

Renewable Energy Country Profile Version 0.6b

These profiles are a work in progress. They are presented to the international community for review and comment. The profiles are undergoing continual updating for technical content, formatting, grammar, and other issues. Each country profile will be modified on a continuous basis as new information is made available.

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18.0 Moldova

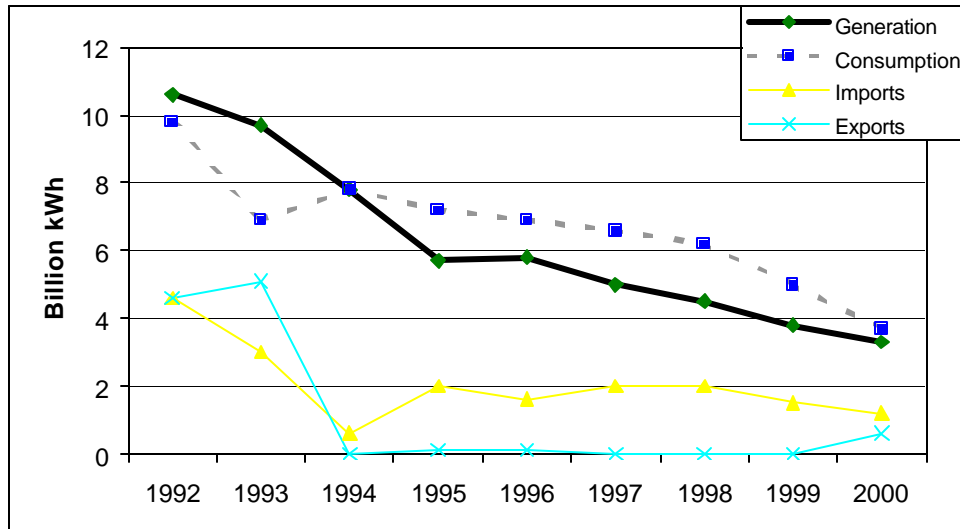
18.1 Overview of Electricity Supply

Moldova has seen significant difficulties since it received independence in the early 1990's. The GDP has consistently shrunk throughout the 1990's while inflation reached an annual rate of over 1,000% for a period. Additionally, political _____ have caused serious problems to the energy sector and the government. An ethnic Russian group residing in the Transdneister Region has effectively declared independence from Moldova. While the largest generation facility in Poland is now under the control of this group.

Electricity generation is made up with a majority of thermal, coal and gas, plants with the balance in CHP plants, providing district heating, and a small amount of hydroelectric generation. The generation assets are in serious need of rehabilitation and modernization as they have deteriorated over the past decade. The problem has been exacerbated from unpaid consumer electric bills for electricity and district heating.

Fuel	Number of Units	Capacity (MWe)	Percent of Capacity
Nuclear	--	--	--
Thermal	N/A	996	94.3%
Hydro	N/A	60	5.7%
Other Renewables	--	--	--
Total	N/A	1,056	100%

Electricity hasn't been able to meet demand since 1994. This has caused Moldova to be a net importer of power, while mounting significant debt from unpaid bills for imported power.



(Privatization Status)

1.1.1 Wind Resources

Current Status of Wind Energy³⁾

No wind turbines operate in Moldova.

Republic of Moldova is dependent on imported energy resources from Russian Federation, Ukraine (gas, coal, oil) and Romania (electric energy). Today, Moldova is a net importer of energy, with only 3% of primary energy demand covered by domestic sources. Hence, the use of renewable energy is very interesting and highly prioritized. But wind energy is only in private use and small heating plants are being developed in Moldova.

Most of Moldova's natural gas and residual oil are imported from Russia. Coal is imported from Ukraine and Romania. Electric power is being provided by the Moldovan Thermal Power Plant and the Dubasari hydroelectric plant under an interim arrangement. Even with that, about one-third of Moldova's electric power is imported from Ukraine.

A country wide wind-atlas is available, which indicates wind speeds of 4-5 m/s at 30 m height in 3 areas.

No industry association was identified. There are some small manufacturers for small units used for heating.

No other projects were identified. However, Union Fenosa, one of the major wind park operating utilities of Spain is active in Moldova. This company may be a possible spear point for developing wind energy in Moldova.

Based on the available wind atlas Moldova has a poor technical potential for wind energy development.

Wind Energy Resource Potential^{1), 2)}

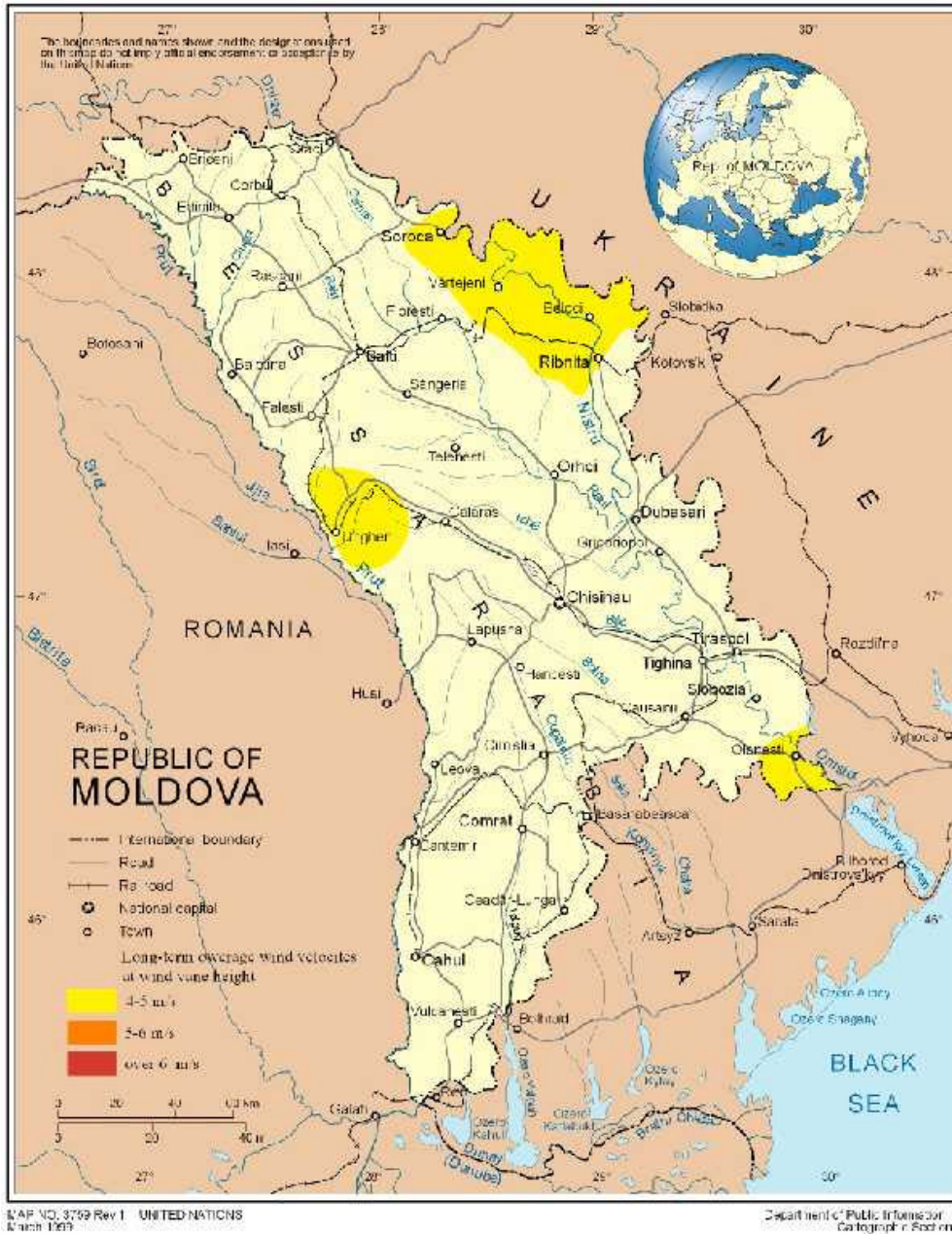
“Master Plan of Wind Power Development of the USSR till 2010”, 1989 (MPWD) included a country-level wind map. According to this map the wind power resources of Moldova are poor as a whole. Wind regimes in the country are dictated by the local topography (watersheds, slopes, valleys). The wind power potential is available only in the open territories where unfavorable landscape impact is minimum. Upon the slopes and in valleys the wind velocities are low. As a whole only about 10% of the territory may be used in the country for wind power development.

In contrast to above statement, the Romanian wind atlas indicates wind speeds ranging from 4.5 – 10 m/s at 50 m height and depending on the topography in the areas bordering to Moldova (South and southeast of Moldova). Therefore the 10×10^9 kWh/y technical potential estimated in above mentioned study is quite probably not accurate. Therefore we would set the total potential wind power capacity at 1'000 MW.

Under these circumstances we would rate the technical wind energy resource potential of Moldova as very good. But this must be documented by country wide state of the art wind measurements.

Identification of Areas/Projects with High Potential for Wind Energy

Judging by the Romanian wind atlas, the most promising areas in the south and southeast of the country.



Wind atlas of Moldova

Table 1-2 Moldova Areas/Projects with High Potential for Wind Energy..

Project Name and Location	Size (MW)	Description
Northern-eastern region of the country		Separate areas on the Podolsk Hills in the middle reaches of the Dniester river near the boundary with the Ukraine.
Southern-eastern region of the country		Separate areas near the Dniester estuary.
Western region of the country		Separate areas in the Carpathians piedmonts near the boundary with Rumania.

Barriers/Incentives for Wind Energy

Specific incentives for the implementation of wind projects in Moldova include:

- Restructuring and privatization of the energy sector aiming involvement of private investors has started
- Republic of Moldova has practically no fossil fuel resources, this fact puts renewable sources in a key role for the country energy policy.
- Western European utilities, familiar with wind energy are already in the country

Specific barriers to the implementation of wind projects in Moldova include:

- The misconception that available wind potential is poor

Table 1-3. Moldova Wind Energy Profile.

Current status of wind energy	
Installed capacity	None
Projects under construction	None
Supporting regulations?	None
Industry association?	No
Wind energy resource potential	
Level of information available	Good
Highest wind class	Class 6 (600 W/m ²)
Country -level wind atlas available?	Yes.
Estimated potential (MPWD)	10*10 ¹² kWh/annum, gross (theoretical) potential 11*10 ⁹ kWh/annum, technical potential
Estimated potential (Interwind)	1'000 MW
Target established?	Yes. By 2005 to reducing with 10% the energy intensity of the GDP (2-3% per year) and use of renewable sources of energy 2,5-3% of total energy amounts.
High wind speed locations	South and Southeast, possibly north
Identification of areas/projects with high potential for wind energy	
Recommended strategic assessments	Study 1 : Country wide appraisal of wind resources, by state of the art wind measurements at 50 m Study 2 : an appraisal of legal and economical frame work
Identified areas/projects	None
Incentives/barriers for wind energy	
Significant incentives	<ul style="list-style-type: none"> • Restructuring and privatization of the energy sector aiming involvement of private investors has started • Republic of Moldova has practically no fossil fuel resources, this fact puts renewable sources in a key role for the country energy policy. • Western European utilities, familiar with wind energy are already in the country
Significant barriers	<ul style="list-style-type: none"> • General belief that the wind energy potential is poor
Overall Prospects	<p>Good</p> <p>It is presumed that the Moldovian Wind Atlas does not reflect the true wind energy potential of this county. Combine with the fact that Moldova has nor indigenou fossil fuel resources and western grid operators experienced in wind energy are active in the country, it is quite probable that we see some wind energy development in the mid-term.</p>

- 1) “Master Plan of Wind Power Development of the USSR till 2010”, 1989
- 2) Romanian Wind Atlas, ICEMENERG 1993
- 3) An Energy Overview of the Republic of Moldova, www.fe.doe.gov

5.17 Moldova Renewable Energy Profile

5.17.3 Solar Resources

Current Status of Solar Energy

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

Solar Energy Resource Potential

The measurements of solar radiation are carried out in Moldova only in one point – a capital of the country Kishinev. The data on monthly and annual of solar radiation incidence for this point that were averaged for the observing period of many years are presented in Tables 1 and 2 [1].

Table 1

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

Name of place	I	II	II	IY	Y	YI	YII	YII	IX	X	XI	XII	Yearly
Kishinev	126	166	303	460	607	692	685	598	440	281	117	92	4567

Table 2

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

Name of place	I	II	II	IY	Y	YI	YII	YII	IX	X	XI	XII	Yearly
Kishinev	140	143	253	355	464	574	591	559	450	338	124	95	4086

As it follows from the data presented in Tables 1 and 2 Moldova possesses the satisfactory potential for using solar energy.

Identification of Areas/Projects with High Technical Potential for Solar Energy

The territory of Moldova is quite not large (34 ths. m²). The climatic conditions are practically homogeneous for the entire territory. Therefore it is impossible to allocate any zones, which have the considerably higher solar energy potential in comparison with data presented in Tables 1 and 2.

Barriers/Incentives for Solar Energy

The main barrier for development of using solar energy is an economic one. Economy of the country is currently in unsatisfactory state that exclude a possibility of attracting the inside investments for realizing any significant projects in the field of solar energy. The application of small solar plants of different purposes is eliminated by the practical absence of solvent demand.

Table 17-3. Moldova Solar Energy Profile.

Current status of solar energy	
Installed capacity	Is absent except of some solar water-heating plants with small thermal power.
Projects under construction	Are absent.
Supporting regulations?	Are absent

Industry association?	No data.
Solar energy resource potential	
Level of information available	Fair
High range of solar insolation	1.5 – 2.0 kWh/m ² /day [2] (worst month); up to 3.5 kWh/m ² /day (year average [1])
Country -level solar atlas available?	No. The measurement of solar radiation are carried out only in one point
Target established?	No data.
High solar insolation locations	Radiation climate is homogeneous with some increasing insolation from North to South of the country.
Identification of areas/projects with high potential for solar energy	
Recommended strategic assessments	Technical-and economic analysis of possibilities and scales of using solar energy under modern economic and ecological conditions.
Identified areas/projects	Development of experimental project on using solar energy in agriculture on the example of one agricultural enterprise.
Incentives/barriers for solar energy	
Significant incentives	Favorable solar climate. Absence of own traditional energy resources.
Significant barriers	The weak economy of the country, which exclude the attraction of inner investments in development of solar energy. Low tariffs for electricity and heat..
Overall Prospects	Poor. In spite on favorable climatic conditions and demand to use the alternative energy source, unsatisfactory state of economy in the country doesn't allow to attract the investments in solar power engineering.

References

1. Applied scientific reference book on climate of the USSR. Hydrometheoizdat, L., Issue 11, 1990.
2. Internet site: www.bpsolar.com/ContentDocuments/17/PVSystem Sizing Tools.zip

5.17.4 Geothermal Resources

Current Status of Geothermal Energy

On the basis of studies of oil and gas prospecting holes, the reservoirs of thermal water with temperature 30-50°C were found in Moldova. The usage of thermal water is absent, and there is no national program for their using in future.

Geothermal Energy Resource Potential

The highest temperature up to 50°C was measured at depth of 1km at Southeast of Moldova near city Kagul. At West in foothill of Carpathian Mountains (near city Ungueni) the well were drilled up to crystalline basement. The maximum temperature 46°C was here fixed. The resources of thermal water were not determined.

Identification of Areas/Projects with High Potential for Geothermal Energy

The fields with high temperature thermal water are absent in Moldova.

Barriers/Incentives for Geothermal Energy

A main incentive for using thermal water in Moldova is the absence of own fuel resources.

Specific barriers to the implementation of geothermal projects in Moldova include:

- Poor knowledge of thermal water resources.
- Low tariffs for electricity and heat

Table 17-4. Moldova Geothermal Energy Profile

Current status of geothermal energy	
Installed capacity (electric)	0
Installed capacity (thermal)	0
Projects under construction (electric)	0
Supporting regulations?	No
Industry association?	No
Geothermal energy resource potential	
Level of information available	Poor
Country geothermal atlas available?	No.
Estimated potential (electric)	0
Target established?	No
High enthalpy geothermal locations	Absent
Identification of areas/projects with high potential for geothermal energy	
Recommended strategic assessments	No
Identified areas/projects (electric)	No
Incentives/barriers for geothermal energy	
Significant incentives	Absent
Significant barriers	Poor knowledge of thermal water resources. Low tariffs for electricity and heat
Overall Prospects	
	Poor. Absence of data on thermal water resources and low heat tariffs make unlikely the utilization of geothermal energy in Moldova.

References

1. A Strategic Plan for the Development of European Geothermal Sector. *Blue Book on Geothermal Resources*, European Communities, 1999.

5.17.5 Biomass Resources

Current Status of Biomass Energy

The references of information don't contain the data on projects realized for using biomass for energy purposes in Republic Moldova.

“National plan on utilizing the industrial and domestic wastes” was developed in the Republic.

Biomass Energy Resource Potential

Table shows the overall biomass resource data for Moldova.

Moldova Biomass Resource Data (FAO 2002a, FAO 2002b).

Biomass resource type	Total production	Production density
Primary crop production, tonne	(avg. 1999-2001, tonne)	(tonne /1000 Ha)
Total primary crops (rank among COO)	8,514,487 (15)	2,587 (7)
Top 10 primary crops		
Grasses (misc), Forage & Silage	2,575,000	782
Sugar Beets	1,315,604	400
Maize	1,018,898	310
Wheat	850,142	258
Grapes	528,336	161
Potatoes	365,563	111
Maize for Forage & Silage	299,480	91
Sunflower Seed	282,817	86
Barley	201,053	61
Vegetables and Roots, Fodder	199,693	61
Animal units, number	(number)	(number / 1000 Ha)
Cattle	434,000	132
Poultry	13,650,000	4,148
Pigs	755,950	230
Equivalent animal units	872,880	265
Forest products, cubic meters	(avg 1999-2000, cu m eters)	(cubic meters /1000 Ha)
Wood fuel and charcoal	32,720	10
Wood residues	25,100	8

The geographical location and climate of Moldova are favorable for the development of agriculture.

The technical biomass resource potential for energy purposes is estimated in Republic as more than 370 thousand toe per year.

Identification of Areas/Projects with High Technical Potential for Biomass Energy

The references of information don't contain the data on new projects for using biomass for energy purposes in Moldova.

Barriers/Incentives for Biomass Energy

The main restricting factor for production and construction of new biogas plants (especially in agriculture) consists of the relatively high investment expenses per a unit of power.

Table 17-5. Moldova Biomass Energy Profile.

Current status of biomass energy	
Installed capacity	No data
Projects under construction	No data
Supporting regulations?	No
Industry association?	No
Biomass energy resource potential	
Level of information available	Poor
Relative biomass potential (total / density)	Total: 2%; Density: 44%
Country-level biomass investigations available?	No
Estimated potential	Technical biomass potential for using in energy purposes is estimated as more than 370 thousand toe??
Target established?	Yes
High density biomass areas	No data
Identification of areas/projects with high potential for biomass energy	
Recommended strategic assessments	Study 1 Detailed evaluation of economic biomass potential that can be used for energy purposes. Study 2 Formation of a list of investment projects
Identified areas/projects	??? ?????
Incentives/barriers for biomass energy	
Significant incentives	1. Absence of own reserves of organic fuel. 2. Considerable waste of agricultural production
Significant barriers	1. Insufficient investments in pilot and demonstration projects. 2. Absence of sufficient financial funds of population..
Overall Prospects	Fair

References

1. Energy Efficiency and Sustainable Development. Document by the Republic of Moldova. Strategic Issues of Energy System Reforms in Central and Eastern Europe. Round Table, 4-6 December 1995, Paris.
2. First National Communication of the Republic of Moldova Under the United Nations Framework Convention on Climate Change, 2000.
3. Economy of the USSR in 1990. Statistical yearbook/Goscomstat of the USSR. – Finances and Statistics, 1991.
4. Journal of abstracts/ Nontraditional and renewable energy sources. VINITI, Moscow, 1990-2002.
5. Renewable energy. Quarterly Information Bulletin published by Russian Center on Solar Energy “Intersolarcenter”, Moscow, 1997-2002.

Renewable Energy Profile (draft)

REPUBLIC OF MOLDOVA

HYDRO POWER POTENTIAL FOR DEVELOPMENT OF SMALL AND MEDIUM SIZE HYDRO

According to the adopted classification, small HPPs are of capacity up to 30 MW, medium-size HPPs are of capacity up to 100 MW.

1. Current State of Hydro Power

Hydro installed capacity totals 64 thou kW. Hydropower accounts for 2% of total generating capacity.

Existing Hydro Power Plants in Moldova

Hydro power plants	Installed capacity, MW
Dubosari	48
Kostesh	16

2. Hydro Power Resources of Moldova

By absolute indices of potential hydro resources Moldova is the last among the CIS countries.

Hydro Power Resources of Moldova

Characteristics	Indices		Share of HPPs, % from the total
	Total	Including small HPPs of capacity up to 30 MW	
Gross theoretical hydropower potential, - Billion kWh/year - concentration of power resources on the territory, thou.kWh/km ²	2.1 62	0.8	38
Technically feasible hydropower capability, Billion kWh/year	1.2	0.2	17
Economically feasible hydropower capability, Billion kWh/year	0.7	Not determined	-
Power generated by existing HPPs, - Billion kWh/year - per cent of economic potential, %	0.3 45	Data are not available	

At estimation of total hydropower potential of Moldova small hydropower were singled out.

3. Plans for Development of Hydropower Potential

First Priority Potential Medium-size Hydro Power Projects

Projects	Installed capacity, MW	Location
Reconstruction of existing HPP Dubosari	48	Dnister river

In future hydropower resources can be developed by construction of small hydro.

4. Favorable Factors for Development of Hydro Potential:

- lack of investments

Bibliography

1. Power Resources of the USSR. Hydropower Resources. A.N.Voznesensky et al.,1967
2. Small Hydropower, L.P.Michailov et al, 1989
3. Periodicals: Hydraulic Construction, Power Stations, etc