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National Human Development Report

Chapter

8

**Climate Change
Impact on the
Energy Sector**

8. CLIMATE CHANGE IMPACT ON THE ENERGY SECTOR

8.1. Summary

Climate change will have a range of effects across the energy sector. Energy supply, demand and infrastructure will all be affected as climate-related risks will take their toll. Moreover, these risks are set to heighten the already quite salient vulnerabilities of Moldova's energy sector. Since Moldova's strategic framework does not fully take into account climate change risks to the development of energy sector, it may well happen that climate-related evolution will put a question mark over the feasibility of the ambitious goals.

8.2. The current situation in Moldova's energy sector

Moldova's energy sector displays a series of vulnerabilities, which mostly stand to be magnified by climate change effects. The vulnerabilities can chiefly be observed in areas such as *production capacity*, *energy efficiency* and *security of supply* and are to a certain extent determined by the interplay of historical and geographical factors.

Thus, Moldova has only very limited energy production capacities, limited mostly to electric-

Box 16. Access to energy and human development

Access to modern energy services is fundamental to fulfilling basic social needs, driving economic growth and fueling human development. This is because energy services have an effect on productivity, health, education, safe water and communication services. Modern services such as electricity, natural gas, modern cooking fuel and mechanical power are necessary for improved health and education, better access to information and improved agricultural productivity.

When looking at linkages between energy services and human development in low income countries, empirical evidence shows that a threshold level of modern energy services is required to achieve growth and improvement in human development in developed and developing countries. Higher energy consumption in low income countries is frequently linked to higher levels of greenhouse gas emission, since usually no modern or ecologically less damaging energy sources are available. Addressing the energy needs of developing and low income countries requires a combination of strategies and actions, including the following:

- Developing country governments should commit to expanding access to modern energy services by making it a national development priority;
- Strategies for rural electrification should be based on decentralised power generation. Decentralisation has the potential to assist with technology transfer, increased equity in distribution and consumption, and increased participation of local people in the supply of energy services;
- The realities of poor people's economic means should also be borne in mind in any energy reform. There should be a wide range of energy technology options to ensure that poor people can make a choice based on their income and be able to switch fuel in response to price fluctuations.

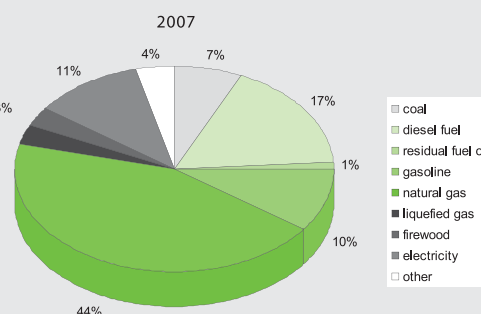
Source: Extract of Amie Gaye, 2007, Access to Energy and Human Development, HDRO Occasional Paper 2007/25.

ity production by 3 co-generation power plants (CHPs, producing both electricity and heat) and one hydro power plant. Most of the production capacities were constructed in period 1950-80, while the plant with the highest generative capacity is Cuciurgan power plant, which is situated in the break-away region of Transnistria and is therefore beyond control of the Moldovan authorities. Although the joint production capacity of electricity in the Republic of Moldova (Transnistria included) was estimated at 3,000 MW in 1990, more recently (as of 2006)¹¹³ it was estimated at 1,200 MW due to infrastructure having become worn out. Furthermore, since 80 per cent of the total capacity is in the Transnistrian region, the actual production capacity is much lower. Currently, due to wear-out the actual power generation capacity in right-bank Moldova is less than half the original installed capacity, estimated initially at 435MW.¹¹⁴ At the same time, since domestic energy is produced at worn-out plants and a large part of the energy infrastructure (especially thermal energy infrastructure) is obsolete, energy efficiency is very low in Moldova: energy intensity is estimated to be three times higher than in the EU.¹¹⁵

Given the limited domestic energy generation capacities, Moldova relies heavily on imports to satisfy its energy needs: imports made up almost 90 per cent of the total in 2007.¹¹⁶ Limited domestic market liberalisation and a lack of diversification in the supply of natural gas (the Russian state-owned company Gazprom is the only supplier) exacerbates still further Moldova's vulnerability to interruptions of foreign energy supplies. This dependency is also magnified by historical factors. Since Moldova's energy sector was designed as an integral part of the Soviet Union's integrated system, it was and still is deeply integrated into fSU power system. Thus, Moldova's power grids are mostly connected (15 interconnects) and actually integrated with the Ukrainian power grid system and much less so with Romania (with which it has 4 interconnects), while natural gas pipelines go only an east-west direction, transporting Russian gas to the Balkans, while no reverse connection has been established. For example, the impaired gas transportation system resulted in the fact that Moldova duly became a collateral victim of the Russian-Ukrainian gas dispute last winter.

The main energy resources consumed are natural gas, petrol and electricity (see Chart 33).

Chart 33. Main types of the energy resources, %



Source: *Statistical Yearbook, NBS, 2008.*

Households and industry are the main consumers of electricity and gas (which is also used for heat production). At the same time, energy consumption has fluctuated significantly over the past 20 years. In the wake of Moldova's independence energy consumption fell almost five-fold between 1990 and 2000 following a dramatic contraction of the economy and a steep decline in personal incomes as the domestic economy embarked on a transition path. As economic growth resumed and personal incomes started to grow, energy consumption started to pick up as well, increasing by 20 per cent between 2000 and 2006.¹¹⁷ According to the National Energy Strategy, energy consumption is expected to more than double by 2020. Use of renewable energy remains quite limited so far, being estimated at 3 per cent to 4 per cent of the total (hydro and firewood, see more in Box 17).¹¹⁸

Given the external vulnerability of the Republic of Moldova towards disruptions and price hikes in the foreign energy supply, it is hardly surprising that recent developments on the global energy markets have hit Moldovan consumers particularly hard. Over the past few years, prices for imported gas and electricity have risen many times over, especially for gas, as Russia has started to apply a new price policy toward fSU countries. Furthermore, rising prices appear to undermine state efforts aimed at installing gas networks in rural Moldova, since exorbitant gas prices prohibit rural consumers from connecting to the networks.

¹¹³ National Energy Strategy of Moldova (2007-2020).

¹¹⁴ Report on National Policies in Energy Efficiency and Renewable Energy Sources, Ministry of Ecology and Natural Resources, June, 2009.

¹¹⁵ National Energy Strategy of Moldova (2007-2020).

¹¹⁶ Statistical Yearbook of the Republic of Moldova, NBS, 2008.

¹¹⁷ NBS.

¹¹⁸ Report on National Policies in Energy Efficiency and Renewable Energy Sources, Ministry of Ecology and Natural Resources, June, 2009.

Box 17. Renewable energy potential in the Republic of Moldova¹¹⁹

The following renewable energy sources can be employed in the Republic of Moldova: biomass, solar, wind, hydro and geothermal energy. Overall, the technical potential of these energy sources (excluding geothermal) is estimated at 2,500 tonnes of oil equivalent (toe).

Solar energy potential is estimated at 1,200 toe. The National Programme for developing renewable energy sources envisages a three-fold use of solar energy: drying agro-products, water heating and electricity production in photovoltaic installations. The Programme envisages three separate projects for each type of resource that would have estimated costs of 8m, 8.4m and 0.2m Euros respectively. The energy produced would substitute for 38.5, 11.5 and 0.5 toe respectively and would reduce GHGs by 38.5, 11.5 and 0.5 thousand tonnes, respectively.

Biomass energy potential is estimated at 2,700 toe. The biomass, mostly firewood and wasted wood, is envisaged to be used for house heating and cooking through modern installations with effective power of not less than 75-80 per cent. Overall costs for woods, biogas and biofuel energy production would be 7.6m Euros, resulting in 117 thousand toes of annual fuel substituted and a 258 thousand tonne GHGs reduction.

Wind energy potential is estimated at 0.7 toe. Wind energy is envisaged to be used for electricity production at stations with general installed power capacity of 8MW. According to the Programme, an investment of 5.5m Euros is required, which would result in a substitution of 5 toe of fossil fuel energy and a reduction of GHGs emissions of 16,900 tonnes.

Hydraulic energy potential is estimated at 0.3 toe. In order to use it, several mini-plants were envisaged to be constructed with power of 200-400 kW and flux mini power plants with total power of 100 kW on the Dniester, Prut and Raut rivers. This energy is expected to be used for small-scale irrigation. Implementation of the planned activities would require 10m Euros investment, leading to annual fuel substitution of 23,800 toe and GHGs reduction of 13,000 tones.

Source: National Programme for developing renewable energy sources (2003-2010).

Tariffs for heat energy also started growing as a result of rising gas prices and the complicated situation in the heat generation sector in Chişinău, Moldova's capital, which put painful strains on households as well as the public budget. Even the date of the start of the heating season for such social public institutions as hospitals, schools and kindergartens is often a bone of contention, without even mentioning the exceptional situation of last winter when a cut-off in the gas supply endangered the normal functioning of many important social institutions in Moldova.

Both energy scarcity and its expensiveness (relative to low population incomes) can have significant impacts on human development. Such socially important institutions as hospitals, schools and kindergartens are vitally dependent on energy supplies. While electricity supply is very reliable, the heat supply, whether centralised as in Chişinău, or autonomous, as in towns and rural areas, is not. In Chişinău, the main cause of dis-

ruptions is high tariffs set in a non-transparent manner by the bankrupt heat provider. These disruptions are further exacerbated by political meddling and an inefficient bill compensation policy for the vulnerable population, while in previous years, city hall subsidised heat provision for the whole population of Chişinău. At the same time, the centralised heat provision infrastructure is obsolete and loss-making, while the heat provider is facing a bankruptcy procedure.

In towns (where centralised heating has either not been maintained or is absent altogether) and rural areas public authorities and the population rely mostly on coal, to heat socially important buildings, and firewood, to heat dwellings. These methods, however, even if slightly cheaper, are much less efficient and healthy ways to heat.

Hence, if only indirectly, spillovers from the energy sector may significantly affect human development in Moldova.

¹¹⁹ There is also potential for energy production from urban waste, however, its potential has not been properly estimated so far.

8.3. Possible impact of climate change

The possible effects of climate change are set to have a marked impact on the Moldovan energy sector, being sometimes exacerbated by the vulnerabilities outlined above.

The impact of climate change is most likely to be felt in the energy distribution infrastructure, and in changing patterns of energy demand and energy production capacities (supply).

- **Impact on distribution infrastructure.** More frequent and more violent extreme weather events such as storms or lightning strikes could damage supply grids and present a threat to electricity transmission and distribution.¹²⁰ In Moldova, recent extreme weather events, such as the floods of 2008, caused serious disruptions to power supply in the affected locations. At the same time, other weather calamities, such as strong winds and heavy rains, reportedly caused local power supply disruptions in different Moldovan regions in July 2009. Almost 300 localities suffered power supply disruptions in January 2009 because of strong winds and related events.
- At the same time, the Report's climate projections (see CLIMATE CHANGE AND ITS CHALLENGES FOR MOLDOVA) envisage increases in the maximum mean and absolute temperatures, which are associated with an increased frequency of extreme weather events, meaning the increased strain on the country's power distribution networks can easily be anticipated.
- Furthermore, if a warmer climate results in growing energy demand, then extra power demand could cause transmission lines to sag, lowering the effectiveness and efficiency of the distribution system.¹²¹
- Changing patterns of energy demand. Overall, climate change is associated with rising temperatures which can result in a lower demand for heating

during winter and higher energy demand through summer due to a surge in the use of air conditioning. The rise in energy demand due to hotter summers will take place across southern Europe and the Mediterranean region.¹²² Moldova will be no exception. The Report's climate projections show that temperature increases will be observed throughout all annual seasons.

Thus, it is expected that springs will begin earlier and autumns will last longer, while in aggregate the duration of the warm period may increase by 3-4 weeks in the 2020s and by over two months by the 2080s. The anticipated rise in the number of days with temperature over 10°C will mean that building heating will be required on a smaller number of days (in Chişinău centralized heating season starts when daily temperature is below 8°C).

At the same time, the Report's projections show that summers and autumns are expected to become hotter and drier. Therefore, demand for the electricity required to ensure air cooling in the buildings is likely to surge. Even without taking climate change effects into consideration, electricity consumption is expected to grow by over 15 per cent over the period from 2006 to 2020.¹²³ Taking into the equation climate change effects on demand could push demand for electricity still higher.

- Climate change can also affect energy supply. Although Moldova currently mostly covers its energy needs through imports, the National Energy Strategy envisages strengthening local production capacities by modernising and enhancing the existing CHPs (I, II and North) as well as constructing new mini-CHPs. Another focus of efforts will be boosting production from renewable sources, such as biomass, solar and wind energy. However, climate and water availability projections show that some of these plans may be put at risk when climate change effects start making themselves felt.

¹²⁰ German Strategy for Adaptation to Climate Change, 2008.

¹²¹ Colombo et al, quoted in The Impacts and Costs of Climate Change Report, Paul Watkiss et al., 2005, Commissioned by European Commission DG Environment.

¹²² Energy and Environment Report, European Environment Agency, 2008.

¹²³ The National Energy Strategy (2007-2020).

Thus, currently 65 per cent to 70 per cent of total water is used in industrial heating and cooling and hydro-energy production (see CLIMATE CHANGE AND WATER RESOURCES). However, as has been shown, water quantity in Moldova is quite sensitive to climate change effects. Thus, water scarcity will start adversely affecting national development goals by 2020 if only surface water is taken into account. If ground water is added then water scarcity will become a development obstacle by 2030. Furthermore, one of the climate change effects on water supply will be growing instability in annual water flows: growing short-term over-supply due to spring and flash floods and scarcity due to longer and more severe droughts. Hence, growing water scarcity may become the main obstacle to enhancing local hydro- and cogeneration power production.

Furthermore, the climate projections (see CLIMATE CHANGE AND ITS CHALLENGES FOR MOLDOVA) show that the anticipated worsening of humidity conditions and growing aridisation may result in a deterioration of the ecological-climatic conditions for plant growing towards the end of the century. In the longer run it represents a serious threat to energy production from biomass.

8.4. Policy discussion and recommendations

Policy framework

Moldovan authorities are fully aware of the main challenges facing the country's energy sector. Some governmental documents tackle these challenges as a group, others focus on only one of them.

The most comprehensive document to date is the National Energy Strategy (2007-2020). The strategy correctly traces the main problems for Moldova's energy sector. It outlines as the main objectives ensuring the security of the energy supply, promoting energy conservation and efficiency, and making greater use of renewables in order to satisfy domestic energy demand. Thus, it sets the ambitious target of making renewable energy sources achieve 10 and 20 per cent shares in the energy balance by 2010 and 2020, respectively. On conservation and efficiency, it envisages a revitalization of the National Agency for Energy Conservation and implementation of the National Plan for Energy Conservation (2003-2010).

It also seeks to boost local production capacity by setting up small hydro power plants that would decrease the country's dependence on external energy supplies. Another step in this direction is the privatisation of CHPs with the aim of modernising them. At the same time it emphasises policy and institutional alignment with EU legislation, rules and practice. It also envisages Moldova joining UCTE and the Energy Treaty Community and consolidation of the transit capacity of Moldova's power grids and better inter-connection with Romanian power networks.

However, the strategy has little to offer in the sense of diversifying gas supply to the country and given the distribution network constraints the current dependency is set to persist for some time to come.

It is worth mentioning that this is the third energy strategy adopted in Moldova over the decade from 1997 to 2007. All strategies had more or less similar objectives, and both earlier strategies achieved very little with no proper assessment conducted of the reasons for their failure. If history is any guide, the implementation of the current strategy will be a tall order. So far, less than 0.1 per cent of the funds envisaged for the 2007-2020 period was actually invested in the implementation of the strategy's objectives. At the same time, the schedule set for harmonization with the EU *acquis communautaire* in the energy sector is also not being respected and adoption of the respective amendments has been lagging.¹²⁴

Progress has also been very uneven in meeting the relevant goals set out in the EU-Moldova Action Plan. Among the most significant failings are: a lack of funds to support the implementation of many infrastructure and legislative actions; tariff distortions have been reduced but still persist; efforts on energy efficiency and renewable energy have been limited; privatization in the sector stagnated while the situation in the thermal energy area remains notoriously poor.¹²⁵

Adaptation options and recommendations

Although climate change is set to pose significant challenges for Moldova's energy sector, it should be said that most of the solutions on the table need to be implemented even if climate change were not taken into account. However, the risks stemming from climate change are set to heighten the existing challenges even further.

¹²⁴ Free Trade Agreement between the Republic of Moldova and European Union: Feasibility, perspectives and potential impact, Expert-Grup, 2009.

¹²⁵ See for more details: EU-Moldova Action Plan as capacity test for Moldovan Government: Screening implementation of the Plan's economic provisions, Expert-Grup, 2008.

At the same time, it would be wrong to ignore the fact that most of the steps to be taken are already in the most important development documents of the country, although climate change-related challenges are not explicitly taken into consideration. Nonetheless, progress in implementing these measures has been very sluggish at best. There are several reasons for this state of affairs amongst which we can mention:

- Energy issues are rarely on the top of the government's agenda, save in outright crisis situations like last winter's;
- The challenges of climate change are rarely reflected in the country's development policy, and even more so within strategic thinking on energy;
- The government has lacked a long-term strategic vision regarding development of the energy sector and has not ensured proper monitoring and assessment of the process (recall here the situation with the three national energy strategies, implementation of which has been never properly ensured);
- Proper financing of the activities envisaged was never ensured, although activities that have been carried out were implemented with the support of the international donor community.

Given the fact that most of the adaptation efforts represent either 'no-regret' or 'win-win' solutions we think it is worth stressing the most important of them as well as outlining their importance for the economic and human development of the country.

- **Flatening consumption curve.** Given rising energy prices as well as the eventual strain on the development of local power production (due to the climate change effects discussed above), rationalisation of energy consumption is needed. Since electricity is mostly consumed during day hours and much less so during night hours, an eventual rebalancing of consumption would mean more efficient use of the electricity produced during night hours through Demand Side Management (DSM) measures. One of the major incentives

would be the introduction of a tariff difference for the consumption in peak and non-peak hours for industry consumers. Overall, the result would be a general reduction in the tariffs paid by consumers.

- **Changing consumer behaviour.** There is a need for technological modernisation with regard to energy consumption that would induce the implementation of energy saving lighting and equipment in households, industry and in all sectors of the national economy. A public awareness campaign and relevant tariff incentives (higher tariffs for high energy use) may be important steps in this direction.
- **Energy efficiency and renewable energy sources.** The National Energy Strategy sets very ambitious targets on both accounts. However, the record of implementation of previous strategies and of National Programme for Energy Conservation (2003-2010) is dismal. The main reasons are probably a lack of consistency in public policies. Several steps could help re-launch efforts in this direction:
 - The introduction of technology standards for energy efficiency (equipment, buildings, etc.);
 - The promotion of a tariff policy that supports 'energy-savers';
 - Educational and information campaigns that would encourage efficient energy use;
 - Modernisation of current energy production capacities in order to make them more efficient. Possible water scarcity due to climate change should also be taken into account in this respect;
 - Support consumers' efforts aimed at thermal insulation of buildings; here again, tariff incentives can play an important role.

The development of renewable energy sources in Moldova is just at the beginning. At the same time, some important

steps were taken in 2009, including most of all the development and adoption of a methodology for calculating tariffs for renewable energy and adopting a regulation on the origins of renewable energy.

All in all, the importance of renewables should not be underestimated. First of all, their development is an inherent part of the international efforts at climate change mitigation and the promotion of the 'green' economy. Secondly, in Moldova, the development of renewable energy sources could have important impact on the development of rural regions given the fact that most projects can be implemented on the community level. This means renewable energy can ensure a more secure supply of energy to small rural communities and allow them to diversify their energy supply, which has become more and more costly and often imposes additional costs for connecting to centralised networks (especially in the case of the gas systems). Furthermore, the production of energy from biomass presents new opportunities for rural farmers who are already involved in rape growing. Development of processing plants will also mean better energy supply for rural communities (including for heating schools, kindergartens, etc.) and a greater source of income for the biofuel sold. In this respect, however, attention should be paid to the growing aridisation risks resulting from climate change.

Initial investments are needed, however, for the development of renewable energy sources in Moldova. Thus, the government should seek more support from the donor community for the development of such projects as well as create proper conditions for foreign investor interest in the production of renewable energy in Moldova. At the same time, renewable energy development can provide a favourable venue for public-private partnerships.

Most of the important measures needed to promote the development of renewable energy sources in Moldova are already in the National Energy Strategy and the Law on Renewable Energy. Among those it is worth outlining critical measures.¹²⁶

- Harmonisation of the national legislative and regulatory framework with the European one;
- Guarantee the openness of the power grid network for the selling and distribution of the electricity produced from renewable energy sources;
- Ensure that renewable energy sources are granted obligatory acquisition quotas by the energy providers;
- Promote research on the potential and development of renewable energy sources in Moldova (such as Wind Atlas, Land Register, Solar Radiation Atlas, Available Wastes Catalogue (for combustion wood, agricultural and wooden wastes, zoo-cultural residues) or small rivers hydro-energetic potential).

- *Consolidation of infrastructure and adaptation to climate change risks.* Given the growing risks of the extreme weather events that can impair the operational capacities of power transportation, consolidation of existing networks is needed with a focus on wind-proofing of cables, emergency water connections for power plants, etc.¹²⁷ At the same time, the relevant state agencies' capacity to respond in an emergency situation should be enhanced.

Policy Recommendations

In-depth sector-specific assessments should be carried out to establish vulnerabilities and concerns related to climate change, such as high energy demands, a low water level that may hamper electricity production, extreme weather events, etc. These assessments will underscore the need to rethink and restructure energy supplies, develop renewable energy sources such as wind and solar power, and strengthen the electricity grid to cope with greater fluctuations in demand¹²⁸ and will serve as arguments, baseline information and incentives for authorities to actually achieve the National Energy Strategy objectives.

Priority Recommendations

- A cost-benefit analysis of all adaptation options in order to establish the financial capacity of the government and the

¹²⁶ The Renewable Energy Law (no. 160, of 12.07.2007); see also http://courseweb.stthomas.edu/moldova/energy_appendix.htm.

¹²⁷ German Strategy for Adaptation to Climate Change, 2008.

¹²⁸ EU action against climate change. Adapting to climate change. European Communities, 2008.

volume of financial resources needed to implement them would also be very welcome.

- Objectives, set out in the National Energy Strategy should be reassessed in order to determine the feasibility of their achievement in the time given. Instead, objective targets and deadlines should be proposed.
- The National Energy Strategy should be amended with a chapter providing for climate change adaptation measures. These measures should be prepared after research in the field. In this respect, close cooperation between authorities, academia and international organizations would be desirable.

These amendments should be developed by the Ministry of Economy, which is responsible for the Energy sector, in conformity with international agreements and conventions signed and ratified by the Republic of Moldova, under the supervision of the Inter-ministerial Adaptation Commission. This Commission will control the process of elaboration and will ensure the inter-relation of all sector strategies and exclude the possibility of conflicting provisions.

- The strategy could provide for measures and incentives for efficient use of alternative energy resources and at the same time reduce energy costs. Low levels of energy efficiency are currently a threat to climate change adaptation efforts. Raising efficiency levels could transform that threat into an opportunity, also generating gains for human development.¹²⁹ Gradual evolution and progress towards **efficient use of available energy resources** and use of renewable sources of energy, on personal and/or country level should be supported. At the same time there is a

need to inform the people and to offer access to information on **alternative energy resources and energy efficiency**, tailored based on national and local needs of the population. Additionally, mechanisms and incentives in this respect are necessary and cooperation of authorities with scientist in the field should be encouraged by means of awards and empowerment. It could also be based on already existing experiences; for example it could support the implementation of technologies that produce biogas by using manure from farming activities and organic wastes.

In the short run these measures will need strong support from authorities, including a financial effort for a plan to manage the resultant biogas, train people in this field and organise manure and organic waste collection. But in the long run these measures could pay for themselves. In order to ensure that this process develops appropriately, authorities should cooperate with international organisations and private investors for knowledge and experience transfer, especially with those who have already had pilot projects in this field in Moldova and also start collaborating with local private companies in the field to ensure the transparency of the process.

- The quality of energy supplied to the population and companies must urgently be improved. An Action Plan would provide for special measures in the case of emergencies and natural disasters and a means for the population to get involved as a watch-dog for the quality of services provided. In this respect there must be easier ways for the population to get involved and express its opinion, but the population must also be offered access to information related to the specific requirements of energy security and reliability.

¹²⁹ Human Development Report 2007/2008.