

Analysis of the energy security of the Republic of Moldova in the context of accession and integration to the European Union

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Abstract. *Energy security, which is defined by the availability at all times of energy in all its forms, in sufficient quantities and at affordable prices, without unacceptable or irreversible environmental impact, must be the central pillar of the strategic analysis of the national security of the Republic of Moldova, in the context of accession and integration to the European Union. Easy access to energy resources is an essential condition for the security and well-being of Moldovan individuals, businesses and communities. Given the status of the Republic of Moldova as an acceding state to the European Union, which is at the forefront of defense of the entire Euro-Atlantic space against the offensive of the hostile interests of the Russian Federation, the region has become the hottest geopolitical, geoeconomic and geostrategic space for direct confrontation of the interests of the West and East, with a huge potential for escalation to a military conflict. Against this background, the preferred means of threat of the Russian Federation proves to be the energy weapon, used both for the promotion of major economic interests, as well as as an instrument of influence and political blackmail. Therefore, energy is no longer only a factor of the equation of economic power of the Moldovan state, but also an element of political influence and control, with reflections in the military capabilities. The authors want to analyze the state of energy security regarding the state of energy resources and electricity.*

Keywords: *Energy security, Energy resources, Energy weapon.*

1. Introduction

The Republic of Moldova is a state located in South-Eastern Europe and has the following neighbors, according to Figure 1:



- North, East and South – Ukraine;
- West – Romania.

The Republic of Moldova is a parliamentary Republic with a president as head of state and a prime minister as head of government and is a Member of the United Nations, the Council of Europe, the Partnership for Peace, and other international organizations, and is a candidate state for membership in the European Union.

The Republic of Moldova is a state with no direct sea exit, but it has a 430-meter stretch of Danube at its southern extremity, through which it has potential access to the Black Sea as well.

The main cities:

- Chisinau (capital);
- Balti;
- Tiraspol;
- Tighina;
- Ribnita;
- Ungheni;
- Cahul;
- Soroca;
- Dubasari;
- Straseni, etc.

The main rivers:

- Nistru;
- Prut;
- Răut;
- Botna, etc.

Since 1990, the territory of the Republic of Moldova located on the eastern bank of the Dniester (Nistru) River is under de facto control of the separatist regime in Transnistria (controlled and/or supported by Russia).

Mineral resources:

- Limestone;
- Chalk;
- Gypsum;
- Sand;
- Sandstone;
- Bentonite;
- Tripoli;
- Diatomite.

Non-metallic mineral resources:

- Graphite;
- Phosphorite;
- Zeolite;
- Fluorite;
- Bariite;
- Iodine;
- Bromine;
- Iron;
- Lead;
- Zinc;
- Cooper.

Energy resources (very small amounts):

- Lignite;
- Oil;
- Natural gas. [6]



Figure 1. Map of Republic of Moldova

2. The state of energy security of the Republic of Moldova

2.1. Security of natural energy resources

Currently, the Republic of Moldova does not have its own natural energy resources (oil, natural gas, coal, uranium, etc.), except for small amounts of oil and natural gas present in the south of the country.

Because of this, Republic of Moldova is heavily dependent on imported natural energy resources, and the current level of harnessing the potential of renewable energy sources does not cover consumption needs.

The energy resources used to produce electricity and heat are [1] [2]:

- Natural gas: 91,1 %;
- Biofuels and waste: 4,6%;
- Oil products: 2,5%;
- Electricity: 1,3%;
- Coal: 0,5%.

Imports of energy resources and electricity are:

- Electricity: 80%;
- Oil products: 99%;
- Natural gas: 100%;
- Coal: 100%.

2.2. Security of electricity supply

The power system of the Republic of Moldova works in sync with the power system of Ukraine, which is part of the Integrated / Unified Energy System (IPS / UPS) of the Russian Federation, at a voltage of 330 kV with the following countries: Belarus, Ukraine, Kazakhstan, Georgia, Mongolia, Kyrgyzstan, Azerbaijan, Tajikistan.

The 330 kV voltage is atypical for the European ENTSO-E power system, which operates at the transmission voltage of 400 kV, and for this reason dependence on the Russian IPS/UPS power system is generated. [3]

A. Power supply and transport

The power supply and transport of electricity is carried out through the National Power Grid belonging to the Moldelectrica company, with the following infrastructure, according to Figure 2 [3] [5] [9]:

- 1 (one) 400 kV overhead line for cross-border interconnection with Romania (stability and reliability of the power system):
 - *Vulcănești – Isaccea*;

- 1 (one) 400 kV national overhead line (stability and reliability of the power system):
 - *Vulcănești – CERS Moldova.*
- 7 (seven) 330 kV overhead lines of cross-border interconnection with Ukraine (stability and reliability of the energy system):
 - *CERS Moldova – Novoodeska;*
 - *CERS Moldova – Usatove;*
 - *CERS Moldova – Podilska;*
 - *CERS Moldova – Artsyz;*
 - *Răbnița – Podilska (circuit 1);*
 - *Răbnița – Podilska (circuit 2);*
 - *Bălți – Dnistrovska HPP.*
- 3 (three) national air overhed lines of 330 kV (stability and reliability of the energy system):
 - *CERS Moldova – Chișinău (double circuit);*
 - *Chișinău – Strășeni;*
 - *Strășeni – Bălți.*
- 15 (fifteen) 110 kV overhead lines of cross-border interconnection with Ukraine (trade):
 - *Etulija – Budzhak;*
 - *Vulcănești – Reni;*
 - *Vulcănești – Kosa;*
 - *Vulcănești – Bolgrad (circuit 1);*
 - *Vulcănești – Bolgrad (circuit 2);*
 - *Vulcănești – Bolgrad (circuit 3);*
 - *CERS Moldova – Belyaevka;*
 - *CERS Moldova – Rozdil;*
 - *CERS Moldova – Starokazachye;*
 - *Vasilevik – Kr. Okni;*
 - *Brich – Dnistrovska HPP;*
 - *Otaci – Namiya;*
 - *Ocnița – Shahta;*
 - *Soroca – Poroghi;*
 - *Larga – Nelypivtsy.*
- 4 (four) 110 kV overhead lines for cross-border interconnection with Romania (trade):
 - *Cioara – Huși;*
 - *Ungheni – Țuțora;*
 - *Gotești – Fălciu;*
 - *Costești – Stâncă.*



Figure 2. National Power Grid

B. Electricity generation

The generation of electricity shall be carried out by means of the following power stations (plants): [5]

- CERS Moldova (Cuciurgan) – 2520 MW:
 - *the largest methane-based thermal power plant in the Republic of Moldova;*
 - *the only natural gas distributor is the Russian company SAD Gazprom (generates total dependence on Russia);*
 - *natural gas supplier is the daughter company of Moldovagaz – Tiraspoltransgaz.*
- CET 1 Chișinău – 66 MW;
- CET 2 Chișinău – 240 MW;
- CET Bălți – 24 MW;
- CHE Costești – 16 MW;
- CHE Dubăsari – 46 MW;
- Other generation sources – 87 MW.

C. Buyers of electricity

The following actors are present in the electricity market:

- Gas Natural Fenosa Energy supply – universal service provider;
- Electricity Supply North – provider of universal service;
- Red Union Fenosa – operator of the distribution system;
- Moldelectrica – transmission and system operator;
- Red Nord – operator of the distribution system.

2.3. Security of natural gas supply

The natural gas system of the Republic of Moldova is connected to the Unified Gas Supply System of Russia, which generates total dependence on this system.

The largest natural gas actor in the Republic of Moldova is Moldovagaz, which is a Moldovan-Russian joint stock company with the following share distribution: [1] [2]

- SAD Gazprom holds 50,0% + 1;
- SAD Gazprom controls another 13,44% of the Management Committee of the property of Transnistria (handed over to the management of SAD Gazprom);
- The Government of the Republic of Moldova holds 35,33%;
- different individuals and legal entities holds 0,23%.

Moldovagaz provides the following services:

- purchase of natural gas from the mother company SAD Gazprom;
- natural gas transport and transit through:
 - *Moldovatransgaz*;
 - *Tiraspoltransgaz (in the transnistrian region)*;
 - *Vestmoldtransgaz (interconnector operationalization Iasi – Ungheni – Chisinau)*;
- natural gas distribution through the 12 distribution companies;
- gas transit through the TransBalkan pipelines to:
 - *Romania*;
 - *Bulgaria*;
 - *Greece*;
 - *Turkey*.

The supply, transport and transit of natural gas shall be carried out through the Natural Gas Transmission Network, which shall have the following infrastructure, as shown in figures 3 and 4: [10]

- supply (Ukraine):
 - Gas Pipeline 1: Ananiev – Cernăuți – Bogorodceni (ACB);
 - Gas Pipeline 2: Ananiev – Tiraspol – Ismail (ATI);
 - Gas Pipeline 3: Șebelinka – Dnepropetrovsk – Krivoi – Rog – Ismail (DKRI);
 - Gas Pipeline 4: Tiraspol – Odesa (TO3).
- supply (Romania):
 - Gas Pipeline 5: Iași – Ungheni – Chișinău (IUC).
- transport:
 - 656,307 km. main pipe;
 - 903,478 km. pipe connection;
 - 3 gas compression stations;
 - 1 gas measuring station;
 - 81 gas transfer measuring stations;
 - 221 cathodic protection stations.

System of import and transit of natural gas, as shown in Figure 3:



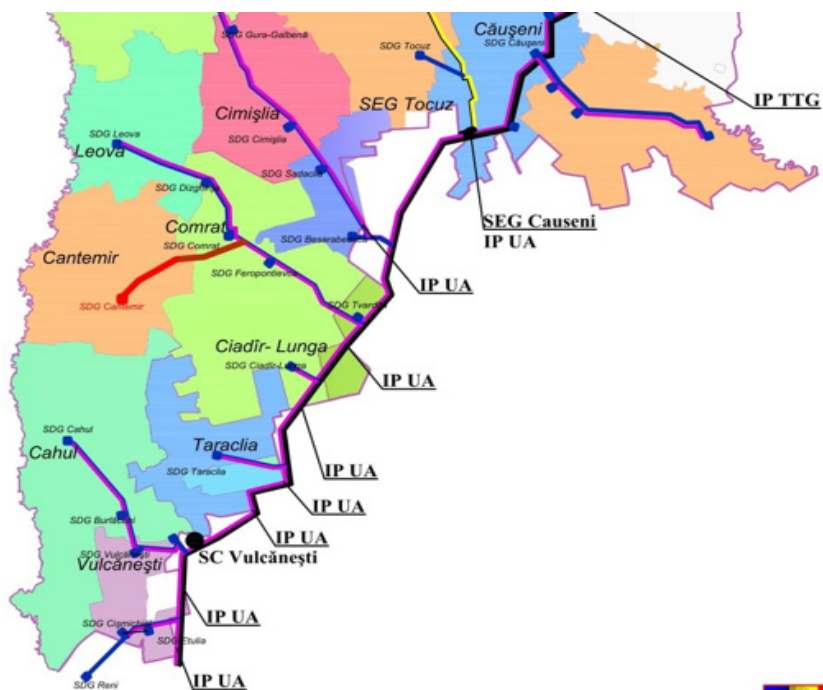
Figure 3. Import and transit of natural gas

The main gas crossing entry points are shown in table 1.

Table 1. Import of natural gas (crossing entry points)

CROSSING ENTRY POINTS		STATUS
1	Olekseevka (Ukraine – Moldova Republic)	operațional
2	Ungheni (Romania – Moldova Republic)	under construction
3	Grebenichi (Ukraine – Moldova Republic)	operațional
4	Căușeni (Ukraine – Moldova Republic)	operațional
5	Isaccea (Romania – Moldova Republic)	operațional











-  **Conducte magistrale de transport**
-  **Conducte de derivație**
-  **Rețea de cablu fibră optică**
-  **SDG- Stații de distribuție a gazelor**
-  **SEG- Stație de evidență și consum al gazelor**
-  **SC- Stație de compesare a gazelor**
- IP** **Punct de interconectare**
- TTG** **SRL "Tiraspoltransgaz"**
- VTG** **SRL "Vestmoldtransgaz"**

Figure 4. Natural gas transport infrastructure

Major consumers of natural gas of the Republic of Moldova:

- Thermal Power Plant CERS Moldova;
- Moldovan Metallurgical Factory;
- Moldavkabel company;
- Cement Factory Râbnita;
- Electromas company;
- Tirotext company;
- Kvint company.

3. Identify vulnerabilities

Vulnerabilities identified:

- a) The lack of own natural energy resources (oil, natural gas, coal, etc.), except for small amounts of oil and natural gas present in the south of the country;
- b) fully dependent on imported natural energy resources (oil, natural gas, coal, etc.);
- c) massive imports of energy resources and electricity;
- d) atypical electricity transmission voltage (330 kV);
- e) the impossibility of interconnection with the European electricity system ENTSO-E, only with major investments in power infrastructure;
- f) dependence on the Russian power system IPS / UPS;
- g) economic insecurity, through excessive and unilateral dependence of domestic systems of foreign monopolistic electricity and natural gas;
- h) lack of storage deposits of natural gas;
- i) there is no access to liquefied natural gas (LNG).

4. Conclusion

Since Moldova does not have its own natural energy resources (oil, natural gas, coal, uranium, etc.), it is strongly dependent on imported natural energy resources, and the current level of harnessing the potential of renewable energy sources does not cover the consumption needs.

As is probably known, the largest electricity producer in the Republic of Moldova is CERS Moldova, which is a natural gas-based power plant located on the left bank of the Dniester and belongs to the Russian company SAD "inter RAO UES".

Natural gas is distributed by SAD Gazprom from Russia and supplied by Tiraspoltransgaz, a company that is part of the Moldovagaz giant.

If natural gas is imported only through the TransBalkan gas pipeline, which does not cover the country's natural gas needs, then a real threat to the National Power System will be generated.

The debt of almost \$7 billion to the Russian distributor SAD Gazprom is putting energy security at risk by creating total dependence.

In this context of energy, economic and national insecurity, caused by total energy dependence, the Republic of Moldova must invest massively in the construction of critical power infrastructures (power substations and overhead lines operating at 400 kV, power plants, gas pipelines and natural gas stations, etc.), in the context of the security of supply and supply of electricity and natural gas from the European ENTSO-E (electricity) and ENTSO-G (gas) systems.

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