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NUCLEAR ENERGY AGENCY
COMMITTEE FOR TECHNICAL AND ECONOMIC STUDIES ON NUCLEAR ENERGY DEVELOPMENT AND FUEL CYCLE

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1st Meeting of the Ad hoc Expert Group on "Nuclear Energy and Security of Supply"

Summary Record

22-23 November 2007
NEA Headquarters, Issy-les-Moulineaux

Pal Kovacs
Tel: 33(0)1 45 24 10 68
Email: Pal.Kovacs@oecd.org

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Ad hoc Expert Group on "Nuclear Energy and Security of Energy Supply" (SoS)
Summary Record of the 1st Meeting

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Item 1. Welcome

1. Stan Gordelier, Head of the Nuclear Development Division at OECD/NEA, greeted all the participants and the student observers from the Institute of Political Studies of Paris. He thanked them all for coming to the meeting and opened the meeting. In his speech he presented first the OECD/NEA and how this organisation works. The project's background and issues are relating to security of energy supply in a sustainable economy framework that has got a lot of attention from public and politicians. Member governments delegated their experts to conduct an analysis, to share country experiences and to draw out key messages. Secretariat is there to help the Expert Group. Then he mentioned that nuclear power is seen as part of the answer to both climate change and security of supply issues. It is virtually CO_2 free. Fuel for nuclear reactors is available from a wide selection of countries and the biggest providers are regarded as politically reliable countries. There are very few studies on the actual role of nuclear energy to alleviate anxieties on security of energy supply. That is where the Expert group comes in. The main goals of the study are: identification and categorisation of the causes of insecurity; proposals for different methodologies to assess the role that nuclear power can play in improving energy security; and presentation of the lessons learned from different country experiences. Finally he pointed out that the objective is to publish the findings in a formal OECD NEA publication by the end of 2008.

Item 2. Introduction of participants

2. The Secretariat invited participants to introduce themselves briefly, highlighting their specific interest and expertise in the field of the study. It was noted that Austria, Slovenia and Germany delegates had sent apologies for not being able to attend the meeting and Belgium delegate and the OECD IEA participant will only be present for the discussions on the 2nd day. Experts from Australia, the Czech Republic, France, Hungary, Italy, Japan, the Netherlands, Turkey, the Slovak Republic, Spain, the United States, and representatives of the European Commission, the Euratom, and the IAEA and participants from OECD delegations of Turkey and Taiwan introduced themselves (see list of participants can be found in Appendix 2).

Item 3. Adoption of the agenda

3. The proposed agenda was approved with one change. The Secretariat proposed to postpone the nomination of a Chairman after Agenda Item 8 to allow the group to discuss the chairmanship responsibilities (see NEA/NDC(2007)9 for a preliminary agenda and Appendix 1 to this document for a detailed agenda as approved by the Expert Group).

Item 4. Overview of the project objectives and scope

4. Pál Kovács, Secretariat to the project, presented the objectives of the study. As it was requested by the Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle (NDD) the study has to identify relevant quantitative approaches in evaluating of the role of nuclear power in improving security of energy supply and providing decision makers with robust, authoritative

information to support technology choices for electricity generation. First the Secretariat prepared a preliminary study that:

- reviews the literature on analysis techniques developed to assess risks to insecurity;
- investigates the relevance of such techniques to identify and quantify the risks associated with insecurity of electricity supply;
- reviews the analysis to date of the security of supply (SoS) issue.

5. The second phase, starting with the date of the 1st meeting of the Expert Group, the group is asked to review the methodology and indicators proposed, to complete the list of literature and to assess the role of nuclear energy in enhancing security of electricity supply in the light of the methodology(ies) presented and the indicators agreed by the Expert Group during the 1st meeting.

6. The four dimensions (geopolitical, technical, economic, and environmental) of SoS were noted as well as the work plan and the main milestones towards publication.

7. Prof. William D'Haeseleer commented the report prepared by the Secretariat. He proposed discussing 3 dimensions of SoS:

- Strategic energy security supplies, the amount of fuel stocks available. Strategic fuel stocks require proper contracting and the effect of storability should also be considered to decrease energy dependency.
- Consumers need continuous power flow while natural gas has limited storability and electricity is not storable. Adequate balance for the amount of active power should be achieved.
- To avoid blackouts, electricity supply security should be achieved through reactive power balance and voltage stability.

Item 5. Presentation of room documents

8. Pál Kovács listed, during his presentation, all the OECD/IEA, NEA publications and other relevant documents related to security of energy supply.

9. The Secretariat also prepared a CD rom that contains all the relevant studies, reports and documents related to security of energy supply, in addition to country presentations to the Expert Group meeting. It was noted that the information stored on the CD rom will also be presented on the restricted website for the Expert Group the access to which is limited only to the members of the group. It was noted that the details on how to access the restricted website will be sent out soon after the meeting.

10. The CD rom was distributed to Expert Group members on the second day of the meeting.

Item 6. Presentations on main issues in relation to security of supply and the role of nuclear energy in improving security of electricity supply in their home countries

11. Following countries gave national presentations: Belgium, Hungary (2), Japan (2), the Netherlands, Spain, United States, European Commission, Euratom, IAEA and the OECD IEA.

12. **Ms. Alessandra Fagiani**, Italian delegate, distributed a summary report issued by the Italian Ministry for Economic Development on the actual Italian Government's policy on nuclear energy and the main issues related to SoS in Italy.

13. **Dr. Christian Kirchsteiger**, European Commission delegate, presented results of the conference on the "Safety and Security of Energy Infrastructures" jointly organised by TREN and JRC SEIF-CV in 2005. Regarding terminology, he proposed to separate clearly safety, security and SoS. He also emphasized the need for reciprocal inclusion of safety, security and SoS in standards and norms. He noted that the preliminary study, prepared by the Secretariat, covered the problems experienced with different assessment methods (including full probabilistic methods) and the SoS indicators. He noted a set of alternative models for quantification namely the ECN model, the NEA Nuclear Sustainability Indicators and the UN Sustainability Indicators. He mentioned that it would be a challenge to compare different approaches to define indicators that evaluate the contribution of nuclear power to SoS and to define CO_2 savings due to nuclear power generation as regard to climate change.

14. **Mr. Ronald Hagen**, United States delegate, provided some examples of SoS experiences in the United States. A basic issue in the US is how to fuel the nuclear fleet. The current gaseous diffusion technology used at the only remaining US enrichment is old. Currently, there are two gas centrifuge plants under construction and conversion capacity is scheduled to expand in the country. One firm is also interested in laser conversion technology that has never been used before and another firm is examining an additional gas centrifuge facility. The policy framework that supports nuclear power industry to be developed in the US includes the following main components:

- streamlined regulatory processes (including Early Site Permits, Combined Operating Licences and Limited Work Authorisations);
- NP2010;
- domestic and international Global Nuclear Energy Partnership (that develops reliable fuel services, grid-appropriate reactors and proliferation resistant technologies);
- domestic and international Generation IV (that supports development of new generation reactors); and
- the Energy Policy Act.

15. He emphasized that **price of nuclear fuel might be a crucial issue in the future** as the uranium supply is dominated by around six mines (such as Cigar Lake in Canada and Ranger in Australia) that provides much of the world's nuclear fuel. The future uranium price will heavily depend on inventories and long term agreements on fuel supply that will expire in the coming years.

16. **Mr. Miklós Horváth,** maintenance manager of Paks NPP in Hungary, observer to the meeting, presented a practical example on how the application of the (n-2) security criterion has helped Paks NPP to avoid blackout caused by power grid disturbance after switching-off the 380 kV double circuit line Conneforde-Diele on the E.ON Netz grid. He presented the technical details of the busbar reconstruction using SF6-type circuit breakers.

17. **Mr. Hiroshi Ujita** Japanese delegate, representing the Institute of Applied Energy (METI) provided an overview of Japanese Experiences with Security of Supply. He explained why Japan has the lowest energy self-sufficiency ratio among the major industrialised countries (4%) as nuclear power is discounted and how scenario planning technique is used by METI. He listed all the uncertainty factors in scenario planning by the Pacific region. He presented a possible pathway for Japan as a combination of three main future power generation technologies (fossil, nuclear and renewable energy) to achieve secure

energy supply up to 2100. Further development of nuclear power generation seems to be the only reliable energy strategy path for Japan. He presented a model for energy security evaluation for the Pacific region.

18. **Mr. Koji Nagano** Japanese delegate, representing CRIEPI, concentrated his presentation on how to quantify energy security. The question is how to achieve the best energy mix. He emphasized the importance of energy resources accessibility in sufficient amount in the Japanese context. The current share of nuclear power generation is 35% and the energy strategy tries to increase the nuclear share up to 50%. As it was evaluated by CRIEPI, it is rather ambitious to meet the CO_2 target in Japan for 2100. The potential risk of large earthquakes in Japan calls for special attention in formulating the energy strategy. He explained the difference of risks for some countries and presented the consequences to replace nuclear power replacement with oil based power generation using the "import premium" concept. He also explained the possible effects of future centralised and decentralised electricity generation.

19. **Mr. Henk Wels** Netherlands delegate from NRG, first presented NRG activities related to risk management and decision analysis. KEMA (in Arnhem) is interested in fossil fuel, while ECN (in Petten) perform more work on renewables. After presenting the current status of nuclear power generation he showed grid reliability indicators (production supply, transport balance) before and after liberalisation which are direct indicators to security of supply in the Netherlands. He noted that the Netherlands are dependant on import and on scenarios to build new plant. In the Decision Analysis method of the Stanford University, the goal of decision analysis is to find the weakest link in the chain and quantify non-numerical factors dominant to decision-makers. He has shown an example of a detailed influence diagram of different factors potentially important for a decision and the results of the modelling in a tornado diagram that shows the level of dominancy for different decisions. He also mentioned factors important for security of supply in the Netherlands, namely:

- cooling water supply temperature problems experienced at fossil plant sites;
- lack of investment in power plant replacement projects.

20. **Mr. José Luis Perez Rodriguez**, Spanish delegate, representing ENDESA started by explaining the first Spanish winter power storage that just happened the day before his arrival to the meeting. Spain experienced 56% increase in electricity consumption in 9 years. The current electricity production is mainly based on gas. The growing costs have not completely been transferred to consumers. The country depends largely on imported oil and natural gas. Based on the structure and the interconnections of the grid, Spain behaves as an island – like Japan. Despite the energy saving policies implemented by the government, the emissions are steadily growing since 1990. As a countermeasure only gas power policy is applied, Spain will have serious problems to comply with Kyoto Protocol. To avoid more blackouts the installed capacity is weak. The energy model has to drastically change but there is no political support for nuclear power generation. Main message of ENDESA is "diversification of energy sources is possible".

21. **Mr. Ian Cronshaw,** representing OECD IEA, provided a global overview on energy challenges. He mentioned that public does not want expensive energy while the price of oil is around 100 USD/barrel and there is less hope each year for improvement. In WEO-2007 global energy demand set to grow by 50 to 53% in next 25 years but:

- OECD resources are in decline;
- OECD production is falling steadily;
- resource nationalism is experienced;
- imported gas and LNG increasingly comes from far distances;

- significant investment are needed regarding gas exploration, development, transmission and storage;
- internationally traded coal prices have reached new highs in 2007;
- almost all energy sources are becoming more expensive.

22. WEO-2007 prognoses that while China and India will continue to grow. Consumption of fossil fuels continues to grow markedly. Several coal-based power technologies are available today but coal price is coming up as gas prices are growing. China becoming a net coal importer in 2007 is a major coal price driver. Fuel efficiency might be improved globally, but IEA has already included a significant improvement in energy efficiency in the analysis.

23. In Europe, liberalisation improved capacity utilisation, but combined with an aging energy portfolio, the time for new investment is now. There is a need for diverse electricity and imported gas, more nuclear power and more grid interconnection at the same time. Grid augmentation is the key to integrate Europe into a much bigger market. Reserve power generating capacity has reached a point where investment is needed, but it does not come. Gas consumption is also peaking. WEO-2007 refers to Norwegian gas production is being limited. In Germany the future of gas consumption is peculiar. Globally, gas and lignite small power plants will likely being built.

24. In the OECD countries, hydro power is falling because of less rainfall, but of course this trend may reverse.

25. Demand side solutions are important for the future. Cut-off of large consumers can be an efficient method for peak load reduction. However, this mechanism works for the Nordic market but might not work in other places.

26. Supply side time frames for nuclear energy, including uranium mines, are rather long. The average construction time of reactors is approximately 5 years. For new capacities, the real issue is not the CO_2 reduction or replacement of a current technology with natural gas, but the time necessary to replace technology.

27. Key messages of WEO-2007 are as follows:

- Start now a new investment cycle.
- Cleaner energy mix for the coming 30-40 years. Even the 550 ppm CO_2 target would require very well developed technologies now.
- In order to respond to investors, we need a faster licensing period, establish proper regulatory environment and reduce regulatory uncertainty.
- Act according to CO_2 and carbon prices.
- More public debate and clear market signals are needed.

28. Mr. Stan Gordelier noticed that WEO-2007 calculates with 300 new build NPPs by 2030, and even with this assumption, the 450 ppm CO_2 emission target is gone. Therefore, countries should really start building now.

29. As a policy instrument, coal fire plants start to suffer from higher CO_2 prices. WEO main messages are that both technology and policy instruments are needed to improve the current situation. Stability of regulatory regimes is an important key for both instruments.

30. **Dr. János Hauszmann,** Hungarian delegate, representative of the Paks NPP, presented the Fuzzy model developed to analyse the influence of economic, societal, environmental and legal factors important to security of energy supply and the risks related. He emphasized that research on security of supply should not only be based on mathematical-statistical methods that are taken from past experiences. It should also be dealing with information from people's expectations that sometimes drive prices. According to information collected from the media on the complex environment surrounding nuclear power generation, he defined the dominant factors and it's relating features. He showed the "radius of relevance" at global, industrial, regional and local (company) levels. He also presented the positive and negative trends for a set of the dominant factors for nuclear power. He noted that currently there are no solutions provided for a 4 000 MWe capacity replacement in Hungary.

31. **Dr. Zsolt. Pataki**, representing the European Supply Agency, first noted that ESA was formed because of SoS reasons as it's role is to ensure security of nuclear supplies to users in the European Community. The instrument is a "common supply policy" that is based on equal access of nuclear operators to sources of supply.

32. In the European context, both market and regulatory perspectives are relevant to the security of supply. He mentioned several important issues related to security of supply in Europe, namely:

- Nuclear power produces 32% of Europe's electricity with 152 reactors spread across 27 Member States.
- Nuclear energy is the largest source of low carbon electricity in the EU.
- Main advantage is that uranium resources are relatively well dispersed around the globe and, despite uranium price increases, fuel costs are still relatively low compared to electricity generation from fossil fuels.
- Despite the lack of uranium resources on the EU territory, several companies in the EU are active in uranium mining elsewhere.
- Significant parts of conversion, enrichment and fuel fabrication are performed in the EU.

33. Regarding market uncertainties, ESA expects some problems in the secondary sources as DOE depleted uranium inventory will run out by 2013. The time period covering 2010-2015 is estimated to be critical for uranium enrichment because of the transition from the gas diffusion technology to centrifuges. The ESA Annual Report is available on the ESA public website and he proposed to add this document to the reference list. As recommendations he emphasized the importance of the adequate level of strategic inventories and diversification of fuel supply sources.

34. **Mr. Zafer Ates**, First Secretary of the Permanent Delegation of Turkey to the OECD gave an overview of the energy situation in Turkey. There are no NPPs in the country at this moment. The energy demand has been increasing over the past decades. Currently Turkey relies heavily on fossil fuel. Gas power plants produce 45% of electricity. Electricity consumption increases by 7-8% annually. By 2020, the power demand is expected to increase by 40-56GW. Rational and sustainable energy policy is essential for the country. Iraq and Egypt natural gas and offshore oil are new energy sources. The law that provides the framework to develop nuclear energy has been approved by the President just two days ago (20/11/2007). Depending on the interest of the private sector, 5 000 MW nuclear capacity is expected to be put into operation by 2020, which will represent 5-6% of total electricity production. State guarantee might support private initiatives.

35. Answering the question from the Japanese delegate, he explained that Turkey wants to become a reliable transit country between the producer countries and Europe in general and the EU in particular, providing alternatives to current supply routes like the planned Nabucco gas transit line.

36. **Ms. Alessandra Fagiani**, Italian delegate, distributed the illustrative record of the Ministry on the main issues related to security of energy supply. She also explained that Italy is getting more active in the area of nuclear R&D. Several days ago, a bilateral co-operation agreement has been renewed between the United States and Italy in many nuclear fields among them the decommissioning the waste disposal and the development of new reactor technologies. The same week when Italy celebrated the 10 year anniversary of the nuclear moratorium, the country joined the GNEP. The Italian government is also considering participating in GIF. The country has a well-developed natural gas transport system allowing diversified supply from the Russian Federation, Algeria and other countries. However, Italy relies highly on natural gas. Because of related environmental problems, the country needs to change its energy strategy. R&D in Italy currently concentrates on electricity transmission, clean coal technologies, H_2 economy, Generation-IV International Forum, radioactive waste management.

37. Dr. Christian Kirchsteiger proposed to discuss risks associated to imported electricity. Given the difference between country borders and international company borders to what extent is it feasible to count on imported electricity, instead of constructing new power generating units at home.

38. Answering the question of the EC representative, Ms. Alessandra Fagiani explained that, for nuclear phase-out countries, strategic nuclear investment abroad can contribute to improve security of electricity supply in the home country.

39. **Prof. William D'Haeseleer** Belgium delegate, representing the Energy Commission 2030 that was established in 2005 by Royal Decree in Belgium. In his presentation he highlighted the current energy situation in Belgium and the objectives of the scientific and economic analyses to evaluate Belgium's options with regard to the energy policy up to 2030. As he explained the main goal of the study was to assure an energy system that simultaneously guarantees security of supply, produces electricity environmentally friendly and at affordable cost for the society. Medium-term dependency on imported primary energy in Belgium is 79% while long-term dependency is calculated to be at 97%. The study showed that the more the CO_2 emission target is decreased the CO_2 tax value increases dramatically. The baseline scenario that considers 30% emission reduction by 2020 is not sustainable given the breakthrough of CCS technologies is uncertain. The analysis also covered the carbon value and the amount of GDP supporting CO_2 reduction with and without nuclear and CCS. The study concluded that 30% domestic energy-related CO_2 reduction is impossible; a realistic domestic Belgian CO_2 reduction might be around 15% by 2030. Alternative scenarios were also presented.

40. The Energy Commission 2030 also provided qualitative reflections on natural gas dependence for Belgium. The number of major natural gas reserves is limited. They are the Russian Federation, Iran and Qatar. Huge investment should be made into power generation because by 2030 all power generating units have to be replaced. Demand for gas in each scenario is increasing by 2030. There is a controversial development for electricity demand that is increasing and the gas sources and financial resources that are decreasing. He presented a figure on the adequacy for electric power generation for the European countries. As a result of the portfolio analysis three different factors are relevant ensuring security for the demand and supply side: diversity on primary sources and technologies, stable investment climate, transmission and distribution networks.

41. Answering the question of the Japanese delegate on CCS infinite potential he explained that Belgium has no host formation for CO_2 storage. The market value for storage expected to be many times more than it is assumed today. Belgian experts think that industrial scale CCS by 2030 would be a too

optimistic assumption. The future role of nuclear power depends on the policy makers. The study presented only tendencies and not the right values. Aging of power plants were also assumed.

Item 7. Issues of common interest to be addressed in the study

42. **Dr. Christian Kirchsteiger** proposed assessing the amount of CO_2 avoided due to nuclear power generation to decrease the effect of climate change. The European Commission is interested in presenting fuel SoS events and the role of the European Supply Agency, mapping current SoS activities in different countries; investigating transboundary impacts; and analysing how can more SoS-robust energy networks by realised. He recommended using fully quantitative complex models for the assessment.

43. **Mr. Miklós Horváth** proposed applying the (n-2) security criterion for high power grid design that improved security of electricity supply in the Hungarian case.

44. **Mr. Hiroshi Ujita** proposed using a risk evaluation method to assess:

- energy system costs;
- price fluctuations;
- availability of suppliers and supplier routes;
- availability of energy sources including oil, gas, solar;
- effect of potential disasters;
- effect of sabotage;
- effect of energy crisis (contingent and structural) and their countermeasures.

45. He recommended analysing and optimising energy security as a combination and variation of individual safety and energy structure.

46. **Mr. Koji Nagano** proposed doing the quantification and valuation of different energy reserves and using the "import premium" model to illustrate the effect of replacement strategies for different energy resources.

47. **Mr. Henk Wels** proposed using the quantitative "decision analysis" method developed by the Stanford University for modelling. The goals are to find dominant factors that influence security of energy supply, to quantify all factors based on their importance and to provide graphical interpretation (tornado diagram) to analyse the results. He proposed to estimate the risks of blackouts and brownouts.

48. **Dr. János Hauszmann** proposed collecting and analysing news on SoS, from the past and for the coming time period, that contain factual information and visions about the future. The analysis would be supported by statistical and artificial intelligence devices, information theory considerations and soft logic. The results of the analysis will then arrive to a Fuzzy model that will aggregate all the statements that will be also suitable to perform simulation.

49. **Prof. William D'Haeseleer** proposed working on a portfolio analysis, similar to the one performed in the Belgian study, covering the CO_2 tax level and the GDP share necessary to meet SoS requirements for electricity production at a regional level. He noted that the Belgian model is run by Athens University.

Item 8. Nomination of the Chairman

50. On behalf of the Secretariat, Stan Gordelier suggested electing the Chair and nominating a co-Chair in order to lower the burden of the Chair. The Group welcomed the proposal and elected Mr. Ronald Hagen to Chair and Mr. Henk Wels to co-Chair the Expert Group, and they kindly accepted this joint responsibility.

Item 9. Review of the outline of the study

Discussions

51. Koji Nagano emphasized some important and missing issues. He explained that the different notions and concepts depend on the time horizon. As an example, he presented the simulation results of the SRES-B1 scenario of the Integrated LDNE21 Optimization Model developed by CRIEPI. This scenario investigates future energy mix up to 2100. In this scenario, conventional coal and nuclear power will disappear once in the midst of 21st century, forming the basis of global energy supply in the 2nd half of 21st century. Electricity grid development is rather a management issue and a strategic matter. The strategic question for Japan is how to design the best mix and how to bring, in their territory, resources sufficient to their needs.

52. He also highlighted that nuclear reactors can be operated, for more than 2 years in Japan, with the current stockpiles of nuclear fuel, even in case of a complete block of import. Strategic stockpiles for oil are lasting 175 days (3,6 PJ). Nuclear stockpile is calculated to cope with the fuel needs for 2,2 year (6,8 PJ) and without additional cost of storage. He proposed to present results of assessment on storability at the next meeting of the EG.

53. In addition to cost of power generation, cost competitiveness of nuclear energy has to be discussed in detail as well. The study should also mention the special Working Party on Nuclear Energy Economics initiated by the NDC. Special characteristics of nuclear energy, which goes beyond market mechanisms, have to be explained in the study. Long operating lifetime must also be considered.

54. Lubor Zezula mentioned that electricity grids in Europe are very complex and long-term planning covers only 15 years time period in Europe.

55. William D'Haeseleer suggested not overestimating the future role of market self-regulation and take-up. Market does not handle sudden perturbations and does not take-up long-term base-load investments.

56. Energy price should not be part of the social policy. Electricity was cheap in the 70s. Now people start to figure out that isolation might be useful. High taxes and low electricity generation costs help governments to reduce consumption and use these taxes for other purposes. Cheap for the society and cheap for the investor – these are different issues. If nuclear power generation is too expensive, no private investor will go for it. It depends on governments if they take the initiative and nuclear power may become more attractive.

57. Henk Wels defined electricity customers as people that can react to markets or can not. There are large amount of people who can not change habits in using electrical power. William D'Haeseleer noted that subsidies to people who find it difficult to afford electrical power should be decoupled from market mechanisms for electrical power.

58. Regarding quantitative assessment, Henk Wels noted that fault tree analysis and HAZOP are not useful, too static, no time series. A Decision Analysis model outcome might be a simple model that

describes the risk of blackouts in a quantitative ways as a set of function of time and input data. The model has to be understood by a high-level decision maker and also by the public. Political information might change the picture. The model should also deal with the situation on the grids. Some countries are very limited in exchanging electricity.

59. Based on ESA experience, Zsolt Pataki proposed to use risks assessment method to define probability scale, to identify route causes that challenge the SoS (for example: accidents, social-political, regulatory and market) and to study their impact fuel supply and the performance of NPPs. ESA has already identified 16 route causes so far.

60. Ronald Hagen proposed to address the role of China, India and Russia on their large contribution to the global development of nuclear energy and the uncertainties they caused.

61. We should pay attention to the following questions: Do we have capabilities? Do these capabilities have the sufficient quality? Do we have the qualified people? Risks to SoS caused by these factors.

62. Bradley Horsfall proposed to include discussion on fuel supply chains.

Methodology

63. The EG agreed to work in two subgroups:

- subgroup on qualitative assessments of factors important to SoS;
- subgroup on quantitative evaluation of factors relevant to SoS.

64. To define which factors are the most important for the SoS the EG agreed to benefit from the models already developed (e.g. in Belgium, the Netherlands and Hungary).

65. The study will be based on country reports that corresponds to the mandate of the EG. However, it will focus on three regions: Europe, North-America and Pacific. Special discussion need to be added for China, Russian Federation and India.

66. Some practical examples on selected countries will be presented to illustrate the issues covered and the approaches in the study.

Issues to be addressed

67. The EG agreed to address the following items in the study:

- Joint definition of risks, (safety, security, socioeconomic) hazards. Differentiation of short-term risk and lifecycle risk;
- Quantitative estimation of risks of blackouts and brownouts as function of time;
- Mechanisms to internalise risk;
- Quantitative estimation of the best energy mix and the supply routes;
- Proposal for a quantitative method and assessment of differences in risks of import of electricity or fuel (with special attention to Japan);

- Comparison of assessments on storability (time, cost, opportunity cost, volumes) for different fuel types;
- Definition of critical time period. (The definitions of "Critical time period" are different. The critical time period starts in 2007 for the IEA and in between 2010-2015 for the ESA);
- The part of a country's GDP that corresponds for fuel supply for each country;
- Comparison of the costs of electricity production;
- Cost competitiveness of nuclear energy;
- Risk of price rises for uranium and the level of toleration for different countries;
- Enrichment technologies and facilities as current limiting factors for the expansion of nuclear power;
- Experience and the most important issues for the countries (Japan, Belgium, Hungary) that are almost 100% dependent on import of energy sources;
- Import and grid resources;
- Energy as a function of cost and price. Role of market self regulation in handling sudden perturbations and take up long term base load investments;
- Market adjustments vs. policy interventions. The role of governments in price setting, energy price and social policy, cheap electricity for the consumer and the investors;
- Potential for change in consumer behavior;
- Fuel supply chain.

Main deadlines

68. The time horizon starts today with the description of the current energy situation and the important events/issues. The target date is 2030. However, the study has to provide reflections and forward-looking qualitative assessment for a longer term, beyond 2030 (2050-2100).

69. The EG also agreed to provide relevant publications to the Technical Secretary of NEA who will add them to the reference list and uploads it to the EG restricted website (e.g. Transport balance document from the Netherlands).

Item 10. Tentative table of content of the report

70. Based on the discussions, the following items to be covered in the report were brought up in the discussions:

Executive summary

Table of content

Introduction

Key definitions and concepts concerning SoS

Dimensions of SoS:

- geopolitical, regional, geo-economics (resources for specific locations) from national examples;
- transport and transmission infrastructure;

- power generating capacity;
- financial, economic, and institutional framework (futures market, the role of governments, availability of qualified personnel) business and institutions handling risks;
- national examples;
- regulations;

Dimensions of SoS for:

- energy;
- electricity generation and distribution;
- specifics for nuclear power generation (specifics going beyond market mechanisms, long operating lifetime, high fixed costs, R&D, etc);

Qualitative assessment of factors important to SoS

- differences between country experiences;

Quantitative methods for the assessment of SoS

- practical examples of different methods used in member countries;
- presentation of results of the assessments:

  - Europe;
  - North-America;
  - Pacific region;

Conclusions, lessons learned and recommendations

List of references

Annexes

- Country reports

Item 11. Working method, responsibilities, schedule

71. It was agreed that Secretariat prepares the detailed summary report of the first meeting of the Expert Group. The summary report will be distributed to Group members the latest by 15th December 2007.

72. Chair with the Secretariat will continuously ask Expert Group members for their contributions to the next meeting.

73. It was also agreed that draft texts for the chapter on qualitative approaches should be sent to the Chair, Mr. Ronald Hagen and to the Secretariat **by 14 March 2008**. Mr. Hagen will contribute to the chapter on qualitative approaches and methods for evaluation of the role of nuclear power in contributing to SoS.

74. Draft results of the quantitative analyses will be first presented at the 2nd meeting of the Expert Group. Mr. Henk Wels, co-Chair to the Expert Group, will also contribute to the chapter on quantitative methods for evaluating the role of nuclear power in contributing to SoS.

75. The responsible experts for the different subchapters are the following:

- Mr. Cameron (Australia) will help in focusing on the fuel supply issues (qualitative).
- Prof. D'Haeseleer (Belgium) will help with definitions, influence of intermittency of fluctuating sources, capacity credits (wind power, loop flows), portfolio analysis, "n-1" grid performance analysis and design, avoiding blackouts (precise definition of blackouts and rolling blackouts (quantitative).
- Mr. Zezula (Czech Republic) will present draft on state energy policy and energy mix implications (qualitative).
- Mr. José Luis Perez Rodriguez (Spain) will help with data collection, draft on comparison of PSA tools and other decision-making tools, and reviewing the different models.
- Mr. Zafer Ates (Turkey) will contact the two other delegates, members to the Expert Group, to define the content of the contribution to the Expert Group efforts. After having in hand the summary report of the 1st meeting, he will inform Secretariat on the outcome of the consultation with the experts in his home country.
- Dr. Sophie Gabriel (France) will ask her responsible ministry for data collection, and she will contribute drafting methodology, the fuel chain, excluding the economics.
- Dr. János Hauszmann (Hungary) will contribute to the quantitative evaluation based on the methodology presented during the meeting (quantitative).
- Ms. Alessandra Fagiani (Italy) will provide draft on geopolitical and economic aspects of SoS (qualitative).
- Mr. Koji Nagano (Japan) will contribute to all chapters, summarising up country experiences, key country aspects for SoS for the 1st chapter. For the 2nd chapter he will provide some draft on economic, financial and social mechanisms of SoS. He plans contributing to both qualitative and quantitative evaluation, and some discussion on the primary energy mix. He will also help drafting some thoughts on the effect of competition in the nuclear fuel cycle (quantitative).
- Mr. Hiroshi Ujita (Japan) will help with explanation of differences in the costs of SoS, categorisation of risks for the Japanese case, optimisation of the best mix, and the costs. He will also try to draft a Pacific case study, reflecting on SoS issues special to the Pacific region. This draft will include India and China (qualitative).
- Ms. Tatiana Kamenska (Slovakia) will draft the energy supply situation for the Slovak Republic, SoS insights for the nuclear fuel cycle, the effect of price of the uranium and enrichment (qualitative).
- Mr. Alan McDonald (IAEA) will send to NEA Secretariat IAEA publications relevant to the study. Secretariat will add these technical reports to the list of references and will also upload them to the restricted website for the Expert Group (qualitative).

- Dr. Zsolt Pataki (Euratom) will help drafting texts on the front-end of the nuclear fuel cycle, the risks in SoS for the different segments of the nuclear cycle, including uranium mining and milling, conversion, enrichment and fuel fabrication, and their applications meaning for nuclear power. He noted that we should base the study on ideas developed in background publications (qualitative).

- Mr. McDonalds and Dr. Pataki will also help in reviewing the first draft report.

76. The Secretariat is preparing a website for information exchange. The Summary Report of the meeting will be agreed by the Chair. However, it will remain draft until it is approved by the Expert Group 2nd meeting.

77. Secretariat also noticed that all documents and information submitted to this project will be made public after 3 years of the publication of the report.

Item 12. Date of the 2nd meeting

78. Taking into account the lead times necessary for the draft of the chapter on qualitative methods and to perform the quantitative analyses, it was decided that the Group would schedule its 2nd meeting to discuss the first draft chapters and the results of the qualitative analyses on 22-23 May or alternatively on 5-6 June 2008 at the OECD/NEA Headquarters in Paris, France, starting at 9:30 a.m.

79. The 3rd meeting of the Expert Group is tentatively scheduled for October 2008.

Item 13. Any other business

80. The student observers from the Institute of Political Studies of Paris explained how they can contribute to the activities of the Expert Group. It was agreed that they will take a qualitative approach presenting the political and geopolitical dimensions of SoS including national and regional policies, the risks and constraints. They will process the information gained from analytical literature, governmental officials, and will also perform case studies for China and Russia. They agreed to support the quantitative part of data processing and analyses as requested by Expert Group members.

81. Members of the Expert Group accepted all these proposals.

Item 14. Closing of the Expert Group meeting

82. Chair closed the meeting.

Appendix 1

1st Meeting of the Expert Group on Nuclear Energy and Security of Supply (SoS)

22-33 November 2007, Issy-les-Moulineaux, France, 7th Floor, Room B

Preliminary Agenda

22 November 2007, Thursday starting at 9.30

1. Welcome – Secretariat
2. Introduction of participants – Participants
3. Adoption of the agenda – Participants
4. Overview of the project objectives and scope – Secretariat
5. Presentation of room documents – Secretariat
6. Presentations on main issues related to security of supply, the role of nuclear energy in improving security of electricity supply in their home countries – Participants
7. Issues of common interest to be addressed in the study – Participants
8. Nomination of the Chairman – Participants

23 November 2007, Friday

9. Review of the outline of the study – Secretariat, Participants
10. Tentative table of content of the report – Secretariat, Participants
11. Working method, responsibilities, schedule – Participants
12. Date of the 2nd meeting – Participants
13. Any other business
14. Closing of the Expert Group meeting

Appendix 2

List of Participants – 1st meeting

AUSTRALIA

Dr. Ron CAMERON*
Chief of Operations,
Australian Nuclear Sc. & Tech. Org.
Private Mail Bag 1
Menai NSW 2234
Tel: +61 2 97 17 3733
Fax : +61 2 95 43 1452
Email: rfc@ansto.gov.au

Bradley HORSFALL
Assistant Manager
Energy Policy - Projects Section
Energy and Environment Division
Dept of Industry, Tourism and Resources
Level 11, 10 Binara Street
Canberra City ACT 2601
Tel: +61 2 6213 7412
Fax : +61 2 6213 7361
Email: brad.horsfall@industry.gov.au

Dr. Ron HUTCHINGS*
Counsellor (Nuclear)
Australian Embassy – Permanent Mission to the UN, Mattiellistrasse 2-4
A-1040 Vienna
Tel: +43 1 5067 4119
Fax : +43 1 504 1178
Email: ron.hutchings@dfat.gov.au

AUSTRIA

Bojan TOMIC*
ENCONET Consulting Ges.m.b.H.
Auhofstraße 58
A-1130 Vienna
Tel: +43-1-879 211-111
Fax : +43-1-879 211-150
Mobile: +43-664-338 6680
Email: b.tomic@enconet.com

Steven C. SHOLLY
Senior Risk Analyst, University of Vienna
Institute of Risk Research
Türkenschanzstrasse 17/8
A-1180 Vienna
Phone 1: + 43-1-4277-53934 (direct line)
Fax : +43-1-4277-9539
Phone 2: +43-1-4277-53901 (secretariat)
Email: steven.sholly@irf.univie.ac.at

BELGIUM

Prof. William D'HAESELEER
Representing SCK/CEN, Mol Belgium
K.U. Leuven
Applied Mechanics and Energy Conversion
Celestijnenlaan 300a – bus 2421
B-3001 Heverlee
Tel: +32 16 32 25 10
Fax : +32 16 32 29 85
Email: william.dhaeseleer@mech.kuleuven.be

CZECH REPUBLIC

Mr. Lubor ZEZULA
Project Manager
Nuclear Power and Safety Division
Nuclear Research Institute Rez plc
Husinec – Rez 130
250 68 Rez
Tel: +420266172082
Fax : +420266172334
Email: zez@ujv.cz

FRANCE

Olivier AUBOURG
DGEMP-Télédoc 143, Sous-Direction de l'Industrie Nucléaire - Ministère de l'Ecologie, du Développement et de l'Aménagement Durables
61, boulevard Vincent Auriol
F-75703 PARIS Cedex 13
Tel: +33 (0) 1 44 97 06 14
Fax : +33 (0) 1 44 97 09 30
Email: olivier.aubourg@industrie.gouv.fr

Dr. Sophie GABRIEL
CEA-Centre de Saclay
CEA/DEN/DANS/I-tésé
F-91190 Gif-Sur-Yvette CEDEX
Tel: +33 (0)1 69 08 27 43
Fax : +33 (0)1 69 08 35 66
Email: sophie.gabriel@cea.fr

GERMANY

Mr. Torsten FLEISCHER*
Institute for Technology Assessment and Systems Analysis
Forschungszentrum Karlsruhe GmbH
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen
Tel: +49 7247 82 4571
Fax : +49 7247 82 4806
Email: torsten.fleischer@itas.fzk.de

HUNGARY

Mr. János HAUSZMANN
Chief Expert, Paks NPP Ltd.
P.O. Box 71
Paks, 7030
Tel: +36 75 50 8198
Fax :
Email: hauszmann@npp.hu

Mr. Miklos HORVATH (observer)
Director of Maintenance, Paks NPP Ltd.
P.O. Box 71
Paks, 7030
Tel: +36 75 50 69 59
Fax :
Email: horvathm@npp.hu

ITALY

ing. Alessandra FAGIANI
Ministry of Economic Development
Directorate Gen. for Energy & Mineral Res.
Office B6 - Nuclear Energy
Via Molise, 2
00187 Rome
Tel: +39 064 70 52 270
Fax : +39 064 78 87 976
Email: alessandra.fagiani@sviluppoeconomico.gov.it

JAPAN

Mr. Koji NAGANO
Senior Researcher
Energy Technology Policy, Socio-Economic Research Center, Central Research Institute of Electric Power Industry (CRIEPI)
2-11-1 Iwado-kita, Komae-shi,
Tokyo 201-8511
Tel: +81 3 3480-2111 ex.1553
Fax : +81 3 3480 3492
Email: nagano@criepi.denken.or.jp

Mr. Hiroshi UJITA
Senior researcher
The Institute of Applied Energy
1-14-2 Nishi-shinbashi, Minato-ku,
Tokyo 105-0003

Tel: +81 3-3508-8891 / +81 3 6367 0224 (direct)
Fax : +81 3-3501-1735
Email: ujita@iae.or.jp

NETHERLANDS

Mr. H. WELS
NRG
PO box 9034
6800 ES Arnhem

Tel: +31 6 1506 33 92
Fax : +31 26 44 59 035
Email: wels@nrg-nl.com

SLOVAK REPUBLIC

Mr. Michal PILKA*
Risk Manager
Slovenske elektrarne, a.s.
Hranicna 12
827 36 Bratislava 212

Tel.: +421 2 58 66 33 29
Fax.: +421 2 53 41 75 25
Email: Pilka.Michal@seas.sk

Tatiana KAMENSKA (Observer)
Slovenske elektrarne, a.s.
Hranicna 12
827 36 Bratislava 212

Tel.: +421 2 58 66 3569
Fax.: +421 2 53 41 75 25
Email: Kamenska.Tatiana@seas.sk

SLOVENIA

Prof. Andrej GUBINA, PhD*
University of Ljubljana
Faculty of Electrical Engineering
Tržaška 25
1000 Ljubljana

Tel: 386 1 426 46 51
Fax :
Email: andrej.gubina@fe.uni-lj.si

SPAIN

José Luis PEREZ RODRIGUEZ
Department of Nuclear Engineering in the Deputy Direction General for Engineering and R&D
Endesa Generación S.A.U.
C/Ribera del Loira, No. 60 Madrid

Tel: +34 91 213 16 90
Fax :
Email: jlperezr@endesa.es

TURKEY

Mr. Zafer ATES
First Secretary
Permanent Del. of Turkey to the OECD
9, rue Alfred-Dehodencq
75116 Paris

Tel: +33 1 42 88 50 02
Fax : +33 1 42 88 50 02
Email: zates@mfa.gov.tr

Mr. Bora Sekip GÛRAY*
Head of Div., Strategy, Development of Supply
General Directorate of Energy Affairs
Ministry of Energy and Natural Resources
ETKB, Inonu Bulvari, No 27, Kat 18
06100 Bahcelievler, Ankara

Tel: +90 312 203 44 66
Fax : +90 312 223 69 84
Email: Bora.Guray@tedas.gov.tr

Mr. Benan BASOGLU*
Expert
General Directorate Electricity Production
Elektrik Uretim A.S. Genel Mudurlugu
Inonu Bulvari No 27, B-9
Bahcelievler, 064990 Ankara

Tel: +90 312 212 69 00
Fax : +90 312 213 01 03
Email: benan.basoglu@euas.gov.tr

UNITED STATES

Mr. Ronald HAGEN
Program Analyst
Office of Nuclear energy
US Department of Energy
Nuclear Fuel Assurance, NE-6
1000 Independence Ave. S.W.
Washington, D.C. 20585

Tel: +1 202 586 1381
Fax : +1 202 287 3701
Email: ronald.hagen@nuclear.energy.gov

EUROPEAN COMMISSION

Dr. Christian KIRCHSTEIGER
European Commission
DG TREN-H2 - EUFO 04/295
10, rue Robert Stumper
L-2557 Luxembourg
LUXEMBOURG

Tel: +352 4301 36498
Fax : +352 4301 30139
Email: christian.kirchsteiger@ec.europa.eu

EURATOM

Dr. Zsolt PATAKI
Economic Analysis, Head of Sector
Euratom Supply Agency, European Com.
EUFO 4191
L-2920 LUXEMBOURG

Tel: +352 4301 35298
Fax : +352 4301 38139
Email: zsolt.pataki@ec.europa.eu

IAEA

P.O. Box 100
A-1400 Vienna, Austria

Alan MCDONALD
Programme Liaison Officer
Department of Nuclear Energy (IAEA)

Tel: + 43-1-2600-22650
Fax : 43-1-2600-29598
Email: A.McDonald@iaea.org

Dr Hans-Holger ROGNER*
Section Head, Planning and Economic
Study Section, Nuclear Energy Dpt

Tel: + 43 01 2600 22776
Fax : 43 01 2600 29598
Email: H.H.Rogner@iaea.org

Forenc L. TOTH*
Planning and Economic Study Section
Department of Nuclear Energy (IAEA)

Tel: +
Email: F.L.Toth@iaea.org

IEA

9 rue de la Fédération
75739 Paris Cedex 15

Ian CRONSHAW
Head of Division
Energy Diversification Division

Tel: +33 (0)1 40 57 67 30
Email: ian.cronshaw@iea.org

Ulrik STRIDBAEK*
Senior Policy Advisor
Elect. Markets, Energy Diversification Div.
Tel: +33 (0)1 40 57 65 97
Fax: +33 (0)1 40 57 67 39
Email: ulrik.stridbaek@iea.org

François NGUYEN*
Senior Energy Analyst
Energy Diversification Division
Tel: +33 (0)1 40 57 67 26
Email: francois.nguyen@iea.org

Institut d'Etudes Politiques de Paris Département des Affaires étrangères (observers)

Alena PUKHOVA
31 Boulevard Jourdan
M.E.C., Chambre 155
75014 Paris
Tel: +33 06.29.76.58.31
Fax :
Email: alena.pukhova@sciences-po.org

Nicolas FESCHAREK
7 P Boulevard Jourdan
Maison du Portugal, Chambre 414.
75014 Paris
Tel: +33 06.69.38.91.71
Fax :
Email: nicolas.fescharek@sciences-po.org

MARIA KOZLOVA
Résidence Rollin
14, rue Rollin
75005 Paris
Tel: +33 06.42.05.42.43
Fax :
Email: maria.kozlova@sciences-po.org

Bruno LE GALLIC DE KERIZOUET
6, rue du Montparnasse
Collège Stanislas, Internat prépas
75006 Paris
Tel: +33 06.27.11.22.27
Fax :
Email: bruno.legallicdekerizouet@sciences-po.org

Svetlana POGODINA
1, rue Guichard
75116 Paris
Tel: +33 06.69.17.22.28
Fax :
Email: svetlana.pogodina@sciences-po.org

Vivien ZHANG
46 bis rue de l'église,
75015 Paris
Tel: +33 06 26 90 72 62
Fax :
Email: vivien.Zhang@sciences-po.org

NEA

Stan GORDELIER
Head of Division
Nuclear Development Division
Tel: +33 1 45 24 10 60
Fax: +33 1 45 24 11 17
Email: Stan.Gordelier@oecd.org

Pal KOVÁCS
Administrator
Nuclear Development Division
Tel: +33 1 45 24 10 68
Fax: +33 1 45 24 11 17
Email: Pal.Kovacs@oecd.org

Hélène Déry
Assistant
Nuclear Development Division
Tel: +33 1 45 24 10 64
Email: Helene.dery@oecd.org

* sent their regrets.