

Symposium on Developments and
Prospects of Gas Markets and the
Gas Industry in the ECE Region
in the Years 2000-2010
Istanbul (Turkey)
4-8 October 1993

Original: ENGLISH

REPORT

INTRODUCTION

1. The Symposium was organized in accordance with a decision of the Working Party on Gas at its second session, held in January 1992, and in response to a request of the Committee on Energy at its first session, held in November 1991. The Symposium was held in Istanbul from 4 to 8 October 1993 at the invitation of the Government of Turkey.

PURPOSE OF THE SYMPOSIUM

2. The purpose of the Symposium was to assess the availability of new gas supply sources outside the ECE region to meet future requirements of the ECE countries as well as the medium- and long-term prospects of gas markets and the gas industry, including trade.

3. Profound changes are taking place in the ECE region with regard to energy markets and gas in particular, such as restructuring and reform measures in economies in transition; integration of energy markets and other policy initiatives, such as the European Energy Charter, free-trade agreements in North America; environmental factors and the role of gas in the protection of atmosphere and problems related to climate change; new technologies that lead to a more efficient use of gas and create new market opportunities.

ATTENDANCE

4. The Symposium was attended by representatives of Albania, Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, Israel, Italy, Lithuania, Netherlands, Norway, Poland, Romania, Russian Federation, Slovenia, Spain, Switzerland, Turkey, Turkmenistan, Ukraine, United Kingdom and United States of America.

Algeria, Egypt, Iran, Kazakhstan, Qatar and Yemen were represented under article 11 of the terms of reference of the Commission. A representative of the World Bank also attended.

ADOPTION OF THE AGENDA

5. The provisional agenda was adopted (ENERGY/WP.3/SEM.1/1).
ELECTION OF OFFICERS

6. Mr. Mete GÖKNEL (Turkey) was elected Chairman of the Symposium. Messrs. L. D'Andrea (United States of America), L. Gad (Denmark), C. Bernardet (France), H. Heidinger (Austria), G. Yardim (Turkey) and W. Czernie (Germany) were nominated Chairmen for Working Sessions 1, 2, 3, 4, 5 and the Round Table, respectively.

OPENING SESSION

7. The ECE Deputy Executive Secretary opened the Symposium.

8. Mr. V. Atasoy, Minister of Energy and Natural Resources of Turkey, welcomed the participants on behalf of his Government. He recalled the importance of natural gas in the context of energy efficiency and protection of the environment. More specifically, its role in power generation and the construction of natural gas combined cycle power stations would contribute to the rational use of energy and to energy efficiency. He underlined the challenges for new agreements and infrastructure with the drastic changes in Europe.

9. Mr. M. Göknel, Chairman of the Board of Directors and General Manager of BOTAS Petroleum Pipeline Corporation, welcomed the participants. He described the achievements and status of the natural gas industry in Turkey and highlighted the importance of natural gas in residential, commercial and industrial areas for a sustainable development. He drew the attention of the Symposium to changes in central and east-European countries and their consequences, claiming new concepts for supply security.

10. The ECE Deputy Executive Secretary expressed her deep appreciation and thanks to the Turkish Government and to BOTAS for co-sponsoring this Symposium. She drew the attention of the participants to the outcome of the United Nations Conference on Environment and Development - the Earth Summit, held in Rio de Janeiro and the on-going discussions on changes in production patterns aiming at sustainable development. She underlined the important role of gas in meeting energy requirements, taking into account the new energy concepts and approaches on the road towards the twenty-first century. She highlighted the salient features of the ECE policy approaches in energy. She also presented a number of projects currently under way in the programme of work of the Working Party on Gas, in particular the initiative to establish a Gas Centre for the Promotion and Development of a

Market-based Gas Industry in Economies in Transition. She expressed the hope that the high level of expertise gathered at the Symposium would provide an important synthesis for elaborating guidelines for future work to be undertaken in cooperation with Governments and municipalities, the business community, and international organizations of the United Nations system.

11. The working sessions on each of the five groups of topics were conducted by the respective session Chairmen. At the beginning of each working session, the General Rapporteurs introduced their general reports thus opening the debates.

WORKING SESSIONS

GROUP OF TOPICS NO. 1: DEVELOPMENTS IN THE GAS INDUSTRY AND THE ROLE OF GAS IN RELATION TO OTHER ENERGY SOURCES. PROSPECTS AND PROBLEMS OF GAS INDUSTRY DEVELOPMENT IN ECONOMIES IN TRANSITION.

Reports: ENERGY/WP.3/SEM.1/R.3, R.4, R.5, R.8, R.13, R.15, R.18, R.22, R.25, R.30, R.34, R.36, R.37, R.39, R.41 and R.43.

General report: ENERGY/WP.3/SEM.1/R.101

Chairman: Mr. L. D'Andrea (United States of America)

General Rapporteur: Mr. A. Fronska (Poland)

Participants in the discussion: Mr. A. Oduolowu (World Bank),
Mr. A. Mastepanov (Russian Federation),
Mrs. G. Kamcici (Turkey), Mrs. M. Erksan (Turkey),
Mr. Z. Benko (Hungary) and Mr. A. H. Abubakr (Egypt).

Discussion:

12. The primary energy consumption has increased steadily since 1950 and the energy supply continues to attract a great deal of importance all over the world as a vital factor for economic and social development.

In the aftermath of the oil crisis during the 1970s and in particular in 1979, energy prices increased considerably and oil has been replaced by coal as the major source of commercial energy, with natural gas growing even more rapidly and nuclear energy developing.

Coal, with world power resources of 521 billion tons of hard coal and 518 billion tons of brown coal, is the most abundant fossil energy in the world. Proven reserves of oil and natural gas have increased tremendously during the last few years, reaching 137 billion tons and 131 trillion cubic metres, respectively.

The global energy consumption in 1990 in the ECE region is:

Solid fossil fuels	26%
Liquefied fossil fuels	37%
Gaseous fossil fuels	25%
Nuclear energy	7%
Hydro energy	5%

The future global energy demand will depend to a large extent on economic growth, fuel prices, security of supplies, environmental considerations, taxes, legislations, advanced energy conversion and transmission technologies.

13. According to energy projections, fossil fuels will continue to be the main energy supply source for a considerable time in the future; the participation of natural gas will be higher than the average and will increase its present share by 25%, due to the fact that:

- it is a relatively inexpensive fuel for those countries that have access to it;
- it is a clean primary energy option;
- it provides high efficiency and easy regulation during combustion;
- the construction of gas burners is easier in comparison with other options.

However, an important constraint to a greater use of gas in the future will be the need to find and develop new resources.

14. Proven natural gas reserves in Europe have been estimated at 55 trillion m³, of which 88% are located in the former Soviet Union, 4.7% in Norway, 2.8% in the Netherlands and the rest in other countries. The demand for natural gas in Europe is increasing.

Taking into account an annual economic growth of 2.5% in western Europe and 4-6% GNP in central and eastern Europe, projections show that the natural gas share in primary energy consumption is expected to rise from 15% to 20% in western Europe and from 23% to 25% in central and eastern Europe by the year 2000. This increase in consumption will take place more specifically in the commercial and residential sectors. Given the fact that central and east-European countries will increase slowly but continuously consumer gas prices, especially in the domestic sector, the question of gas demand has to be examined again. This may lead to a review of the energy - and in particular gas - forecasts.

15. The Commonwealth of Independent States (CIS), with 47 trillion cubic metres of proven reserves, will remain the main supplier of natural gas of Europe, providing approximately 150 billion cubic metres (bcm) in the year 2010. A new agreement for the pipeline from Siberia to Belarus, Poland and Germany will provide European markets with substantial additional quantities of natural gas.

Algeria plans to export up to 60 bcm of natural gas per year before the end of the decade; 58 bcm are already committed - LNG plants are being refurbished to restore their capacities. The Trans-Med pipeline is being expanded and a new Maghreb-Europe gas pipeline is under construction.

Nigeria with 3.4 trillion cubic metres of proven reserves could be an important LNG supplier in the year 2000 and beyond.

Qatar and Oman have programmes to develop their gas reserves.

Prefeasibility studies for four alternatives of pipeline of 30 bcm per year from Turkmenistan to Europe via Turkey are being made.

Iran with 17 trillion cubic metres of proven reserves will be another possibility to provide natural gas to the ECE region.

Yemen is also increasing its natural gas reserves.

16. Central and east-European countries were characterized by higher energy intensity (energy consumption per unit of GNP) and lower efficiency in energy use.

In transition from centrally planned to market economy, the Governments have started to promote the restructuring of the gas industry (privatization of the distribution companies), setting up new pricing policy for gas and elaboration of legislation for environmental protection, giving new dimensions to diversification of gas supplies, favouring transfer of new technology and know-how, and implementing new standards and safety measures.

GROUP OF TOPICS No.2: EXPANSION AND GROWTH OF THE RESOURCE BASE FOR
NATURAL GAS BOTH FOR CONVENTIONAL AND
UNCONVENTIONAL SOURCES

Reports: ENERGY/WP.3/SEM.1/R.7, R.21, R.26, R.33, R.35 and
R.44.

General theme report: ENERGY/WP.3/SEM.1/R.102

Chairman: Mr. Lars Gad (Denmark)

General Rapporteur: Mr. Kaplan Basniev (Russian Federation)

Participants in the discussion: Messrs. R. Ter-Sarkisov (Russian Federation), L. D'Andrea (United States of America), R. Boularas (Algeria), A. Oduolowu (World Bank), G. Bosniatsky (Russian Federation), C. Bowkley (United Kingdom).

Discussion:

17. Data analysis regarding the availability of natural gas resources shows that proven resources are sufficient to provide natural gas at the present level of production for another 55-60 years. However, the geographical distribution of these resources is uneven. The main parts

of these resources are located in the Russian Federation and the Middle East. There is a shortage of indigenous natural gas resources in the United States of America and Europe. These factors will to a considerable extent influence future developments of international gas markets.

18. Numerous mid- and long-term socio-economic and energy scenarios for the Mediterranean countries show a strong growth of natural gas consumption, from 110 bcm in 1990 to some 240-290 bcm by the year 2010. In the same way, it is expected that natural gas demand in Europe (excluding CIS countries) will grow from 330 bcm in 1990 to some 570-650 bcm by the year 2010. Although the three main suppliers of Europe (CIS, Norway and Algeria) are believed to be able to considerably increase their export capacities, the number of gas suppliers of the ECE region, which are outside the region, will probably increase, thus diversifying the sources of natural gas. In this respect the role of the Mediterranean region as a crossroads for natural gas trade between producing republics of Northern Africa, Middle East and new countries of Central Asia, on the one hand, and European consumer countries, on the other, will rapidly grow.

19. There is an evident growth of the role of non-conventional gas sources such as gas hydrates, coal-bed methane, gas from tight formations etc. in providing an additional source of energy. World potential gas hydrates resources are estimated at about 70-100 trillion cubic metres. Enormous resources of natural gas in the form of gas hydrates that are accumulated in the Black Sea basin could provide countries of this region with this type of energy for many decades. The investigation, prospecting and development of the gas hydrate deposits has now reached such a level that a Coordinating Committee composed of representatives of the Black Sea Basin countries can be established to bring as soon as possible the natural gas concentrated in hydrate form below the waters of the Black Sea into the energy balance.

20. The last few years have shown a growing interest for exploration and production of methane from coal-beds. By its ability to provide a clean source of energy, in a suitable form and at affordable cost, coal-bed methane can substantially assist to fulfil critical social and economic needs.

21. The large-scale commercial success of coal-bed methane recovery in the countries of the region will to a large extent depend on the exchange of experience and information regarding the assessment of resource potential, exploration, production and utilization technologies, environmental and safety issues related to coal-bed methane.

22. The improvement of the environment being a global issue, it calls for a more efficient use of methane and preventing its emission to the atmosphere. This can help to reduce gases which give rise to global warming. International cooperation on measures to promote the commercial exploitation of coal-bed methane is an important and timely objective, which has generated interest world-wide and to which ECE can serve as a catalyst.

GROUP OF TOPICS NO. 3 - ENVIRONMENTAL FACTORS INFLUENCING GROWTH IN DEMAND FOR GAS, INCLUDING RATIONAL USE OF ENERGY

Reports: ENERGY/WP.3/SEM.1/R.6, R.9, R.10, R.16, R.20, R.23, R.38, R.40 and R.42.

General Theme Report: ENERGY/WP.3/SEM.1/R.103

Chairman: Mr. C. Bernardet (France)

General Rapporteur: Mr. C. Bernardet (France)

Participants in the discussion: Mr. L. Gaurier (France), Mr. M. Guiducci (Italy), Mrs. F. Jonon (France), Mrs. K. Steczko (Poland), Mr. G. Bosniatsky (Russian Federation), Mrs. J. P. Jonchere (France), Mr. S. La Bella (Italy), Mr. H. Blanc and Mr. R. Lassaille (France).

Discussion:

23. Under the impact of growing environmental issues, new dimensions are being given to the plans and projects to meet the increasing energy demand for the future with new concepts aimed at sustainable energy development. These new concepts play an increasingly important role by providing the decision-makers with constraints, from conversion of primary energy sources to end-use.

24. All energy types have various degrees of detrimental emissions due to utilization and conversion technologies, and type of fuel. Pollution emitted by fossil fuels has an impact which can be classified as local (particulates, lead compounds, volatile organic compounds, dust); regional (emissions of sulphur dioxide - SO₂ and nitrous oxides - NO_x to the atmosphere, causing national and transboundary air pollution and damage to ecosystems); and global impacts (atmospheric concentrations of greenhouse gases such as carbon dioxide - CO₂ and methane -CH₄ causing global warming).

25. Natural gas combustion has relatively low emissions of atmospheric pollutants, in particular compared with coal, and produces no solid waste. It is sulphur-free and its contribution to CO₂ emissions per standard unit of energy is much less than that of other fossil fuels. Progress has been made in reducing NO_x emission and still more is to be done. Different technologies to decrease NO_x emissions in industrial burners are now available, using different means, such as:

- reducing the flame temperature;
- reducing the local concentration of oxygen;
- reducing the reaction time.

For residential uses of natural gas there are two solutions for reducing NO_x emissions:

- by involving the use of additive devices with conventional burners, or
- by designing low-NO_x burners which have been tested already,

such as special atmospheric burners, forced draught burners, fully premixed burners, pulsed-combustion burners, catalytic burners and a low-power household cogenerator.

26. Natural gas is one of the most suitable fuels to promote rational use of energy through the advanced high performance technologies aiming at energy efficiency, such as special atmospheric boilers, condensation boilers, decentralized liquid heating, efficient high-temperature radiant tubes, cogeneration, water vapour pump and greenhouse heating.

27. More specifically, the decentralized solutions can compete successfully with central steam and water heating systems, overcoming heat transmission losses in large installations by providing gains of 20% to 50% in efficiency, depending on the type of technology and process.

28. Electricity generation and road transport are very important areas where natural gas could be a substitute for polluting fuels. Coal could be replaced by natural gas in electricity production or some coal-fired power stations could be repowered, more particularly as gas combined cycle power plants or cogeneration plants with gas turbines to produce electricity and heat to increase fuel efficiency from 30%-35% to 50% at least.

29. In the use of natural gas as a motor fuel:

- exhaust gases are free of lead, sulphur compounds and particulates;
- carbon monoxide (CO) emission is halved;
- emission of unburnt hydrocarbons is minimized and consists primarily of non-toxic methane;
- there are no losses by evaporation; and
- it emits 25% less carbon dioxide (CO₂) than the petroleum fuels.

30. It is important to note that it is in the interest of the gas industry to maintain the high degree of control over the risks attaching to its activities for environmental protection and for the security of the users. Special attention should be paid to the reduction of hydrogen sulphur content and control of its transboundary dispersion.

31. In the energy sector, combined-cycle technology and use of natural gas in electricity generation has the greatest potential for the coming years by making the largest contribution to increased gas consumption.

32. In the industrial sector, natural gas already constitutes predominant marked shares. Some countries may still hope to substitute gas for other fuels - liquid or solid - in a bid to improve the quality of the atmosphere economically. The high-performance uses of natural gas account for a significant proportion of what are referred to as the best available technologies.

33. In the building sector covering residential buildings and the commercial activity, there has been substantial progress made in the west in terms of energy efficiency and clean gas appliances. Such progress has still to be realized in the central and eastern Europe.

34. In the transport sector, gas as a motor fuel is one answer to the problem of air pollution, from which the transport industry is becoming one of those most responsible.

Group of Topics No. 4: DEVELOPMENTS OF PRICING AND FISCAL POLICIES FOR ENERGY AND GAS IN PARTICULAR

REPORTS: ENERGY/WP.3/SEM.1/R.14, R.18, R.19, R.29

GENERAL THEME REPORT: ENERGY/WP.3/SEM.1/R.104

Chairman: Mr. Hartmut Heidinger (Austria)

General Rapporteur: Mr. Frens Geuzinge (Netherlands)

Participants in the discussion: Mrs. D. Pastizzi-Ferencic (UN/ECE), Mrs. N. Satana (Turkey). Messrs: L. Olivieri (Italy), C. Bernardet (France), N. Goto (United Kingdom), C. Bowkley (United Kingdom), L. D'Andrea (United States of America), L. Gad (Denmark), R. Lassiaille (France), H. Blanc (France), A. Fronska (Poland).

Discussion:

35. Gas prices in most west-European countries are based either on the cost-plus principle or on the market-value principle. Under the market-value principle, gas prices can be linked to the cost of using alternative fuels in the relevant market segment. Gas prices in the domestic consumer market are generally tied to the cost of gas oil, whereas the price to industrial consumers is related to that of heavy fuel oil (and to a great extent to a cost of gas-oil). In the power station market, the gas price is linked to the cost of using oil, coal and nuclear power. Generally, the value of natural gas in the market is made up of two elements - the price of the reference fuel and the premium of natural gas. The latter refers to the advantages of using gas over alternative fuels (difference in investment and exploitation costs, environmental benefits). Sometimes legislation influences the balance of the market forces (e.g. emission limits).

36. In the countries of the former eastern bloc, gas prices were fixed on the basis of political and/or social considerations. Competition between the different fuels was governed not by market forces, but by the administrative planning process. For example, the gas price to domestic consumers in these countries is typically well below west European gas prices, and industrial consumers there pay higher prices for their gas than domestic consumers.

37. The development of the west-European gas market to its present status has in part been made possible by the application of the market-value principle. Natural gas is competing on the energy market. The market-value principle means that the consumer never pays more for his gas than it is worth to him in relation to the alternative fuel in his particular market segment. Another important factor has been the take-or-pay contracts which give the producer a guaranteed market for 10 or 20 years. These contracts and the application of the market-value principle are the two pillars underpinning the development of the European gas market.

39. The demand for gas in Europe will continue to grow in the years ahead and the infrastructure will have to be extended to accommodate it. New pipelines and storage facilities will be required and new production areas will have to be brought on stream. Overall, the cost of providing new, additional gas will increase: the "new" gas will have to be transported over longer distances, either by pipeline or in the form of LNG. The net effect will be upward pressure on "border prices" in Europe. The European gas industry is facing a major challenge. The structure of the market in eastern Europe will have to change if the demand for additional gas at competitive prices is to be met (against a background of rising costs). The first prerequisite in the transition to a market economy is the creation of a market-led pricing system which recognizes the value of gas as a product. It was noted during the discussion that this process will take years, especially in the residential sector.

Group of topics No. 5: INSTITUTIONAL CHANGES AFFECTING GAS INDUSTRY DEVELOPMENTS AND INTEGRATION OF GAS MARKETS IN EUROPE AND NORTH AMERICA. INTERREGIONAL AND INTRAREGIONAL GAS TRADE.

Documentation: ENERGY/WP.3/SEM.1/R.2, R.7, R.8, R.12, R.26, R.28 and R.32.

General theme report: ENERGY/WP.3/SEM.1/R.105

Chairman: Mr. Gökhan Yardim (Turkey)

General Rapporteur: Mr. Domenico Dispenza (Italy)

Participants in the discussion: Mrs. S. Cornot-Gandolphe (France), Mrs. M.F. Chabrelie (France), Messrs: M. Hafner (France), E. Ferrari (Italy), J. Mas (Spain), D. Adams (United Kingdom), R. Sani (Iran), T. Rose (France), V. Cezayirlioglu (Turkey), L. Pintican (Romania), D.B. Mashiah (Israel), S. Öztürk (Turkey), K. Chen (United States of America), W. MacLeod (United Kingdom), R. Boularas (Algeria), L. D'Andrea (United States of America).

Discussion:

39. Natural gas demand in Europe is expected to continue to grow over the next twenty years. Environmental problems, increasing use of gas for power generation and the establishment of gas enterprises in some countries are the main reasons for this growth. Present suppliers of gas to the ECE region may not be able to satisfy increasing demand for gas. Other suppliers, few and often more distant, could be needed. During the last thirty years, European gas companies have been progressively building an international gas transmission network adapted to their needs. This highly efficient network constitutes a link between their own networks which were built on the basis of sound economic principles and for specific projects.

40. To satisfy increasing demand with present or potential suppliers will require building new international gas transmission networks, completing existing ones and improving the links between networks. Such extensions would be based on specific projects designed to further develop gas trade. It is not economically sound to consider building an interconnection

between gas networks for gas supply security reasons only. The high costs of such links, which would only be used in cases of a gas supply interruption and on the basis of mutual assistance between gas companies, have to be compared with the costs of other solutions such as ensuring equal security, gas storage (underground or in liquid form) or having short-term customers. Gas enterprises in western Europe have not built interconnections for security reasons only. But security resulting from the mutual agreements made by some enterprises for other aims is one of the advantages of the existence and extension of interconnections.

41. Gas transportation cost is an important factor in the gas industry, but it varies widely depending upon many conditions. Therefore, gas transportation is an activity which offers opportunities of economies of scale. Gas companies often establish joint ventures to make gas competitive in the case of long distances between the gas source and the end-user because only very large annual volumes of 20 bcm or more are sufficient to make such propositions economical, considering that volumes of this magnitude are too large for only one buyer. In that framework, what could the role of governments or international institutions be? An increased share of natural gas in total energy consumption in Europe seems to be a common policy objective for most governments and intergovernmental organizations; consequently they have to take the necessary measures to facilitate the increased use of natural gas and development of the gas transmission network. This could be done by a suitable stable legal framework, thus creating the market stability which would allow long-term agreements to be negotiated.

42. It is extremely important that governments of central and eastern European countries experiencing dramatic economic and political changes, establish regulations which will promote international gas transportation. Cooperation among gas companies would be easier if all countries adopted laws or regulations allowing the principles of the market economy to prevail. Fiscal laws that would increase the already high costs of gas transportation should not be imposed. Likewise, the amount of capital needed for projects could be shared among several partners. This could facilitate access to financing, such as grants or loans from international organizations. Furthermore, such sharing would allow gas companies in central and eastern Europe to benefit from the knowledge of western European companies such as negotiating gas supply agreements. International cooperation among gas companies, such as the creation of buyers' consortia, is very important in order to maintain market equilibrium between an increasing number of buyers and present and potential suppliers, which will be limited in number in the future.

GROUP OF TOPICS NO. 6: ROUND TABLE DISCUSSION ON ENHANCING AND PROMOTING INTERNATIONAL COOPERATION IN THE GAS INDUSTRY

Chairman: Mr. Wilfried Czernie (Germany)

Participants in the discussion: Messrs. A. Mastepanov (Russian Federation), L. Gad (Denmark), L. D'Andrea (United States of America), H. Blanc (France), G. Luciani (Italy), P. Benkoczy (Hungary), A. Oduolowu (World Bank).

Discussion and conclusion:

43. Although it is difficult to find a common denominator to reflect all points of view and cover all facets of the discussion, there are four findings which reflect the essence of the Round Table discussion on enhancing and promoting international cooperation in the gas industry:

(a) Cooperation in the gas industry in the ECE region enjoys a positive tradition and a solid basis. The prospects for mastering the challenges and responsibilities of the future are therefore good. Differences in the political, legal, institutional and economic systems of the various ECE nations have not proved to be an obstacle in the past, nor are they likely to stand in the way in the future.

(b) It was almost unanimously agreed that there was a need to expand cooperation not only in the gas industry but also in energy policy and the energy industry as a whole. The benefits to all concerned are obvious. Past experience confirmed the advantages of stronger integration and closer cooperation.

(c) The implementation of new cooperation and integration projects involves the coordination of many technical, economic, institutional and legal aspects, and the success of the projects depends on many preconditions. One of these preconditions is that cooperation can only be a lasting success if it is based on a fair and equitable partnership and if opportunities and risks are fairly balanced between all partners.

(d) A further precondition is a clear division of responsibility between politics and the gas industry itself. This division of responsibility should set the emphasis on market forces and entrepreneurial initiative:

(i) It is up to energy businesses to contribute capital and entrepreneurial experience, maybe even to develop new forms of cooperation. This applies in particular to projects involving cooperation with what used to be centrally planned economies.

(ii) It is up to the politicians to create an appropriate framework which would ensure that European cooperation in the energy sector is guided by competitive principles and a market philosophy approach. Energy companies must have the leeway they need to go about their business. Regulation, administration and intervention should be kept to a minimum.

44. The ECE was called on to promote a common understanding of these goals and to act as a platform for a more intensive dialogue in order to promote stronger cooperation. Obviously, this would only be possible if ECE member countries were ready and willing to offer their active support.

CONCLUSIONS AND RECOMMENDATIONS

45. In an effort to sum up the conclusions of the Symposium, participants agreed:

- (a) To underline the vital importance of energy policies aimed at sustainable energy development;
- (b) To point out that:
 - (i) energy demand would increase all over the world as a vital factor of social and economic development;
 - (ii) fossil fuels would remain a predominant source of energy for a long time in the future;
 - (iii) the main issue for decision-makers is to meet the growing demand of global energy by limiting local, regional and global environmental and health-related impacts, be they short-, medium- or long-term;
 - (iv) natural gas could indeed make a significant contribution as a future fuel in commercial and domestic use and more specifically in electricity generation and cogeneration of heat and power areas, due to its environmentally-friendly and competitive character in comparison with other fuels.
- (c) To highlight in this regard the following challenges:
 - (i) to enhance the efficient and rational use of energy;
 - (ii) to improve conversion efficiency to produce less pollutants per unit energy produced;
 - (iii) to reinforce technology transfer of the most advanced clean combustion technologies at the international level.
- (d) In the light of all the above-mentioned facts, and taking into account the diversity of national policies among ECE countries, the Symposium made the following recommendations to the Working Party on Gas:
 - (i) to take note of the report of the Symposium, particularly of its findings regarding future developments of existing and emerging new gas markets and gas demand/supply trends;
 - (ii) to enhance cooperation between gas-producing and gas-importing countries within and outside the region in order to improve the efficiency of production, transportation, distribution and use of gas, and in finding the best solutions to carry out new projects to meet the growing gas demand;
 - (iii) to invite gas industries of the ECE region to increase cooperation in the exploration, development and production of non-conventional gas sources, such as gas hydrates, coal-bed methane, gas from tight formations, etc. that could serve as a significant additional energy source for the countries of the region;

- (iv) to increase cooperation between the gas industries of the ECE region by enhancing assistance to countries in transition in developing market-based gas industries in these countries;
- (v) to spread the growth and support the increasing internationalization of the gas markets by providing exchange of knowledge and information on policy and regulatory framework of the market-based gas industry, and market information on a global basis;
- (vi) to take note of the initiative launched by a number of countries representing economies in transition and supported by a number of western countries to establish a Centre to Promote and Develop a Market-based Gas Industry in Economies in Transition and to support this initiative. The work of the Centre is deemed to be an extension of the programme of work of the Working Party on Gas and of the ECE priority to assist economies in transition. Interested Member Governments, enterprises, governmental and non-governmental organizations were invited to support the Centre financially and in-kind;
- (vii) to invite Governments to organize a special seminar (workshop) focusing on commercial and financial implications arising from gas export/import projects envisaged for European gas markets;
- (viii) to invite ECE Governments to consider hosting a similar symposium in four years' time or less, oriented to supply and demand and other related issues, provided that gas market developments and market trends show that examination of these changes is warranted and desirable;
- (ix) to invite the Turkish Government and the secretariat to consider the possibility of publishing the proceedings of the Symposium together with selected papers.

Study Tour

46. On 7 October, participants took part in a study tour to the LNG Terminal in Marmara Ereğlisi, some 100 km away from Istanbul (see Annex II).

Adoption of the report

47. The Symposium adopted the report on 8 October 1993.

Closing Ceremony

48. The participants thanked the Turkish Government and the Organizers for the opportunity offered to them to exchange views and experience on the gas industry and gas market developments to enhance international cooperation. They also made reference to the warm hospitality and excellent facilities available to participants.

49. The secretariat expressed great satisfaction at the outcome of the Symposium. Its conclusions and recommendations would be presented to the Working Party on Gas for consideration. The secretariat thanked the organizers for the hospitality, cooperation and assistance provided.

ANNEX I

LIST OF DOCUMENTS

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.101	GENERAL REPORT: Developments in the gas industry and the role of gas in relation to the other energy sources. Prospects and problems of gas industry developments in economies in transition. (Mr. A. Fronska, Poland)	I	E
ENERGY/WP.3/SEM.1/R.102	GENERAL REPORT. Expansion and growth of the resource base for natural gas both from conventional and unconventional sources. (Mr. K. Basniev, Russian Federation)	II	E/F/R
ENERGY/WP.3/SEM.1/R.103	GENERAL REPORT: Environmental factors influencing growth in demand for gas, inclu- ding rational use of energy. (Mr. C. Bernardet, France)	III	E/F
ENERGY/WP.3/SEM.1/R.104	GENERAL REPORT: Developments of pricing and fiscal policies for energy and gas in particular. (Mr. F. Geuzinge, Netherlands)	IV	E
ENERGY/WP.3/SEM.1/R.105	GENERAL REPORT: Institutional changes affecting gas industry developments and integration of gas markets in Europe and North America. Interregional and intraregional gas trade. (Mr. D. Dispenza, Italy)	V	E

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.1	List of documents (ECE secretariat)		
ENERGY/WP.3/SEM.1/R.2	Prospects of gas trade in the European region. New rules for a wider cooperation between exporting and importing countries. (Mr. E. Ferrari, Italy)	V	E
ENERGY/WP.3/SEM.1/R.3	Developments of natural gas use in Turkey. (Messrs. M. Dogruer and B. Can, Turkey)	I	E
ENERGY/WP.3/SEM.1/R.4	Developments and prospects of gas industry in Hungary in the years 2000-2010. (Experts of MOL Hungarian Oil and Gas Corporation, Hungary)	I	E
ENERGY/WP.3/SEM.1/R.5	Fuel switching to natural gas in industry - the French experience (Mr. L. Gaurier, France)	I	E
ENERGY/WP.3/SEM.1/R.6	Natural gas, a solution to environmental pollution. (Mr. L. Gaurier, France)	III	E
ENERGY/WP.3/SEM.1/R.7	Long-term natural gas supply for Europe and the Mediterranean. (Messrs. M. Hafner and M. Grenon, France)	II,V	F
ENERGY/WP.3/SEM.1/R.8	The Maghreb-Europe pipeline: An international cooperation example. (Mr. J. Mas, Spain)	I,V	E
ENERGY/WP.3/SEM.1/R.9	Conventional and innovative methods for Nox reduction in domestic gas appliances. (Messrs. M. Guiducci and R. Accornero, Italy)	III	E

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.10	Experimental determination of the influence of an air-gas modulating system on the seasonal efficiency concerning wall-installed boilers: Comparison between different appliances. (Messrs. G. Schiavone, M. Mattutino and V. Scevarolli, Italy)	III	E
ENERGY/WP.3/SEM.1/R.12	The development of trade in natural gas in Europe: The new infrastructures (gas pipelines and liquefied natural gas). (Mesdames. S. Cornot-Gandolphe and M-F. Chabrelie, France)	V	F
ENERGY/WP.3/SEM.1/R.13	Development of natural gas in Turkey. (Ms. G. Kamcici, Turkey)	I	E
ENERGY/WP.3/SEM.1/R.14	Pricing principles of natural gas and its competitiveness in the energy market. (Ms. N. Satana, Turkey)	IV	E
ENERGY/WP.3/SEM.1/R.15	Natural gas market prospects for Turkey. (Ms. M. Erksan, Turkey)	I	E
ENERGY/WP.3/SEM.1/R.16	Evaluation of ecological benefits from methane use in high-pollution areas. (Mr. J. Rachwalski and Mesdames K. Stevzko and J. Zaleska-Bartosch, Poland)	III	E

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.18	Developing new residential gas markets: Problems and opportunities. (Messrs. C.M. Gloria and L. Maina, Italy)	I,IV	E
ENERGY/WP.3/SEM.1/R.19	Natural gas purchase and selling prices for distribution companies. (Mr. L. Olivieri, Italy)	IV	E
ENERGY/WP.3/SEM.1/R.20	AMES: A pilot system conceived for pollution control in urban areas. (Messrs. I. Giovannini and M. Girard, Italy)	III	E
ENERGY/WP.3/SEM.1/R.21	Perspectives of coal-bed methane exploration and production in Poland. (Messrs. K. Hoffmann and T. Bromeek, Poland)	II	E
ENERGY/WP.3/SEM.1/R.22	Contribution of line packing and line drafting for handling variable consumer demand in natural gas transmission systems. (Messrs. I. Durgut and F. Rashidi, Turkey)	I	E
ENERGY/WP.3/SEM.1/R.23	Implications of emerging gas technologies for the environment, particularly for a rational use of energy. (Ms. F. Jonon and Mr. R. Staropoli, France)	III	F
ENERGY/WP.3/SEM.1/R.25	Natural gas use in Istanbul. (Mr. U. Tamer, Turkey)	I	E

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.26	Prospects of increased international cooperation in dissemination and exchange of gas technology information: Objectives and status for the IEA International Centre for Gas Technology Information. (Mr. L. Gad, International Energy Agency)	II,V	E
ENERGY/WP.3/SEM.1/R.28	Activities of Turkish Standards Institution (TSE) on natural gas. (Mr. S. Ozturk, Turkey)	V	E
ENERGY/WP.3/SEM.1/R.29	The carbon tax on energy, developing countries and natural gas. (Ms. C.M. Siddayao, World Bank)	IV	E
ENERGY/WP.3/SEM.1/R.30	Lithuanian gas sector survey. (Mr. K. Zilys, Lithuania)	I	E
ENERGY/WP.3/SEM.1/R.32	The central and east European gas market - implications of a major new supply via Turkey. (Mr. R.W. Grabham, UK)	V	E
ENERGY/WP.3/SEM.1/R.33	Non-conventional source of natural gas of Black Sea. (Mr. Y.F. Makogon, Russian Federation)	II	R
ENERGY/WP.3/SEM.1/R.34	Contemporary problems of the energy complex of Russia. (Mr. A.T. Shatalov, Russian Federation)	I	R
ENERGY/WP.3/SEM.1/R.35	The situation of the gas industry in the Russian Federation. (Messrs. K.S. Basniev, A.N. Dmitrievsky and A.D. Sedykh, Russian Federation)	II	R

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.36	Natural gas situation in Egypt. (Mr. A.H. Abubakr, Egypt)	I	E
ENERGY/WP.3/SEM.1/R.37	Prospects of the development of the gas industry in Kazakhstan in the years 2000-2010. (Mr. I. Zhapargadiev, Russian Federation)	I	R
ENERGY/WP.3/SEM.1/R.38	The natural gas demand for power generation in Italy - ENEL and independent generators' strategies. (Mr. S. La Bella, Italy)	III	E
ENERGY/WP.3/SEM.1/R.39	Developments and prospects of gas markets and the gas industry in Romania in the context of restructuring and modernization process of the international cooperation background adopted by the European Energy Charter. (Messrs. L. Pintican and S. Stanescu, Romania)	I	E
ENERGY/WP.3/SEM.1/R.40	Technologies for reduction of nitrogen oxides formation for oil and gasfiring heat-producing plants. (Mr. H. Durukan, Turkey)	III	E
ENERGY/WP.3/SEM.1/R.41	LNG shipping as a major factor in gas supply diversification strategy. (Mr. K.C. Chen, United States of America)	I	E
ENERGY/WP.3/SEM.1/R.42	Ecology and natural gas of Russia. (Mr. G. Bosnystsky, Russian Federation)	III	R

Symbol	Title/Author/Country	Theme	Language
ENERGY/WP.3/SEM.1/R.43	Perspectives and development of the gas industry in Poland. (Messrs. A. Findzinski, J. Tokarzewski and A. Fronska, Poland)	I	E
ENERGY/WP.3/SEM.1/R.44	Algerian gas - a major role in future supplies of Europe. (Mr. R. Boularas, Algeria)	II	E

ANNEX II

STUDY TOUR TO LNG TERMINAL, MARMARA EREGLISI

1. HISTORY

In line with world developments, and with a view to meeting some additional requirements in the form of LNG, increasing the security and elasticity of supply and diversifying sources of supply, Turkey began negotiations with Algeria in 1984.

An agreement on purchasing LNG from Algeria was signed on 25 April 1985. An LNG import terminal is being constructed to receive LNG from LNG carriers to store, regasify LNG and transport natural gas to the Turkey pipeline.

The feasibility study performed by BOTAS was concluded positively. After this step, an agreement with M.W. Kellogg was signed on preparation of project data books and selecting a suitable location for the LNG Import Terminal.

Studies for selecting the location were focused on Marmara Region. Finally, with the approval of related governmental authorities, the location on the east coast of Marmara Ereğlisi, near Sultanköy was selected. The LNG purchase contract between BOTAS and SONATRACH (Algeria) was signed on 14 April 1988. According to this contract, BOTAS agreed to import an annual 2 billion cubic metres of natural gas equivalent of LNG starting from 1993.

For the construction of the LNG Import Terminal, international companies were invited for bidding by 2 June 1988.

Upon evaluation of bids on cost and loan conditions, SN. TECHNIGAZ-STFA Consortium was selected. After the technical negotiations with the Consortium, the contract was signed on 7 August 1989, the loan agreement, signed on 12 September 1989, and engineering and construction activities began.

The duration of construction of the project was originally 36 months and the terminal will be started up by the end of 1993.

The original cost of the project was US \$217.8 million and then increased to US \$239 million due to some additional requirements.

2. MAIN FEATURES OF THE TERMINAL

INTRODUCTION

The Terminal, in the present stage of development, is capable of handling a nominal capacity of 2 bcm/year of gas with a maximum send-out rate of 685,000 Nm³/h of gas.

Obviously, as in all terminals, the three main circuits are:

- ship unloading up to the tanks;
- liquid send-out from the tanks and vaporization; the gas being injected in the main trunk of the Turkish grid;
- gas vapour handling, considering two basic purposes:
 - (i) the return of vapour to the ship during unloading;
 - (ii) the handling of the boil-off to be recondensed or injected in the pipeline.

MAIN EQUIPMENT

3 LNG unloading arms 16"

- capable of unloading an LNG tanker of 125,000 M₃

1 LNG vapour arm 12"

- capable of ensuring the return of LNG vapours from the tanks to the tanker during LNG unloading.

3 LNG tanks

- capacity of 85,000 M³ LNG;
- made of 9% Ni steel for the inner tank, carbon steel for the outer tank and surrounded by a concrete bunwall;
- all penetrations are from the top, each tank is fitted with four LP pump well and with nozzles to fill the tanks by the top or by the bottom.

9 LP pumps

- unit capacity 300 M³ LNG/h discharge pressure 14 Bar (A) these pumps are at the foot of the wells in each tank and are fully immersed.

1 Recondenser

- has the capacity to recondense in the main LP stream the boil-off of the three tanks during normal send-out operations.

5 HP pumps

- the design is with an external electrical motor;
- unit capacity 330 M³ LNG/h;
- discharge pressure 108 Bar (A).

2 ORP Vaporizers

- ORV: Open Rack Vaporizer
- unit capacity 228,000 Nm³/h.

4 SMV Vaporizers

- SMV: Submerged Vaporizer
- unit capacity 124,600 Nm³/h.

2 B.O. Compressors

- unit capacity 7,130 Nm³/h.

2 Ship unloading compressors

- unit capacity 25,600 Nm³/h.

1 Pipeline compressor

- unit capacity 7,130 Nm³/h.

UTILITIES AND SAFETY SYSTEMS

Utilities include particularly the following main systems:

- flare circuits enabling direction of the vapours to a safe location in case of overpressure in the main circuits;
- a draining circuit designed to recycle the LNG or to dispose of the LNG and vaporize in order to flare it;
- a recirculation circuit designed to maintain cold the various cryogenic parts of the Terminal in case of no send-out or in case of repairs on certain main circuits;
- a sea water circuit to feed the ORV vaporizers including high flow pumps;
- gas, smoke, fire and LNG detection systems controlling the imitiation of the fire-fighting and foam and powder systems in addition to the alarm system;
- the nitrogen circuit designed to make inert the circuit to be maintained or repaired and to dry and make inert the circuits prior to being cool-downed.

ADDITIONAL DESIGN REQUIREMENTS

Apart from the LNG normal design requirements due to the proximity of the fault in the Marmara Sea, a high seismic activity is expected and all the design criteria were taken accordingly. As an example, the storage tank design necessitated calculating tanks of low height and with special anchoring systems for both inner and outer tanks.