with endocrine-disrupting effects).

Studies have revealed the risks for soil quality of large-scale exploitation of agrofuels. The findings of one such study in Switzerland show that farming geared to the production of agrofuels (unfortunately also known as "biofuels", which is likely to cause confusion with agricultural produce labelled as organic) is incompatible with sustainable organic farming, as it does not return enough nutrients back into the soil.

Organic farming hinges on closed cycles of food substances: the nutrients drawn from the soil are returned to it in the form of compost, organic fertiliser or manure. In contrast, in the production of plants for fuel, nearly 100% of the biomass is removed from the soil farmed. This means that the risk of ensuing soil deterioration must be reduced by external additives.

For these reasons, many farmers organisations are condemning the development of agrofuels as a new form of industrial exploitation of agriculture, requiring even more arable land, machinery and chemicals with the likelihood of rapid development of "monoculture deserts" at the expense of small-holding and family agriculture. They see this trend as a real threat to their family agriculture as, in the long term, the multinationals will not only be favoured by permissive legislation and grants but will also have control over the means of production (seeds, machines, transport). Farming organisations are also critical of the emergence of a new lobby around this new energy source. The issue was raised at the World Forum for Food Sovereignty (Nyéléni, 2007), where participants from the five continents drew attention to the potential excesses and dangers of what might become a new lobby for a new kind of oil.

Moreover, from an economic viewpoint it is clear that the production of fuels from agricultural produce has already heavily contributed to rising food prices on the world market, with dramatic consequences on the diets of millions of people.

V. The advantages

The world's most powerful industries see the development of agrofuels as a source of substantial profits. The possibility of governments backing them with laws and grants makes the prospects even more enticing. The main players are the car manufacturers (which hope that the advent of agrofuels will force people to change cars), oil producers (which control the system of fuel distribution), the companies that control world trade in seeds (which will gain greatly from both increased demand for agrofuels and higher prices of foodstuffs which will have to compete with them) and the transnationals producing GMOs.

The other sectors standing to make economic gains are the large forestry and cellulose transnationals (which produce for the paper industry today but could, with a minimum of technological changes, convert to ethanol processing factories) as well as the industrial manufacturers of chicken and cattle feed, which are considering the possibility of developing agrodiesel from animal fat.

It is somewhat surprising that the European Commission (which has set a 10% target for the share of agrofuels within fuel consumption by 2020, compared to an estimate of 1.6% in 2006) has chosen to back the development of agrofuels despite the alarm signals recently sounded by scientists, farmers and environmental activists. The President of the European Commission has acknowledged the potential environmental problems of agrofuel production but has stated his assurance that they could be avoided, adding that more research would improve production. The European Commissioner for trade is confident that consumers would pay for agrofuels only if they have the guarantee that agrofuel production would not pollute the environment elsewhere.

The agrofuels "boom" may seem easily justifiable on the basis of some theories and above all its presentation as a miracle solution to the world's energy problems. However, the more we go into this subject in detail, the clearer it is that the over-development of agrofuels is causing problems for society. That is why the political decision-makers, in Europe and elsewhere, must base their actions on full, reliable information covering all the areas that might be affected by the development of the agrofuel industry.

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COUNCIL OF EUROPE CONSEIL DE L'EUROPE

AS/ENA (2008) 06
5 February 2008
aena08_06

Environment and renewable energies

Outline report
Rapporteur: Mr Hermann SCHEER, Germany, SOC

I. Time to act

The current energy system has two predetermined breaking points, the finiteness of conventional fossil and nuclear fuel resources, and a growing number of crises in the world that are related to energy. At some point in the foreseeable future these breaking points could cause a situation to arise in which the energy system as we know it today would no longer be able to function. To ensure that this will not happen it will be necessary to effect an immediate changeover to renewable energies. This is a challenge of historical importance that the member states and their governments need to address. The problems that will have to be dealt with in connection with carrying out this changeover are small in comparison to the conflicts that are inherent in the current energy system and are bound to grow more pronounced as time goes on. The nations and governments of the world still have a choice. But continued waiting and delaying will eventually result in this choice being taken out of their hands by worsening energy crises. Waiting until then to initiate an energy policy changeover would make it necessary to undertake a much greater effort and could have enormous political and social repercussions.

II. The finiteness of conventional energy resources

Mankind is living on a dwindling supply of resources. Conventional energy reserves that accumulated over many millions of years are being used up at an increasingly rapid pace. A child who is born today is likely to witness a situation within his or her lifetime in which our civilization will have to do without oil, gas, or uranium, since these resources will have been exhausted by then. The end of conventional fuel resources will necessarily mean the end of today's methods of generating power. When this point will be reached is, essentially, undisputed. Based on known fuel reserves that it would be technically and economically feasible to exploit it can be estimated approximately how long these reserves will last us. In the case of oil we are looking at about 42 years, in the case of natural gas 65 years, in the case of coal 170 years, and in the case of uranium perhaps another 50 years.

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III. The world's worst energy-related crises

i. Climate crisis

The latest assessment report by the Intergovernmental Panel on Climate Change merely confirmed what has long been known. The average temperature on the earth's surface has risen by 0.74 degrees Celsius since the end of the 19th century. According to scientific models it will continue to rise by another 1.8 to 4 degrees Celsius by the year 2100. The consequence of this will be climate change on a scale larger than anything seen over the past 10,000 years. Extreme weather events, such as severe storms, floods, and droughts will occur more frequently than is already the case today. One of the most serious consequences will doubtless be the resultant rise in sea level. During the 20th century scientists measured a rise in average sea level of between 10 and 20 centimeters. It is predicted that by the year 2100 there will be a further rise in sea level of between 18 and 59 centimeters. This will make large areas of land uninhabitable and threaten water supplies for billions of people.

The cause of all these negative changes is clear. They have been brought about first and foremost by the burning of conventional fuels to obtain energy.

ii. Dependency crisis

In the case of fossil fuels more and more countries are becoming dependent on fewer and fewer sources. In the case of uranium the situation is quite pronounced, with ten countries accounting for more than 90 of global uranium production.

The majority of European countries are dependent on imports to cover more than half of their energy needs. It is obvious that there is a potential here for crisis in the future. Growing dependency on energy imports can also lead to political dependency. Foreign, security, and human rights policy could become a political football for energy policy interests. Indeed, wars could potentially break out over access to remaining resources.

iii. Poverty crisis

Developing countries without fossil fuel resources of their own, i.e. the majority of them, have to pay the same prices for fuel imports as everyone else on the world market, even though they have an average per capita gross domestic product level that is considerably less than ten percent of the average GDP figure for the Western industrial nations. Based on their national incomes the developing countries have a financial burden that is, de facto, ten times greater and more when it comes to paying for their fuel imports. At the same time, due to a lack of networked energy supply infrastructures, they are more strongly dependent on oil supplies that are not provided via pipelines than is the case with industrialized countries. The consequences of energy poverty are excessive exploitation of biomass, desertification, rural exodus into already crowded slums on the peripheries of major cities, destruction of social structures, and a breakdown of political order that could lead to international conflicts.

iv. Nuclear crisis

Nuclear waste needs to be stored safely for 100,000 years. No one can provide guarantees that far into the future. The inherent uncertainty associated with final storage sites for nuclear waste is obvious, as is the fact that we are leaving behind a difficult legacy for future generations.

But even the day-to-day operation of nuclear power plants involves unconscionable risks. The ability to control nuclear energy and to keep it safe for civilian use has been recurrently called into question by accidents of serious and even catastrophic proportions. Today these dangers are compounded by the threat of terrorism which could some day target nuclear power plants.

v. Water crisis

The water crisis being seen in many regions of the world, to an increasing extent also in the northern hemisphere, is in large measure a result of our use of nuclear and fossil fuels to generate power. In connection with the operation of nuclear and coal-fired power plants around 3 cubic meters of water are evaporated for every megawatt hour of electricity generated. A modern nuclear power plant can generate around 8 million megawatt hours of electricity per year. This puts the amount of water consumed at around 24 million cubic meters. It is easy to understand that this level of water consumption in connection with the generation of electricity could have a disruptive effect on regional water cycles.

In regions where water is scarce the water needs of power plants enter into direct competition with the water needs of the human population. This begins with the production of fossil fuels. Water is needed, for instance, to wash coal. In oil fields water is pumped underground to create the pressure needed to push the oil up to the surface.

vi. Health crisis

Scientific publications have come to the conclusion that around a fourth of the people in the world have health problems of some kind as a result of emissions produced by the burning of fossil fuels, including asthma and other bronchial disorders. The present energy system has a negative influence on human health and the quality of life and as a consequence of this is also responsible for increased health care costs.

Indoor emissions, such as occur when people burn wood in houses and huts, are particularly dangerous to human health. The World Health Organization attributes many of the premature deaths seen in Africa to emissions of this kind.

IV. Alternatives

It follows from the above-indicated crises that the alternative to the present energy system is to be found in emission-free energy resources. The changeover described under Roman numeral one, "Time to act", can only succeed with energy resources of this kind.

i. Is nuclear energy an emission-free alternative?

Nuclear energy is frequently named as a climate-friendly option for the generation of electrical energy. It is often argued that the operation of nuclear power plants does not result in the production of greenhouse gas emissions. However, this argument fails to take into account the fact that the use of nuclear energy does, indeed, result in the production of greenhouse gas emissions, given that the use of fossil fuels is required in the course of mining uranium ore, refining uranium, and producing uranium fuel rods. As such, nuclear energy is an indirect cause of greenhouse gas emissions produced in the various phases of uranium processing. The world's uranium reserves are declining and this has already made it necessary to mine lower-grade ores. Studies indicate that over the next twenty to thirty years a kWh of electricity from a nuclear power plant will have a larger carbon footprint than the same amount of electricity generated by a gas-fired power plant. It is already the case today that nuclear power results in considerably more carbon dioxide emissions per kWh hour of electricity than is the case for wind energy. As such, nuclear energy is not an acceptable alternative.

ii. Is clean coal technology an alternative?

In a number of European countries it is currently being debated whether or not clean coal power plants constitute an acceptable alternative. The objective pursued in these plants is to remove the carbon dioxide from the flue gases produced and to store it in some form. However, this process would result in considerable efficiency losses for the power plants in question, ranging between 20% and 40%. In addition to this, it has not yet been determined how carbon dioxide can be stored securely and how much this would cost. This technology is still far from being developed to a level of perfection that would enable it to find widespread use. As such, it is also not an acceptable alternative.

iii. Renewable energies

a. Efficiency and emissions

A modern wind turbine will produce up to 100 times more energy than was needed for its construction and operation over a thirty-year period. In the case of solar panels this factor is currently 10, but is rapidly increasing as a result of further technological advances. Thus, the efficiency of these systems is guaranteed. The carbon dioxide emissions associated with wind energy are well below those of all types of fossil fuels, viewed over the entire length of the production chain. Biomass energy is not completely climate-neutral in every instance, but it is nonetheless better in this regard than fossil fuels. The prerequisite for ensuring this is that as much biomass must be grown again as was used for the purpose of producing energy.

b. Rapid implementation

The potentials of the various renewable energy forms can be mobilized rapidly when used in decentralized form. Wind turbines, solar arrays, or water-driven power plants can be planned and constructed much more quickly than large-scale thermal power plants. This is particularly true of nuclear power plants, given the inordinate amount of time needed for their planning and construction. Expanding the use of renewable energies to produce electricity will require international technology transfers. This, in turn, will require a considerable increase in the training of specialists to operate the systems put in place.

c. Land needs

The use of renewable energies will require a certain amount of land use, for instances to provide locations for the construction of wind farms or fields for growing biomass. The use of some locations for the placement of wind turbines may evoke protests from the local population and they may want to assert landscape protection rights. However, this claim must be compared with the impact on landscapes caused by conventional energy producers as well as the consequences of emissions for the environment, which rank higher in the hierarchy of dangers. In the case of land needs for biomass production there is a fear of competition with land needs for food crop production. There are also predictions that this will lead to the creation of large-scale monocultures. Forms of biomass production are needed that will rule out these dangers. And this is possible.

d. Energy mix and storage of solar and wind energy

An energy mix is needed to be able to make use of the full potentials offered by renewable energies. Initially a mix of conventional and renewable energies is needed, in which the percentage of renewable energies would gradually rise and that of conventional energies would gradually fall. The objective, in the end, would be to have a mutually complementary mix consisting of all forms of renewable energy, including a storage system for solar and wind power, given that electricity production from these sources is subject to fluctuation.

e. Costs

The full costs of conventional power production must be compared with those for power produced with renewable energies. A comparison of these full costs must include any subsidies paid as well as the various system costs. With the exception of bioenergy, renewable energies do not entail fuel costs and infrastructure costs are low for the most part. In the case of conventional energies, there are rising fuel costs and follow-on costs to worry about. Renewable energies involve only engineering costs for the most part and the latter will decline as system production volumes increase. Conventional energy costs, by contrast, will continue to rise.

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Committee on the Environment, Agriculture and Local and Regional Affairs
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Nuclear energy and sustainable development

Preliminary draft explanatory memorandum
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I. Introduction

The international community has to find effective solutions to three interrelated tasks — energy security, economic growth and environmental protection. Fair, competitive responses to global energy challenges based on market economy principles will help to prevent potentially destructive effects on production, supplies and transit of energy resources and establish a solid basis for the dynamic and sustainable long-term development of our civilisation.

Over the next 30-50 years nuclear energy will make a significant contribution to resolving the problem of energy security as a basis for sustainable development.

Nuclear energy is the most feasible, technologically proven, environmentally acceptable and competitive alternative to hydrocarbon energy. We believe that developing nuclear energy is a move in the right direction.

Nuclear energy is viewed as an attractive option because of certain competitive advantages, such as the least dependency on fuel prices in comparison with other sources of energy, insignificant volume of energy cargo transportation, detailed consideration of nuclear and environmental safety matters, environmental protection, the absence of greenhouse gas emissions or adverse effects on climate.

The main prerequisites for widespread development of nuclear energy are enforcing the nuclear non-proliferation regime, ensuring security and safety of nuclear materials and further reducing the different risks posed by its development.

Nuclear energy use can become a framework for establishing an energy system ensuring sustainable, environmentally safe, cost-effective and socially acceptable development and improvement in all fields of human activity in the 21st century.

Its development will contribute to global energy security, which will be possible only within a solid framework of international cooperation.

At the same time, it has to be acknowledged that individual solutions are no longer appropriate. In an increasingly global world, only those who realise this fact will be capable of effective action.

To properly respond to the new challenges and exploit new opportunities, the world nuclear energy industry should consolidate its efforts. The different players should be systematically involved in the international nuclear fuel cycle, pooling and making efficient use of competitive advantages.

Further internationalisation of the nuclear fuel cycle to ensure stable access to its products and services for the countries concerned, while strictly complying with and strengthening the international nuclear non-proliferation regime, is a strategic thrust for nuclear energy.

The tasks facing Russia and the international community are of a truly global nature. That means that sustainable, safeguarded and safe development of nuclear energy can be achieved only through joint bilateral and multilateral efforts.

Russia, as one of the world's major suppliers of uranium-related products and services, is fully open to and prepared for such cooperation.

II. Global energy issues and sustainable development

In recent years, energy has become highly topical all over the world. Today's world is changing fast in terms of both newly emerging countries with rapidly developing economies and the growing energy consumption of developed countries.

Growing tension on the energy markets in recent years is not a temporary phenomenon. The world's developed and developing countries have aligned themselves in terms of *per capita* energy consumption.

At the same time the economy cannot survive without an adequate energy supply, regardless of the country's political system or its level of development, and this applies equally to centrally planned and market economies and to developed and developing countries.

Energy supply has come to the fore. Energy resources are critical for improving living standards and expanding opportunities for people in both developed and developing countries of the world.

Assuming that the existing consumption level in developed countries will attain a balance, total energy production has to increase at least threefold, and that is without taking world population growth into consideration.

Thus, ensuring efficient, solid and environmentally safe energy supplies at prices corresponding to the fundamental principles of market economy is a major challenge for humankind.

III. Principles of ensuring global energy security

The tasks and principles of global energy security include the following:

- Openness, transparency, stability, efficiency and competitiveness of markets with regard to production and supplies is key to ensuring global energy security;
- Establishing transparent, fair, stable and efficient legal frameworks and legislative and regulatory systems;
- Encouraging investment in the energy sector;
- Improving energy efficiency and energy saving through national and international initiatives;
- Diversification of energy, geographical and industry markets;
- Ensuring security of energy infrastructure;
- Developing and introducing innovative energy-efficient technologies;
- Environmental responsibility in development and use of energy resources, introduction and exchange of environmentally safe technologies contributing to resolving the issue of climate change and sustainable development;
- Joint actions to mitigate the consequences of energy emergencies;
- Resolving energy problems of the poorest population groups in developing countries.

Many of these tasks which must be solved if global energy security is to be ensured and strengthened were touched upon by the G8 leaders in their Saint Petersburg Summit declaration in 2006.

i. Improving transparency, predictability and stability of global energy markets

The presence of free, competitive and open markets is vital to an efficient global energy system as a key prerequisite for sustainable development.

Transparency and predictability of energy policy and regulatory regimes in each State contributes greatly to shaping efficient energy markets.

Expanding dialogue between energy-producing and energy-consuming countries can promote transparency, predictability and stability of global energy markets.

Transparent, stable and predictable national legislation and regulatory systems guaranteeing the environmental security component make a significant contribution to global energy security.
Smooth functioning of world energy markets also requires regular and timely exchange of accurate and credible information.

ii. Improving the investment climate in the energy sector

To ensure adequate energy supplies on a global scale, several trillion US dollars should be invested in the energy sector by 2030, with a considerable part of that amount allocated to satisfy the needs of developing countries.

Conditions should be created and maintained to attract investment in the energy sector by establishing competitive, open, fair and transparent markets.

When making decisions on investment great importance is attached to the energy and environmental policy of a given State, and predictable regulatory regimes in energy-producing, energy-consuming and energy-transiting countries should therefore be promoted, including the adoption of stable legislation based on the principles of market economy, investment governance and forecasting of medium- and long-term demand for energy resources, as well as establishing clear and consistent taxation systems, and removing excessive administrative barriers.

Attracting investments in all stages of the energy cycle can make it easier to:

- introduce innovative energy-efficient technologies;
- encourage wider use of renewable and alternative sources of energy, primarily nuclear energy;
- introduce and expand use of more environment-friendly and efficient technologies and methods, including in nuclear energy;
- develop efficient generation capacities in the field of electric power production, including the development of nuclear energy as one of the priorities;
- expand and improve efficiency, security and safety of power networks, as well as possibly linking them up with energy systems of other States, including developing countries.

Capital flow to energy production should be facilitated, including for building new, more efficient installations and upgrading the existing power plants and nuclear power plants, ensuring wider use of renewable energy sources.

Supplying properly qualified human resources for the energy sector in the long term is critical to ensure energy security.

Adequate measures are required, therefore, to ensure proper training of energy sector employees, including in the field of new and innovative energy sources and technologies necessary to ensure long-term energy security. The training of highly qualified personnel for nuclear energy is especially important.

iii. Improving energy efficiency and energy saving

Saving energy resources plays an important role in strengthening energy security. It is often a more cost-efficient and environmentally responsible means of meeting the growing demand for energy.

Energy efficiency and energy saving are among the most efficient solutions to the problem of reducing greenhouse gases emissions.

In all development scenarios, energy saving, ie making energy consumption more efficient, is a priority activity achieving maximum impact in the shortest time in resolving the climate change issue. Expanding the use of nuclear energy can make a decisive contribution here.

iv. Energy diversification

Energy diversification is one of the most effective instruments for reducing risks in the field of global energy security.

Developing low-carbon and alternative energy, making wider use of renewable energy resources and introducing innovative technologies in all energy sector industries can help reduce risks in global energy security.

Nuclear energy has a special role to play in diversifying energy sources, being the most feasible, technically proven, environmentally acceptable and competitive alternative to carbon energy.

Nuclear energy is viewed as an attractive option because of such competitive advantages as the least dependency on fuel prices in comparison with other sources of energy, insignificant volume of energy

cargo transportation, detailed consideration of nuclear and environmental safety matters and environmental protection.

v. Innovative energy technologies

At the G8 Summit held in 2007 in Heiligendamm, the G8 leaders noted that "Innovation is one of the crucial drivers of economic growth in our countries. We therefore agreed to take action to promote innovation as well as research and development."

Developing potentially valuable technologies, including those linked to the construction of improved power circuits, superconductivity, nanotechnologies (including biological nanotechnologies), conducting research and development in the field of fusion energy within the International Thermonuclear Experimental Reactor (ITER) project, implementation of the IAEA International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) and the arrival of these innovative technologies on the market will contribute to improving energy sector efficiency and strengthening global energy security.

Of all innovative energy technologies, nuclear energy is the most feasible option, which, thanks to scientific and technical advances in the field and the developed infrastructure, can take the lead in energy production in the 21st century and ensure sustainable human development.

vi. Resolving the issues of climate change and sustainable development

Sustainable development implies an environmentally responsible approach to development and use of energy resources.

The entire international community has acknowledged that the climate change issue must be resolved.

The Kyoto Protocol, the first international instrument applying market principles to environmental protection, is an effective mechanism promoting the reduction of greenhouse gas emissions and efficiently resolving the issue of climate change.

Nuclear energy has a highly significant role in attaining the goals of the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC). The advantage of nuclear energy is that it contributes the least to the "greenhouse effect". It is estimated that a nuclear power plant produces the lowest volume of greenhouse gases per unit of energy compared with all types of energy used at present or to be used in the future. Energy production in nuclear power plants can enable humankind to cut greenhouse gas emissions and significantly reduce their impact on the atmosphere, while large-scale introduction of nuclear energy or the even more efficient new generation of energy based on using energy of the deep structure of matter will enable us to resolve the issue of climate change resulting from human activity.

vii. Reducing energy poverty

It is impossible to drastically reduce poverty in general without resolving the issue of energy poverty; neither it is possible to support the health care services, supply people with safe drinking water, improve sanitation, make agriculture more efficient and increase food production or create employment by attracting investment in the enterprises of developing countries.

There appears to be a need for expanding access to energy resources for the poorest population groups and improving energy efficiency in developing countries.

Programmes of assistance to the developing countries should be aimed at improving their policies and regulation systems in order to attract private capital. International financial institutions should help resolve these problems.

Nuclear energy can play an important role in reducing poverty and ensuring long-term energy sustainability in developing countries. At the same time, the development and use of nuclear energy should include the development of energy infrastructure and personnel training.

IV. Factors contributing to reducing the role of conventional energy

A number of foreign governments (Germany, USA, France, Japan etc) have chosen to ensure energy security by reducing dependency on non-renewable sources of energy - imported oil and natural gas - through developing alternative electrical energy sources, primarily nuclear energy.

This is not an arbitrary choice. Several years ago most experts believed that oil would remain the main source of energy indefinitely but they have now changed their minds. According to some estimates, oil will remain the dominant source of energy for 30 years at the most, for several reasons.

Firstly, oil prices are high and fluctuate. In 2005 world oil prices rose by 42 percent as compared to 2004, while the average European imported natural gas price increased by 48 percent. At the same time, the share of fuel in the structure of goods has become highly significant.

However, from a strategic point of view, prices are not the main reason. A more important factor is that, as the number of energy consumers grows, especially in countries like India and China, a shortage of oil will become inevitable.

It is not possible to constantly step up extraction either. The oil reserves available are limited, and not only because the volume of the subsoil is limited but also for a number of other reasons. There is also an energy limitation, because the extraction of oil which is difficult to access may require more energy than it will generate. In this case cost becomes a secondary parameter.

Another source of energy is natural gas, which is also a valuable raw material for many other industries. Dmitry Mendeleyev said that burning natural gas is almost the same as using banknotes as fuel. Nevertheless, we still do it.

The third important source of energy is coal. For example, in Russia coal is the source of about 18 percent of all the energy produced. There is enough coal for another 300 years, but the use of coal is restricted by environmental regulations.

There is growing concern over atmospheric pollution which calls for urgent solutions.

In addition, there are problems relating to transportation infrastructure, which may prove inadequate to transport the growing volumes of conventional energy as energy consumption increases.

All this means that ensuring efficient, stable and environmentally safe energy at prices reflecting the fundamental principles of market economy is a challenge for our countries and humankind in general requiring solutions to a number of serious interrelated issues, such as:

- growing demand for energy resources (it is estimated that by 2030 demand will increase by more than half, with 80 percent of it met by fossil fuel, reserves of which are limited);
- growing dependency of many countries on imported fuel;
- the need for enormous investment in all stages of the energy production cycle;
- the need to protect the environment and resolve the issue of climate change;
- political instability, natural disasters and other threats.
- as all these issues are of a global nature, partnership should be forged between all the parties concerned in order to strengthen global energy security.

V. The role of nuclear energy in sustainable development

Nuclear energy plays a special part in solving the problems of energy resources, ensuring sustainable development and energy security. This has already been recognised by Russia and many other countries in the world.

We recognise that nuclear energy should be environmentally safe, cost-effective, stable in terms of non-proliferation and should be underpinned by a sound system ensuring security and safety of nuclear materials and facilities.

It will be impossible to reach a sustainable fuel and energy balance within the next 30-50 years without large-scale development of nuclear energy.

Today, nuclear energy is the only feasible and available source of energy valuable in terms of preserving the balance between world energy production and the growing demand for electric power. Nuclear energy is also attractive in terms of reducing atmospheric pollution and, consequently, resolving the problem of climate change.

One key point is that 30 to 40 years ago, when the nuclear energy industry was in its infancy, it was merely an aspect of military nuclear programmes. Large-scale civilian nuclear programmes were implemented mostly in countries where major military nuclear programmes existed.

Today, given increasing prices for hydrocarbons and the boom in energy consumption, nuclear energy has gained its own value.

i. Prerequisites for nuclear energy development

The situation in the world is very different now and characterised by two important features:

1. Nuclear energy development has become global. Whereas in the past only certain countries developed nuclear technologies, today the process has become truly global. More and more countries find it right and reasonable to have access to cheap and efficient nuclear energy.

2. Taking into consideration that in the area of nuclear energy almost no country in the world can act absolutely independently, the nuclear energy market is one where everyone depends on everybody else.

Such mutual dependence and the global nature of the market call for serious joint review of the rules governing this market. Given its tight links with military programmes, the market remained closed and isolated for quite a long time. Today, it has become global and more open, but a number of outdated and obsolete rules were retained.

In terms of ensuring safety and security of nuclear energy, the most important factor is creating open, transparent and equal conditions for countries to access the market of goods and services offered by the world nuclear energy sphere.

At the same time, it should be understood that improving public opinion regarding civilian nuclear programmes and relevant decisions by the leaders of States is a necessary condition but not the only one.

With no facilities and no proper set-up for the nuclear fuel cycle, there will be no nuclear renaissance. And there are still a number of tasks to be resolved in this area.

If new nuclear power plants are commissioned throughout the world, there will be enormous pressure on the first stage of the nuclear fuel cycle, whose major phases include the extraction of natural uranium, its enrichment and fuel production. Production will have to be expanded. Only if this development goes hand in hand with the development of generating facilities can we expect peaceful nuclear programmes to play the leading role in supplying humankind with energy.

A further important task to be resolved is the management of spent nuclear fuel and radioactive waste.

ii. Nuclear renaissance

Today, nuclear energy is an efficient and stable source of about 17 percent of electric power produced worldwide. At the same time, rapid economic growth in certain regions and countries has already made it necessary to plan ahead for new energy capabilities and development of the relevant production and energy infrastructure. According to IAEA estimates, between 30 and 80 percent of increased energy capacity in Asia, for example, can be achieved by building nuclear power plants.

With this in mind, the fact that nuclear energy development has been actively discussed worldwide, which is a true nuclear renaissance, seems reasonable and logical. Besides this, a nuclear renaissance is becoming increasingly feasible.

Considering that the experience of running nuclear power plants in recent years has shown that this kind of energy is efficient and safe, it is only logical that many countries have already adopted programmes for more widespread nuclear power plant construction.

Countries like Russia, China, India, the Republic of Korea, the USA and Japan have clearly stated their intentions as to nuclear power plant construction. For example, by 2030 nuclear energy may become the major source of energy in Japan, supplying over 40 percent of the country's energy.

Decisions to develop civilian nuclear power programmes have been taken in countries which have never developed and do not intend to develop the military component of nuclear programmes. Turkey has decided to build a nuclear power plant on the Black Sea coast. Construction is to begin in 2007, and three power plants will have been completed by 2015. The Australian Prime Minister has supported nuclear energy development in his country, and experts believe that nuclear electric power may already be generated in Australia in 10 years' time. Construction of a nuclear power plant in Poland is under consideration. Asia-Pacific countries also plan to develop nuclear energy.

In a number of other countries, such as Great Britain, Italy and even Germany, well-known for its anti-nuclear policy, there is growing discussion of the future role of civilian nuclear energy as a key component of the energy balance.

When evaluating the quantitative indices of nuclear renaissance American experts concluded that aggregate world nuclear power plant capacity will increase from 371 GWt in 2005 to 438 GWt in 2030, which is a very significant increase, especially since the commissioning of new nuclear power facilities has been a fairly rare occurrence in the last 20 years.

iii. Nuclear energy development in Russia

Russia is one of the many countries sharing this opinion.

In that country opting for national nuclear energy is not only a political decision imposed by circumstances but backed by a specific programme of action aimed at creating the full spectrum of necessary conditions. Nuclear energy is developed on the basis of the necessary legal, financial and administrative framework.

The Federal targeted programme entitled "Development of Russia's Nuclear Energy Production Complex in 2007 – 2010 and subsequently up to 2015" is a public-private partnership for building new nuclear energy facilities. Government support at this stage does not imply that Russian nuclear power plants are not competitive in comparison to other types of energy but acts as a compensation mechanism until market relations are developed. The Russian Government has decided that market relations should be introduced into the electric power sector after 2011.

In July 2007 the Russian Federation Government approved the Federal targeted programme "Ensuring Nuclear and Radiation Security for 2008 and up to 2015", which provides for state funding for management of spent nuclear fuel and radioactive waste and decommissioning, problems that remained unsolved in the previous stages of nuclear energy development.

A Federal Law has been adopted, providing for restructuring of the industry and a transition to market relations in its civilian sector. For the first time, legal entities have been granted the right to own nuclear materials and facilities, while state-owned enterprises in this sphere are to be transformed into joint stock companies.

This summer saw the founding of AtomEnergoProm, a holding comprising major civilian nuclear energy enterprises. The Nuclear Energy Production Complex open joint stock company is to concentrate the resources needed for the tasks ahead.

Today our minimum target is to ensure that at least 16 percent of energy is produced by nuclear power plants and the weighted average target is the index set by the Energy Strategy (22 percent), while a 25-30 percent share is called for in real terms, this being the average index of the developed countries.

Long-term technology policy envisages the development of a model design "Nuclear Power Plant 2006" based on a WWER reactor and gradual introduction by 2030 of new fourth-generation fast neutron reactor nuclear energy technology, complete nuclear fuel cycle and uranium-plutonium fuel, which should remove limitations with regard to fuel raw materials for the foreseeable future.

iv. Complying with the nuclear non-proliferation regime

Large-scale nuclear energy development across the world is closely linked with the access of more and more States to nuclear technologies, materials and equipment. This means that the international community faces issues related to nuclear non-proliferation and nuclear and environmental safety, as well as ensuring security and safety of nuclear materials and economic competitiveness of nuclear energy and reduction of the related risks.

In these circumstances, the States with developed nuclear industries should pool their efforts in order to provide assistance to States interested in developing nuclear energy.

In the current situation, given the new challenges and threats facing the world community, the balance between developing world nuclear energy and complying with the nuclear non-proliferation regime should be ensured.

Maintaining that balance is not an easy task. As already pointed out, more and more countries are opting for nuclear energy development, which will inevitably entail uranium enrichment and the need to process spent nuclear fuel. Building the nuclear fuel cycle facilities required is expensive. Another important task is IAEA control. Furthermore, there is always a risk that civilian technologies might be used for military purposes.

In this context, a problem arises of how, on the one hand, to guarantee access to nuclear fuel and services relating to spent nuclear fuel management for the countries concerned and, on the other hand, to restrict the spread of nuclear technologies and the construction of new nuclear facilities in different parts of the world and avoid new risks for the nuclear non-proliferation regime.

It is not possible for technical, political and ethical reasons to prohibit access to cheap and efficient nuclear energy for those countries.

This is impossible when access to cheap and efficient energy resources is a key prerequisite for development.

The task facing the world community is to develop new systems that would guarantee the right of any country in the world to use nuclear energy for civilian purposes while ensuring strict compliance with the nuclear non-proliferation regime.

VI. Nuclear fuel cycle initiatives

We recognise that this is an extremely complex matter and international cooperation is therefore especially important in seeking solutions to the aforementioned problems.

In recent years, a number of initiatives have been launched with regard to the nuclear fuel cycle, including the following:

- the initiative of Vladimir Putin, President of the Russian Federation, on energy support for sustainable human development, resolving the issues of non-proliferation of nuclear weapons and improving the environmental situation on the planet, announced during the Millennium Summit in 2000, and of the USA (the IAEA International Project on Innovative Nuclear Reactors and Fuel Cycles);
- the International Forum Generation-IV project;

- IAEA activities geared to identifying a mechanism guaranteeing fuel supply for nuclear power plants in the countries developing nuclear energy;
- bilateral Russian-American cooperation in civilian nuclear energy;
- initiative of the President of the Russian Federation of 25 January 2006 on developing a global nuclear energy infrastructure (International Uranium Enrichment Centre);
- the US Initiative for Global Nuclear Energy Partnership (GNEP);
- joint statement by the Presidents of the United States of America and Russia on Nuclear Energy and Non-Proliferation and Joint Actions, of 3 July 2007.

These and other initiatives are all important, each having its own advantages and limitations.

The initiative of the Russian Federation President of 25 January 2006 on developing a global nuclear energy infrastructure is one of the mechanisms aimed at allowing equal access to nuclear energy for all the countries concerned while ensuring compliance with the requirements of the nuclear non-proliferation regime.

The initiative is aimed at further developing nuclear energy as a basic component for ensuring global energy security. We believe that the Russian initiative provides a feasible opportunity to develop nuclear energy across the world swiftly and safely taking due account of the need to ensure non-proliferation of the most sensitive nuclear technologies for uranium enrichment and spent nuclear fuel processing.

As with its national nuclear energy development programme, Russia's approach to these issues involves gradual, phased supply of resources and specific progress. We are well aware that what the world is expecting from us is not promises and attractive but unworkable models, but specific yet small-scale actions proven in practice.

Uranium enrichment technology is the most sensitive part of the first stage of the nuclear fuel cycle in terms of proliferation. Therefore, a solution is required that would curb the tendency of countries striving to develop nuclear energy to independently develop enrichment technologies. This solution should meet at least three requirements: it should guarantee a reliable supply of nuclear fuel, be commercially attractive and ensure compliance with the nuclear non-proliferation regime.

Since uranium enrichment is a necessary technological process in producing nuclear fuel for power plants, and at the same time the most sensitive part of the nuclear fuel cycle in terms of proliferation, the first International Uranium Enrichment Centre (IUEC) has been set up in Angarsk, in the Russian Federation.

In practice, the Centre guarantees States access to uranium enrichment capabilities to meet nuclear fuel needs without creating their own nuclear fuel cycle, which consumes a great deal of time and resources.

The sponsors of the Centre, under an inter-governmental agreement of 10 May 2007, are the Russian Federation and the Republic of Kazakhstan. The Centre's main task is to provide guaranteed access to the uranium enrichment capacities of the Angarsk Electrochemical Plant Federal State Unitary Enterprise with a view to providing uranium enrichment services so that fuel for nuclear energy may be produced.

To ensure that the Centre is run on market principles, it was set up under Russian Federation laws as an open joint stock company, making the initiative more financially attractive, since participating organisations will not only have access to uranium enrichment services to satisfy their needs but also receive dividends from the Centre's activities.

Third states may join the Centre at any time, with no political conditions attached.

Russia has been working constructively with the IAEA to identify specific parameters for the participation of the Agency in the Centre's activities.

Since the materials of the Centre should be covered by IAEA safeguards, we have taken an unprecedented step: to enable the Agency to monitor activities at the Angarsk Electrochemical Plant, which is the underlying basis for the Centre, the Plant has been excluded from the list of especially

sensitive facilities of the Russian Federation and included in the list of nuclear fuel cycle facilities covered by IAEA safeguards. The necessary procedures to include the Centre in this list are currently being completed.

To our mind, the Centre could very well become involved in the IAEA project on guaranteed supplies. The Centre can guarantee uranium enrichment services with the use of time-tested, technology-intensive and competitive technology of isotope enrichment, as well as contribute to establishing the system of guaranteed supplies of nuclear fuel to satisfy nuclear energy needs.

In response to the initiative of Mohamed ElBaradei, IAEA Director-General, on a nuclear material bank under the auspices of IAEA, the Russian Federation intends to create an enriched uranium reserve whose storage is to be entrusted to the Centre. Materials from this reserve will be supplied upon IAEA request in *force majeure* circumstances (when both enricher and the market deny uranium supplies for political reasons) to any State developing a civilian nuclear energy programme on condition that it complies with its non-proliferation commitments.

We believe that the Russian proposal to create an enriched uranium reserve at the Centre as a branch of the IAEA nuclear fuel bank will enable us to implement in practice the new mechanism provided for by the guaranteed supplies concept and will be a step towards creating a world infrastructure for nuclear energy of the future.

President Putin's initiative is based on the understanding that there should be numerous international centres around the world. Russia is not striving for a monopoly; we are just trying to provide an example by setting the Centre up on our territory.

On 3 July 2007 the Presidents of Russia and the USA adopted a Joint Russian-American Declaration on "Nuclear Energy and Non-Proliferation: Joint Action".

This Declaration reflects our common approach regarding a new form of joint action to support the expanded use of nuclear energy and implementation of earlier initiatives in the field of multilateral approaches to the nuclear fuel cycle.

To attain the goals set out in the Declaration, we propose activities in fields such as supporting the supply of modern nuclear reactors, promoting the development of infrastructure necessary for nuclear energy and supporting access to financial resources for the construction of nuclear power plants, including loans from international credit organisations, supporting guaranteed supplies of nuclear fuel, and providing assistance in managing spent nuclear fuel.

It should be stressed once again that our task is to give all States intending to use and develop nuclear energy an opportunity to freely choose their nuclear fuel cycle strategy, including the opportunity to benefit from nuclear energy without creating their own nuclear fuel cycle elements which would be costly and unsafe in terms of nuclear safety and nuclear non-proliferation.

Furthermore, Russia supports other nuclear fuel cycle-related initiatives, including the initiative by the US President on Global Nuclear Energy Partnership and the proposals made by the group of major suppliers of enriched uranium within the guaranteed supplies scheme.

VII. Innovations in nuclear energy

Of all innovative energy technologies, nuclear energy is the most feasible option and, thanks to scientific and technical advances in the field and developed infrastructure, can take the lead in energy production in the 21st century and ensure sustainable human development.

At present, many nuclear energy countries are implementing programmes aimed at creating an image of nuclear energy acceptable for both producers and consumers, drawing up principles, requirements and criteria for its creation and functioning in the future, and specifying and launching the necessary research and development.

Innovative nuclear energy will be based on principles differing from those typical for modern nuclear energy, which is based on fuel supply, electricity generation and spent nuclear fuel management technologies, each run as a separate and independent operation.

Innovative nuclear energy will bring together all these operations within one technologically closed-loop fuel cycle, solving two major problems: where fuel comes from and where nuclear waste goes.

What is the most feasible option for supplying energy for the sustainable development of civilisation today?

The most energy-rich raw material known today is natural uranium. The aggregate capacity of the world uranium reserve is ten times greater than that of world reserves of hydrocarbons — coal, oil, and natural gas together. However, modern nuclear energy technologies involving thermal reactors make it possible to use only one uranium isotope — U-235. Its natural uranium content, consisting of a number of different isotopes, is as low as 0.7 percent. The content of another component of this mix - U-238 - is 140 times higher, while almost 90 percent of it goes into enrichment facility refuse and another 10 percent into spent nuclear fuel, which is often inaccurately referred to as nuclear waste. In general, the thermal reactor-based system can extract energy from only about 0.5 percent of all nuclei of natural uranium. If this type of nuclear energy is intensively developed, we will run out of uranium very soon, in another 50 years.

One of the major advantages of nuclear energy raw material is its renewability, thanks to the possibility of generating energy and regenerate fuel using fast neutron reactors.

This technology is now ready for large-scale introduction, and Russia is leading the field in this respect.

This is confirmed, in particular, by the successful functioning of fast neutron sodium reactors BR-10, BOR-60, BN-350 and BN-600. The latter has been operated for over 25 years at the Beloyarskaya Nuclear Power Plant in the Urals, and it is the only commercial fast reactor in the world. Another, more powerful reactor, BN-800, is now being constructed there.

In fast reactors, both all natural uranium and accumulated refuse of enrichment enterprises and nuclear waste of thermal reactors will become fuel.

There are various development options: a fast reactor can be constructed with a core that generates the same amount of fuel which is subsequently burnt.

The system can also be geared to expanded fuel generation in a special blanket around the core, which will produce more plutonium than will be burnt. This excess plutonium can be used to launch new fast reactors.

In addition, there is natural thorium, the world reserve of which is several times greater than the world uranium reserve. Using fast reactors this resource can also be easily integrated in innovative nuclear energy.

Achieving these ambitious tasks will depend on numerous interrelated factors. In addition to creating and developing basic elements of a new technological platform for innovative nuclear energy, many new industrial facilities should be constructed and new specialists should be trained for them. A brand new nuclear energy system should be deployed, involving a closed-loop fuel cycle that is safe, low-waste, environment-friendly and sustainable in terms of nuclear weapon proliferation.

All this requires time and considerable investment. Investing incomes from oil and gas could boost the development of this energy resource. As a result, in 30 to 50 years' time the world could have a virtually inexhaustible source of energy for a historical period of several thousand years.

i. The IAEA International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)

International cooperation has been launched and developed to devise principles, requirements and criteria for the future creation and functioning of innovative nuclear energy.

At the Millennium Summit (6 September 2000, USA) the President of the Russian Federation, Vladimir Putin, proposed an initiative on the sustainable development of humankind and radical means of addressing the issues of non-proliferation of nuclear weapons and the environmental protection of planet Earth.

The Russian initiative has been implemented through the IAEA International Project on Innovative Nuclear Reactors and Fuel Cycles which at present brings together 28 countries including the leaders in world nuclear energy, the USA, France, Japan, and the European Commission. Dynamically developing countries such as China and India have played an active part in the project almost since it was launched.

INPRO is aimed at developing innovative nuclear energy systems and nuclear fuel cycles excluding the use of plutonium and highly enriched uranium, as well as enrichment and processing technologies sensitive in terms of proliferation of nuclear weapons.

The Project has been widely supported worldwide, which is reflected in the relevant IAEA General Conference and United Nations General Assembly resolutions and the documents of the Saint Petersburg G8 Summit.

INPRO will enable nuclear energy to make an adequate contribution to satisfying the growing demand for energy in the 21st century.

INPRO will also serve as the scientific and technical basis needed to fulfil the tasks set out in the Russian President's initiative on developing global infrastructure for nuclear energy (2006), and principles of Global Nuclear Energy Partnership.

This international project will provide an opportunity to unite all the participating countries concerned, including both nuclear technology countries and nuclear technology users, in jointly reviewing means of satisfying energy demand, and to facilitate implementation of international initiatives aimed at developing and expanding the use of nuclear energy for civilian purposes in strict compliance with the nuclear non-proliferation regime.

We view the INPRO as a platform for joint identification of international and national measures required for devising and deploying innovative nuclear energy systems and the use of advanced and economically competitive technologies, characterised by enhanced safety and minimum risk of proliferation and negative effect on the environment, in the innovative process.

Expanding the use of nuclear energy as a reliable source to satisfy the growing energy demand in developing countries calls for solutions for a number of tasks:

- devising common user requirements for nuclear technology and requirements for infrastructure in the consuming country;
- supporting international cooperation in identifying and implementing innovative solutions meeting the new requirements for nuclear technology;
- promoting infrastructure development and personnel training;
- supporting regional approaches;
- control over and participation in creating international nuclear fuel cycle centres;
- ensuring guaranteed supplies.

Innovations in nuclear energy at this stage of its development and expansion of its use call for a responsible and structured approach.

Methodology could be developed to attain this goal, a kind of international standard for systematic evaluation of nuclear energy solutions and scenarios at the national, regional and global level, taking into consideration all critical aspects of nuclear energy development (safety, environmental friendliness, cost-effectiveness, resistance to proliferation etc), as well as current achievements and potentially valuable technological solutions.

Using methodology like this could make it easier to forecast national and regional development of nuclear energy, identify optimum options and potential difficulties, provide countries with up-to-date recommendations on risk evaluation and prevention etc.

ii. International Thermonuclear Experimental Reactor (ITER) project

Special attention should be focused on one innovative nuclear system in particular, the International Thermonuclear Experimental Reactor (ITER) project.

The significance of the ITER project can hardly be overestimated: it is deservedly viewed as a real means of harnessing a new source of energy for the benefit of all humankind.

- Thermonuclear energy is attractive because of the virtual inexhaustibility of fuel resources and its environmental friendliness. Thermonuclear reactor fuel (hydrogen isotopes) can be found in limitless quantities.
- Thermonuclear energy is safer than nuclear energy. It does not pose a threat of Chernobyl-type accidents and leakages of radioactive substances, as it is based on synthesis and not fission and therefore cannot result in a chain reaction.
- The initial designs for a system involving magnetic plasma confinement called Tokamak, which served as a basis for the ITER project, were developed by Russian scientists. Tokamak (stands for Toroidal-Shaped Envelope with Magnetic Coils) has been the only survivor of the 114 thermonuclear reactor concepts proposed by physicists around the world.
- The Tokamak concept was tested by the Kurchatov Institute experts and was proclaimed a success. The achievements of Russian scientists in the field of superconductors and original methods of fine electron plasma heating also played a significant role in the ITER project.

However, the design and technologies of thermonuclear power plants are extremely complex. ITER will go down in history as an ambitious global project implemented through consolidated efforts of the whole of civilisation. Its intellectual and financial scale is even greater than that of the International Space Station. A constant temperature of 150 million °Centigrade has to be maintained inside a thermonuclear reactor (whereas the temperature inside the Sun is only 20 million °Centigrade). It is under this plasma temperature that the hydrogen isotopes burn, leaving no radioactive refuse. At the same time, the amount of energy produced with a unit of thermonuclear fuel is 10 million times greater than those produced through uranium nuclei fission in nuclear power plants' reactors.

ITER is designed to overcome the final obstacle on the way to creating the first thermonuclear power plant, which will resolve the energy problems facing humankind.

Implementing innovative projects like INPRO and ITER could provide the solutions needed to ensure global energy security and sustainable human development.

VIII. Conclusions

Today, there is growing interest in nuclear energy as a means of ensuring energy supplies for the world's sustainable development. Developing nuclear energy will enable humankind to resolve one of the most pressing global issues, the issue of climate change. Innovative development of nuclear energy will allow it to be regarded as a renewable energy source that can meet the growing demands of humankind. At the same time, large-scale use of nuclear energy in the 21st century will face not only system and technology obstacles characteristic of modern nuclear energy, but also political, infrastructure and economic restrictions.

Overcoming those obstacles and resolving the task of comprehensive energy support for sustainable development is closely linked to the construction of a world infrastructure for nuclear energy based on a new innovative technological platform, including the establishment of international centres providing nuclear fuel cycle services under IAEA safeguards (uranium enrichment, managing spent nuclear fuel, and personnel training).

Foundations for a global nuclear energy infrastructure cannot be laid without broader international cooperation and active participation of all the countries concerned.