Financing Energy Efficiency Investments for Climate Change Mitigation

National Case Study:

"*An Analysis on the Policy Reform Impact on Implementation the Renewable Energy Sources in the Republic of Moldova*"

United Nations
Economic Commission for Europe

Chisinau
November, 2009

TABLE OF CONTENTS

TABLE OF CONTENTS 2

LIST OF ACRONIMS, ABBREVIATIONS AND UNITS 3

1. CONTEXT 4

1. A. SECTOR CHARACTERISTICS BEFORE THE POLICY REFORMS 4
1. B. REGULATORY FRAMEWORK BEFORE THE POLICY REFORMS 5
1. C. INVESTMENT PROJECTS 6
1. D. SPECIFIC POLICY BARRIERS 6

2. POLICY REFORMS 6

2. A. POLICY REFORMS TO ATTRACT INVESTMENTS 6
2. B. POLICY AND/OR REGULATORY PRECONDITIONS NECESSARY FOR THE IMPLEMENTATION OF THE POLICY REFORM 10
2. C. STAKEHOLDERS INVOLVED 10
2. D. IMPLEMENTATION OF THE POLICY REFORM 11
2. E. BENEFITS OF THE POLICY REFORM 12

3. IMPLEMENTATION OF THE RES PROJECTS 12

3. A. TECHNICAL DESCRIPTION OF THE RES PROJECTS 12
3. B. FINANCIAL DESCRIPTION OF THE RES PROJECTS 15
3. C. BENEFITS OF THE RES PROJECTS IMPLEMENTATION 16
3. D. ASSESSMENT METHODOLOGY USED TO DETERMINE THE RES PROJECT BENEFITS 19

4. CONCLUSIONS AND RECOMMENDATIONS 21

4. A. CONCLUSIONS ON THE BENEFITS OF THE INTRODUCED REFORMS 21
4. B. LESSONS LEARNED 22
4. D. RECOMMENDATIONS FOR POSSIBLE ADOPTION OF A SIMILAR APPROACH IN NEIGHBORING COUNTRIES 23

BIBLIOGRAPHY 23

LIST OF ACRONIMS, ABBREVIATIONS AND UNITS

TrPP	Transnistrian Power Plant
CHP	Cogeneration Power Plant
HPP	Hydro Power Plant
RED	Electricity Distribution Company
ANRE	National Agency for Energy Regulation
NAEC	National Agency for Energy Conservation
PP	Power Plant
RPP	Renewable Power Plant
O&M	Operation and Maintenance
UCTE	Union for the Coordination of Transmission of Electricity
CPIM	Moldova Consumer Price Index
WACC	Weighted Average Cost of Capital
GO	Guarantee of Origin
RES	Renewable Energy Source
AFI	Association of Foreign Investors
Ch WTE PP	Chisinau Waste to Energy Power Plant
WTE	Waste to Energy
MSW	Municipal Solid Waste
PWF	The Parks of Wind Farms
WAsP	Wind Atlas Analysis and Application Program
IRR	Internal Rate of Return
ERR	Internal Rate of Return
MDL	national currency (Moldavian Lei)
CDM	Clean Development Mechanism
GDP	Gross Domestic Product
DAF	Delivered at Frontier
EEF	Energy Efficiency Fund
TWh	Terra Watt hours
MW	Mega Watt
Hz	Hertz

1. CONTEXT

1. A. Sector Characteristics before the Policy Reforms

Moldova lacks own fossil fuel deposits. Hydro resources are also limited and mostly developed by Dubasari (48 MW) and Costesti HPP (16 MW). That is why the country has had to orient itself exclusively to fuel resources located out of country, so that at the present around 98% of the total energy resources consumed are from the import.

Along with the lack of primary energy resources, only about 30% of the electricity consumed on the right bank of the Dniester River can be covered from the local power plant, the deficit of power being around 700 MW from approximately 900 MW pick load needed at the present. Most part of the local electricity is produced based on the gas that is imported from one country through the pipelines that passed one country as well.

The most reasonable solution to cover the demand of power would be to use the capacities of the Transnistrian Power Plant (TrPP) in Dnestrovsk (on the left bank of Dniester River) along with some import of electricity from the East. But because of Transnistria secessionism produced in 1992 a secure and reliable power supply from TrPP cannot be ensured. That is why the right bank Dniester River territory of the Republic of Moldova has to choose other solutions to satisfy the country power demand and overcome energy security problem. In the Table 1 the evolution of country electricity production, electricity imported and electricity consumed by final consumes is shown.

Table 1: Production, Import and Consumption of Electricity in the Republic of Moldova, millions kWh [1]

Items	2003	2004	2005	2006	2007	2008
Electricity production at right bank of Dniester river	**842**	**831**	**1000**	**958**	**904**	**905**
incl.: CHP-1	113	113	129	125	131	121
CHP-2	622	608	725	690	682	641
CHP-North	39	45	56	62	55	55
HPP Costeşti	63	58	84	76	33	82
other internal producers, incl. sugar factories' CHP	5	7	7	6	3	7
Electricity purchased	**3364**	**3255**	**3465**	**3660**	**3827**	**3860**
Incl.: distribution companies: RED North	602	570	588	625	649	655
RED North-West	318	277	287	304	328	331
RED Union Fenosa	2444	2371	2484	2610	2715	2751
Eligible consumers		36	106	121	136	123
Electricity imported at right bank of Dniester river	**2522**	**2424**	**2465**	**2703**	**2923**	**2955**
incl. in %	75	74	71	74	76	77
Electricity consumption by final consumes [3]	**2353**	**2439**	**2695**	**2987**	**3165**	**3232**

As it is seen from the table, in 2008 77% of electricity consumed on the right bank of Dniester River has been imported. Major country's (right bank of Dniester River) dependence on external energy resources supply contributes to the overall vulnerability of the economy and undermines the long-term objectives of macroeconomic stability and economic growth.

In 2007 new Energy Strategy for the period up to 2020 was published [2]. The strategic objectives of the national energy policy for this period are:

- Ensuring security of energy supply;
- Promoting energy and economic efficiency, and use of renewable energy sources;
- Liberalization of the energy market and restructuring of the energy industry, in accordance with the requirements for the country's integration into the European energy system.

According to the document, in order to diminish big country power dependency on the import, new power plant and interconnection lines should be built during 2010-2020. Among them renewable energy sources should reach up to 6% in 2010 and 20% in 2020 in the country's energy balance. In 2005 year the share of renewables in energy consumption was 71.4 ktoe, just 3.6% of the total primary energy supply. Hydro energy and biomass have the largest share, while solar and wind energy as well as sources of reduced thermal potential is inadequately explored [2].

1. B. Regulatory Framework before the Policy Reforms

Before the policy reforms were initiated in 2007, the Republic of Moldova's legislative and regulatory framework for the energy sector was reflected in the following principal documents: Law No. 1525-XIII as of 19.02.1998 on Energy Sector, Law No. 136-XIV as of 17.09.1998 on Gas, Law No. 137-XIV as of 17.09.1998 on Electricity, Law No. 1136-XIV as of 13.07.2000 on Energy Conservation, Government Decision No 360 as of 11.04.2000 on approving the Energy Strategy of the Republic of Moldova until 2010, Government Decision No 1527 as of 26.11.2002 on approving the establishment of a National Agency for Energy Conservation (NAEC), Government Decision No 1528 as of 26.11.2002 on approving the Regulation of the National Fund for Energy Conservation, Government Decree No 1078 as of 05.09.2003 on approving the National Program of Energy Conservation for the years 2003-2010, as well as in the second-tier legislation approved by the National Agency for Energy Regulation (ANRE).

By the moment the policy reforms being initiated, the basic legislative and regulatory framework for the energy sector has been already developed in the Republic of Moldova. However, it was clear also that it needs a further development and improvement in conformity with the requirements aimed at implementation of adequate energy security, high energy efficiency; minimum energy price thresholds obtained in competition; and minimized negative environmental impact. Also, there was important that the existent sector legislation would be further harmonized adequately with the Energy Community Treaty and *Acquis Communautaire* in the area of energy.

In that context, in the frame of the new policy reforms there was necessary to discontinue cross-subsidizing of the electricity and heat tariffs as soon as possible, including subsidies in the form of differentiated tariffs; to favor renewable energy generation; to focus on the diversification of energy resources in the energy balance, including the imported ones; to incentives and regulate improved energy efficiency, etc.

To be noted that until 2007, notwithstanding the existence of certain relatively good applicable regulations, the achievement of the defined goals was facing certain difficulties created mainly due to the lack of the adequate institutional framework. For example, In 2002 NAEC was transformed in a self-financing body, the event that leaded to total its inactivity.

It was necessary also to improve the independence and competence levels of the National Agency for Energy Regulation and to vest it with the authority to approve all Tier II regulations, to calculate and approve tariffs for heat generated in a centralized way in Moldova's urban centers, etc.

It was relevant to enhance the primary legislation on energy efficiency and renewable energy as well as to develop the secondary legislation to make it operational. Also, there was a need for harmonization of sectoral laws in terms of intent and objectives and establishing the economic incentives to stimulate the implementation of the energy efficiency and renewable energy in the Republic of Moldova.

1. C. Investment Projects

At least six investment projects for construction of power plants have been announced and even initiated in diverse regions of the Republic of Moldova in the past ten years. None of these projects has been implemented. One of the factors that blocked the projects implementation was the low tariffs, because some investors, as a project implementation precondition, required that the Government has to commit to buy the produced electricity at a price that had to be set from the very start, that would include all production costs plus the possibility to pay back the investment made within 7-10 years.

1. D. Specific Policy Barriers

The assessment performed on identification of specific barriers showed that due to (i) poor payment capacity of the consumers in the Republic of Moldova; (ii) a relatively high investment risk in the country, as well as lack of interest to build electric power stations on a free electrical power production market, (iii) availability of electrical power generation sources (i.e., Ukraine, TrPP) at a lower price than the one from a newly built plant, the investors' interest in construction of new plants in the Republic of Moldova (Right Bank of the Dniester River) during the last years was rather limited. Another major impediment was the problem of tariffs that needed to be urgently solved, because the current tariffs do not stimulate the attraction of investments in energy production.

The tariffs for the electricity needed to be urgently adjusted to the real production costs (including depreciation of investments as if it is made for a new plant). Thus the power generation market could become attractive for investors, while construction of new plants and rehabilitation and upgrading of the old ones would add to the energy security of the country.

Other specific barriers on Energy Efficiency and Renewable Energy Sources implementation were as following:

- Energy efficiency legislation was more declaratory than operational;
- Actions in the area of developing and implementing secondary legislation, institutional capacity building, developing sectoral programs, and securing financing were required;
- There were identified discrepancies and contradictions between laws;
- While legislation considered incentives for energy efficiency activity development, the lack of mechanisms and underpinning legislative framework stand as the most significant barriers against their implementation.
- Inefficient legislation to support the structure of the National Agency for Energy Conservation under the Ministry of Economy and lack of financial and human resources for its operation.
- The limited consumer's capacity to pay more expensive electricity in the country would impede much to launch the construction of big RES, as price for electricity produced at renewables is usually much higher than prices of power at traditional sources used in Moldova.

2. POLICY REFORMS

2. A. Policy Reforms to Attract Investments

Between 1997 and 2000 the power sector located on the right bank of Dniester River was unbundled. Moldova's wholesale electricity market is now made up of dispatch/transmission, distribution, generation, and supply (including local supply, import/export, and transit operations) licensees and

eligible customers. The power market is based on bilateral contracts between distribution companies and regulated generating companies; on fixed price, non-regulated bilateral contracts between distribution companies and suppliers; and on non-regulated bilateral contracts between eligible consumers and suppliers.

Up to 2006 a lot of normative acts were published to attract investments in power plant construction, including based on renewable sources: Electricity Law (1998); Energy Law (1998); Energy Conservation Law (2000); Law on Foreign Investments (2000); The Energy Strategy of the Republic of Moldova until 2010 (2000); Resolution of the Government of the Republic of Moldova from 31.10.2000, concerning utilization of the Renewable Energy Sources (2000); National Program on Energy Conservation for the period 2003-2010 (2002); Power Plant Construction Regulation (2003); Law on Investments in Entrepreneurial Activity (2004); Economic Growth and Poverty Reduction Strategy Paper for 2004-2006 period (2004); Law on the Basic Principals on Entrepreneurs Activity (2006). According to the Energy Conservation Law (2000) a special Fund should be created in order to enforce energy efficiency and renewable resources development. Unfortunately, the Energy Conservation Fund was not been created. In 2006 the article that made reference to the respective Fund was abolished. Instead of it a new provision was introduced: "The state financial sustaining". Even some financial resources have been allocated by authorities they have not been utilized because no feasible projects have been presented. And that's because of lack of capacity of the National Agency for Energy Conservation (NAEC). In 2002 NAEC was transformed in a self-financing body, the event that leaded to total its inactivity. In order to repair the situation the Ministry of Industry and Infrastructure took some measures:

a) It has drafted the Law on Energy Efficiency (2009) oriented to replace the Law on Energy Conservation (2000) in effect. Instead of NAEC to create Energy Efficiency Agency. The draft is still in process of coordination.
b) It has elected a new Director of NAEC, but the last was not appointed because the financing source is not defined/exist yet.

Even the created framework for investments in renewables permitted investors to enter in the country power market, there has been no one renewable power generation unit build in the Republic o Moldova since power market reforms have been launched, except those financed through technical assistance came from foreign donors, as 100 kW PP on biogas built in village Colonita, not far from Chisinau. The last tried not one time to sign a contract of selling the surplus of electricity to the distribution company, but each time failed. That's because at that time (until 2006) the following dominated issues impeded to appropriate the existing renewable resources:

a) The legal framework didn't specify clear the RPP (Renewable Power Plants) right of access to the electricity grid;
b) The renewable sources should compete for the cheapest electricity on the market along with independent energy suppliers, i.e. with either Ukraine power source or TrPP. In the conditions when the price for electricity provided from the last sources varied from 2.5 to 3.5 US c/kWh, while the electricity generated by RPP exceeded much these values, no chance for renewable sources to enter in the market with the perspective to recover both the investments made for PP construction and imminent annual O&M costs;
c) Because of relatively small amount of electricity produced by RPP and not stable its generation during the time;
d) The distribution companies, the main country potential buyers of renewable electricity, have had a low interest to enter in a long contract for purchasing the power from these sources. The connection to the grid of such plant creates some technical and dispatch problems.
e) The power market was not liberalized and there were not created legal framework to sell electricity based on green cards.

As Moldova has one of the highest priorities goal to join to Energy Community and UCTE it ought to approximate its legal framework, including one regulating the penetration of the RES in the overall power consumption. Starting with 2007 years radical measures have been undertaken in this respect:

I. Renewable Energy Law was approved and published (2007) [4]. According to this normative Act the National Agency for Energy Regulation (ANRE), the existing Moldovan regulator in energy sector, has been authorized to (Art. 12):

a) Approve the tariffs for each type of renewable energy and fuel, calculated by the producer based on the methodology approved by ANRE for the following 15 years which will foresee the recover of the investments made, eventually, in construction, installation extension or modernization, as well as of interconnection lines, of transport and distribution of energy and fuel. The rate of return prescribed shell not exceeds the double as of the rate established in the traditional energy sector. At the stage of tariffs approval the price for analogical commodities/services established at the international market will be taken into consideration;
b) Elaborate, as per the case, the acts necessary to regulate the relationship between the participants on renewable energy market;
c) Elaborate the projects of the contracts on commercialization of renewable energy and fuel, foreseeing free and not discriminatory access of renewable energy and fuel producers to the centralized power and heat grid, as well as to the distribution grid and installations of fuel;
d) Issue the license for renewable fuel production.

The Law prescribes as well (Art. 24 and Art. 25):

a) The tariffs for renewable energy are established and approved annually depending on the installations type and their production capacity, on production volume and foreseen supply, on the period of renewable energy supply;
b) At the stage of these tariffs establishment the appropriate prices on the international market will be taken into account.
c) Petroleum products importers and internal power suppliers shell acquire from the authorized producers the established quantity o renewable energy and fuel in accordance with the established by ANRE the share part, depending on the share they hold on power and petroleum product market.

In order to enforce both energy efficiency and renewable energy resources development the Law establishes Energy Efficiency Fund. The main target of the Fund is to manage the available financial resources in order to promote the financing of the activities in the domain of energy efficiency and to turn to good account renewable energy resources according to the strategies and programs elaborated by the Government. Unfortunately, up to now the Fund has not been created.

II. Based on published Law on Renewable Energy (2007), ANRE has elaborated the Methodology for the determination, approval and application of tariffs for the electricity generated from renewable energy and biofuels (February 2009). This document is one crucial in attracting investments in the development of renewable sources in the Republic of Moldova. The mechanism applied for determining and regulation of tariffs is based on the following principles [5]:

- Protection and enhancement of state energy security;
- Reduction of negative impact of the energy sector on the environment;
- Covering companies' real costs for adequate exploitation of production units and for normal carrying out of the regulated activity;

– Performing by the companies an efficient and profitable activity that would allow them to recover their financial resources invested in development, modernization and reconstruction of production capacities.

This Methodology is mandatory for renewable energy generation companies in case the capacity of the power plant of the producer is not less than 10 kW and the electricity generated is designed to be commercialized on power market and for all companies producing biofuel designed to be commercialized on the market of petroleum products.

The Methodology is valid for a period of 15 years starting from the date it was published.

For each investor wishing to build a renewable energy source the provisions of the Methodology ensures him the recovering of all needed and proved costs plus a return on investments made, much higher than one applied to the traditional national electricity distribution companies. The costs are recovered amongst the tariff and comprise:

1. The cost of fuel purchased for renewable power production;
2. The company O&M costs in year t (CDt) related to production and commercialization of renewable power. They include labor costs; material costs; third Parties service cost; other O&M costs; taxes and fees. For the first two years of activity, the companies shall present detailed materials necessary to determine their own O&M costs. O&M costs accepted by ANRE for the year two of activity shall be considered as basic costs (CDo). For each of the following years the basic costs shall be adjusted to Moldova Consumer Price Index (CPIMt, i.e. inflation) of the previous years and corrected to efficiency factor (0.99 in the formula below)

$$CD_t = CD_o \times \prod_{i=1}^{t} 0{,}99 \times (1 + \frac{CPIM_t}{100})$$

3. Cost of capital, comprising both depreciation of investment made and rate of return on net investments put in operation. The rate of return in % is calculated according to the following formula:

$$Rr_t = WACCe.t._t \times K_t$$

Where:

$WACCe.t._t$ - Weighted Average Cost of Capital determined and approved by ANRE for the electricity distribution companies in year "*t*". In 2008 it reached the level of 15.05%; in 2009 it constitutes 14.24%.

K_t- multiplier coefficient applied for generation renewable energy and bio fuel in year "*t*". It is established in the manner as following:

- For the first five years of activity (years 1-5) it shall be equal to 1.5;
- For the second five years of activity (years 6-10) it shall be equal to 1.3;
- For the third five years of activity (years 11-15) it shall be equal to 1.1.

III. In order finalize regulatory framework for implementing renewable power sources in the country, in May 2009 ANRE has published the Regulation concerning the Guarantee of Origin for Electricity Produced by Renewable Energy Sources [6] and then, in June 2009 ANRE has elaborated but not approved yet the Model Contract on selling electricity produced by renewable energy sources. The main provisions of these mandatory documents, that are crucial for any investor in

renewables, are as follow:

a) The Guarantee of Origin (GO) specifies:

i) Renewable source from which electricity has been produced;
ii) The date of issuance;
iii) The address of RES;
iv) Capacity;
v) The quantity of electricity produced and permit producer to prove that electricity has been produced from RES. It is issued by Disco or Transport Operator, depending on which grid RES is connected.

b) For RES based on Waste Incineration GO is issued for electricity produced exclusively from waste only. The share part of electricity produced by RES on waste is determined for by grid operator each month taking into consideration the incineration technology applied and the quantity of fossil fuel used.

c) ANRE is placing on its web site the detail information on GOs issued by grid operator each month.

d) According to the contract on selling electricity, the producer submits to electricity supplier GOs together with the invoice to be honored by supplier.

e) The subject of the contract signed between producer of renewable electricity and power supplier is the selling the renewable electricity to the buyer (electricity supplier) based on the tariff established by ANRE.

f) The contract establishes the rights and duties of the parties. In particular the penalties applied when the volume of delivered electricity varies more than ± 10%.

2. B. Policy and/or Regulatory Preconditions Necessary for the Implementation of the Policy Reform

As it was mentioned above, practically all necessary regulatory framework is prepared at present for reaching the targets of the policy reform undertaken, except of the Model Contract on selling electricity produced by renewable energy sources that is elaborated, but not approved yet by ANRE.

In order to make more clear the provisions that prescribe RES rights of access to the grid, Electricity Law has passed a brought discussions amongst the interested parties of Moldova and now it is amended respectively and will be presented to the Government to be submitted further in the Parliament for approval by the end of 2009. Along with the amendments specified above, the Law will enforce the independency of Regulator. Their directors' shall be approved by the Parliament, not by the Government as it is applied at present according to the existing Electricity Act.

2. C. Stakeholders Involved

In the conditions of the Republic of Moldova, to ensure a real interest to invest in RES development the following stakeholders need to be involved having their own role in promoting the policy reform:

a) Parliament - to approve in time new Electricity Act and modify Renewable Energy Law if such needs will appear in the future.

b) Government – to submit to the Parliament the amended Electricity Act. In the same time, according to Renewable Energy Law of the Republic of Moldova (Art. 5, Art. 6, Art. 11) [4], the Government has the following role in the policy reform:

   1. Realizes the objectives and established the priorities of RES development;
   2. Establishes the mode of organization and administration of activities in the domain of renewables;
   3. Approves the State program concerning promoting the production and utilization of renewables and monitors their realization;
   4. Utilizes the mechanisms and means of stimulation in order to sustain economically the activity in the domain of renewables;
   5. To ensure both the state energy security and environment protection, including by increasing the share of renewables in energy balance. The policy applied in this respect will be realized by means of state, of economy branches and of local programs, being monitored by the appropriate authorities;
   6. To ensure 6% of renewables in energy balance by 2010 year and 20% - by 2020;
   7. To attract investments in renewables;
   8. To make operational the Energy Efficiency Fund.

c) Regulator – to send to the Government the amended Electricity Act; to approve the Model of Contract on selling electricity produced by renewable energy sources; to monitor the implementation and application of the regulations approved by ANRE.

d) Association of Foreign Investors (AFI) – if the case request, to intervene when the regulatory framework is subject to modifications. AFI is member of State Committee for Regulation of Entrepreneurial Activity of the Ministry of Economy on reviewing the drafts of normative acts that are subject to be approved by authorities. The normative act cannot be promoted further if the Committee recommendation is one negative.

e) Agency for Innovation and Technology Transfer – to coordinate, motivate and implement the mechanisms of innovation activity and technology transfer, including in the field of RES. The Agency fulfills the following attributions [33], including in area of renewables:

   ○ realizes the state policy in the sphere of innovation activity and technology transfer, including renewables;
   ○ develops proposals for the improvement of the normative and regulatory basis in the sphere of innovation activity and technology transfer, including renewables;
   ○ establishes the strategic directions for the innovation activity and technology transfer, these directions being reflected in programs and projects at all levels;
   ○ offers specialized assistance in the sphere of innovation activity and technology transfer, including renewables;
   ○ organizes exhibitions of the obtained achievements in the sphere of innovation activity and technology transfer;
   ○ exercises other attributions established by law.

f) University Centre „Energie Plus" (Technical University of Moldova) - to contribute to the creation of the informational, scientific and didactic environment for renewable energy sources promotion, a just energy policy, clean technologies and environment protection [34].

2. D. Implementation of the Policy Reform

The crucial step made in Moldova toward creating a favorable environment for renewables development was the publishing Renewable Energy Law (2007) [4]. The followed approved Regulatory framework created by ANRE during 2007-2009 (i.e., Methodology for the determination,

approval and application of tariffs for the electricity generated from renewable energy and fuel sources, Regulation concerning the Guarantee of Origin for electricity produced by renewable energy sources, Model Contract on selling electricity produced by renewable energy sources) has permitted to establish very clear rules for any investor wishing to place its money in building renewable energy sources. And what is most important, the investments made are guaranteed to be recovered in relatively shot time, not exceeding 7-8 years as the preliminary calculation has shown. Annual O&M costs plus legal taxis and fees are included in the price for electricity generated by RES as well; the power produced being guaranteed to be sold in full quantity if it is foreseen in the appropriate contracts with buyers. Because the real changes in the renewables regulatory framework have been finished in the summer 2009, it is premature to evaluate the real impact of legal transformations have made. Nevertheless the steps undertaken by some of the investors after the publishing the normative acts [5, 6] encourage to believe that available country renewables will be subject of thorough studies with the followed construction of RES. It is the case to mention in this respect the intentions made by the following two participants on renewable energy market.

1. On November 17, 2006 Mayoralty of Municipality Chisinau has signed a preliminary contract with the Italian company STR Engineering Consulting Ltd on construction of a waste incineration plant. Because of lack of an appropriate regulatory framework the contract has remained without any actions. Only in September 15, 2009 the idea was revitalized and Mayoralty of Chisinau municipality signed the contract with the same company on construction of the plant. STR Engineering Consulting Ltd will invest around 200 million €. The plant will be put in operation in 20 month after the contract has been signed.
2. On October 15, 2009 the Joint Venture Company MODEOLE Ltd (an enterprise with the foreign capital), have addressed a request to the Ministry of Environment to obtain the preliminary Notice on five wind parks projects planned to be realized on country territory. The total installed capacity is 204 MW.

2. E. Benefits of the Policy Reform

The reform made in the regulatory framework during 2007-2009 has created the necessary environment were the renewable projects become attractive. The reasonable costs related to the construction and operating of RES plus a profit, much higher than one applied for country electricity distribution companies, is included in the price for electricity produced and last is ensured to be sold to the regulated buyers at the tariff approved by the Regulator. In such manner the investor is always financially solvable. Having such legal insurance in recovering the costs, the banks, from where the credits are taken for RES construction, would have enough insurance the money borrowed and the interest applied to it are paid in time. In other words the risk of business in renewables in Moldova has been diminished significantly lately and investors have very high interest to place their money in the country Renewable Energy Sources development.

3. IMPLEMENTATION OF THE RES PROJECTS

There are two renewable projects that merit being examined below.

3. A. Technical Description of the RES Projects

1. Chisinau Waste to Energy Power Plant (Ch WTE PP)

Brief description: Because there is no any detailed information on the technology to be applied by the investor, it is assume that it will correspond to ‘waste-to-energy’ one, widespread in the world, an example being AEB Amsterdam WTE [11].

The Plant will be built in the area of Municipality Chisinau, near to the existing Chisinau Wastewater Treatment Plant. WTE plants serve two purposes, environmental disposal of solid wastes and generation of electricity.

All amount of wastes generated in Chisinau will be incinerated at the respective plant; the energy produced being used for electricity generation. The technology to be applied is imported, and can be treated as know-how transfer. The dominant 'waste-to-energy' technology is combustion of "as-received" municipal solid wastes (MSW) on a moving grate. The feeding hopper (Figure 1) of the mass-burn furnace is kept full of solid wastes. At the bottom of the hopper, a hydraulically operated ram feeder forces the solids onto the feed end of the grate. From there on, the bed of solids moves slowly towards the discharge end, due to gravity and the periodic motion of the grate bars. In many mass-burn furnaces, e.g. at the AEB Amsterdam WTE, the grate is a horizontal belt conveyer [7].

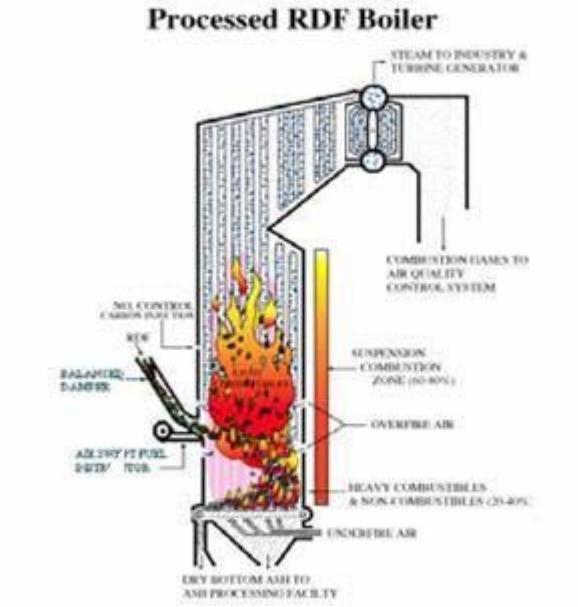


Figure 1: Processes RDF Boiler

Moldova waste energy potential:

According to [12], annually the municipality services of Moldova record around of 1,143-1,266 thousands m^3 of Municipal Solid Waste (MSW) transported to the landfills. Base on the information accumulated related to the characteristics of the MSW and the number of population in the appropriate localities [14] the norm of MSW generated by a person has been calculated. It is ranged from 0.25 kg/inhabitant in Nisporeni or Cimislia to up to 0.8 kg/inhabitant in Balti and 1.3 kg MSW /inhabitant in Chisinau.

Extrapolating this values to others localities the following quantities of MSW assumed to be generated in the localities of the Republic of Moldova annually, including in Municipality Chisinau (Table 2).

The caloric value of Moldova MSW is much less that one from Western Europe and is equal to approximately 1100 kcal/kg [15]. The total value of energy contained in the annual generated.

Moldova's MSW is equal to 0.86 TWh, including 0.48 TWh/year in Chisinau MSW. Because of very low efficiency of WTE technology the electricity delivered for consumption from such PP could not exceed 0.095 TWh/year.

Table 2: Annual Generation of MSW in the Republic of Moldova

Locality	Inhabitants	Tones /year	Locality	Inhabitants	Tones / year	Locality	Inhabitants	Tones / year
Chisinau	785,087	372,708	Soroca	101,489	11,234	Teleneşti	74,916	7,233
Bălţi	148,114	20,073	Anenii Noi	83,105	8,386	Ungheni	117,219	13,957
Briceni	76,590	7,463	Călăraşi	79,604	7,884	Basarabeasca	29,500	2,135
Dondueni	46,388	3,774	Criuleni	72,787	6,945	Cahul	123,808	15,176
Drochia	91,492	9,641	Dubăsari	35,211	2,655	Cantemir	63,406	5,733
Edineţ	83,884	8,499	Hînceşti	123,499	15,118	Căueni	92,904	9,859
Făleşti	93,600	9,968	Ialoveni	97,987	10,664	Cimişlia	62,903	5,670
Floreşti	91,492	9,641	Nisporeni	67,386	6,235	Leova	53,896	4,600
Glodeni	62,893	5,669	Orhei	125,915	15,576	Ştefan Vodă	72,498	6,906
Ocniţa	56,801	4,936	Rezina	53,200	4,521	Taraclia	44,609	3,587
Rîşcani	71,297	6,746	Străşeni	91,491	9,640	Găgăuzia	159,717	22,632
Sîngerei	93,906	10,016	Şoldăneşti	44,109	3,535			
TOTAL	**3,572,703 inhabitants**				**669,013 tones/year**			

In order to determine CO_2 emission reduction from Chisinau WTE operation three factors have been taken into consideration: emission reduction from excluding CH_4 generation from MSW in the landfill; CO_2 emissions from natural gas burned, used to enrich and dry waste for burning; plus CO_2 emission reduction from displacing electricity produced at traditional PP.

a) According to Table 4 of [13], specific CH_4 generation from MSW is equal to 0.0516 t CH_4/t MSW. Applying this value and the data from the table above, we are obtaining 403.72 thousand t CO_2 emissions reduction from excluding CH_4 generation.

b) Because of low caloric value of Chisinau MSW and high humidity of it, natural gas is used to enrich and to dry the waste fuel, in order to maintain burning in the burner of WTE PP. Around 48.11 million m^3 of natural gas will be burned annually in this respect, producing approximately 90 thousand t CO_2/year.

c) In order to calculate CO_2 emission reduction from displacing electricity at traditional PP the conservative fuel is used for traditional power generation, i.e. natural gas for which IPCC [10] default value of 56.1 t CO_2/TJ is applied. The electricity produced at Chisinau WTE PP will display the one produced at TrPP at which the efficiency does not exceed 40%. For such conditions, the CO_2 emission reduction potential from Chisinau WTE PP would constitute 132.2 thousand t CO_2/year.

The total CO_2 emission reduction from Chisinau WTE PP operation will be equal to 445.9 thousand t CO_2/year.

2. The Parks of Wind Farms (PWF).

Brief description: According to the project five parks of wind farms will be built on country territory: 64 MW (32 turbines) in the location Cotihana, district Cahul; 44 MW (22 turbines) in Baimaclia, district Cantemir; 58 MW (29 turbines) in Pohoarna, district Floresti; 26 MW (13 turbines) in Nucareni, district Telenesti; 12 MW (6 turbines) in Dubna, district Soroca. In frame of wind installation used the wind turbine V 90-2.0 will be applied, with the following technical characteristics: the nominal capacity 2000 kW, IEC IIIA; starting speed - 4m/s; nominal speed – 12 m/s; stopping speed – 25 m/s; frequency – 50 Hz; the temperature of operation: from -20^{o}C up to +40^{o}C; height: 80-125 m; weight: 148-335 tones; the level of noise produced by the turbine (at the level of 10 m from the ground, the turbine height – 80m, the air density – 1,224 kg/m^3): 94.4 – 104 dB(A) for the speed of wind of 4-8 m/s respectively.

PWF will have a total capacity of 204 MW and produce 543.3 million kWh per year, constituting 13% from the electricity consumed by the country in 2008.

Energy potential: According to [8], the theoretical energy potential of the wind in the Republic of Moldova is 204 GW at the load factor equal to 0.3. As to the technical potential there are two opinions on this subject. According to European Bank for Reconstruction and Development [9] the technical energy potential of the wind in the space of country territory is evaluated at the level of 1.3 TWh. Taking into consideration the specific wind load factor in the case examined equal to 0.3 the capacity would be 500 MW. A bit other values are estimated in [8]. The technical capacity of wind is calculated at the level of 612 MW and energy at 1.6 TWh. The last data is obtained by the Moldova Technical University Research Centre "Energie Plus" based on the statistical data recorded between 1990 and 1999 and applying the package of software WAsP (Wind Atlas Analysis and Application Program) for the conditions of the Republic of Moldova.

In order to calculate CO_2 emission reduction the conservative fuel is used for traditional power generation, i.e. natural gas for which IPCC [10] default value of 56.1 t CO_2/TJ is applied. The electricity produced at Moldova Wind Farms will display the one produced at MTPP at which the efficiency does not exceed 40%. For such conditions, the CO_2 emission reduction potential from technical wind utilization would constitute 657-809 thousand t CO_2/year.

As per the project Parks of Wind Farms planned to be launched in the Republic of Moldova, CO_2 emission reduction will reach 275 thousands tones of CO_2 eq. per year.

3. B. Financial Description of the RES Projects

Investments: Investments attracted for the implementation of Chisinau WTE PP project constitute around 200 million Euro [16] and for the Parks of Wind Farms 288 million Euro (204 MW*1414 Euro/kW) [17].

Costs: It is premature to evaluate exactly the direct and indirect costs of the projects examined in conditions when they are not implemented yet. Even so some of the costs could be estimated:

Chisinau WTE PP: Operation & Maintaining Costs for Chisinau WTE PP are determined based on Amsterdam WTE PP [11] O&M costs, the lasts being adjusted to the conditions of Chisinau. In particular, the average remuneration cost per employee is taken 10 times lower than for Amsterdam case.

Table 3: Comparative Operation & Maintaining Costs for Chisinau and Amsterdam WTE PPs

O&M Costs at WTE PP	Unit	Amsterdam WTE	Chisinau WTE
Number of waste processed	tone	800,000	372,665
Number of employees	persons	300	140
Number of employees per 1 tone processed	person/tone	0.000375	0.000375
Per month remuneration at WTE PP	Euro/month/person	3,911	403
Personnel costs	thou Euro	14,078	676
Maintenance costs	thou Euro	14,717	6,856
Residue processing costs	thou Euro	8,903	4,147
Rent and leases	thou Euro	16,827	1,500
Other operating expenses	thou Euro	11,751	1,000
TOTAL O&M costs	thou Euro	66,276	14,179

The total Chisinau WTE PP O&M costs will constitute 14.178 million Euro per year. The lifetime of the plant is equal to 30 years [16], so that the annual depreciation will be 6.67 million Euros.

Parks of Wind Farms: In order to determine O&M costs, specific value is applied. According to [18] fix O&M costs constitutes 81.8 US$/kW for a wind plant of 80 MW. According to [19], O&M costs constitute 42.2 US$/kW-yr or 36.1 Euro/kW. In [3], O&M costs are evaluated at the level of 27.3-29.1 $/kW-yr. For Moldova Wind Project 20 $/kW is applied as the remuneration costs are much

lower. Applying exchange rate of 1.45 US$/Euro, the Parks of Wind Farms O&M costs will constitute 2.814 million Euros per year.

The useful life of wind farm is taken at the level of 20 years [21-24]. To this lifetime the annual depreciation would constitute 14.4 million Euros.

Financial scheme to finance the projects: According to regulatory framework existing at present the investors in the renewables are invited to choose their own investment scheme, having in mind that:

a) the rate of return cost applied to investments and included in the calculation of renewable electricity price is based on Waited Average Cost of Capital (WACC) used for calculation basic tariff for Moldova distribution companies, where the ratio indebtedness / equity capital is equal to 0.54, i.e. the ratio of 35% to 65% is applied and it is stable up to 2012, when the Tariff methodology for calculation the basic tariffs for distribution companies [25] will be revised. It is expected that in the following modifications of the last Methodology the ratio indebtedness / equity capital will increase, but not exceeding the value 1;

b) in order to attract investments in renewables the rate of return applied to net value of investments and included in the determination of price for renewable electricity generated is much higher than one applied to power distribution companies and is equal to 1.5*WACC for the first 5 years after the putting in operation of RES, 1.3*WACC – for the next 5 years and 1.1*WACC – for the last 5 years.

In the projects benefit calculation below all the investments are borrowed from the bank, credit period being 7 years and the interest applied is 10%.

3. C. Benefits of the RES Projects Implementation

All the benefits are determined based on the assumptions and calculation model developed by the author of this Report.

Economic and financial benefits: In order to determine the projects' economic and financial benefits the tariffs for electricity produced by the Chisinau WTE PP and the Parks of Wind Farms have been calculated for each year of PP lifetime, the last being 30 years for WTE PP and 20 years for PWF, applying Methodology for the determination, approval and application of tariffs for the electricity generated from renewable energy and fuel sources [5]. Knowing the income from electricity production and sold from the PP bus-bar, the investments maid during the years, the costs bore and social benefits obtained in the projects the following economic and financial parameters have been calculated: Net Present Value of Net Benefits; Internal Rate of Return (IRR); Economic Rate of Return (ERR); Payback period (Table 4).

Table 4: Economic and financial benefit from Chisinau WTE PP and the Parks of Wind Farms

Parameters	Currency	Chisinau WTE PP	The Parks of Wind Farms
Net Present Value of Net Benefits	Mold. thou MDL	1,922,942	2,988,284
	thou US$	124,954	189,866
IRR	thou MDL	19%	22%
	thou US$	17%	19%
ERR	thou MDL	Do not produce positive economic impact	23.9%
	thou US$		22.9%
Payback period	thou MDL	8 years	6 years
	thou US$	9 years	7 years

The difference between the values in MDL (Moldavian Lei) and US$ for IRR, ERR and Payback period is explained by the fact that exchange rate MDL/USD during the PP Lifetime is taken increasing by 0.1 MDL/US$ each year. Chisinau WTE PP does not produce a positive economic

impact because in the scenario with the project O&M costs are significant higher (10 times) than in the one with the project. Even if the project is considered as CDM Project positive impact cannot be achieved. High level of IRR and quite low Payback period is determined by the fact that all reasonable O&M costs enter in the calculation of the price for renewable electricity and thus they are covered by the income obtained after the electricity produced is sold. In the same time the rate of return reflected in the price for renewable electricity is quite high. It was assumed that WACC=15%, the value a bit less than used by Moldova Distribution Companies for tariff calculation in 2008 (15.05%). So that the rate of return for the first 5 years is equal to 22.5%; for the next 5 years – 19.5% and for the last 5 years up to the end of Lifetime period – 16.5%.

Energy saving and environmental benefits: All the power plant examined above are planned to be connected to the transport grid, not to distribution one. So, that it is not expected a decreasing of electricity losses in the national networks. In the same time both projects are sources of fossil fuel earnings. Chisinau WTE PP permits to burn 22 million m^3 of natural gas less in conditions when in the power system is consuming the same quantity of electricity. The operating of the Parks of Wind Farms leads to 146.7 million m^3 of natural gas less consumption each year. As a consequence less emission of CO_2 will be recorded each year. As it was specified above the total CO_2 emission reduction from Chisinau WTE PP operation will bee equal to 445.9 thousand t CO_2/year (it is taken into consideration the exclusion of CH_4 emission from MSW disposal on land as well) and for Parks of Wind Farms planned - 275 thousands tones of greenhouse gases per year. At the price of 10 US$/t$CO_2$ the benefits will constitute 4.46 million US$/year for Chisinau WTE PP and 2.75 million US$ for the Parks of Wind Farms project.

Social benefits: Both projects examined have a big positive social effect. By construction of Chisinau WTE PP and the Parks of Wind Farms new jobs will be created, 140 and 203 units respectively. The costs of GDP they are producing were included in ERR calculation: more than 140 thousand US$/year for the first project and more than 200 thousand US$ for the second project.

Beside those ecological benefits specified for Chisinau WTE PP above, the excluding MSW disposal on land would lead to improving of underground water, much affected by the existing landfill; excluding odor nuisance around; excluding the risks of fire and explosion; to exclude involving of new agricultural soil for waste disposal, etc.; The project realization will permit to produce new construction materials, to recycle many materials, be a source of heat in case in the region new costumers appear.

In the same time the development of large renewable projects as ones analyzed above will create a real burden for electricity consumers. The price for power produced by WTE PP and PWF is much higher than those of local PP and imported one. In the table below it is shown the prices of electricity produced at WTE PP and PWF in the first year of their operation in comparison with the price of CHP-1, the most expensive local PP. Chisinau WTE PP purchase price exceed CHP-1 price by 325% and PWF – by 81%.

Table 5: RES Purchase Price Comparison

Indicators	Chisinau WTE PP	PWF	CHP-1
Price of electricity produced, MDL/kWh	5.87	2.5	1.38
% increase in comparison with CHP-1	325%	81%	0%

Thus we can conclude: as soon as a) the quantity of electricity produced by renewables and their prices will participate in establishing the medium price taken into consideration for calculation the tariff applied to final consumers and b) the medium purchase price is pass-through in the consumers tariff calculation [32], the participation of WTE and PWF in electricity balance will influence much the tariff to final consumers. In the table below it is demonstrated how separate participation of analyzed renewable PPs, as well as their combined generation, would influence both the Moldova power market medium purchase price and the tariff applied to final consumers in 2009. It is assumed

that both electricity produced and purchase price of WTE PP and PWF in the first year of their operation are applied in 2009. Because the PPs located on right bank of Dniester River are regulated ones, the renewable electricity is displacing the electricity coming from TrPP.

Table 6: Renewable PP price impact on both average country power market purchase price and on the final tariff applied to consumers

Indicators	Chisinau WTE PP	PWF	Existing power
Average market price when Renewable PP participates separately in the calculation, MDL/kWh	1.16 61% increase	1.2 67% increase	0.72
Average market price when Renewable PPs participate together in the calculation, MDL/kWh	1.64 92% increase		0.72
Tariff to final consumers when Renewable PP participates separately in the calculation, MDL/kWh	1.65 50% increase	1.68 53% increase	1.1
Tariff to final consumers when Renewable PPs participate together in the calculation, MDL/kWh	2.22 102% increase		1.1

As it is seen from the table, when both examined RES are participating in the covering Moldova power demand the tariff applied to final consumers is twice higher than in the absence of renewable electricity sources. Such enormous economic effort from the consumers would lead to diminishing the country dependency on electricity imported by 17.5% only. Even a 50% increase of the tariff would be happened, when one RES is participating in power generating balance, it is too much for local consumer in the following 5-7 years.

We assume that both the high country authority and ANRE has not evaluated the possible impact of RES broad opening to investments on the Moldova power market when the policy reforms has been launched since 2007 and that leave to believe that a revision of the regulatory framework would produce further. It is important to emphasize in edition that after the date of RESs putting in operation the followed evolution of their combined average purchase price will decrease by 1.6-2.0% per year, from 3.37 MDL/kWh to 2.32 after 20 years, or from 0.27 US$/kWh to 0.16US$/kWh respectively. In the Figures 2 - 4 the evolution of the purchase price for separate renewable PP examined and for their combined operation is presented.

Figure 2. Electricity purchase price of Chisinau WTE PP

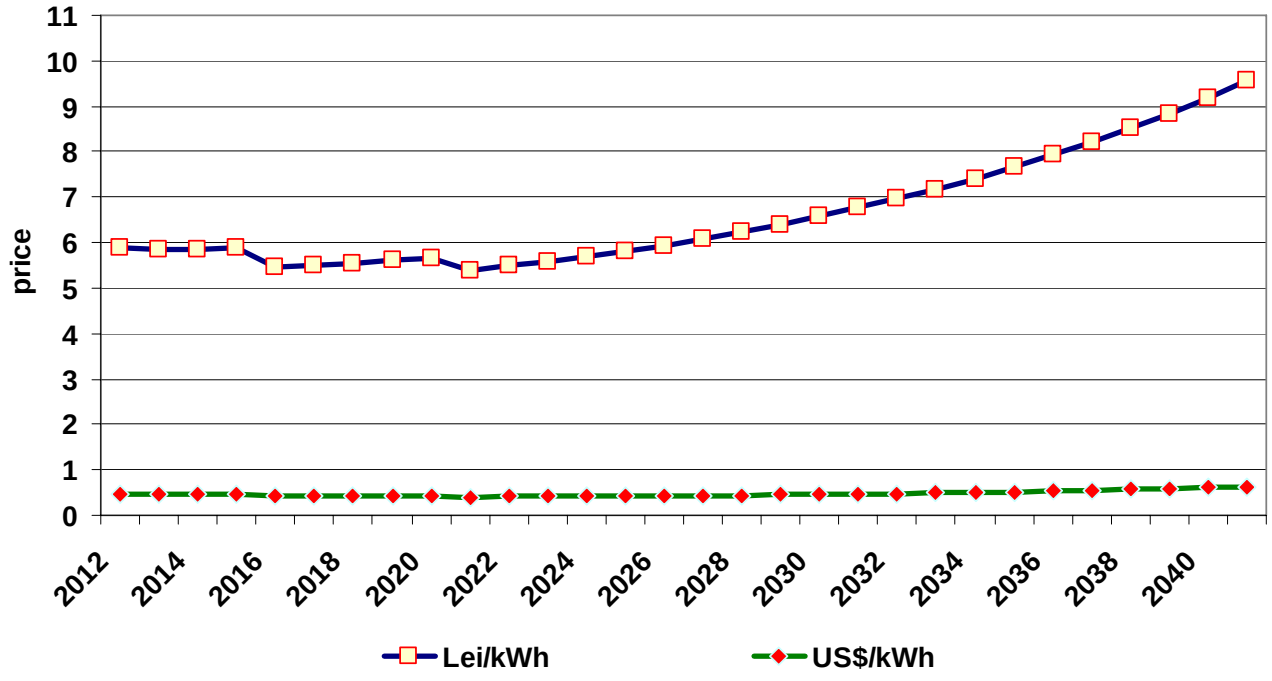


Figure 3. Electricity purchase price of PWF

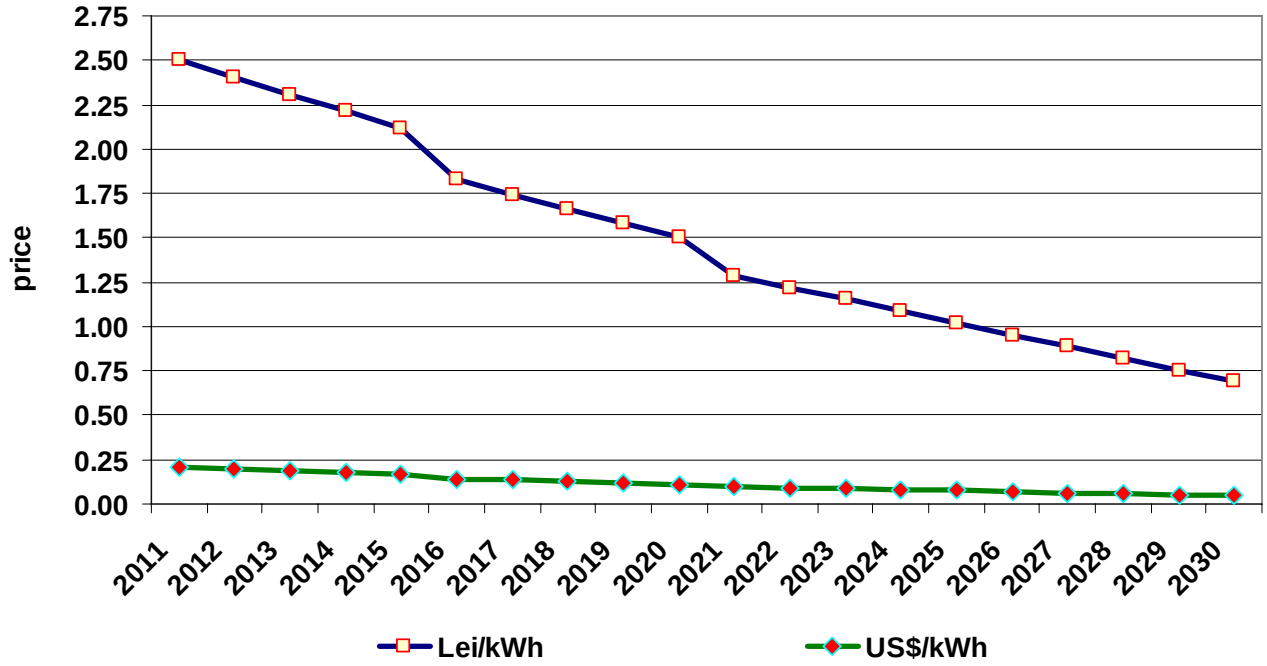
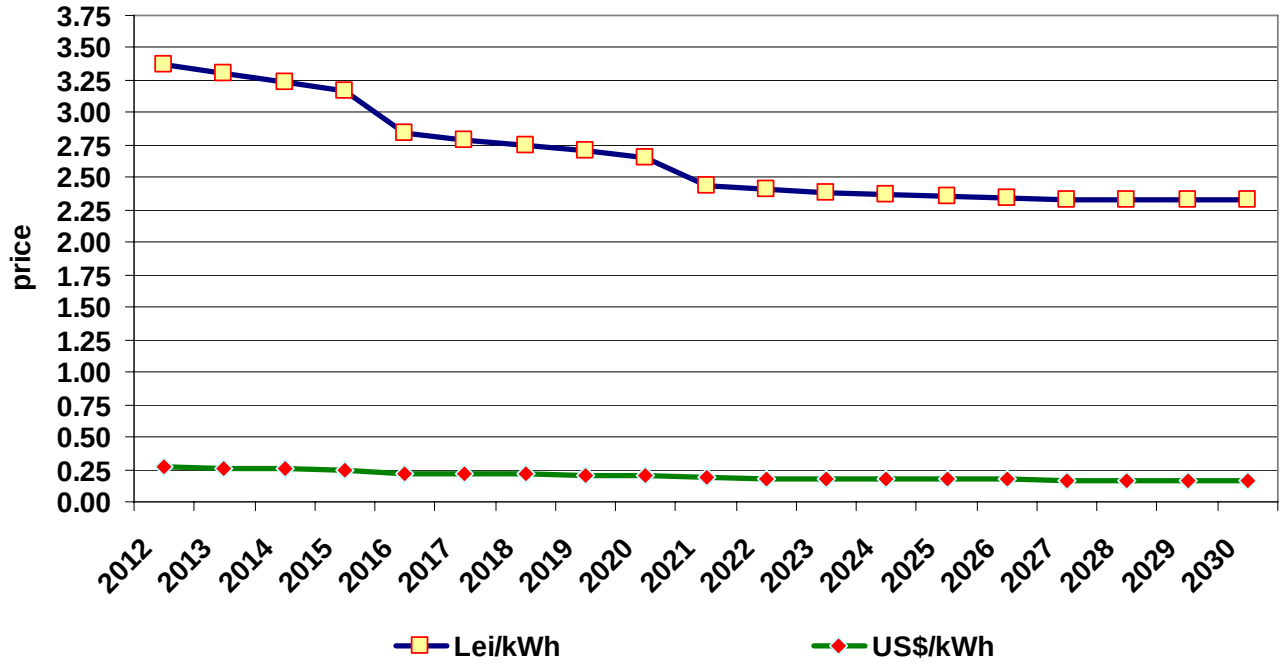


Figure 4. Combined electricity purchase price of WTE PP+PWF



3. D. Assessment Methodology Used to Determine the RES Project Benefits

In order to assess the projects benefits two Excel spreadsheet calculation models have been elaborated: one for Chisinau WTE PP and other for the Parks of Wind Farms project. Each of them is composed from sub models: Initial data, Tariff calculation, Finance, Social costs, CO_2 emissions at

TrPP; CO_2 reduction; ERR calculation. The sub model "Tariff calculation" reflects the calculation of the renewable annual tariff according to the Methodology in effect [5]. In the "Finance" sub model - Net benefits before taxis per years, Net Present Value of Net Benefits, IRR and payback period is calculated. "Social costs" sub-model is elaborated for determination the economic impact, on the national level, of new jobs creation as a result of RES construction. The results obtained from this sub-model are used for ERR calculation. In order to determine CO_2 emission reduction as a consequence of displacing electricity at traditional PP "CO_2 emissions at TrPP" sub-model is developed; "ERR" sub-model has the scope to determine Economic Rate of Return. An economic rate of return is a measure of the income generation potential of the project versus the project costs. It is, essentially, an internal rate of return (IRR), except that economic prices rather than financial prices are used. In our case for ERR calculation investor profit, i.e. rate of return, is not taken into consideration. In the same time, economic social impact and CO_2 emission reduction economical effect is taken into account, the lasts being absent in IRR calculation, i.e. Chisinau WTE PP and the Parks of Wind Farms are not considered as CDM projects.

Along with the models elaborated and described above, the Excel spreadsheet model for calculation of the tariffs to final consumers as per [32] has been used as well.

In the "Initial data" sub-model the following values are assumed:

1. a 5%/year increase for natural gas price at DAF is applied up to the end of PP lifetime [26];
2. 1.272 – the coefficient of DAF gas price increase at delivered point of WTE PP [27]
3. 5% – Forecasted annual TrPP electricity purchase price increase
4. 0.57 – Load factor at WTE PP bus-bar 0.304 – at PWF [8]
5. 5% – Moldova Consumer Price Index
6. 15% – Waited Average Cost of Capital applied for all the years of PP Lifetime period
7. 11.4 MDL/US$ – Exchange rate in 2010
8. 1.45 US$/Euro – Exchange rate applied for all the years of PP Lifetime period
9. 0.1 MDL/US$ – annual increase of exchange rate
10. 3 employees/MW at WTE PP and 2 employees/MW at PWF
11. 2 years – period of construction for WTE PP and 1 year – for PWF
12. 30 years [16] Lifetime for WTE PP and 20 years [21-24] – for PWF
13. 5 US$/t$CO_2$ – CO_2 emission price
14. 7 – Bank Credit period
15. 10% – Bank interest
16. 785,400 – number of Chisinau habitants
17. 1,021 tones/day – quantity of MSW generated in Chisinau daily; according to [28]: 800-1000 tone/day; according to more credible source [12]: 1.3 kg/day per habitant of Chisinau, i.e. total per day would be 1.3*785.4=1021tone/day
18. 1100 kcal/kg – Chisinau waste calorific value, according to [15]; to burn the wastes no less than 3,767kJ/kg or 900 kcal/kg is needed [29]
19. 2,200 kcal/tone – Western Europe waste calorific value, according to [15]
20. 725 kWh/tone waste – Electricity produced at West Waste-to-Energy PP where waste calorific value is around 2,200 kcal/kg
21. 10.6% – the share of electricity used for own purpose [11]
22. 3% – electricity losses in feeding transformer at WTE PP
23. 7,963 kcal/m^3 – natural gas calorific value
24. 30% – the share of natural gas used for enriching waste fuel in order to maintain burning
25. 0.3 t/m^3 - specific Chisinau waste weight
26. 90 MDL/m^3 – the price paid by municipality Chisinau for waste processing
27. 700 kcal/kg – According to [29] around 100-300 kg.c.e./tone of waste are used to dry the waste; we assumed 100 kg.c.e./tone, i.e. 700 kcal/kg

28. 800,000 tone/year - quantity of MSW processed at Amsterdam WTE PP
29. 3,265 million US$/year – Moldova GDP [30]
30. 3.5%/year GDP growth during all PP Lifetime
31. 40% – efficiency of TrPP
32. 33% – level of Chisinau waste humidity [13]
33. 1,118 Euro/kW – Specific Delivery Price of Wind Installation [17]
34. 15% – % of Design & construction work % from total PWF project investment cost [17]
35. 7.5% – per cent of transport, assemblage, start-up etc. costs from total PWF project investment cost [17]
36. 20 US$/kW – PWF specific O&M costs [3, 18-19]
37. 1.564286 employees/MW – number of employees per 1 MW at conventional PP[31]

4. CONCLUSIONS AND RECOMMENDATIONS

4. A. Conclusions on the Benefits of the Introduced Reforms

In comparison with the traditional power plant, power sources based on renewables require quite big investments for their construction. For example, the investments in Waste-to-Energy technology lie between 7500-9500 US$/kW [7], while the investments in coal PP reach 2500 US$/kW. It is evident to wait from the investor a wish its money involved in such kind of projects be recovered in the terms corresponding to the country risks and, in the same time, to have an insurance such perspective be protected by the law.

It seams that country' authorities succeeded to build the legal and regulatory framework in correspondence with investors' interests. During the last 2-3 years the following normative acts have been published in this respect:

- Renewable Energy Law (2007) [4]: according to this document the National Agency for Energy Regulation has been authorized to approve renewable prices based on the appropriate tariff methodology; elaborate the projects of the contracts on commercialization of renewable energy foreseeing free and not discriminatory access to the grid; ensure all the energy produced by RES be sold on the local or foreign market. In order to enforce both energy efficiency and renewable energy resources development the Law establishes Energy Efficiency Fund.
- The Methodology for the determination, approval and application of tariffs for the electricity generated from renewable energy and biofuels (February 2009) in effect for 15 years: all reasonable costs bore by the investor in renewables are recovered through the price of energy delivered to the grid. What is most important, in order to incentive the investments in renewables the rate of return for the first 5 years is 1.5 times higher than one applied to local distribution companies, the last being calculated by using Weighted Average Cost of Capital methodology and applying beforehand established formulary. For the following 5 years the incentive coefficient is diminished to 1.3, reaching 1.1 for next 5 years.
- The Guarantee of Origin for Electricity Produced by Renewable Energy Sources [6]: the respective document establishes procedure ensuring RES owner to be paid for energy delivered in the grid.
- The Model Contract on selling electricity produced by renewable energy sources: the subject of the contract is the selling the renewable electricity to the buyer based on the tariff established by ANRE.

4. B. Lessons Learned

Even the cost of fuel does not participate practically in the price for electricity produced by renewables, the last is much higher than power price at traditional PP where the share of fossil fuel cost is significant. In other words, investments and O&M costs are causing high prices of renewable energy mostly. As the calculation has shown the price of Chisinau WTE PP in the first year of its operation exceeds the price of most expensive electricity from Moldova power market (CHP-1) by 325%; the price of PWF – by 81%. According to the Methodology for calculation of the tariffs for electricity supplied to consumers [32], the price of electricity purchased is pass-through in the tariff calculation for final consumers, independently of its magnitude. In our case the tariff for consumers is obtaining twice higher than the one determined without RES implication. And what is imported to emphasize is that an enormous economic effort from the consumers lead to diminishing the country dependency on electricity imported by 17.5% only. It is hard to believe ANRE will accept such scenario of tariff evolution. That is why a modification of the existing Renewable Tariff Methodology is expected to take place. If so the attractiveness of investments in renewables should be kept while the reserves for smooth increasing of supply tariffs will be involved. As such reserves could be: declare the construction of RES as CDM projects, the cost of CO_2 reduction being included in the diminishing of PP price value; as the price for electricity generated by PWF is decreasing during the years, it is the case to apply a purchase price calculated not for the current year but for more years forward. Such procedure will lead to diminishing the price during the first year of RES commissioning, keeping the investor expected revenues for this period of time; to include in the price diminishing the costs of other benefits obtained at WTE PP, i.e. the benefits from the selling of recycling materials, good waste collection management leading to increasing the caloric value of waste and thus reducing natural gas consumption in the electricity production, etc.

According to the Regulation concerning the Guarantee of Origin for Electricity Produced by Renewable Energy Sources [6], GO is issued for electricity produced exclusively from waste only. The share part of electricity produced by RES on waste is determined for by grid operator each month taking into consideration the incineration technology applied and the quantity of fossil fuel used. This provision leave an uncertainty on the methodology applied for electricity price calculation for Chisinau WTE PP. From one site, the rule excludes fossil fuel participation in the determination of the price. From other site, fossil fuel is used as technological material to ensure the maintenance of waste burning, not for direct electricity production. All these issues should be clarified additionally.

4. C. Recommendations for Future Policy Reforms

The following recommendations for future policy reforms have been identified:

1. Renewable Energy Law specifies that at the stage of tariffs establishment the appropriate prices on the international market will be taken into account. Such very vague statement needs to be developed more precisely in the respective normative acts approved by Regulator. In order to ensure the quality of such document, a respective study is required to be done. It should disclose the impact of different renewables development scenarios on both the investment climate in renewables and consumers capacity to pay more expensive energy in the following time. Based on the results obtained for specific country energy market the recommendation to the abovementioned regulation should be proposed.
2. It is declared that Moldova has big biomass reserves for renewable energy production, but a credible database does not exist in this respect. For example, if the reserves of urban waste could be determined more or less exactly, the needed information to estimate their real energy contained is much problematic. That is why the respective attention should be done to the creation of a credible source of information on the real biomass energy potential and how it evaluate in time.

3. Country Wind Atlas is still not developed properly and the one existing is not available for using.
4. Energy Efficiency Fund, declared in the Renewable Energy Law from 2007, planned to be used for RES development too, is still on the paper. Firm actions from the Government should be undertaken EEF be created soon, together with Energy Efficiency Agency.
5. National Education, Training and Public Awareness Program in renewables and energy efficiency should be launched overall in the country.

4. D. Recommendations for Possible Adoption of a Similar Approach in Neighboring Countries

Moldova experience has shown that a real break in renewables deployment has happened not by launching of special fund for RES promoting, but by creating an environment where the investments become attractive. Renewable Energy Law was published in 2007. The respective Low, as Law on Energy Conservation (2000), foreseen to establish Energy Efficiency Fund, but nothing has happened until now.

Only after the Renewable Tariff Methodology was approved many investors have begun to manifest interest to put up their money in the country RES development. And that because the document ensure the recovery of the investments made by both the price regulated and engagement the energy produced be sold in the grid. Of course, the Methodology could not be elaborated and approved by ANRE if the appropriate Law, i.e. Renewable Energy Law, would not be published.

Moldova Case Study examined above has demonstrated that Renewable Tariff Methodology approved has not taken into consideration the possible impacts of its application.

The implementation of Chisinau WTE PP and PWF lead to very high increasing of the tariff applied to final consumers, the fact that could not lead to document revision. That's why before such important document is approved it should be subject to a test, by applying simulation scenarios of RES extension in order to determine the bottlenecks and develop the recommendations the methodology be viable and stable in time to any further evolution of events.

BIBLIOGRAPHY

1. ANRE 2008 Annual Report. www.anre.md
2. Energy Strategy of the Republic of Moldova up to 2020. Official Monitor no. 141-145/1012 from 07.09.2007
3. National Position Paper. BSEC/PDF/002/10.2004. Academy of Sciences of the RM. Institute of Power Engineering. Chisinau 2009, 26 pages
4. Renewable Energy Law of the Republic of Moldova. Official Monitor no. 127- 130/550 from 17.08.2007.
5. Methodology for the determination, approval and application of tariffs for the electricity generated from renewable energy and fuel sources. Official Monitor no.45-46/172 from 27.02.2009.
6. The Regulation concerning the Guarantee of Origin for electricity produced by renewable energy sources. Official Monitor no.99-100/424 from 05.06.2009
7. Nickolas J. Themelis and Saman Reshadi. Potential for reducing the capital costs of WTE facilities. Proceedings of the 17th Annual North American Waste-to-Energy Conference. NAWTEC17. May 18-20, 2009, Chantilly, Virginia, USA.

8. Bostan, V. Dulgheru, I. Sobor, V. Bostan, A. Sochireanu. Sisteme de conversie a energiilor regenerabile. Tehnica-Info, 2007, 592 pages.
9. http://www.ewea.org/index.php?id=91 Wind Energy: The facts. An analysis of wind energy in the EU-25.
10. 2006 IPCC Guidelines for National Greenhouse Gas Inventories
11. City of Amsterdam. Waste and Energy Company. Annual Report 2005. http://www.afvalenergiebedrijf.nl/bijlagen/82695%20aeb%20jrvslg%20eng%20klein_nw.pdf
12. Gheorghe Duca, Tatiana Tugui. Managementul deseurilor. Chisinau, 2006, 248 pages.
13. Moldova: Intern Inventory Report on Waste Sector under the UNDP-GEF Regional Project "Capacity Building for Improving the Quality of Greenhouse Gas Inventories (Europe/CIS region)", Chisinau, January 2006.
14. www.statistica.md
15. http://www.zn.ua/3000/3320/35544/.
16. Flux. Periodic newspaper. 30.10.2009. http://www.flux.md/editii/200985/articole/7706/
17. P. Todos, I. Sobor, D. Ungureanu, A. Chiciuc, M. Plesca. Renewable Energy. Feasibility Study. Chisinau. 202, 158 pages.
18. Department of Trade and Industry, United Kingdom, The energy challenge, Energy review report 2006, July 2006, Appendix, Table B1, pp. 194-195
19. University of Cape Town, Energy Research Centre, Energy policies for sustainable development in South Africa, Options for the future, April 2006, Table 8.23, p. 134
20. Sustainable Development Commission-United Kingdom, Wind power in the UK, A guide to the key issues surrounding onshore wind power development in the UK, May 2005, Table 5, p. 30
21. The World Bank Group, Energy and Mining Sector Board, Energy Sector Management Assistance Program (ESMAP), Technical and economic assessment of off-grid, mini-grid and grid electrification technologies, ESMAP technical paper 121/07, December 2007, Table A2.1, p. 77, Table A2.2, p. 77, Table A2.3, p. 78, and Table A2.4, p. 80, p.86.
22. Navigant Consulting Inc., Levelized Cost of Generation Model - Renewable Energy, Clean Coal and Nuclear Inputs, Integrated Energy Policy Report (IEPR) Committee Workshop on the Cost of Electricity Generation, June 2007 (prepared for: California Energy Commission), p. 72-75.
23. International Energy Agency (IEA), Tackling investment challenges in power generation in IEA countries, 2007.
24. Department of Trade and Industry, United Kingdom, The energy challenge, Energy review report 2006, July 2006, Appendix, Table B1, pp. 194-195.
25. The Methodology for calculation of the tariffs for electricity supplied to consumers. Official Monitor no.127-130/502 from 17.08.2007, the modifications – in Official Monitor no.175-176/504 from 19.09.2008.
26. http://eetd.lbl.gov/ea/emp/reports/53587_memo.pdf (natural gas price forecast)
27. Price for gas. ANRE Decision, Official Monitor no. 140-141/650 from 11.09.09
28. http://www.rec.md/index.php?option=com_content&task=view&id=237&lang=ro
29. http://www.ct-line.ru/waste/city.html
30. http://geo.worldbank.org/
31. http://intrefs.ru/11/refs.php?id=00193
32. The Methodology for calculation of the tariffs for electricity supplied to consumers. Official Monitor no.175-176/504 from 19.09.2008
33. http://www.aitt.md/node/157
34. http://www.energyplus.utm.md/