

Renewable Energy in Republic of Moldova

Mrs. Doloșcanu Tatiana
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FACTS AND FIGURES

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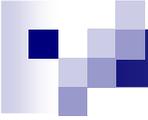
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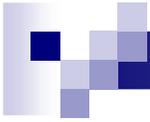




Each member firm provides services in a given geographical area and is subject to the legislation and professional regulations of the country / countries. CG helps to coordinate the activities of member firms and provides its customers international resources and local skills to help them excel regardless of where they work.

The CG professionals are united by a culture of collaboration, which promotes integrity, high quality of services provided and diversity. CG team has the advantage of a work in an environment that continuously improves, it faces different challenges and evolves from a professional viewpoint. CG experts are dedicated to strengthening corporate responsibility, for the formation of public confidence and not least to influence in a positive way the communities they belong.

The major objective of those 200 CG professionals is to become a standard of excellence.



OVERVIEW OF THE RENEWABLE ENERGY IN REPUBLIC OF MOLDOVA



REPUBLIC OF MOLDOVA TARGETS IN RENEWABLE ENERGY

The law of renewable energy form 2007 governs the legal framework for the renewable energy sector.

Until 2020, Moldova aims to increase the share of alternative energies up to 20% of the total energy consumption. There is also an obligation of our country to the European Union to achieve these indicators by 2020.

Moldova is implementing a state program for exploitation of renewable energy. At present renewable energies represents only 5-6% form the total Energy consumption.

The total technical potential of the main types of renewable energy sources in Republic of Moldova is estimated at 3.65 million tons of oil equivalent, which exceeds 1.3 times the annual energy consumption in the country.

The potential for renewable energy sources in Moldova has not been realized. The table below displays summary statistics about Moldova:

| | | |
|---|--|------|
| <u>Demographical Information</u> | | - |
| Population, millions (2009) | | 4.32 |
| Land area, thousand sq km (2009) | | 33.8 |
| <u>Macroeconomic Information (2008)</u> | | - |
| GDP, billion US\$ | | 10.6 |
| Real GDP growth rate, percent | | 7.30 |
| Foreign direct investment (net), million US\$ (2007) | | 447 |
| <u>Electricity disposition, billion kWh (2006)</u> | | - |
| Generation | | 3.82 |
| Consumption | | 5.81 |
| Exports | | 0.23 |
| Imports | | 3.74 |
| <u>Generation capacity, GW (2005)</u> | | - |
| Nuclear | | 0.00 |
| Thermal | | 0.97 |
| Hydro | | 0.06 |
| Other renewables | | 0.00 |
| Total | | 1.03 |
| <i>Sources: CIA World Factbook, U.S. Energy Information Administration, United Nations Conference on Trade and Development.</i> | | |



Energy strategy's fundamental principles of Republic of Moldova until 2020:

- Energy supply systems oriented towards serving the needs of the customer;
- Reasonable tariffs and the development of a favorable investment climate;
- Enhancing Moldova's role as an important transit country for electricity and gas.



Future Potential of Republic of Moldova

In the Republic of Moldova there will be built a first factory and this will be the second factory in Europe producing biogas from sugar beet presses.

The factory will be built between 2011-2012 and will involve an investment of 10 million euros.

Renewable energy projects in Moldova are eligible for financing support from the Central European Initiative and a credit line of 20 million euros from the European Bank for Reconstruction and Development.

The potential of different types of renewable energy in Republic of Moldova

| Types of RES found in Republic of Moldova | The theoretical Potential of RES, million tons of oil equivalent | Technical potential of RES, million tons of oil equivalent | The economic potential of RES, million tons of oil equivalent |
|---|--|--|---|
| Solar energy | 12 | 1,2 | 0,9 |
| Wind power | 2,1 | 0,7 | 0,5 |
| Biomass | 1,0 | 0,5 | 0,4 |
| Water power | 0,45 | 0,3 | 0,2 |
| Low-grade heat sources | 9,5 | 0,95 | 0,65 |
| <i>Total</i> | 25,05 | 3,65 | 2,85 |



Solar energy

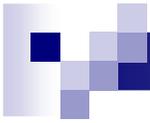
In spite of absence of own traditional energy resources and the vital necessity of using alternative energy sources in Moldova, solar energy has no noticeable usage.

The first stage of solar energy use in Moldova will have the following priorities:

- Heating of water using solar collectors
- Drying fruit, vegetables and medicinal plants
- Photovoltaic conversion for pumping water and for electric energy supply of small consumers.

Timing of return on investments in terms of Republic of Moldova is from 3 till 12 years.

Until now, in the Republic of Moldova there are installed dozens of solar water heaters with a total area of about 1 thousands sq. m². In the warm season, such plants can provide a replacement of about 75% of traditional energy spent on heating water sanitary and domestic purposes.



**Monthly and annual total solar radiation
incident on horizontal surface, MJ/m²**

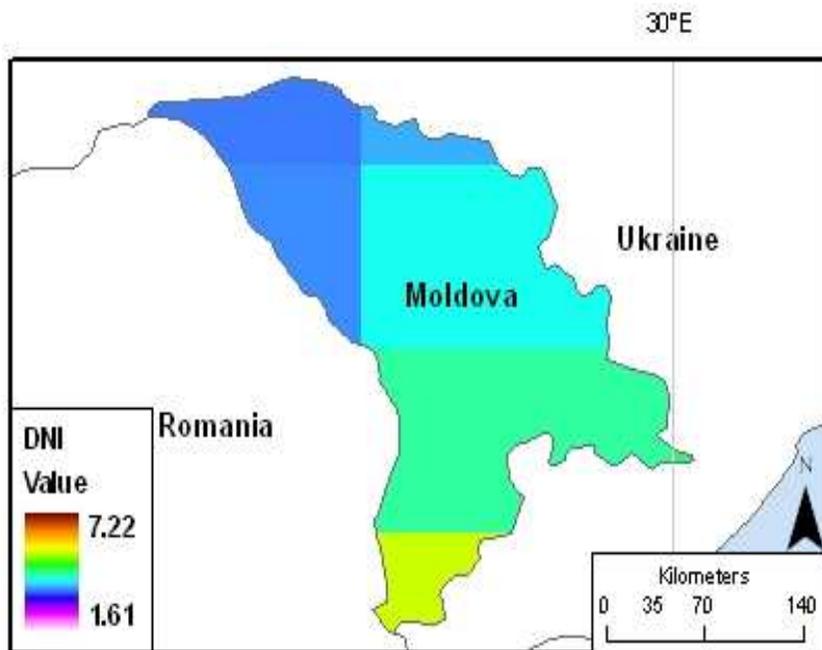
| Location | Chisinau |
|---------------|----------|
| Jan | 126 |
| Feb | 166 |
| Mar | 303 |
| Apr | 460 |
| May | 607 |
| Jun | 692 |
| Jul | 685 |
| Aug | 598 |
| Sep | 440 |
| Oct | 281 |
| Nov | 117 |
| Dec | 92 |
| Yearly | 4567 |

**Monthly and annual direct solar
radiation incident on surface normal
to sunlight beams, MJ/m²**

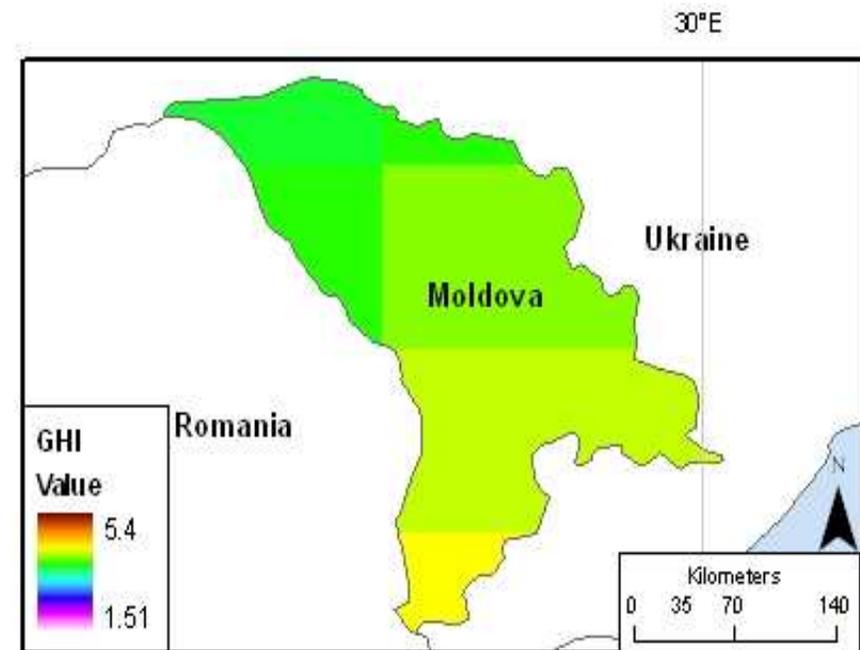
| Location | Chisinau |
|---------------|----------|
| Jan | 140 |
| Feb | 143 |
| Mar | 253 |
| Apr | 355 |
| May | 464 |
| Jun | 574 |
| Jul | 591 |
| Aug | 559 |
| Sep | 450 |
| Oct | 338 |
| Nov | 124 |
| Dec | 95 |
| Yearly | 4086 |

The following figures display the direct normal insolation and global horizontal irradiance for Moldova. As shown, the greatest potential for solar energy is in the most southern part of the country. However, the insolation and irradiation values are not extremely significant in this region.

Moldova Solar Direct Normal Insolation (Source: NASA)



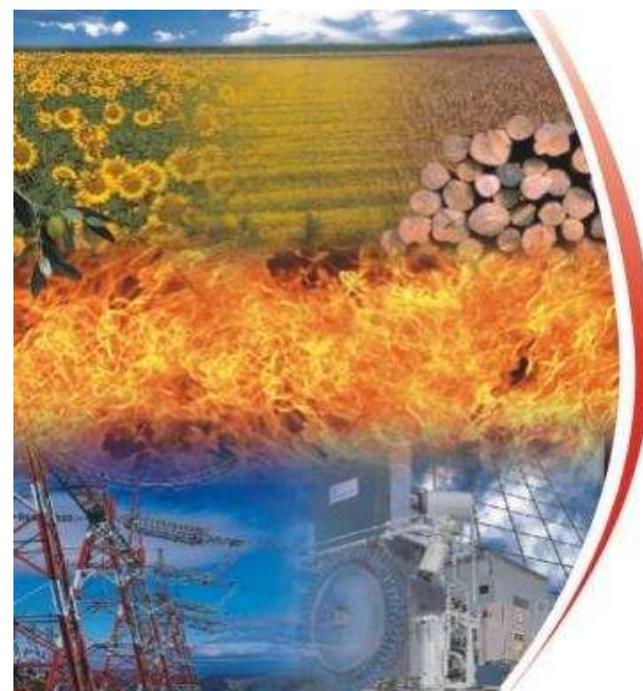
Moldova Solar Global Horizontal Irradiance (Source: NASA)



Biomass

Biomass in Republic of Moldova is represented by the following categories: wood, waste products of agriculture (straw, animal dung and poultry), the waste of processing industry (husk sunflower, grape, sugar beet, and waste wood treatment) as well as solid and liquid waste. A promising market in Moldova is using more efficient plants for biomass burning (performance factor up to 80%) .

| Types of Biomass | |
|---|---------------|
|  | Wood fuel |
|  | Rubbish |
|  | Alcohol fuels |
|  | Crops |
|  | Landfill gas |





While there is some experience with small scale rural biomass applications in Moldova, there is no experience of larger scale or more efficient use. The main generators of biomass suitable for energy purposes are forestry, agriculture, food industry and housing services.

Time of return on investment, depending on the technology transformation and types of waste, ranging from 4 to 12 years.

Moldova has sufficient biomass resource to provide significant generation if utilized.

There is good potential for biomass to be included in social infrastructure and energy system development programs, also developing cross-border cooperation, especially with Ukraine.



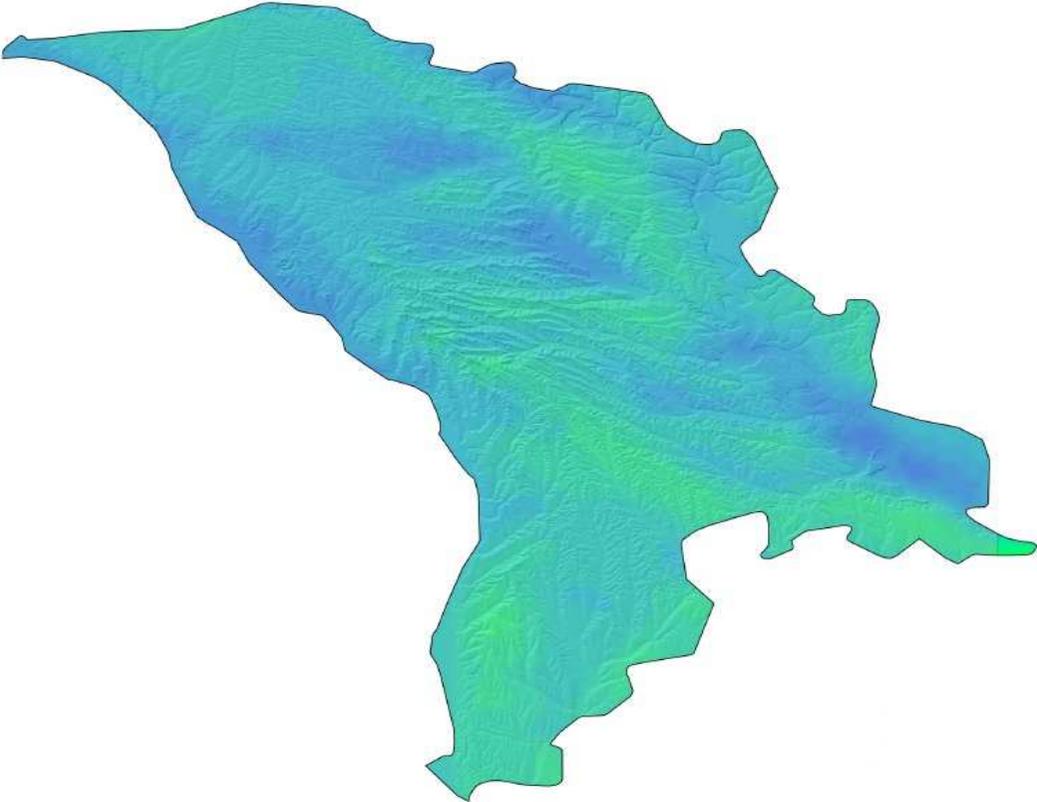
Wind Power

The ability to use wind energy in Moldova is very limited due to low, in most places, the average of wind speed of an average 3 - 4 m / s.

In some places, where the wind speed is 5 - 7 m / s, can be fully powered windmills (wind turbines), but in terms of return on the investment for them it will be at least 8 years. In addition, such facilities must give power to a network of high voltage, but in the Republic of Moldova there is no statutory obligation to purchase electric energy from such a manufacturer.

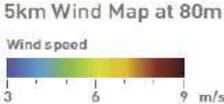
Plans to build a 400 kW transmission line to transfer the wind power installed in the eastern part of Moldova are being discussed. The line will connect the grids of Moldova to the grids of Romania.

Moldova Wind Map at 80m



Moldova Wind Resource
Map (Source: 3Tier)

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Hydropower

Despite the large number of rivers in Moldova, the potential for hydroelectric generation is relatively low, and there are only two significant-size hydroelectric power plants. The largest of these is the Dubasari facility on the Dneister River, which was built in 1954 and has a generating capacity of approximately 48 megawatts. The Dneister River basin covers over half of Moldova's territory, with several major tributaries.

The greatest potential for hydropower development in Moldova is in small hydro construction. The Dneister River basin and the Prut and Danube river basin cover the vast majority of Moldova's territory, and technically represent the best areas for development.

Electric Power of Micro hydroelectric stations can be used mainly for irrigation of small territories (approximately 6000 hectares in the basins of these rivers).

Time of return on investment for such hydroelectric stations ranged from 4 to 8 years.



Rivers of Moldova



The energy of low-grade heat sources

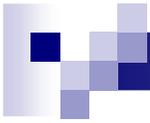
The Republic of Moldova has significant natural sources of heat with a relatively low temperature (-5 ... +35 °C) :

- the water of rivers, lakes, reservoirs, wells;
- soil;
- geothermal water;
- atmospheric air.

This energy using heat pumps can be used for heating and hot water supply.

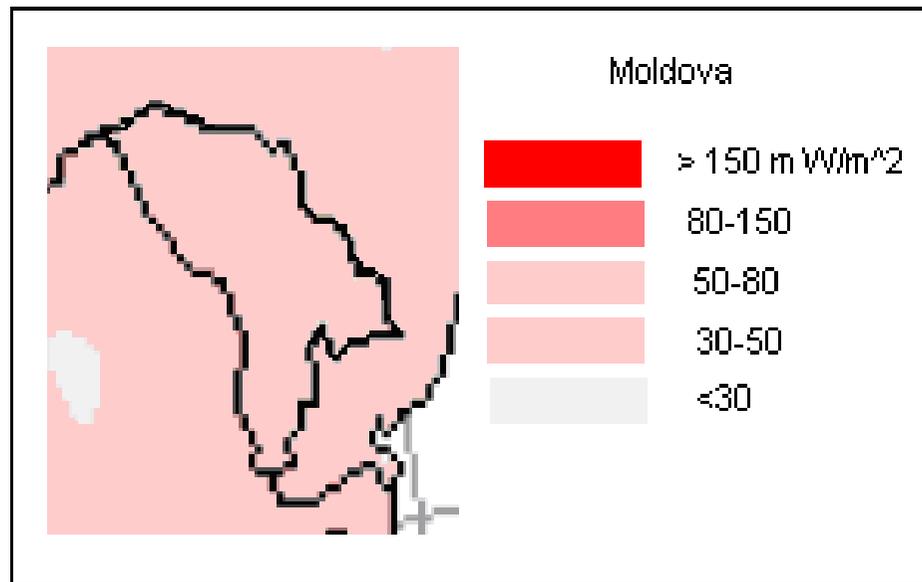
Therefore, their use would provide significant savings by using geothermal water heat (temperatures average around 35 °C), the sources of which are in the southern part of the country.

In terms of return on investment this ranges from 7 to 12 years. More advantageous is the use of heat pumps with high power.



On the basis of studies of oil and gas prospecting holes, reservoirs of thermal water were found in Moldova. The usage of thermal water is absent, and there is no national program for geothermal resources.

The highest temperature of 50 °C was measured at a depth of 1 km, southeast of Moldova near the city of Cahul.



Heat Flow (m W/m²) in Moldova



FACTORS FOR RENEWABLE ENERGY PROJECTS IN REPUBLIC OF MOLDOVA

- Legal conditions improving;
- More support measures to be introduced;
- High prices for hydrocarbon fuels and electricity;
- Ecological production and organic farming (for example the use of solar installations for drying fruits, vegetables, berries, medicinal herbs);
- The use of renewable energy sources can be decisive, particularly for recreation and health centers.



FACTORS AGAINST RENEWABLE ENERGY PROJECTS IN REPUBLIC OF MOLDOVA

- Legislative, institutional and informational barriers;
- Technical, technological and financial barriers;
- High investment costs;
- Monopolistic structure of power markets.



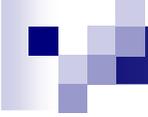
Conclusion

Republic of Moldova has, theoretically seen, a high technical and economic potential of solar energy. At least this applies to the application of heat pump systems and technologies for processing biomass.

- **The most promising** and relatively simple solution is to develop in Moldova solar thermal technologies and solar cogeneration (simultaneous production of heat and electricity) with water and air as coolants.
- **The second area** of relevance to the Republic of Moldova is a large-scale introduction of plants for the conversion of waste biomass. There are also promising combined technological and technical solutions, such as the simultaneous use of solar energy and long-term heat storage of biogas co generator to provide electricity, heating and hot water.

- **A third promising trend** is the use of low-grade thermal energy using heat pumps installation for heating and hot water supply of residential houses and industrial premises. It also will be competitive combined technologies, providing with the same equipment, to obtain heat or cold in the respective periods of the year, as well as with the use of solar energy and biogas plants.





CURRENT RENEWABLE ENERGY PROJECTS IN REPUBLIC OF MOLDOVA

- Hydroelectric power installation in Costesti, that has a weight of only 3.5% in the country's energy balance;
- Up to 10 power stations, built in the last 4-5 years working on energy produced from biomass;
- Four micro installations for conversion of kinetic energy of rivers;
- Two small wind power plants;
- Systems for conversion of solar energy for individual consumers and for electricity supply of missile antihail stations;
- In 2003 the World Bank approved the Moldova Energy II Project worth 35 million USD. So far, the project has improved heating in 23 schools and 12 medical institutions.



Thank you!

Tatiana Doloscanu
Partner
Consult Group
77 Vlaicu Pircalab street
2012 Chisinau
Tel.: +373 22 22 40 11
doloscanu@consultgrup.eu

www.consultgrup.eu