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Increasing energy efficiency for secure energy supplies

Note by the secretariat

I. Introduction

1. This note presents the major outcomes of the study prepared by the International Sustainable Energy Development Centre (ISED) for the project “Increasing Energy Efficiency for Secure Energy Supplies”. The project has been under implementation for the period 2008–2010 and is being finalized in 2011. It is included in the Project Plan 2009–2012 for the Energy Efficiency 21 (EE21) Project (ECE/ENERGY/2009/8).

II. Background

2. Increasing Energy Efficiency for Secure Energy Supplies is a subregional project of the EE21 programme. The goal of the project is to promote the development of energy efficiency investment projects designed to reduce the domestic consumption of hydrocarbons in the Russian Federation, Kazakhstan and other Central Asian energy exporters in order to release additional energy resources which could be used for either domestic consumption or to increase oil and natural gas exports, which will enhance security of supply. ISED prepared a study entitled “Increasing energy efficiency for secure energy supplies in the Commonwealth of Independent States (CIS) region”. The results of this study are expected to be discussed at the Workshop organized by UNECE and ISED in Moscow on 3 and 4 February 2011.

3. ISED used documentation provided by the CIS member States as a basis for comprehensive research on fuel and energy production and consumption in those countries, analysing the situation on the energy markets, summarizing experience of implementing energy-saving policies, examining the current state of legislation on energy conservation and considering possible mechanisms for attracting investment for energy-saving projects and programmes.

III. Review of the energy sector in the CIS region and assessment of the rationale for improving energy saving and efficiency

4. In most of the CIS countries, energy conservation is one, if not the most, important way of ensuring energy security.

5. After the collapse of the Soviet Union, the newly independent States that emerged on its territory were faced overnight with serious energy problems, specifically with ensuring sustainable energy supplies. For those countries with limited fuel and energy resources, the main issue was having to spend large amounts of foreign exchange on acquiring them abroad. Countries whose energy reserves were not a cause for concern faced serious problems in finding investment for the branches of the energy sector and the power industry on the scale needed to maintain them in a state that could guarantee stable energy supplies to the economy and the population, as well as an adequate level of exports, since deductions from export earnings form a very important part of budget revenue.

6. Moreover, rising energy prices became a serious problem because they increased the energy component in the production costs of industrial products from the CIS countries, reducing their competitiveness on both domestic and foreign markets. A further factor is the dependence of most CIS countries on imported equipment for energy extraction and power generation, which, combined with the serious ageing of plant and equipment, entails significant foreign exchange spending. Thus, practically all the CIS countries, for different reasons and to a greater or lesser extent, are anxious to ensure their energy security, and to find the most efficient but also least capital intensive ways of doing so, the most realistic of which is to move the economy onto energy-saving technology.

7. One of the most important steps in increasing an economy's energy efficiency is to improve the process of converting fuel into electricity. It is particularly important to improve the efficiency of fossil fuel-based electricity production because, in the future, electrical power will form an increasing proportion of the energy used. It is generally recognized throughout the world and in the CIS countries that the electrification coefficient in the output of any country's energy balance, that is, the proportion of electricity in total final energy consumption, will continue to grow in the future, as electricity is currently the most flexible, efficient and, in practice, completely environmentally clean source of energy.

8. Energy saving and reducing energy consumption are very important ways of improving energy security, but not the only ones. Energy conservation and efficiency will play a growing role in solving the problem of energy security, particularly in the conditions of the CIS countries, if they are combined with other approaches such as:

- Expanding and enhancing economic, scientific and technical cooperation in the energy sector and in moving the economy onto an energy-saving development path
- Making the economy and the population more independent of external energy supplies by using local energy sources as much as possible, where they are economically viable, attracting national and foreign investors for that purpose
- Creating adequate strategic reserves of oil, gas and coal

9. In this connection, there is increasing regional collaboration between all the CIS countries. In October 2008, a decision was taken on collaboration in the energy sector as a key area, with a draft framework drawn up in line with the plan of action for implementation of the first stage (2009–2011) of the CIS Economic Development Strategy to 2020. It reflects all the concerted views and coordinated approaches of the CIS member States on collaboration in the field of energy and lays out the aims, tasks, principles, mechanisms and main areas of cooperation.

10. The aims set out in the document include:
- Meeting the CIS member States' domestic energy needs from domestic and foreign sources
 - Increasing both their export capacity and actual exports of energy resources
 - Achieving sustainable growth in their national economies on the basis of efficient use of energy resources and of the possibilities of international trade in them
11. The CIS Electric Power Council, set up in February 1992, plays an important role in organizing collaboration and coordination between the member States on electric power. A decision adopted at its sixth meeting on 23 October 1993 established a commission for the operational and technical coordination of joint work by the energy systems of the CIS and the Baltic countries. Its aim is to coordinate the activities of the power companies towards successful joint operations between the energy systems of the CIS and the Baltic countries, and between them and those of other countries. This decision to set up an inter-State partnership in the 1990s was a significant boost to the reconstruction of the power pool of the CIS and the Baltic States.
12. In June 2000, YES Rossii (the united energy system of the Russian Federation) and the national energy system of Kazakhstan began operations in parallel and, in September 2000, the energy systems of Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, combined in the united energy system of Central Asia, were first brought into parallel operations with the Kazakh national energy system. In August 2001, the energy systems of Ukraine and the Republic of Moldova joined the parallel operations of the CIS States' power pool. Thus, the energy systems of 11 of the 12 CIS countries (with the exception of Armenia) have been operating in parallel since autumn 2001.
13. The CIS member States' power pool also now operates in parallel with the energy systems of Lithuania, Latvia and Estonia, as well as that of Mongolia. There is transfer and exchange of electricity with the power systems of neighbouring States: Norway, Finland, Poland, Slovakia, Hungary, Turkey, Iran, China and Afghanistan. Thus, at the turn of the twenty-first century, a certain stabilization has been achieved in the work of the electricity sector in the CIS countries, quantitative indicators have risen and quality has improved. Since 1998, there has been a sustainable increase in electricity production and consumption in the CIS member States' power pool. In 2008, the figures were 22.8% and 21.4% higher than those for 1998, with totals of 1,462.2 billion kWh and 1,442.3 billion kWh.
14. There is a series of unresolved issues in this most important area of activities. Armenia's energy system still operates in isolation from the CIS member States' power pool and in parallel with Iran's energy system. The system produces excess power, exchanging electricity with Iran and exporting electricity to Georgia.
15. The sustainable parallel operation of the CIS power pool has been greatly helped by the adoption of principal technical requirements, which were developed and submitted for the approval of the Electric Power Council by the commission for the operational and technical coordination of joint work by the energy systems of the CIS and Baltic countries. The main documents approved by the Council in recent years include framework regulations for frequency and flow in the power pool of the CIS and Baltic countries, regulations for planning power flow graphs, and rules and recommendations on regulating frequency and flow. While it is important to continue developing the principle technical requirements for parallel operations in the CIS power pool, it should also be noted that one main, and as yet unresolved, issue is the need for all those participating in the parallel operations to implement the documents adopted.
16. Article 13 of the agreement on ensuring parallel work by the electricity systems of the CIS member States notes that the parties will take measures to establish and develop an

open and competitive inter-State market for electric power and capacity based on the power systems of the States parties, that is, a common electricity market for the CIS member States. Work began on a practical solution to this in December 2001, with the setting up of a working group under the Energy Council to look at the formation of such a market; the first main document it produced laid out the basic principles for its organization, on the basis of which the CIS Council of Heads of Government approved a framework for the formation of a common electricity market for the CIS countries.

17. Subsequently, between 2005 and 2008, the Council of Heads of Government and the Electric Power Council adopted a number of documents related to the formation of a common electricity market for the CIS countries, including an agreement of 25 May 2007 on the subject, an agreement of 22 November 2007 on harmonized customs procedures for electricity transfers between CIS member States, and general principles for the transit of electrical power through the networks of CIS member States, approved by the Electric Power Council on 19 May 2006.

18. In October 2007, the Council agreed to the proposed stages, and their main features, in the formation of the common electricity market; and in October 2008, it approved a draft protocol on the subject, which was then considered by the CIS Economic Council's Commission on Economic Issues in May 2009.

19. A 2008 report by the Energy Research Institute of the Russian Academy of Sciences concluded that the CIS member States have a huge potential for energy saving of between 420 million and 450 million tonnes of oil equivalent. Currently, the energy intensity of the economies of the member States is between 3 and 3.5 times higher than that of the industrially developed countries. Kazakhstan, Turkmenistan, Uzbekistan and Ukraine have the highest levels of energy intensity of gross domestic product (GDP) in the CIS member States.

20. Between 2000 and 2008, the volume of oil extracted in the CIS member States increased by more than 60% to 609 million tonnes. The main oil-producing countries in the CIS are the Russian Federation (77% of total production in the CIS), Kazakhstan (11%) and Azerbaijan (approximately 9%). Azerbaijan's oil production was four times higher in 2006 than in 2000, Kazakhstan's was double and the Russian Federation's had increased by 51%.

21. By 2008, the Russian Federation was the top producer and biggest exporter of natural gas in the world (79% of CIS production). Turkmenistan was the second largest gas producer in the CIS (8%), with Uzbekistan only slightly behind. Gas production in Kazakhstan is increasing at a faster rate than in 2000. In 2008, total natural gas production in the CIS countries was 734 billion m³, and total consumption was 540 billion m³.

22. Coal production in the CIS in 2008 was 496 million tonnes, or 1.8 times more than in 2000, while consumption over the same period was stable at 100 million tonnes. The main producers and consumers of coal in the CIS were the Russian Federation, Kazakhstan and Ukraine. In recent years, nuclear power stations have accounted for more than 40% of total electricity production in Armenia, about 16% in the Russian Federation and approximately 48% in Ukraine. In the CIS as a whole, approximately 18% of all electricity is produced by nuclear power.

23. An analysis of the changes in production and consumption of primary energy resources between 1990 and 2008 shows that total production by all the CIS member States was higher in 2008 than in 1990. At the same time, primary energy resource production in 2008 was 27% higher than in 2000, with increases of almost 3.5 times in Azerbaijan, 80% in Kazakhstan, 27% in the Russian Federation and 40% in Turkmenistan. In the CIS as a whole, demand for primary energy resources declined by almost 23% between 1990 and 2008, while consumption was almost 12% higher than in 2000. Thus, it may be concluded that the combination of social, economic and technological factors (growth in GDP and

standard of living, as yet unexploited potential for energy conservation) indicates that there will be an increase in demand for energy in almost all the CIS member States. The differences in the structure of energy resource production and consumption are an objective basis for expanding trade and mutual integration between the CIS member States in that area.

24. There is a quite significant potential for exports of energy resources (primarily natural gas) from CIS member States over the period to 2020 and, even when trade within the region is taken into account, this could be further increased by improving energy efficiency in all the CIS member States. Natural gas is at or near the top of the energy balance in almost all the CIS member States, most of which, whether they have an energy surplus or a shortfall, have a programme to reduce the proportion of this type of fuel in the energy balance, not only through energy-saving measures, but also by replacing it with other types of energy resources.

25. A report by the Russian Academy of Sciences modelled three development scenarios for the energy sector: a benchmark and two alternatives. The benchmark scenario takes national forecasts for economic and energy development in the CIS member States. For the period 2008–2020, it shows rapid rates of growth in the production of primary energy resources (1.39 times), including natural and associated gas (1.38 times), coal (1.36 times) and oil (1.27 times). Electricity production will be 1.49 times higher in 2020 than in 2008, while gas production will be increased at the fastest rate, to boost exports. The leaders in this sector over the period in question will be Kazakhstan, the Russian Federation, Turkmenistan, Uzbekistan and, somewhat later, Azerbaijan. The Russian Federation will account for somewhat less oil and natural gas production by the end of the period, mainly to the benefit of the Central Asian States. The CIS member States will increase their oil and gas export capacity throughout the period, while exports of coal will decrease as its use for their domestic needs, primarily electricity production, will increase. There will be more possibilities for exporting electricity with the growing demand, primarily from the Asian markets.

26. The benchmark scenario maintains the current trend in economic development in the CIS member States, with significant growth in fuel and energy resource consumption, low use of alternative types of energy, and high energy intensity of GDP compared to the industrially developed countries. In summary, this forecast of the balance between energy production and consumption in the benchmark scenario maintains the current economic development trend with a significant increase in fuel and energy resource consumption and a low level of use of alternative types of energy. The trend seen between 2000 and 2008 continues, with a virtually direct correlation between economic growth in the CIS member States (and an increase in the well-being of the population) and the level of use of fuel and energy resources. In most of the countries concerned, this will involve electricity consumption (the increase in electricity consumption will entail additional spending on fuel for power stations) and the housing sector. In this scenario, the structure of the energy balance will alter at a moderate pace, bringing no significant change by the end of the period in question. The feasibility of the scenario's targets is confirmed by the levels of development of the fuel and energy industry planned in national programmes, and the forecast balances in the trade in energy resources between the CIS member States and their production for export.

27. The two alternative scenarios are "energy efficient" and "enhanced". The energy efficient scenario was based on estimates of reduced domestic demand for energy compared to the benchmark scenario, achieved through an intensive policy of energy conservation. Environmental issues were also addressed as priorities in this scenario. Extraction and production levels were kept the same as in the benchmark scenario, resulting in the possibility of increased export capacity from improvements in energy saving and

efficiency. This scenario brings a 6–7% reduction in the consumption of fossil fuel resources compared to the benchmark scenario.

28. An intensive energy-saving policy based on the experience of the industrially developed countries would make it possible for the CIS member States to use fuel and energy resources more efficiently by prioritizing investment in scientific research and design and introducing new generation technologies. This would mean guaranteeing innovative development paths in all sectors of the economy and competitiveness on the world market.

29. The “enhanced” scenario is based on estimates of faster rates of growth in the world economy resulting from strong economic activity in the countries of Asia (India and China). It presumes high world prices for energy resources accompanying the increased demand on foreign markets, and high levels of production and extraction of energy resources, including in the CIS member States. GDP grows at 2–3.5% more than in the benchmark scenario. Thus, by the end of the period in question, primary energy resource production in the CIS is 5.5% higher than in the benchmark scenario, and consumption is 0.9% lower because of high energy prices both on the national markets and in trade between the CIS member States.

30. The alternative scenarios (to the benchmark scenario) fundamentally alter the state of production and consumption of energy resources in the balances at national and regional levels. Thus, for the CIS countries that generally have a high energy intensity of the economy and, consequently, significant potential for energy saving, it is particularly important that economic policy should be based on projected economic growth rates that exceed the rates of growth in demand for primary energy resources. It has been calculated, for example, that, if economic development rates in the CIS countries average 3% over the first two decades of the twenty-first century and energy consumption rates increase by 2%, then the total annual demand for primary fuel and energy resources in the CIS countries will rise by no more than 50% over the current level by 2020. However, if economic growth and energy consumption rates are the same, then energy needs will rise by 80%, with all that entails for energy security and, to a certain extent, environmental security.

31. One of a State’s main responsibilities must be to create the conditions to ensure that or a similar ratio between the economic development rate and the rate of growth in energy demand in the long term. In the future, the energy security of the CIS will be defined to a significant extent by the development of a free energy market within the CIS and between the different CIS countries and other countries.

IV. Conclusions for the CIS region

32. Collaboration between the CIS member States in energy saving includes joint investment in energy efficiency projects. The branches and sectors of the economy that are more attractive for energy-saving investments and the projects that can achieve maximum energy-saving, economic and environmental effect with minimum investment should therefore be clearly defined. Some conclusions can be drawn from research work, as discussed below.

33. Much has been done in implementation of the CIS member States’ agreement on cooperation in ensuring energy efficiency and saving of 7 October 2002 and the CIS Economic Council’s decision of 11 March 2005 on the main directions and principles for cooperation between member States in the area, including the adoption of a series of organizational, legislative, scientific, technical, informational, financial and economic measures to develop and expand collaboration between them in the use of energy resources.

34. Belarus has achieved the best practical results in implementing these documents. Comprehensive energy efficiency and energy saving measures, approved by special decisions at State level, have been taken. Staff information and training have been undertaken widely. Growth has been achieved in GDP with practically no increase in energy use. The energy intensity of GDP has almost halved over the past 10 years. The experience in Belarus deserves attention and support and is recommended for use by other CIS member States.

35. However, the work on energy efficiency and saving being done in the CIS member States is not enough to meet current requirements. There is still a large gap in the area of energy intensity of GDP, which is 2.5 to 3 times higher than in the industrially developed countries. The "energy saving" sections of the CIS member States' national energy programmes require revision and updating, especially in respect of providing the necessary scientific and technical resources and implementing the decisions of the Kyoto Protocol. This is demonstrated by the experience of the industrially developed countries, which are renewing their energy strategies, confirming energy saving as a deciding factor in innovative economic development, and investing as a priority in new technology in all branches of the economy on the basis of the most recent scientific research and designs.

36. Not enough work is being done in the CIS member States on using renewable sources of energy.

37. It would be useful if the CIS member States were to develop additional measures for improving the management of energy-saving policies and the standardization, certification and metrology system, implementing appropriate pricing policy, and ensuring access to both locally produced and foreign energy-efficient technologies.

38. A package of recommendations has thus been drawn up on the basis of the findings of an analysis by ISEDC specialists to improve energy saving and efficiency in the CIS region.

V. General recommendations

39. The Governments of the CIS countries must ensure a proper balance between the efforts being made to improve energy efficiency by those involved in energy saving and by energy consumers, and that the significant potential that exists in those areas is put to greater use.

40. Most of the countries need to develop long-term strategies for improving energy efficiency, with different possible scenarios for economic development, reliability of supply and environmental management. The adoption of such strategies should mean that the Governments undertake to provide clear conditions, including the allocation of financial resources, to ensure that the strategies are implemented and the quantitative targets achieved.

41. The Governments should ensure that local authorities and civil society organizations play a greater role in the general process of preparing and implementing policy on energy efficiency.

VI. Legislation, policy and programmes on energy efficiency

42. Governments need to continue developing legislation on energy efficiency, taking appropriate account of recent international developments, including European Union norms and regulations in the area.

43. National energy saving programmes should be initiated immediately; later, during implementation, they may be supplemented by various measures to ensure that changing conditions are properly taken into account.

44. Programmes for the different branches of the economy must be developed to make it possible to achieve targets for reducing energy loss in the national economy.

45. Specific implementation mechanisms must be established and the necessary funding allocated in order to make State policies on energy saving more effective.

46. Governments should draw up new legislation to allow residents' associations to implement decisions on investments in improving energy efficiency in the housing sector.

VII. Institutional framework

47. Governments should strengthen the institutional capacity of their energy ministries (in most countries) or relevant departments (in the Republic of Moldova) so that they can play a more active role in developing and coordinating policy on energy efficiency and the use of renewable energy resources.

48. The energy ministries' functions related to practical energy-saving activities and renewable energy sources could usefully be delegated to the appropriate departments and organizations.

49. The Governments should make wider use of the experience and professional staff of the various institutions and organizations such as universities and centres for improving energy efficiency.

50. Local and regional participants (such as the various non-governmental organizations, municipalities and energy distribution companies) should be involved in preparing and implementing energy efficiency programmes.

VIII. Energy pricing

51. The energy regulating structures should continue to work towards differentiated energy prices for different categories of users to ensure that more account is taken of real expenditure on energy supplies.

52. The energy price regulating mechanism should take account of the efforts made by energy companies to improve energy efficiency (both in the supply chain and for consumers) and to encourage the more active use of renewable energy sources and combined heat and power production.

IX. Funding of energy efficiency and budget and tax policy

53. Action programmes that form part of long-term energy-saving strategies must be given appropriate State funding to ensure their practical implementation.

54. The financing mechanisms used by energy efficiency funds should be improved to ensure that they translate into actual funding for implementation of the Energy Conservation Act. Ways of attracting foreign capital should be studied.

55. A system of incentives should be developed to encourage State organizations to invest in improving energy efficiency and capitalize on the reduced energy costs during the depreciation period.

56. Governments should encourage third-party funding schemes and conclude agreements that have guaranteed energy indicators, these being seen as an important funding instrument for increasing energy efficiency.

57. Taxation of energy users should be linked to incentives for energy efficiency and rational energy use.

X. Energy efficiency, environment and other economic activities

58. Energy efficiency should be more fully and exactly integrated into different economic activities; this will require constant collaboration and cooperation between the various Government ministries, including the Ministries of Energy, Environment and Natural Resources, Economy, and Industry.

59. The Clean Development Mechanism and the Joint Implementation Mechanism of the Kyoto Protocol should be used more actively to encourage both energy efficiency and the use of renewable energy sources.

60. Governments should ensure that the budget and tax measures introduced and the environmental funds set up under the relevant Government structures make it possible to improve energy efficiency, and thus are an important factor in achieving environmental targets and ensuring sustainable development.

XI. Practical energy efficiency measures

61. All the countries need to carry out assessments and take decisions based on cost effectiveness in respect of the maintenance and modernization of their centralized heating systems.

62. Most countries should use State programmes to strengthen existing district heating systems on a decentralized basis, and to create small-capacity combined heat and power production facilities.

63. Governments should continue to gauge energy use and study the possibility of a long-term programme to install individual heat, electricity and gas meters for consumers.

64. Continual improvements should be made to construction standards to encourage the use of the most efficient technologies and methods, taking account of the achievements of different countries of the world in this area (this could, for instance, be based on the European Union Directive on the energy performance of buildings).

65. Governments should continue to work towards the universal introduction of energy certificates for new buildings and study the possibility of extending the system to include existing buildings undergoing reconstruction or modernization.

66. Measures should be developed and implemented to manage demand, including through information campaigns, energy audits and checks of the conformity of equipment with standards (using appropriate marking methods).

XII. Encouraging the use of renewable energy sources and combined heat and power production

67. Most countries have significant potential in terms of renewable energy sources and combined heat and power production; more attention should be paid to these.

68. Renewable energy sources should be considered as one of the ways of providing the energy the public needs. This will involve more targeted research on their potential and its realization.

XIII. Data gathering, monitoring and forecasting

69. Databases must be set up to provide accurate and reliable information on the final users. This will make it easier to better assess the impact of greater energy efficiency, to conduct monitoring, and to decide on the changes needed in energy efficiency policy.
