RENEWABLE ENERGY IN ROMANIA

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A study by Nicoleta Chirila

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1. GENERAL ECONOMIC OVERVIEW

Romania’s economic evolution after 1990 has been strongly influenced by factors specific to the transition to a market economy. The economic reforms necessary for replacing the mechanisms of a centralized economy to those characteristic of a free market and the introduction of principles of energy efficiency in all activities, led to periods of recession at first (1990-1992 & 1997-1999), and then to periods of growth. The period 2000-2008 was characterized by a constant positive evolution with growth rates above the EU average. The years 2009-2010 again were marked by recession, however this time related to the international economic crisis.

1.1 GDP DEVELOPMENT

![GDP Development graph]

Source: BCR Research, INS

After two years of negative readings and a cumulated GDP contraction of more than 8%, in 2011 the Romanian economy recorded a slight growth of 2.5%, mainly driven by a robust increase in industrial output and an exceptional agricultural harvest.

<table>
<thead>
<tr>
<th>Gross Domestic Product (lei million)¹</th>
<th>2008</th>
<th>2009</th>
<th>2010''</th>
<th>2011''</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, hunting, forestry &amp; fishery</td>
<td>34126,4</td>
<td>32297,8</td>
<td>31410,6</td>
<td>37837,7</td>
</tr>
<tr>
<td>∙ Industry</td>
<td>118239,8</td>
<td>120637,4</td>
<td>134673,8</td>
<td>152062,9</td>
</tr>
<tr>
<td>Construction</td>
<td>56130,6</td>
<td>52809,4</td>
<td>52094,4</td>
<td>56744,5</td>
</tr>
<tr>
<td>Services</td>
<td>250038,7</td>
<td>245234,5</td>
<td>253721,5</td>
<td>262703,6</td>
</tr>
<tr>
<td><strong>Gross Value Added (GVA)</strong></td>
<td><strong>458535,5</strong></td>
<td><strong>450975,1</strong></td>
<td><strong>471900,3</strong></td>
<td><strong>509350,7</strong></td>
</tr>
<tr>
<td>Net taxes on products</td>
<td>56164,5</td>
<td>50160,3</td>
<td>50560,8</td>
<td>69201,2</td>
</tr>
<tr>
<td><strong>Gross Domestic Product (GDP)</strong></td>
<td><strong>514700</strong></td>
<td><strong>501139,4</strong></td>
<td><strong>522561,1</strong></td>
<td><strong>578551,9</strong></td>
</tr>
</tbody>
</table>

¹ Some data is not certain. 
² Provisional data

Source: Romanian National Institute of Statistics

¹ 1 leu = EUR 0.22 (exchange rate at 31.12.2012)

extracting, manufacturing & producing / providing electrical and thermal energy, gas, hot water, air conditioning
GDP was also influenced by the evolution of activity volume from private sector.

<table>
<thead>
<tr>
<th>Contribution of the main activities to GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, hunting, forestry &amp; fishery</td>
</tr>
<tr>
<td>Industry</td>
</tr>
<tr>
<td>Construction</td>
</tr>
<tr>
<td>Services</td>
</tr>
<tr>
<td>Gross Value Added (GVA)</td>
</tr>
<tr>
<td>Net taxes on products</td>
</tr>
<tr>
<td>Gross Domestic Product (GDP)</td>
</tr>
</tbody>
</table>

* semidefinite data
* provisional data

Source: Romanian National Institute of Statistics

GDP was also influenced by the evolution of activity volume from private sector.

<table>
<thead>
<tr>
<th>Share of private sector (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Gross Domestic Product (GDP) - total</td>
</tr>
<tr>
<td>Gross Value Added (GVA)</td>
</tr>
<tr>
<td>agriculture, hunting, forestry &amp; fishery</td>
</tr>
<tr>
<td>industry</td>
</tr>
<tr>
<td>construction</td>
</tr>
<tr>
<td>services</td>
</tr>
</tbody>
</table>

* semidefinite data
* provisional data

Source: Romanian National Institute of Statistics

For 2012, real GDP has been projected to grow by only 0.7 %, but to remain supported by investments, which are expected to remain an important driver because of the country's need to modernize its public infrastructure, partly with co-financing from EU funds. However, because of uncertainties on the financial markets, some of the investments initially planned for early 2012 have been delayed most probably to 2013.

According to the National Institute of Statistics a growth of only 0.2 % was recorded in the first nine months of 2012, determined mostly by increases in professional activities, scientific and technical and administrative services of the real estate. The most significant workload reductions were recorded in agriculture, public administration and defense, social security insurance, education, health and social care.
1.2 EMPLOYMENT & EARNINGS

In the context of economic transition, the Romanian labour market experienced significant changes in terms of volume and structure of the main labour force indicators. This process was characterized by the reduction of the economically active population and of employment, with a relatively steady level of unemployment. The financial crisis, which started in the second half of 2008, had adverse effects on the structure of the labour force in terms of reducing employment and increasing unemployment.

<table>
<thead>
<tr>
<th>Economically active population</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>9944</td>
<td>9924</td>
<td>9965</td>
<td>9868</td>
</tr>
<tr>
<td>Employed</td>
<td>9369</td>
<td>9243</td>
<td>9240</td>
<td>9138</td>
</tr>
<tr>
<td>Unemployed</td>
<td>575</td>
<td>681</td>
<td>725</td>
<td>730</td>
</tr>
</tbody>
</table>

* provisional data

Source: Romanian National Institute of Statistics
International Labour Office

<table>
<thead>
<tr>
<th>Unemployment rate (%)</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011'</th>
<th>2012'</th>
<th>2013'</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5,8</td>
<td>6,9</td>
<td>7,3</td>
<td>7,4</td>
<td>7,2</td>
<td>7,1</td>
</tr>
</tbody>
</table>

* forecast

Source: Romanian National Institute of Statistics

<table>
<thead>
<tr>
<th>Employment, by main activity of national economy</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed - total</td>
<td>9369</td>
<td>9243</td>
<td>9240</td>
<td>9138</td>
</tr>
<tr>
<td>Industry - total</td>
<td>2212</td>
<td>2048</td>
<td>1944</td>
<td>1951</td>
</tr>
<tr>
<td>- electricity, gas, steam &amp; air co production and supply</td>
<td>126</td>
<td>129</td>
<td>126</td>
<td>115</td>
</tr>
</tbody>
</table>

* provisional data

Source: Romanian National Institute of Statistics

<table>
<thead>
<tr>
<th>Monthly average net nominal earnings , by main activity of national economy</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1309</td>
<td>1361</td>
<td>1391</td>
<td>1475</td>
</tr>
<tr>
<td>Industry - total</td>
<td>1189</td>
<td>1300</td>
<td>1388</td>
<td>1493</td>
</tr>
<tr>
<td>- electricity, gas, steam &amp; air co production and supply</td>
<td>2389</td>
<td>2573</td>
<td>2671</td>
<td>2744</td>
</tr>
</tbody>
</table>

* provisional data

Source: Romanian National Institute of Statistics

¹ 1 leu = EUR 0,22 (exchange rate at 31.12.2012)

As in any market economy the highest share of employees is involved in the private sector, the share of employment in the private sector has remained during 2008-2011 around 80%.
1.3 INFLATION & FISCAL SITUATION

The Romanian economic environment faced major imbalances caused by inflation. During 2008-2011, in spite of a significant decline of economic activity, inflation had a new persistent character entailed to a great extent by shocks on internal and international markets, as well as higher prices for petroleum and raw materials or changes and evolution of the exchange rate.

Food prices and also the significant depreciation of the leu against the euro have led to a monthly average rate of inflation of 0.3 % for the first nine months of 2012.

The general government deficit decreased from 6.8% in 2010 to 5.2% of GDP in 2011. The deficit is expected to further decrease to 2.8% of GDP in 2012.

For 2013 the budget deficit is expected to fall to 2.2% of GDP due to the measures implemented by the authorities to continue fiscal consolidation:

- a freeze in public wages and further employment cuts in the public sector;
- a pension freeze;
- the introduction of a new social assistance code;
- excise rate hikes for cigarettes and diesel;
- and an increase in royalties for the use of resources necessary to produce construction material.
1.4 MACRO INDICATORS

<table>
<thead>
<tr>
<th>Real economy</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP - %, y/y real ch.</td>
<td>4.2</td>
<td>7.9</td>
<td>6.3</td>
<td>7.3</td>
<td>-6.6</td>
<td>-1.6</td>
<td>2.5</td>
<td>0.7</td>
<td>1.9</td>
</tr>
<tr>
<td>GDP per capita - EUR tnd</td>
<td>3.7</td>
<td>4.5</td>
<td>5.8</td>
<td>6.5</td>
<td>5.5</td>
<td>5.8</td>
<td>6.4</td>
<td>6.4</td>
<td>6.7</td>
</tr>
<tr>
<td>Private consumption - %, y/y real ch.</td>
<td>9.8</td>
<td>11.6</td>
<td>10.3</td>
<td>8.9</td>
<td>-9.1</td>
<td>-0.3</td>
<td>0.7</td>
<td>0.9</td>
<td>1.9</td>
</tr>
<tr>
<td>GFCF - %, y/y real change</td>
<td>15.3</td>
<td>19.9</td>
<td>30.3</td>
<td>15.6</td>
<td>-28.1</td>
<td>-2.1</td>
<td>6.3</td>
<td>4.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Industrial production - % y/y real ch.</td>
<td>2.0</td>
<td>7.1</td>
<td>5.4</td>
<td>2.7</td>
<td>-5.6</td>
<td>5.6</td>
<td>5.8</td>
<td>0.6</td>
<td>1.8</td>
</tr>
<tr>
<td>Retail sales - %, y/y real ch.</td>
<td>17.5</td>
<td>13.5</td>
<td>16.4</td>
<td>19.9</td>
<td>-14.1</td>
<td>-0.4</td>
<td>-2.5</td>
<td>2.5</td>
<td>3.1</td>
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<table>
<thead>
<tr>
<th>External sector</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Exports (FOB) - EUR bn.</td>
<td>22</td>
<td>26</td>
<td>30</td>
<td>34</td>
<td>28</td>
<td>37</td>
<td>45</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>Imports (FOB) - EUR bn.</td>
<td>30</td>
<td>38</td>
<td>47</td>
<td>53</td>
<td>36</td>
<td>45</td>
<td>52</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Trade balance - % of GDP</td>
<td>-9.8</td>
<td>-12.0</td>
<td>-14.3</td>
<td>-13.7</td>
<td>-5.8</td>
<td>-6.1</td>
<td>-5.5</td>
<td>-6.1</td>
<td>-6.3</td>
</tr>
<tr>
<td>C/A balance - % of GDP</td>
<td>-8.5</td>
<td>-10.4</td>
<td>-13.4</td>
<td>-11.6</td>
<td>-4.2</td>
<td>-4.4</td>
<td>-4.2</td>
<td>-4.1</td>
<td>-4.2</td>
</tr>
<tr>
<td>FDI inflows - % of GDP</td>
<td>6.5</td>
<td>9.3</td>
<td>5.8</td>
<td>5.8</td>
<td>3.0</td>
<td>1.8</td>
<td>1.4</td>
<td>1.2</td>
<td>1.3</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Prices</th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>CPI - y/y (%)</td>
<td>8.5</td>
<td>4.9</td>
<td>6.6</td>
<td>6.3</td>
<td>4.7</td>
<td>8.0</td>
<td>3.1</td>
<td>4.0</td>
<td>3.5</td>
</tr>
<tr>
<td>CPI - average (%)</td>
<td>9.0</td>
<td>6.6</td>
<td>4.8</td>
<td>7.9</td>
<td>5.6</td>
<td>6.1</td>
<td>5.8</td>
<td>3.3</td>
<td>3.9</td>
</tr>
<tr>
<td>IPPI - y/y (%)</td>
<td>9.8</td>
<td>11.6</td>
<td>10.5</td>
<td>7.9</td>
<td>1.4</td>
<td>6.3</td>
<td>7.0</td>
<td>5.0</td>
<td>4.6</td>
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<table>
<thead>
<tr>
<th>Labour market</th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment rate - %</td>
<td>7.2</td>
<td>7.3</td>
<td>6.4</td>
<td>5.8</td>
<td>6.9</td>
<td>7.3</td>
<td>7.4</td>
<td>7.4</td>
<td>7.3</td>
</tr>
<tr>
<td>Gross wages - RON</td>
<td>963</td>
<td>1,146</td>
<td>1,356</td>
<td>1,761</td>
<td>1,845</td>
<td>1,902</td>
<td>1,995</td>
<td>2,119</td>
<td>2,225</td>
</tr>
<tr>
<td>Gross wages - %, real change</td>
<td>8.0</td>
<td>19.2</td>
<td>19.9</td>
<td>10.9</td>
<td>-0.8</td>
<td>-2.8</td>
<td>-0.9</td>
<td>-2.8</td>
<td>1.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public sector</th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal deficit - % of GDP (ESA)</td>
<td>-1.2</td>
<td>-2.2</td>
<td>-2.9</td>
<td>-5.7</td>
<td>-9.0</td>
<td>-6.6</td>
<td>-5.2</td>
<td>-3.8</td>
<td>-3.3</td>
</tr>
<tr>
<td>Public debt - % of GDP (Eurostat)</td>
<td>15.8</td>
<td>12.4</td>
<td>12.6</td>
<td>13.4</td>
<td>23.6</td>
<td>30.5</td>
<td>33.3</td>
<td>34.6</td>
<td>35.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interest rates</th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary policy rate, %</td>
<td>7.50</td>
<td>8.76</td>
<td>7.50</td>
<td>10.25</td>
<td>8.00</td>
<td>8.25</td>
<td>6.00</td>
<td>5.25</td>
<td>5.25</td>
</tr>
<tr>
<td>ROBOR 3M - %, %</td>
<td>7.5</td>
<td>8.6</td>
<td>8.4</td>
<td>15.5</td>
<td>10.7</td>
<td>8.2</td>
<td>6.1</td>
<td>6.1</td>
<td>5.6</td>
</tr>
<tr>
<td>ROBOR 3M - %, average</td>
<td>9.8</td>
<td>8.8</td>
<td>7.6</td>
<td>13.0</td>
<td>11.7</td>
<td>0.7</td>
<td>5.8</td>
<td>5.4</td>
<td>5.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FX rates</th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>USD/RON average</td>
<td>2.19</td>
<td>2.81</td>
<td>2.44</td>
<td>2.52</td>
<td>3.05</td>
<td>3.16</td>
<td>3.04</td>
<td>3.55</td>
<td>3.73</td>
</tr>
<tr>
<td>EUR/USD average</td>
<td>1.24</td>
<td>1.25</td>
<td>1.37</td>
<td>1.47</td>
<td>1.39</td>
<td>1.33</td>
<td>1.39</td>
<td>1.26</td>
<td>1.20</td>
</tr>
</tbody>
</table>

Source: BCR Research, NIS, NBR. Eurostat

2. ELECTRICITY SECTOR

2.1 ELECTRICITY PRODUCTION / CONSUMPTION / IMPORT – EXPORT

Romania has a balanced portfolio of generation capacity comprising coal, hydro, nuclear, and gas-fired power plants, with renewable representing a small, but rapidly growing subsector of the generation market.
Historically, Romania’s domestic energy production from coal, oil, gas and hydropower, covered about 70% of the country’s energy needs. After the political changes which occurred in the 1990’s, Romania inherited power production capacities which presently correspond to the technological level of the years 1960-1970.

Romania’s accession to the European Union in 2007 made the local energy market compelled to evolve in line with European directives. By transposing European targets to the national level, Romania aims to increase energy efficiency, enhance the use of renewable energy sources and reduce greenhouse gas emissions. Therefore, the development of new power production capacities has been encouraged. At the same time Romania shows high interest in valorization of renewable sources which have an impact on the overall economic and social development.

Since energy needs to sustain the development trend of the country, improve the energy efficiency, utilize optimally the resources and protect the environment, the evolution of energy consumption has been influenced by the restructuring of the Romanian economy. Consumption decreased significantly between 1989 and 2000, largely owing to the collapse of industrial demand after 1989. However, the situation stabilized in 2000, when electricity consumption rose for the first time in more than a decade, reaching its peak in 2008. 2009 marked a decline in consumption due to the international crises that hit the market. 2010 and 2011 recorded...
increases in consumption of 4.8%, and respectively 3.7%. Currently, electricity demand is fully met by domestic electricity production in Romania. Furthermore, Romania is considered to be a net exporter of electricity.

### 2.2 ELECTRICITY MARKET & MAIN PLAYERS

The Romanian electricity market is fully liberalized since 1 July 2007. In practice however, a large regulated electricity supply market has continued to exist. Consequently, electricity is supplied under two systems: the regulated market, which covers households and part of the industrial sector, and the competitive market, mainly represented by large industrial consumers.

The state-owned companies account for over 90% of domestic electricity generation, the largest contributors including Hidroelectrica, Nuclearelectrica and Energetic Complex Turceni power stations. The electricity transmission system is operated, maintained and further developed by Transelectrica, a natural monopoly owned by the state.

The electricity distribution sector is dominated by three major international players: E.ON, ENEL and CEZ with a cumulative market share of approx. 60%.

The trading and supply sector is relatively fragmented and predominated by privately held companies.
The structure of the Romanian electricity market and main market players

Source: KPMG
2.3 REGULATORY INSTITUTIONS, ASSOCIATIONS & ELECTRICITY COMPANIES

- **Ministry of Economy, Trade and Business Environment (MECMA)** - Specialized body of the central public administration with the status of legal entity, whose main tasks include the drawing up and implementation of the national energy strategy. MECMA is also the majority shareholder in all the former wholly state-owned power and heat generation companies: Hidroelectrica, Nuclearelectrica, Termoelectrica, Energy Complexes Turceni, Rovinari and Craiova, as well as Electrocentrale Deva and Galati with Fondul Proprietatea holding a minority stake.

- **National Energy Regulatory Authority (ANRE)** - Acts as an independent public entity under the Prime Minister’s coordination. It aims to establish independent regulations to ensure efficient, transparent and stable functioning of the electricity and heat sector, while protecting the interests of consumers and investors.

- **Transelectrica SA** - The transmission system operator (TSO) in Romania, responsible for managing the balance of the Romanian transmission network, providing equal and fair access to all parties, balancing the system and providing ancillary services.

- **OPCOM** - The electricity market operator, providing an organized, viable and efficient framework for commercial trade on the wholesale electricity market while ensuring transparency and conditions of non-discrimination.

- **Competition Council** - Autonomous administrative body promoting competition and consumers’ interests, responsible for monitoring behavior of market players, approval of mergers resulting in significant market concentration and state aid issues.

ASSOCIATIONS

- **AGENCY FOR ENERGY EFFICIENCY & ENVIRONMENT PROTECTION**
- **CENTER FOR PROMOTION OF CLEAN & EFFICIENT ENERGY (ENERO)**
- **ROMANIAN WIND ENERGY ASSOCIATION**
- **ROMANIAN PHOTOVOLTAIC INDUSTRY ASSOCIATION**
- **ROMANIAN SMALL HYDROPOWER ASSOCIATION (ROSHA)**
- **ASOCIATIA PATRONALA “NEW SOURCES OF ENERGY”**

ELECTRICITY GENERATING COMPANIES

- **SC CET BACĂU SA**
- **SC CET BRAŞOV SA**
- **SC CET GOVORA SA**
- **SC CET IAŞI SA**
SC CET ORADEA SA
SC ELECTROCENTRALE BUCUREȘTI SA
SC ELECTROCENTRALE GALAȚI SA
SC DALKIA TERMO PRAHOVA SRL
SNP PETROM SUCURSALA PETROBRAZI
SC TERMICA SA SUCEAVA
SC TERMOELECTRICA SA
SPL DE TERMOFICARE PITESTI
SC UZINA TERMICĂ GIURGIU SA
SN NUCLEARELECTRICA SA
SC CE ROVINARI SA
SC CE TURCENI SA
RAAN
SC CE CRAIOVA SA
SC CET ARAD SA
SC ELECTROCENTRALE DEVA SA
SC HIDROELECTRICA SA

Distribution Network Operators

SC CET BACĂU SA
SC CET BRAȘOV SA
SC CET GOVORA SA
SC CET IAȘI SA
SC CET ORADEA SA
SC ELECTROCENTRALE BUCUREȘTI SA
SC UZINA TERMICĂ GIURGIU SA
SN NUCLEARELECTRICA SA
SC CE ROVINARI SA
SC CE TURCENI SA
RAAN
SC CE CRAIOVA SA
SC CET ARAD SA
SC ELECTROCENTRALE DEVA SA
SC HIDROELECTRICA SA

Electricity Suppliers Acting Exclusively on the Wholesale Market

ALPIQ ENERGY SE
SC GLOBAL ELECTRIC TRADING SRL
SC AMV STYLE SRL
SC GRIVCO SA
CEZ AS
SC INVEST DINAMIC PROJECT SRL
SC CEZ TRADE ROMANIA SRL
SC JAS BUDAPEST ZRT
EDISON TRADING SPA
SC KORLEA INVEST SRL
SC ENCAZ SRL
MVM PARTNER ENERGY TRADING LTD
SC ENEL TRADE ROMANIA SRL
SC RE ENERGIE SRL
SC ENERGY MARKET CONSULTING SRL SC ROMELECTRO SA
E.ON ENERGY TRADING SE
SC RUDNAP SRL
SC EZPADA SRL
SC RBS SEMPRA ENERGY EUROPE LTD
EZPADA SRO STATKRAFT MARKETS GMBH
SC GDF SUEZ ENERGY TRADING ROMANIA SC STATKRAFT ROMANIA SRL
SC TRANS ELECTRIC POWER SRL
SC TEN TRANSILVANIA ENERGIE SRL
GEN-I BUKAREST ELECTRICITY TRADING & SALES

DISTRIBUTION NETWORK OPERATORS

SC CEZ SA
SC ENEL BANAT SA
SC ENEL DISTRIBUTIE DOBROGEA SA
SC E.ON MOLDOVA SA
SC ENEL DISTRIBUTIE MUNTENIA SA
SC FDEE ELECTRICA MUNTENIA NORD SA
SC FDEE ELECTRICA TRANSILVANIA SUD SA
SC FDEE ELECTRICA TRANSILVANIA NORD SA

INCOUMBENT SUPPLIERS

SC CEZ VANZARE SA
SC ENEL ENERGIE SA
SC E.ON MOLDOVA FURNIZARE SA
SC ENEL ENERGIE MUNTENIA SA
SC FFEE ELECTRICA MUNTENIA NORD SA
SC FFEE ELECTRICA TRANSILVANIA SUD SA
SC FFEE ELECTRICA TRANSILVANIA NORD SA
ELECTRICITY SUPPLIERS

SC ALPIQ ROMENERGIE SRL
SC ENNET GRUP SR
SC ALPIQ ROMINDUSTRIES SRL
SC ENOL GRUP SA
SC ALRO SA SC EURO-PEC SA
SC ARCELORMITTAL GALATI SA
SC FIDELIS ENERGY SRL
SC ARELCO DISTRIBUTIE SRL
SC GDF SUEZ ENERGY ROMANIA SA
SC ATON TRANSILVANIA SRL
SC GENERAL COM INVEST SRL
SC BENY ALEX SRL SC GEVCO SRL
SC BIOL ENERGY SRL
SC HIDROCONSTRUCTIA SA
SC EFE ENERGY SRL
SC ICCO ENERG SRL
SC EGL GAS & POWER ROMANIA SA
SC ICCO SUPPLY SRL
SC ELCOMEX EN SRL
SC ICPE ELECTROCOND TECHNOLOGIES SA
SC ELECTRICA SA
SC LUXTEN LC SA
SC ELECTRICOM SA
SC ELECTROMAGNETICA SA
SC PETPROD SRL
SC ENERGOTRANS SRL
SC RENOVATION TRADING SRL
SC TINMAR IND SA
SC EFT ROMANIA SRL
SC TRANSENERGO COM SA
SC ENERGY HOLDING SRL
SC TOTAL ELECTRIC OLTENIA SRL
SC ENERGY NETWORK SRL
SC UCM ENERGY SRL
SC ENEX SRL

Source: ANRE
2.4 ELECTRICITY TRANSMISSION NETWORK

Overhead transmission lines: 8800 km  Transmission substations: 76
Distribution lines: 310127 km  Distribution substations: 1296
Consumption: 54.6 TWh (2008), 49.9 TWh (2009), 53.4 TWh (2010) approx 55 TWh (2011)

Source: Transelectrica, 2012
3. RENEWABLE ENERGY – RULE SYSTEM

3.1 MAIN LAWS AND REGULATIONS

- Energy Law no 13/2007 regarding the general legal framework for carrying out the production of electricity together with thermal energy produced in cogeneration;

- Law no. 220/2008 regarding the establishment of a system to promote electricity from renewable energy sources, as amended and supplemented by Law no 139/2010 and thereafter by Emergency Ordinance no 88/2011 subsequently republished and intended to improve the existing system based upon ‘green certificates’ (GCs);


- Government Decision no. 1535/2003 regarding the approval of renewable energy promotion strategy;

- Order no. 42/2011 regarding the approval of the Regulation for the accreditation of producers of RES-Electricity for the application of GCs promotion scheme;

- Order no. 43/2011 regarding the approval of the Regulation for issuance of GCs;

- Order no. 44/2011 regarding the approval of the Regulation for the organization and functioning of the GC market;

- Order no. 45/2011 regarding the approval of the Methodology for the establishment of the annual acquisition quota of GCs;

- Government Decision no. 540/2004 regarding the approval of the Regulation for obtaining the licenses and authorizations in the electricity field;

- Government Decision no. 90/2008 regarding the approval of the Regulation for the connection of users to electricity grids of public interest;

- Order no 25/2004 regarding the approval of the Commercial Code for the Wholesale Electricity Market;

- Order no. 2081/2010 regarding the approval of the Action Plan to promote Smart Grids;

- Law 134 as of July 18, 2012 entered into force on July 26, 2012 and approved the Government Emergency Ordinance No. 88/2011 which, in turn, modified and supplemented the Law 220/2008 setting up the support scheme promoting energy production from renewable sources;

- Law no. 123 as of July 10, 2012 for electric energy and natural gas came into force on July 19th, 2012 and established the procedures of electricity transactions that are to take place
exclusively on the competitive market managed by the Romanian Power Market Operator (OPCOM) in a transparent, public, centralized and non-discriminating manner.

Romania has transposed all relevant EU Directives in the renewable energy field into its regulatory framework. The mechanism for promoting the production of RES-electricity, consisting of the quota obligation system coupled with GCs, the trading market for GCs and the targets set for the production of RES-electricity, comply with the EU provisions.

**Governmental Decisions and basic Regulations to set up and operate the GCs market**

- Government Decision no. 1429/02.09.2004, Decision for the application of the Regulation certifying the origin of electricity generated from renewable sources; published in the OG Part I, no. 843 / 15.09.2004;
- Government Decision no. 1892/04.11.2004, determining the system to promote electricity generation from renewable sources, published in the OG no. 1056 / 15.11.2004;
- Government Decision no. 958/18.08.2005 modifying the GD no. 443/2003 regarding the promotion of electricity generation from renewable sources and modifying and supplementing the GD no. 1892/04.11.2004 determining the system to promote electricity generation from renewable sources, published in the OG no. 809/06.09.2005;
- Government Decision regarding the approval of the Plan with existing and planned activities to promote electricity generation and consumption from renewable sources, published in the OG Part I, no. 1036/22.11.2005;
- Regulation for the organization and operation of the green certificates market, issued by ANRE and approved by Order no. 40/17.10.2005 published in Romania’s Official Gazette no. 938, Part I / 20.10.2005;
- Procedure allocating the amounts of money from the failure of electricity suppliers to meet the compulsory quotas of GC purchase, issued by ANRE and approved by Order no. 45/30.11.2005, published in Romania’s Official Gazette no. 1158/21.12.2005;
- Convention of participation to the GC market, approved under ANRE’s Notice no. 6/17.03.2006.
3.2 GENERATING RES-ELECTRICITY

Preparation of investment project (construction of a RES-plant) & power plant operation

The phases of a production facility using RES according to PNAER

Source: PNAER - (TPA Horwath)

3.3 ACCESS OF RES-ELECTRICITY TO THE ELECTRICITY NETWORK

Different steps:
- submitting an application to Transelectrica (“TSO”) for a technical connection permit;
- receiving approval;
- signing a connection agreement.

The permit is valid for 25 years, granted that the applicant pays a connection fee equivalent to the cost of the connection works and signs the connection agreement with a network operator within three to six months from the issuance of the permit.

The Energy Law enforced in July 2012 stipulates that all producers are entitled to challenge the rejection of access to the grid and obtain a final decision from the relevant authority within two months’ time.

RES and co-generation facilities whose capacity is lower than or equal to 1 MW are entitled to priority access and dispatch.
However, the legislation does not describe the technical and commercial regulations which will be imposed to ensure compliance or the fines and non-monetary sanctions which will be incurred by the network operators failing to meet the obligations.

3.4 RES-ELECTRICITY PROMOTION SYSTEM & INCENTIVES

**GREEN CERTIFICATES MARKET**

Romania’s energy policy has started to show a specific focus on renewable sources, given the commitments and targets set by the European Union in relation to green energy, and the substantial interest demonstrated by potential investors. The main players involved in the preparation and implementation of the energy policy in Romania are the parliament (the main legislative body), the government and the Ministry of Economy, Trade and Business Environment (with their ability to issue certain pieces of legislation and prepare strategies) and ANRE, the regulatory authority in the energy field. Under their supervision, other entities are also involved in this process or indirectly influencing it, including Transelectrica (the majority state-owned transportation grid operator).

The Energy Strategy of Romania for the period 2007-2020 highlights the future energy strategy which covers the need for energy now and in the medium and long term, at a price as low as possible, adequate for a modern market economy. The strategy should assure a civilized high living standard, security of supply, evolution of competitive markets, while respecting the principles of sustainable development.

The National Renewable Energy Action Plan 2010 (NREAP) presents the types of resources and energy potential of renewable energy sources and also the required percentage of electricity to be produced from renewable energy sources, being 35% for the year 2015 and 38% for 2020.

The Romanian system to promote RES-electricity consists of a combination of green certificates and mandatory quotas:

- A Green Certificate (GC) is a document that certifies a quantity of 1 MWh of RES-E supplied to the network;

- A mandatory quota system is defined as the mechanism for promoting the production of electricity from renewable energy in which the suppliers purchase mandatory shares of electricity produced from these sources, for sale to the consumers.
Functionality of GCs market

The producers of RES-electricity, accredited by ANRE, are entitled to receive each month a certain number of green certificates per one MWh of power produced and delivered into the power grid (either to the suppliers or directly to the final consumers).

Green certificates are issued on a monthly basis by Transelectrica and the number of GCs allocated to producers depend on the type of renewable energy and the installed power of their generation capacities:

**Promotion system for RES-Electricity in Romania**

<table>
<thead>
<tr>
<th>Type SRE</th>
<th>Type group</th>
<th>Number of GC/MWh</th>
<th>Time (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hydraulic energy-used in electrical units with PI ≤10 MW</td>
<td>new (after 1 Jan. 2004)</td>
<td>3 GC</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>refurbished</td>
<td>2 GC</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Until 1 Jan. 2004 and nonrefurbished</td>
<td>0.5 GC</td>
<td>3</td>
</tr>
<tr>
<td>2. Wind energy</td>
<td>new</td>
<td>2 GC until 2017</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 GC up to 2018</td>
<td></td>
</tr>
<tr>
<td>3. Biomass, biogas, biofuels, geothermal energy</td>
<td>new</td>
<td>2-3 GC</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>High efficiency cogeneration (over 3 GC)</td>
<td>1 GC</td>
<td>15</td>
</tr>
<tr>
<td>4. Solar energy</td>
<td>new</td>
<td>6 GC</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: ANRE
The suppliers (and certain producers) of power have the obligation to purchase each year a number of green certificates determined by multiplying the mandatory acquisition quota set for the respective year by ANRE with the volume of power (in MWh) supplied to final consumers.

ANRE monitors and assesses on a quarterly and annual basis the compliance targets for each supplier/producer. For not reaching mandatory annual quota, providers must pay to the national operator of electricity transmission, SC TRANSELECTRICA SA, the value of purchased GCs, which is actually a drastic penalty. Starting January 1st 2008 it consists of a value of twice the maximum GC trading value (€ 110/not purchased certificate). Moreover, suppliers who do not pay the value of not purchased GCs as stated above, will have their supply license suspended until the date of full payment.

A GC is valid for 16 months from the date of issuance and then it will be either used/consumed or annulled (if not used by the supplier/producer to fulfill its mandatory GC quota).

Only certain quotas of RES-electricity benefit from the support scheme (“RES Quota”). These quotas have been fixed for each year until 2020, starting 2010, and are calculated progressively: e.g. for 2012 a mandatory RES quota of 12% of gross national electricity consumption was set, while for 2020, the RES quota should reach 20% of the gross national electricity consumption.

![Mandatory quotas as referred to in Law 220/2008 (as amended by Law 139/2010)](image)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Quota</td>
<td>8.3%</td>
<td>10%</td>
<td>12%</td>
<td>14%</td>
<td>15%</td>
<td>16%</td>
<td>17%</td>
<td>18%</td>
<td>19%</td>
<td>19.5%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Source: ANRE

The GCs obtained by the producers are traded on a centralized market managed by a market operator or on the basis of bilateral contracts at a price which must range between the minimum and the maximum limits set by law (EUR 27 to EUR 55, adjustable based on the inflation index). These prices are valid for the period 2008-2025. Afterwards, the trading value shall be determined on the green certificates market, but cannot be lower than the minimum trading value applied in 2025.

The GCs can be traded solely on the Romanian market. Although Directive 2009/28 which stipulates that Member States may voluntarily decide to join or partially coordinate their national support scheme, was implemented in the national legislation, Romania has not taken any steps to agree with other Member States on a joint support scheme that would allow for inter-state trading.

The transfer of GCs is recorded in a special registry dedicated to GCs.

The participants to GCs markets are producers, suppliers and (potentially) administrators/liquidators for producers/suppliers.
For 2011 a final number of 451,841 GCs traded on the Centralized GC Market was recorded, while for 2012 the amount almost doubled registering a number of 866,939 GCs.

As for the number of producers, at the end of 2011, 78 energy producers from renewable sources were recorded in the Register of Energy Producers from Renewable Sources (RES-E):

<table>
<thead>
<tr>
<th>Producers of RES-E</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>wind</td>
<td>2</td>
<td>3</td>
<td>11</td>
<td>12</td>
<td>15</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>water</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>11</td>
<td>14</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>biomass</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>total</td>
<td>3</td>
<td>7</td>
<td>20</td>
<td>23</td>
<td>31</td>
<td>48</td>
<td>78</td>
</tr>
</tbody>
</table>

Source: Transelectrica

Considering the promotion system of RES-electricity, it is obvious that the exploitation of renewable energy in Romania is both an obligation - cf. Romania's alignment to the EU green energy standards - but also a real business, being a challenge both for traditional players on the Romanian energy market, as well as for new players willing to invest in a worldwide promising economic area.

**Benefitting from the GCs promotion system**

According to Law 220/2008, the Green Certificates promoting system as a state-aid scheme is applicable till 2016, so it is unclear what will happen afterwards. ANRE Vice-President, Dr. Ir. Petru Lificiu, stated that investments must be done before 2016.

Procedures:
- Accreditation from ANRE in order to qualify for the GCs support scheme;
- Registration at the Electricity Market Operator (OPCOM) for selling E-RES on the DAM (Day Ahead Market);
- Registration at the Romanian Transmission and System Operator (Transelectrica) in order to obtain the GCs.
- Overcompensation

Overcompensation is defined as an internal rate of return 10% higher than the reference internal rate of return for a specific technology. The internal rate of return is the return of an investment project and calculated by a cost-benefit analysis, which is performed by using the updating technique applied to the investment costs, operating costs and the resulting income throughout the lifespan of the projects.

Under “overcompensation” system the authorities check if everything that was assumed related to RES investments is correct (ANRE will complete a monitoring report for 2012) and if there are differences in the end to reduce the number of GCs granted.

The sectors that face overcompensation for the time being are photovoltaic and micro hydro technologies, mainly due to the decreases in the investment costs, for instance prices for photovoltaic technology have been reduced by half lately.

In case of a downward adjustment of the GCs scheme, the amended scheme will not be applied retroactively, but will only apply to projects that become operational after the changes to the system come into force.

However, the applicability of an adjustment to the scheme (following the first monitoring process) is postponed until January 1st, 2014 for the solar sector and until January 1st, 2015 for all other renewable technologies.

Besides overcompensation, one aspect that is under consideration for the Romanian authorities is represented by the impact of electricity from renewable sources on the bills that have to be paid by consumers. If for individuals and small consumers the clean energy bill is somehow bearable, for the industry sector it is rather scathing.

Therefore, the Energy Minister Constantin Nita examined several ways to reduce this impact:

- Reducing the number of GCs before 2014;
- Reducing the maximum price of a GC from EUR 55 to EUR 30-35;
- Exempting the obligation of large consumers to purchase GCs.

Reducing the number of GCs depends on the completion by ANRE of the monitoring report for 2012, which will probably be ready in March-April 2013. So this reduction is still an option, but only starting 2014, as the report will require some time for debates and consultations.

Reducing the maximum price of a GC would be easily challenged in court and cancelled by the investors, according to some experts in the field.

As far as exempting the obligation of large consumers to purchase GCs is concerned, this could be applicable in a correct way only with the condition to reduce the number of GCs.

In any case, each of the above mentioned initiatives to amend the current legislation would involve a reasonable period of time to thoroughly consult with the players on the RES market.
Funds

Programmes Co-Financed by the EU

Investments in the upgrading and construction of new power production facilities through the use of RES can be financed by the Romanian state together with the European Union through the following programmes:

1. European Regional Development Fund (ERDF) – Sectoral Operational Programme “Increase the Economic Competitiveness” – Measure 4.2 – Investment in Renewable Energy

   Around EUR 200 million have been initially made available for funding renewable energy projects between 2007-2013, of which 85% represents non-refundable EU funds granted by the European Regional Development Fund, and 15% public co-financing funds from the state budget. Until now, calls were launched in 2008 and 2010. To receive EU funds, projects can be worth up to EUR 50 million plus VAT, while the value of the loan for each project is a maximum of EUR 20 million.

   Subsequently the total budget available for this support scheme increased to EUR 463 million, of which 88% are non-refundable EU funds by ERDF and 12% are co-financed by the Ministry of Economy, Trade and Business Environment.

   **Structural funds for renewables**

| 2008 call | 50 projects received  
| 14 projects selected  
| structural funds: ≈ 70 mil. Euro |
| 2010 call | revised Applicant Guide  
| 419 proposals received, representing 9 x the available fund  
| structural funds: ≈ 180 mil. Euro |

   in 2011 another 100 mil. Euro allocated for renewables for projects submitted in 2010 call

   Source: ANRE

2. European Agricultural Fund for Rural Development (EAFRD) – Measure 121 – Modernization of Agricultural Holdings

   The public co-financing component was limited to EUR 800,000 for 2007-2013 with non-reimbursable support of 40%. The last possibility to submit projects was in June 2012, the next chance should be in early 2014.

3. “Europe 2020” is the EU’s growth strategy for the programming period 2014-2020, which is currently under designing status
The state-aid type support is only partially compatible with the green certificates support scheme. Thus, a renewable power producer that already benefits from EU grants may be eligible to receive a lower number of green certificates (determined by ANRE) than the standard numbers set out above. By way of exception, the renewable energy plants, commissioned before January 1st 2013 which benefitted from or were approved to receive state aid before July 13th 2011 (the date of the authorization of the support scheme by the European Commission), will continue to receive the full number of GCs.

Moreover, as an alternative to the green certificates support scheme, certain producers of energy from renewable sources may also opt for other promotion mechanisms. For example, in relation to high efficiency co-generation power plants, a bonus-type support scheme is applicable. On its basis, the relevant producers are entitled to receive a fixed amount in RON per one MWh of power produced in high efficiency co-generation units and destined for domestic consumption. This bonus promotion system cannot be cumulated with the green certificates support scheme and the producers that would be eligible for both, must choose between one of them.”

- **EEA AND NORWAY GRANTS**

The agreement on the European Economic Area focuses on reducing disparities in Europe and to strengthening bilateral relations within 15 countries in Central and Southern Europe.

For the period 2009 - 2014 Romania has been allocated EUR 305.95 million (including EUR 98.5 million for 2007 - 2009) consisting of EEA Grants and Norway Grants. These funds will co-finance projects within 23 different programmes.

The Ministry of European Affairs is the national contact point that coordinates programmes and the management of the financial assistance provided to Romania.

The Ministry of Environment and Forests and the Ministry of Economy, Trade and Business Environment are the “Programme Operators” that manage directly the allocation of funds.

### EEA & Norway grants

<table>
<thead>
<tr>
<th>March 2012</th>
<th>Agreements on the programme areas and priorities for funding signed between the donor states and Romania</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Key areas of support:</td>
</tr>
<tr>
<td></td>
<td>• Increasing competitiveness of green enterprises, boosting green innovation &amp; entrepreneurship</td>
</tr>
<tr>
<td></td>
<td>Programmes to be implemented:</td>
</tr>
<tr>
<td></td>
<td>• Energy efficiency and renewable energy = funded by grants of 16 million euro</td>
</tr>
<tr>
<td></td>
<td>• Green industry innovation = funded by grants of 24 million euro</td>
</tr>
<tr>
<td>2013</td>
<td>Probably the first calls for proposals</td>
</tr>
</tbody>
</table>

Source: TPA Horvath
**NATIONAL FUNDS**

As an alternative to the EU-programmes, funds for investments in alternative energy could also be accessed through the Romanian Environmental Fund of the Ministry of the Environment and Forest. The maximum amount of funds a beneficiary could receive was RON 30 million (+/- EUR 6,8 million).

### Romanian financing programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Details</th>
</tr>
</thead>
</table>
| 2010 | * closed since June - July 2010  
      * 50 projects approved  
      * state funds = 440 million lei |
| 2011 | * total amount allocated to the programme increased to 900 million lei |
| 2012 - 2013 | * not certain if still possible to submit projects |

Source: TPA Horwath

**OTHER INSTITUTIONS TO OFFER FINANCING**

In addition to the above mentioned financial sources for investments in renewable energy, an important role is played by the banks: European Bank for Reconstruction and Development (ERBD), European Investment Bank (EIB), BRD Societe Generale, UniCredit and CaizaBank, UniCredit Leasing Corporation, BCR, Alpha Bank, ING, etc.

### Difference between EEFF and RoSEFF

<table>
<thead>
<tr>
<th>Credit line</th>
<th>EEFF</th>
<th>RoSEFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible companies</td>
<td>Private sector, any size</td>
<td>Private sector, only SMEs</td>
</tr>
<tr>
<td>Investment type</td>
<td>Energy efficiency</td>
<td>Energy efficiency and renewable energy</td>
</tr>
<tr>
<td>Maximum credit amount</td>
<td>EUR 2.5 min</td>
<td>EUR 1 min</td>
</tr>
<tr>
<td>Free technical study</td>
<td>Yes, for all investment</td>
<td>Yes, for investments exceeding EUR 250,000.</td>
</tr>
<tr>
<td>EEFF total financing</td>
<td>EUR 80 min</td>
<td>EUR 60 min</td>
</tr>
<tr>
<td>Number of participating banks</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Timeline</td>
<td>2008 - 2012</td>
<td>2012 - 2014</td>
</tr>
<tr>
<td>EU grants</td>
<td>15 percent</td>
<td>up to 15 percent</td>
</tr>
</tbody>
</table>

*Source: EEFF – the EU-EBRD Energy Efficiency Finance Facility*
3.5 MAIN BARRIERS

Romania still doesn’t have an energy strategy adapted to the imperatives of the present time, including the impact of the economic and financial crisis, penetration of renewable energies, new hydrocarbon finds, repositioning in competition of cross-border hydrocarbon infrastructure projects, electricity markets coupling, transposition of the acquis communitaire, in particular the energy-climate change package, etc.

Main issues are:

- Lack of clarity on wind farms above 125MW;
- Exporting GCs should be possible, but much work remains to be done;
- New regulations are needed to correct flaws in the renewable energy legislation;
- Local authorities are slow to adapt to best practices and new laws with inconsistent application of legislation between different parts of the country;
- Transitional provisions of new laws are often inadequate;
- New Civil Code includes significant new obligations on registration of land rights in the LandBook;
- Lot of confusion over best practice for Environmental Impact Assessments;
- Balancing capacity and compensation remain unresolved.

Although a set of strategic actions has been proposed in the field of electricity, by means of a study commissioned by Transelectrica regarding perspectives of the National Power System, there is yet no comprehensive document available that would guide the government, local administrations, investors, and economic agents in their efforts to align their commercial policy with the sustainable development of the Romanian energy sector.

In addition to such gaps in the regulatory framework, projects in the renewable energy field face difficulties during the development stage throughout the process of securing the land necessary to build, own and operate the capacity. This occurs mostly as a result of the effects of the application of restitution laws enacted after the fall of the communist regime. Difficulties often arise throughout the permitting process as well, due to sometimes unclear and uncorrelated procedures for obtaining quite a substantial number of permits and approvals.

Main issues:

- Many very small land plots;
- Inaccurate cadastral drawings;
- Title deed verification is difficult;
- Locating land owners can be difficult;
- Communal boundaries sometimes change;
- Lack of any form of exclusivity until very late in the process;
- Notarial and cadastral system for land transactions often outdated.

Grid availability also raises concerns and is definitely one of the aspects which need due consideration in the assessment of a project, not only because of the limitations in terms of capacity which cannot be excluded, but also from the perspective of potential reinforcement works which may become necessary and hence impact the overall feasibility and profitability.

Main issues:
- Grid capacity is over-allocated;
- Some grid-connections are not viable, while other projects that have grid connections are not viable;
- Process of cleaning grid connections underway by ANRE and Transelectrica;
- However the program of grid upgrades by network operator appears optimistic.

4. RENEWABLE ENERGY - SOURCES

Romania benefits of environmental conditions which create a diversity of renewable sources with substantial energy potential.

Romania was ranked 13 out of 40 countries in the “All Renewables Index” (August 2012) of put together by Ernst & Young.

<table>
<thead>
<tr>
<th>Source</th>
<th>Annual potential</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>23 TWh</td>
<td>Electricity</td>
</tr>
<tr>
<td>Photovoltaic</td>
<td>60 PJ/year</td>
<td>Heat</td>
</tr>
<tr>
<td>Hydro</td>
<td>36 TWh</td>
<td>Electricity</td>
</tr>
<tr>
<td>of which under 10 MWh</td>
<td>3.6 TWh</td>
<td></td>
</tr>
<tr>
<td>Biomass &amp; biogas</td>
<td>318 PJ</td>
<td>Heat</td>
</tr>
<tr>
<td>Geothermal</td>
<td>7 PJ</td>
<td>Heat</td>
</tr>
</tbody>
</table>

Source: ANRE
The renewable energy spectrum is shared by biomass and biogas followed by wind and solar, in various medium to large proportions, while small hydro and geothermal energy sources are less represented, but nevertheless attractive.

However these are theoretical potentials, real usable potentials are much lower due to technological, economical and environmental limitations and restrictions.

According to data issued by ANRE, renewable energy reached only 1.5% of production by September 2011, a percentage represented entirely by wind energy.

However due to a generous support scheme, the development of renewable projects has been considered to be the most active energy sector in Romania.
Despite the current legislative obstacles and unsupportive grid availability more and more investors show interest in renewable energy sources and more and more projects receive the technical connection permits.

Each year the number of projects has increased and it is forecast to continue growing in the future, especially in the wind, solar and biomass sector.
HOW MUCH DOES RENEWABLE ENERGY COST?

There is a debate raging about the final cost of a renewable energy project.

According to information on the energy market, the figures below are not exact and will depend on the terms of access to land for developers in Romania – but this is a rough estimate:

- **Wind**: EUR 1.7 million per installed MW
  
  In Romania, for a wind project, about 70% the investment goes into the turbine. The remaining costs include buying or leasing the land and the maintenance costs.

- **Solar**: greatly reduced from EUR 3 million per installed MW in 2010, to 1.5 million per installed MW in 2012.

- **Hydro**: up to EUR 2.5 million per installed MW

- **Biomass**: EUR 2.5 million per installed MW

### 4.1 WIND

**POTENTIAL & BEST LOCATIONS**

Romania’s potential in wind energy is considered to be the highest in South Eastern Europe. It is estimated at around 14,000 MW installed capacity, generating around 23 TWh per year.

Wind potential in Romania is mainly concentrated in the Dobrogea, Moldova and Banat regions. Dobrogea – and most notably Constanta and Tulcea – being ranked second in terms of potential in Europe according to a report by Erste Bank.

Romania is now among the ten most attractive countries for wind investments, up three positions, according to the Ernst & Young Country Attractiveness Indices, which include 40 countries.

**CAPACITY INSTALLED**

The first wind turbine installed in Romania was placed in the Industrial Park Ploiesti with a production license from December 2005. The first wind turbine in commercial operation was the one in Braila, Tulcea County, with a production license from February 2006.

From that time on things have constantly been changing and Romania’s wind energy sector has started to play an increasingly important role. Wind resources in Romania have been thoroughly analyzed, revealing high potential in the practical set-up of both small independent units for rural areas and large off-shore projects. The market has been occupied by top international names in this industry with investments of several billion euro.
At the end of 2011 Romania’s wind power station capacity amounted to 982 MW, a more than twofold increase since the end of 2010 and a 70-fold increase compared to the end of 2009.

MW installed in wind in Romania

<table>
<thead>
<tr>
<th>Year</th>
<th>Installed capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>14</td>
</tr>
<tr>
<td>2010</td>
<td>462</td>
</tr>
<tr>
<td>2011</td>
<td>982</td>
</tr>
<tr>
<td>April 2012 / April 2012</td>
<td>1140</td>
</tr>
</tbody>
</table>

Source: TPA Horwath / RWEA

According to data from Transelectrica, Romania’s installed capacity of wind power reached around 1822 MW at the end of 2012.

Because of the attractive investments programme, the wind industry could attract more investors and the installed capacity could double in 2013 and 2014, according to estimates of representatives of the Monsson Group, Romania’s biggest wind farm developer.

**TOP 3 WIND FARM COUNTIES** (data from Transelectrica, Dec. 2012)

- **Constanța** “Romania’s greenest county”- having an installed capacity of over 1000 MW, worth more than EUR 1.5 billion.
- **Tulcea** – having an installed capacity of over 464 MW, worth about EUR 700 million;
- **Galați** - an installed capacity of 387 MW.

(Source: zf.ro)
PROJECTS & MAIN PLAYERS

- **Functional wind farms - August 2011**

<table>
<thead>
<tr>
<th>Top 10 biggest functional wind farms in Romania</th>
<th>August 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topul celor mai mari zece proiecte eoliene functionale în România</strong></td>
<td></td>
</tr>
<tr>
<td>Posiția</td>
<td>Compania</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>1.</td>
<td>CEZ (Cehia)</td>
</tr>
<tr>
<td>2.</td>
<td>ENERGIAS DE PORTUGAL</td>
</tr>
<tr>
<td>3.</td>
<td>ENEL (Italia)</td>
</tr>
<tr>
<td>4.</td>
<td>ENERGIAS DE PORTUGAL</td>
</tr>
<tr>
<td>5.</td>
<td>WIND POWER PARK (Petrom)*</td>
</tr>
<tr>
<td>6.</td>
<td>ENEL (Italia)</td>
</tr>
<tr>
<td>7.</td>
<td>MONSSON (Emanuel Muntean)</td>
</tr>
<tr>
<td>8.</td>
<td>ROMCONSTRUCT TOP (ButanGas)</td>
</tr>
<tr>
<td>9.</td>
<td>LC BUSINESS</td>
</tr>
<tr>
<td>10.</td>
<td>EVIVA NALBANT (Martifer)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
</tr>
</tbody>
</table>

* parc în probe

**Source:** Transselectrica, Asociația Română pentru Energie Eoliană

- **Ongoing wind farm projects – 2011**

<table>
<thead>
<tr>
<th>Ongoing wind farm projects</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>Location</td>
</tr>
<tr>
<td>CEZ</td>
<td>Fantanele</td>
</tr>
<tr>
<td></td>
<td>Cogealac</td>
</tr>
<tr>
<td>IMA Partners and Verbund</td>
<td>Casimcea, Topolog, Daleni</td>
</tr>
<tr>
<td>Enel</td>
<td>Tulcea County</td>
</tr>
<tr>
<td></td>
<td>Constanta County</td>
</tr>
<tr>
<td>PNE Wind</td>
<td>Moldova and Dobrogea</td>
</tr>
<tr>
<td>Iberdrola</td>
<td>Mihai Viteazu</td>
</tr>
<tr>
<td>Renovatio/EDPR</td>
<td>Cernavoda</td>
</tr>
<tr>
<td></td>
<td>Galati County</td>
</tr>
<tr>
<td>IWE</td>
<td>Mitoc</td>
</tr>
<tr>
<td>Alstom</td>
<td>Borsa</td>
</tr>
<tr>
<td>Land Power</td>
<td>Topolog</td>
</tr>
<tr>
<td>Martifer</td>
<td>Casimcea</td>
</tr>
<tr>
<td>GDF Suez Energy Romania</td>
<td>Gemenele</td>
</tr>
</tbody>
</table>

**Source:** Wind Energy in Romania / The Diplomat
Top 3 wind farm developers – 2012

1. CEZ Group (Czech Republic) – operates a 600 MW wind park at Fantanele/Cogealac, Europe’s largest onshore wind project, which involved an investment of EUR 1.1 billion. Fantanele wind farm of 347.5 MW is operational since 2011 and Cogealac wind farm of 252.5 MW is operational since November 2012. CEZ continues its investment policy in Romania: EUR 400 million targeting development through acquisitions in the electricity area, especially renewable energy.

2. ENEL Green Power (Italy) – has an installed capacity of around 500 MW in Dobrogea region, has connected late 2012, three new wind farms to the grid of 206 MW (Elcomex EOL, Targusor and Gebelesis) which involved an investment of EUR 340 million.

3. Energias de Portugal (Portugal) – has an installed capacity of 285 MW both in Dobrogea (Pestera, Cernavoda, Sarichioi) and Moldova (Vutcani, Vaslui county) which involves an investment of nearly EUR 430 million. Energias de Portugal continues to expand with an additional 579 MW in wind projects across the country in the pipeline.

Other big investors

- Verbund (Austria) – currently developing a 200 MW wind farm project in Casimcea (Dobrogea area) in two phases, which involves EUR 300 million. Further planning is to install extended capacities of 700 MW in Topolog-Casimcea-Daeni-Dorobantu region, on the border between Tulcea and Constanta counties. This project will be the largest onshore wind farm in Europe, exceeding the capacity of the planned CEZ investment in Fantanele-Cogealac.

- E.ON (Germany) – already involved in the development of several wind projects, mainly located in Moldova, which may involve an installed capacity of up to 200 MW. E.ON is also active with investments of EUR 44.4 million in the network upgrade of its transformer stations in the country’s northeast.

- Iberdrola (Spain) – already operating a 80 MW wind farm at Mihai Viteazu, has started developing a 600 MW project in Cogealac, Dobrogea.

- GDF Suez Energy (France) – started mid March 2012 the construction of a wind park with a total installed capacity of 48 MW, near Braila county, Gemenele area.
Foreign and Romanian investments announced in the Governmental Report
“Romania: Picture of Regional Investments 2011 – 2012”

<table>
<thead>
<tr>
<th>Company to invest</th>
<th>Value million euro</th>
<th>Investment</th>
<th>County</th>
<th>Starting year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terra SPV One</td>
<td>500</td>
<td>Foreign (Cyprus &amp; Panama)</td>
<td>Botosani</td>
<td>2012</td>
</tr>
<tr>
<td>Montana Energy</td>
<td>40</td>
<td>Foreign (Luxembourg)</td>
<td>Iasi</td>
<td>2012</td>
</tr>
<tr>
<td>Compania Eoliana</td>
<td>38</td>
<td>Foreign (Italian)</td>
<td>Caras-Severin</td>
<td>2012</td>
</tr>
<tr>
<td>Wind Energy Power Service</td>
<td>30</td>
<td>Foreign (Romanian &amp; French)</td>
<td>Suceava</td>
<td>2012</td>
</tr>
<tr>
<td>Proveider Green</td>
<td>17,44</td>
<td>Romanian</td>
<td>Caras-Severin</td>
<td>2011</td>
</tr>
<tr>
<td>Sorgenia Romania</td>
<td>14,6</td>
<td>Foreign (Italian)</td>
<td>Constanta</td>
<td>2011</td>
</tr>
<tr>
<td>Montana Energy</td>
<td>5</td>
<td>Foreign (Luxembourg)</td>
<td>Iasi</td>
<td>2011</td>
</tr>
<tr>
<td>WindKraft SimonsFeld</td>
<td>2,79</td>
<td>Foreign (Austrian)</td>
<td>Caras-Severin</td>
<td>2012</td>
</tr>
<tr>
<td>WPD Romania</td>
<td>-</td>
<td>Foreign (German)</td>
<td>Braila</td>
<td>2011</td>
</tr>
</tbody>
</table>

- **Other announced investments**

  - **Monsson Group** (Romania – private developer) – has a 2400 MW portfolio of projects, mostly in Dobrogea area, out of which 1,700 MW were permitted by the grid operator Transelectrica. About 850 MW have already been sold to various companies, such as Continental Wind Partners, CEZ, ButanGas, Petrom, Steag Gmbh. Recently in 2012, along with Vestas Denmark, Monsson Group started the construction of the Pantelimon wind park, in north Constanta County, which will have an installed capacity of 150 MW.

  - **STEAG GmbH** (Germany) – plans to invest around EUR 200 million in developing a 108 MW Crucea Nord Wind Farm project in Constanta county, which was bought from Monsson Group.

  - **Energy Rose Group** (Cyprus) – operating a 6 MW wind farm in Casimcea plans to have produced a capacity of over 40 MW from five wind farms by the end of 2013.

  - **C-Tech and Rokura** (Romanian consortium) – plan to invest in wind farms of a total capacity of 1200 MW;

  - **Prowind** (Germany) – developing five wind projects in Vaslui county (Deleni – 122,5 MW, Bogdanesti – 56 MW, Viisoara 1 – 47,5 MW, Viisoara 2 – 20,8 MW & Viisoara 3 – 52,8 MW with turbine erection planned for 2013. Further wind developments are currently under
study. Prowind successfully negotiated a 300 MW Grid Connection Agreement and secured land for a total of 800 MW in Vaslui county.

- **Marguerite** (France) & **EnerCap** (Czech Republic) – two investment funds plan to develop a 80 MW wind park in Constanta. They bought 80% of this wind park from EP Global Energy (Cyprus) at the end of 2012. Commercial operations would start at the beginning of 2014.

- **Lukerg Renew** (Lukoil – Russia) & **ERG** (Italy) – invest about EUR 135 million in developing a 84 MW wind farm near Tulcea, its commercial operations being planned to start in 2014.

- **Group Max Boegl** (Germany) - plans to tap the renewable sector in Romania by investing up to EUR 200 million for a 99 MW wind farm in Southeastern Romania, in the Tulcea region. The company will operate the tallest wind mills in the country, as it will use hybrid towers which can reach heights of 140 meters, and will complete the building works in 2014.

- **Eolen Vest** (Filasa International - French) – acquired three wind farms located in Braila, with an installed capacity of 400 MW (Wind Energy Power Trade, Wind Energy Advance Tech and Wind Energy Strategy) with a total investment of more that EUR 600 million.

  The company also announced that it started developing more than 10 wind farms in Suceava, with a total installed capacity of 516 MW and an investment of about EUR 780 million.

  The works should be finalized in the next 2 years.

- **Wind investment under development – ANRE, April 2012**

<table>
<thead>
<tr>
<th>Network operator</th>
<th>Connection contracts</th>
<th>Connection permits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Producers</td>
<td>Installed power (MW)</td>
</tr>
<tr>
<td>TRANSELECTRICA</td>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>Enel Doiornoea</td>
<td>58</td>
<td>1530,56</td>
</tr>
<tr>
<td>FDEE Electrica Distributie Muntenia Nord</td>
<td>30</td>
<td>376,03</td>
</tr>
<tr>
<td>E.ON Moldova</td>
<td>7</td>
<td>16,69</td>
</tr>
<tr>
<td>Enel Banat</td>
<td>3</td>
<td>89</td>
</tr>
<tr>
<td>CEZ (as distributor)</td>
<td>1</td>
<td>1,6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>102</td>
<td>2622,08</td>
</tr>
</tbody>
</table>
According to a report by Transelectrica (TSO) about the concluded grid connection agreements for wind power, agreements for about 14045 MW were signed as of August 27, 2012, the highest value of all renewable energy sources.

Currently the balance is different than in previous years, as several good projects can be found, but less investors are available. The market is not as promising as it used to, but transactions are still being concluded.

Market share of the leading wind turbines manufacturers and suppliers in Romania:

- GE 34%
- Vestas 31.5%
- Gamesa 17.9%
- Nordex 2%
- Fuhrlander 0.9%
- Suzlon 0.8%

### 4.2 SOLAR

#### POTENTIAL & BEST LOCATIONS

Solar energy shows a moderate potential throughout the entire territory of the country, but the most abundant solar resources are located in the southern part of the country and Dobrogea. Considering solely the solar electricity potential, its potential is approximately 1.2 TWh.

#### CAPACITY INSTALLED

During the 1970’s and 1980’s Romania was an early player in the solar power industry, installing around 800,000 m² of early-technology solar cells, which placed the country third worldwide as far as the total surface of photovoltaic panels was concerned.

Although the support scheme was one of the main investment drivers lately, the solar sector has lagged behind. In 2011 the production of electricity using solar PV was insignificant in Romania, while in April 2012 only two PV plants were operational, each amounting to 1 MW.

However, the situation is expected to change, because of the exceptional natural conditions of Romania in terms of solar intensity, the support scheme which is one of the most favorable in the EU and the appetite of investors for developing PV producing facilities.

According to experts from the Romanian Photovoltaic Industry Association, over 200 MW will be installed in PV plants till the end of the year 2012.

Foreign investors are recommended to count on a local partner for the creation of a JV and thus expedite negotiations and obtain the necessary licenses and permits.
PHOTOVOLTAIC PARKS PROJECTS:

- **Zalau local authority** – approved the technical and economical documentation for the project “Installation for the production of electric energy using solar renewable sources – SoArE Zalau” with a total value of EUR 5 million.
  
The project will be submitted to SOP “Increase of Economic Competitiveness”, Axis 4 – “Increasing energy efficiency and security of supply in the context of combating climate change” in order to receive EU funds;

- **Caransebes local authority** – has a partnership with an investor that intends to develop a photovoltaic park financed with EU funds.
  
The local authority is also talking to a group of investors to develop another photovoltaic park with an investment of EUR 3 million;
• **Green Energy Napoca** (GEN - Romania) – developing a park with a power of 66 MW in partnership with Cluj public authority, which involves an investment of around EUR 130 million;

• **Constructim** (Romania) – launched in August 2012 in Buzias, the biggest photovoltaic park in the western area of the country, with a total capacity of 1 MW and an investment of EUR 2 million.

   The company also has some projects of solar energy in Timis county in the development stage.

• **Vim Energy** (Romania) – developing a photovoltaic park with the power of 7,3 MW in Giulvaz, Timis county, which involves an investment of EUR 15 million;

• **Electrasol & Phono Solar** – completed in September 2012 a 500 kW photovoltaic park in Galati, which is said to be the first installation of this kind in the region. The investment amounted to nearly EUR 800.000 out of which 20% was granted by the private investor Estthesis Energy and 80% by the bank;

• **Gigawatt Global** (multinational company) – started the development of a solar park in Giurgeni, Ialomita county, (May 2012) with an installed power of 8 MW and an investment of EUR 15 million;

• **Montana Energy** (Luxemburg) – started the construction works at a solar park in Targu Frumos, Iasi county, with a power of 1 MW and an investment of EUR 5 million;

• **Mohring Energie GmbH** (Germany) – will invest EUR 4 million in constructing a solar park in Vladimirescu, Arad area;

• **Sol Strak Power** (Romania) – will develop at Tarnaveni the most important production centres of solar energy in Romania with an investment of some EUR 72 million;

• **Martifer Solar** (Portugal) – recently signed an agreement for the construction of a large-scale photovoltaic plant;

• **ET Solar** (China) – developing photovoltaic parks with total capacity of 50MW in Southern Romania in a contract with privately-owned energy company Tinmar Ind.

   Over 20 MW are expected to be completed by end 2012 and should be connected to the grid early 2013. Construction works for the remaining 30 MW should start by the end of 2012. The plants are located in the Gorj, Giurgiu and Dolj counties.

   The company announced its intention to expand into the Romanian market by opening a subsidiary in Bucharest;

• **Gehrlicher Solar** (Germany) - was contracted to build and operate the Isaccea solar park with a total power of 9 MW. The Romanian private investors behind the company Ra Ra Parc SRL will operate the park.

   The two parties are also working together on more photovoltaic projects in Romania. While work on a 536 kWp rooftop is underway, other projects are in the planning phases;
- **Samsung** (South Korean) - looks at building two photovoltaic parks in Romania, in the Giurgiu County, south of Bucharest. Samsung’s photovoltaic parks in Romania will have a combined 45MW installed capacity;

- **Photovoltaic New Horizon** (South Korean) – currently working at 3 projects in Romania (60 MW in Alexandria / 3 MW and 5 MW in Giurgiu), with an investment ranged between EUR 10 – 20 million;

- **Casa de Investitii Alianta** (Romania) – owner of a 1.7 MW photovoltaic park connected to the grid in August 2012;

- **EEPro GmbH & NewDev** (Germany) - have acquired project rights relating to a 4 MWp PV-Project close to Bucharest. The project is in ready to build status and construction & commissioning of the plant is expected for mid 2013. As a positive feature, the site has development potential for further 20 MWp.

- **Helios Strategia** (France) – completed a 2.5 MW photovoltaic solar power plant in Ploiesti in partnership with local partners and co-investors;

- **ReneSola** (China) – entered the Romanian market after the member company ReneSola New Energy acquired the share capital of the Romanian company Lucas Est. They bought a 6 MW solar park in Romania and will invest around EUR 15 million to finalize it.

- **Conergy** (Germany) – will start developing in 2013 its first solar power plant in Romania. The 2.2 MW project will be built with local partner Solanna Investment S.r.l. in Bobicesti near Craiova.

- **ICCO Group & Lockheed Martin Company** (US) inaugurated in the Industrial Park Ghimbav in Brasov, the first private project Smart Grid in Romania, total investment amounting to EUR 15 million. In a first phase photovoltaic panels will be mounted both on roofs and ground level of the five industrial warehouses within the industrial park. In a second phase, in 2013, the surface of the park will be extended with 4 hectares, investment which will reach 3 million euro.
Foreign and Romanian investments announced in the Governmental Report
“Romania: Picture of Regional Investments 2011 – 2012”

<table>
<thead>
<tr>
<th>Company to invest</th>
<th>Value million euro</th>
<th>Investment</th>
<th>Starting year</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Giuseppe</td>
<td>20 Foreign</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Ranieri</td>
<td>20 Foreign</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Hidro Enerz</td>
<td>10 Romanian</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Corabia Solar</td>
<td>3,374 Romanian</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Enerosolar</td>
<td>- Romanian</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Lovrin 2 Energia</td>
<td>- Foreign</td>
<td>2011</td>
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<td>Runcu Energia</td>
<td>- Foreign</td>
<td>2011</td>
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<tr>
<td>Firiza Energy</td>
<td>- Foreign</td>
<td>2011</td>
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</tr>
</tbody>
</table>

According to a report by Transelectrica (TSO) about the concluded grid connection agreements for solar power, agreements for about 545 MW were signed as of August 27, 2012.

The photovoltaic market is definitely a target sector for 2012 in terms of transactions of projects, but not yet of constructions.

Some solar panel & solar energy systems suppliers in Romania:

- **IST Grun** – own brand;
- **Alukonigstahl** – brands: Schuco Germany, Jansens Switzerland, Konig Austria;
- **Habitat Energy** – brands: Sunerg Italy, Ropatec Italy, ZeYu China;
- **Iuco Top** – brands: Sinisol Germany, Senteco China, Canadian Solar Canada, Kyriazis Greece;
- **Colourlife** – brands: Luxor Solar Germany, Odersun Germany, IVT Germany, Bernt Lorenz Germany, Flexcell Switzerland, SHURflo USA etc;
- **Delphi Electric** – brands: Flexel UK, Fenix Czech Republic, Eberle Gemany, Airfel Turkey, SMA Germany, REC Norway;
- **Philro Industrial** – brands: Sanyo Japan, Kyocera Japan, BYD Hong Cong, S-Energy Korea;
- **Suninstal** – brands: Unicsun China, Kyriazis Greece, Westech Solar Germany, Steca Germany, Tesy Bulgaria, Grun Australia.
4.3 HYDRO (MICRO < 10 MW)

POTENTIAL & BEST LOCATIONS

The country’s hydropower potential is extremely large with an estimated total usable hydropower of approximately 36 TWh per year. A significant part of this potential is already used for electricity generation counting for around 30% of the total power delivered to the grid.

The vast majority of this production results from large-scale reservoir hydropower plants.

Run-of-the-river Small Hydro Power Plants (SHP) were built for a long period of time, but only recently, after the emergence of the Renewable Energy Act 220/2008, the interest in building and operating such power generators was revamped.

The most important water basins are: Olt, Lotru, Bistrita, Somes, Dragan, Arges, Dambovita, Raul Targului, Sebes, Raul Mare, Cerna, Bistra, Buzau, Motru, and Danube.

Other hydrographic resources include more than 2500 lakes, ranging from the glacial lakes of the mountains to those of the plains and the marshes of the Danube delta region.

Romania’s hydro energy potential, currently at 5900 MW for domestic rivers, could reach 8000 MW with additional investment on the Danube, according to the Environment and Forestry Ministry.

Of the 8000 MW maximum potential, there is around 1100 MW potential capacity for micro hydropower plants, able to provide approximately 3,6 TWh per year.

CAPACITY INSTALLED

<table>
<thead>
<tr>
<th>Year</th>
<th>Total SHP Installed</th>
<th>Installed capacity - MWp</th>
<th>Installed energy output - MWh</th>
<th>No. Economically feasible installations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>230</td>
<td>269</td>
<td>415</td>
<td>3510</td>
</tr>
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<td>2001</td>
<td>233</td>
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<td>2003</td>
<td>236</td>
<td>278</td>
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<tr>
<td>2010</td>
<td>245</td>
<td>305</td>
<td>450</td>
<td>3495</td>
</tr>
</tbody>
</table>

Source: Energy Invest

Small hydropower plants construction growth has followed a constant upward trend over the past 10 years. However the total capacity of small hydro plants is not entirely functional.

Currently there are about 256 micro hydro plants in operation with a total capacity of 400 MW.
Top attractive counties for micro-hydro projects

There are more than 2000 locations in Transylvania, in the mountains that are suited for the development of small hydro plants, out of which Hunedoara county followed by Sibiu county, have the most projects in view.

PROJECTS & MAIN PLAYERS

Investments in micro hydropower plants have not got much attention so far, but interest is slowly rising, despite difficulties in financing. Mostly the micro-hydro projects are realized in a partnership between the local authority and the private investor.

Owners and investors in small hydro in Romania include:

- **Hidroelectrica** (Romania) - 162 small hydro plants;
- **Luxten Lighting** (Romania) - Doftana river basin, Prahova county;
- **Electromagnetica** (Romania) - Brodina, Prahova county and Suceava county;
- **Elsid** (Romania) - Cornu, Prahova county;
- **Balkan Hydroenergy** (Romania) - Sebes, Caras Severin county;
- **Romelectro** (Romania) - Voineasa, Valcea county;
- **Hidroconstuctia** (Romania) - Iliesi and Iod, Mures county;
  They inaugurated the hydropower plant in Plopi, while also planning the development of other 5 micro-hydropower projects;
- **ICPE Electrocond** (Romania) - Sadu, Olt county and Susita, Gorj county;
- **Energy Holding** – acquired in 2004 five hydropower plants located on the River Topolog, Arges, with a combined installed capacity of about 6 MW. The total investments in the safety of installations and buildings, including the replacement or modernization of equipment, reached some EUR 3 million;
- **CEZ Group** (Czech Republic) - purchased at the end of 2010, the hydropower unit located near Reşiţa, in Caraş-Severin County, by acquisition of 100% of the share capital of TMK Hydroenergy Power SRL, which became part of CEZ Group.
  The hydropower unit in Reşiţa has a 18 MW total installed capacity. The system includes 4 lakes with dams (Trei Ape, Gozna, Secu and Văliug) and 4 micro hydropower plants (Grebla
with an installed capacity of 5 500 kW, Crăinicel I with 8 380 kW, Crăinicel II with 3 750 kW and Breazova with a capacity of 370 kW).

Upgrading the TMK-Resita micro-hydropower plants involves an investment of EUR 29,9 million.

CEZ Group plans to fully refurbish the hydropower unit to increase the installed capacity to more than 20 MW;

- **Enel Green Power** (Italy) – intends to invest in micro hydropower plants to reach production of 25 MW per year until 2016;

- **Rott Energy** (Romania) – developing a project which consists in the execution of a hydropower plant on the river Raul Mic Cugir in order to exploit the hydropower potential of Mures River;

  The hydropower scheme will consist of a Tyroler water intake and 2 micro hydropower plants with an installed capacity of 1.7 MW (0, 95 MW and respectively 0, 75 MW);

- **Bulgarian PVB Power** (owned by Italian shareholders) - might build seven micro hydropower facilities on the Somes river, northwestern Romania, following an investment estimated at over 220 million euro, according to Cluj county council announcement. The project, which should take three years to complete, could start in 2013;

- **Obrascon Total** (private Romanian – Spanish) – has completed three hydroplants in Romania and has 10 more projects under development to complete in 2012 and 2013.

According to the latest data from the Ministry of Environment and Forestry, there are 290 submissions for micro hydropower plants, out of which 84 are underway.

Suppliers of turbines, generators, pipes, fitting and construction equipment for micro-hydropower projects:

- **Superlit**
- **Ecovolt** - LP Electric Systems - Pelton, Turgo & Francis turbines
- **Hidro Engineering** – Francis, tube Kaplan, vertical Kaplan, Banki and Pelton
- **UBI Therm Consulting**
- **Elsaco**
- **Endress Group Romania**
- **Eco Power Device**
- **Safcons** - Pelton, Turgo, Banki turbines, Kaplan, Francis turbines
- **M Holding International**
- **Victron Energy**
4.4 BIOMASS & BIOGAS

POTENTIAL & BEST LOCATIONS

For Romania, biomass represents an important RES, both in terms of potential and utilization possibilities, as raw materials used in the production of biofuels and bioliquids are widely cultivated (sunflower, rape, soya, corn, sugar cane or sorghum, energetic willow, Cynara, Miscanthus).

Biomass reserves are mainly wood waste, agricultural waste, domestic waste and energy crops. Production of biomass is not only a renewable energy resource but also a significant opportunity for sustainable rural development.

About 66% of the firewood and wood waste is located in the Carpathians and Sub-Carpathians, and about 58% of agricultural waste is located in the South Plain, West Plain, and Moldavia. Approximately 63,700 km² of Romania is covered by forests, which is approximately 27% of the total land. The exploitable potential of the Romanian forests is estimated at 20,000 cubic meters.

Biomass potential amounts to 318 PJ per year, out of which 15.5% is from forestry residues and firewood, 6.4% sawdust and other wood scraps, 63.2% agricultural waste, 7.2% household waste and 7.7% biogas.

CAPACITY INSTALLED

According to the Romanian Energy Regulatory Authority (ANRE), at the end of March 2012, four companies with projects totaling 28.5 MW in biomass projects, had been licensed.
Top attractive county for micro-hydro projects

The largest quantity of biomass energy is produced in Alba county.

PROJECTS & MAIN PLAYERS

- **Holzindustrie Schweighofer** (Austria) – opened in May 2009 in Radauti the largest local cogeneration power plant using biomass. The plant has a capacity of 22 MW of which 17 MW represents thermo energy and other 5 MW represent electricity, with an initial investment reaching EUR 20 million;

- **M.I.S. Group** (Romania) – inaugurated a brand-new biomass plant at Lunca Ilvei end March 2012, a project funded by the European Union with EUR 2 million. The plant located at the Silvania International factory in Bistrita, is equipped with state-of-the-art technology that does not pollute and that will produce both heat and electricity;

- **S.C.R. Group** (Romania) – built a power plant with an installed capacity of 9 MW at the Pulp and Paper Plant in Dej, following an investment of EUR 16 million. Biofuel use is represented by wood chips (sawdust and bark) which cannot be used in the manufacturing of paper;

- **National Research and Development for Electrical Engineering** (ICPE) together with city of Avrig – announced in December 2011 that a bioreactor fed with biomass will be in built in the city of Avrig, which simultaneously produces electricity and gas. The innovative aspect of this project is the joint use of several techniques for generating energy from different sources at a single facility. The bioreactor could consume several types of biomass – waste from food and catering, and energy plants;

- **Adrem Invest** – has already started a project to build a biomass cogeneration plant in Suceava, which will be completed in two phases over a period of two years. Besides producing electricity from biomass, this plant will also produce thermal energy for heating the city. The investment involved in this development amounts to EUR 45 million;

- **Termica Suceava** will put at Adrem Invest’s disposal access to the electric station which has to be modernized and developed to take the electricity which will be delivered to station;

- **Romita Energie Verde** (Italy) – will build in Bontida, Cluj county, one of the biggest plants using biomass in Western Europe, following an investment of EUR 41 million;
• **CET Govora** (Valcea county) - will invest over EUR 100 milion in developing two cogeneration plants of high efficiency.

ECOCET Govora is one of the plants with a capacity of 4,6 MW electricity and 18 MW thermo energy, which involves an investment of EUR 22,5 million;

• **Valcea Council authority** – approved the investment "Cogeneration electrical plant of high efficiency on natural gases - Project VILCET Energy", with an investment of about EUR 80 million and an electrical capacity of 120 MW;

• **Valcea Authority** – approved the investment "Cogeneration electrical plant of high efficiency on natural gases - Project VILCET Energy", with an investment of about EUR 80 million and an electrical capacity of 120 MW;

• **Petrom** – in partnership with **Archea Biogas NV** - is developing an 860 MW gas plant in Petrobrazi;

• **Adama Technologies** (Israel) – announced in 2010 that they would start building a waste-to-energy facility in Bucharest. The landfill will collect 750,000 tons of municipal waste annually and the facility should capture methane gas for the production of renewable electricity or diesel fuel.

In 2011 the company signed a final agreement for the 2.5 MW municipal waste gasification project. The project will have the benefit of a power purchase agreement with the local grids (with guarantees of local companies) at premium rates and a biomass supply agreement with local companies in each case for a term of 10 years minimum with option for another 10 years;

• **Usitall** (Sweden) - decided to scrap the investment waste-to-energy projects in Romania, after two years of failed negotiations with Romanian local authorities in Bucharest, Timisoara, Galati, Tulcea and Ploiesti.

The company would have ensured the financing, while the municipalities would have got cheaper thermal energy, while at the same time eliminating the waste.

The company planned to invest in up to three plants, each one costing between EUR 100 million euro and 200 million;

• **Biogas Nord AG** (Germany) – will construct a plant with a capacity of 3 MW and an investment of EUR 6.6 million in Satu Mare county, northwest Romania.

The project, which generates power by burning gas made from organic waste, will be commissioned at the end of 2012 or the beginning of 2013.

The company plans to expand and to intensify its marketing and sales activities in Romania in the medium and long term.
Although very few projects are advanced, and ‘ready to build’ ones are even less, it is expected that energy production through cogeneration would explode in 2013 – 2014.

4.5 GEOTHERMAL

**POTENTIAL & BEST LOCATIONS**

Regarding geothermal energy, Romania shows the third highest potential in Europe, with major potential locations in the Western Plain, South Plains (Bucharest region) and Southern Carpathian regions. Total potential reaches around 7 PJ per year.

**CAPACITY INSTALLED**

Exploration drilling for geothermal resources began in Romania in the early 1960’s.

During the past 25 years completions and experimental exploitations of over 250 existing wells have been performed. During 2005-2010, 7 new wells were drilled.

80 wells are used at present generating a capacity of 180 MWth.

The main current use of geothermal energy is for district heating, spas and greenhouse heating.

5,500 residences in Oradea and the whole city of Beius are heated by geothermal energy.

Further geothermal development is technically and economically feasible in Romania (mainly for existing wells), even more at present, with the new Green Certificates Law in force, the “Green House” program extended to private persons, and new financial support programs for large scale renewable energy systems, geothermal being specifically mentioned.
Main uses of geothermal energy

![Pie chart showing the distribution of geothermal energy usage](image)

Source: University of Oradea, Energy Engineering Department

Top attractive county for micro-hydro projects

The largest quantity of energy from geothermal sources is produced in Bihor country, mainly in the towns Oradea and Beius.

PROJECTS & MAIN PLAYERS

There are two companies in Romania currently exploiting most of the geothermal resources, Transgex S.A. and Foradex S.A., which have a long term concession for almost all known geothermal reservoirs.

- **Transgex S.A.** is developing the use of geothermal energy for district heating in 5 towns and 5 villages;

- **Foradex S.A.** has the exploration and exploitation licences for the geothermal resources in the southern part of Romania;

- **Turism Felix S.A.** is a tourist company owning almost all hotels in Felix Spa (the largest spa in Romania), near the City of Oradea, as well as the geothermal wells and the exploitation licence. The geothermal water is only used for health and recreational bathing;

- **The University of Oradea** is a state university. Some of its faculties have geothermal related training and/or research among their activities.
Geothermal Energy in Oradea

- 12 wells drilled before 1990, owned by Transgex, all in exploitation;
- During the last 5 years 2 more wells were drilled and leased by Transgex, to be used in the near future;
- Exploitation license for 90 l/s (annual average);
- Wellhead temperatures between 105°C in the west (Iosia) and 70°C in the east (Nufarul);
- One doublet type system in Nufarul, one more in the near future in Iosia (extension of the current DHS);
- Total geothermal energy delivered: about 430 TJ/yr. (about 15% of total heat demand of the city);
- Annual average flow rate produced: about 57 l/s;
- Plans to develop exploitation in the near future.

Geothermal Energy in Beius

- 2 wells drilled and leased by Transgex;
- Injection well drilled at present;
- Wellhead temperatures 84°C;
- Maximum flow rate 90 l/s (line shaft pumps installed);
- Annual average flow rate produced: about 16 l/s;
- Total geothermal energy delivered: about 110 TJ/year;
- 3 light fuel oil heat plants converted to substations;
- Heat selling price about €15/Gcal (as compared to about €75/Gcal from light fuel oil);
- System extended with micro-substation modules for groups of smaller size consumers;
- Plans to develop exploitation in the near future.

Geothermal Energy in Beius – is an executed Joint Implementation (JI) project between Denmark and Romania. The project was supported by the Romanian company SC Transgex SA, the Danish Environmental Protection Agency, the Municipalities of Oradea and Beius and the Danish project developer Grue & Hornstrup A/S;

Geothermal Energy in Oradea and Beius project comprises the establishment of new district heating system components, along with the rehabilitation of existing district heating system components;
The **Bors geothermal reservoir** is situated about 6 km north-west of Oradea. The geothermal water used for heating 12 ha greenhouses;

The **Otopeni geothermal reservoir** is located north of Bucharest. One well out of 13 is used almost all year round, for health and recreational bathing;

The **Ciumeghiu geothermal reservoir** is located in the Western Plain, 50 km south of Oradea. The reservoir was investigated by 4 wells, but only one was in use (until the greenhouses in the area have been closed), with a capacity of 5 MWt (of which 1 MWt from the separated combustible gasses);

The **Cozia-Calimanesti geothermal reservoir** (Olt Valley). The thermal potential possible to be achieved from the existing wells is about 18 MWt (of which 3.5 MWt from combustible gases), but only 7 MWt is used at present (at peak load).

5. **NECESSARY INVESTMENTS & OPPORTUNITIES**

The Romanian energy generation sector is facing major challenges as a significant percentage of the generation assets are already past their useful technical life, with 30% being approximately 40 years old. Throughout the past 6 years, nearly 3000 MW of thermal generation capacity have been decommissioned in Romania. Further decommissioning is expected in the coming years as many power plants require refurbishments and modernizations to meet EU requirements:

**Rehabilitations**

A significant part of thermal generation facilities and some hydroplants needs rehabilitation – based on the state-owned energy companies’ plans, estimations show that by the end of 2015 around 5.000 MW in installed capacity require investments for several levels of rehabilitation.

These plans are highly dependable on the available sources of financing coming from the state budget, commercial banks and other international financing institutions, but they also depend on other market conditions such as the ability of energy sources to cover the energy demand.

Power generation units cumulating some 55% of the total installed capacity, or 11,066 MW, will be closed down by 2035. As a result, Romania must replace units with an overall output of 5,544 MW by 2020, namely 28% of the total installed capacity. By 2035, Romania will need an available installed capacity of more than 20,000 MW.

The envisaged generation structure shows that 42.3% of Romania's energy production will be covered by nuclear power plants, while hydropower plants should cover 24.3% (currently 29%) and fossil fuel units 16.5% (currently 50.05%) by 2035. Renewable energy units will cover 16.8% of production by 2035.
In addition to rehabilitations, there are two major investments announced and expected on the long term. However, there is a high degree of uncertainty around these two facilities due to the availability of financing sources, both private and public:

**Upgrades to nuclear reactors 3 and 4 at Cernavoda (1400 MW)**

EnergoNuclear S.A. was established in March 2009, after several negotiation phases that took place in 2008 among the prospective investors for the purpose of building and operating the two 720 MW CANDU reactors at Cernavoda (Units 3 and 4). At the end of 2011, the structure of the share capital of EnergoNuclear was the following: SNN with a share of 84.65%, ENEL Italy with a share of 9.15% and ArcelorMittal with a share of 6.2%.

To reduce its share in EnergoNuclear, SNN is in the process of selecting alternative investors for the project, with 15 March 2012 as the initial deadline for submission of indicative offers from other potential investors.

**Hydro pump storage facility (1000 MW) at Tarnita-Lapustesti**

As one of the largest greenfield electricity generation projects in Romania, the Tarnita-Lapustesti PSPP is expected to be completed by 2020, at a total cost of more than EUR 1.164 billion. The project’s state-owned sponsor, SC Hidroelectrica SA, is seeking additional sponsors to assist with majority funding of the project’s costs, while it is also keen to bring in experienced partners that can assist with the choice of technology and operation of the project.

A few electricity companies from China have showed their interest so far to invest in developing these two projects.

According to data from TPA Horwath, a Romanian based company, an important player in the energy sector, announced investment plans:

**Building four new generation assets** (over 2,000 MW – to produce an annual average energy quantity of $\approx 10$ TWh for the period 2015 – 2040)

The company intends to adhere to an integrated development strategy, which consists of its current electricity trading and small hydro generation activities as well as its future plans for electricity generation projects and gas trading activities.

The company intends to attract a strategic investor that will provide a share of the equity financing for the entire project. The financial structure for all the projects is expected to be 30% equity and 70% debt.

**Privatizations**

Regarding sources of financing, the stock exchange market is one of the options which have been overlooked by companies seeking to attract capital. Over the coming months, the Romanian Ministry of the Economy, Commerce and Business Environment is planning to begin the privatization process of the following companies:
- SNGN Romgaz SA (IPO of a 15% stake)
- CNTEE Transelectrica SA (SPO of a 15% stake plus a later capital increase of about 12%)
- SNTGN Transgaz SA (SPO of a 15% stake)
- CN Hidroelectrica SA (IPO of 10% to increase capital)
- CN Nuclearelectrica SA (IPO of at least 10% via capital increase)
- S.C. Electrica Furnizare S.A. (including the supply activity transferred from SC Electrica SA, majority privatization)
- the three remaining Electrica distribution subsidiaries (majority privatization)
- Electrica Serv (majority privatization of all remaining regional companies)
- CupruMin SA (full privatization).

As regards grid availability, there is a need for rethinking and implementation of a perspective plan for the power transmission network which would accommodate the penetration of uncontrollable power generation capacities situated mainly in the southeast of the country.

**Network Development Plan 2008 – 2012 (and roughly for 2017):**

- 1700 MW in 400kV Tariverde power station;
- 600 MW in Vant power station;
- 354 MW in Moldova: Falciu Berezeni, Rosiesti, Vetrisoaia, Smardan-Gutinas;
- 105 MW in Tulcea County: Baia and Corugea-Cismeaua Noua;
- 90 MW in Medgidia Sus area: Pesteria;
- 120 MW in Medgidia Nord area: Targusor and Silistea.

**Total: 3000 MW**

*Source: ANRE*

The country has attracted numerous investments in the renewable sector in recent years, due to a generous support scheme, but the lack of new power transportation facilities may hinder the future development of the industry.

The Romanian energy system currently accommodates close to 2,000 MW in renewables, with envisaged projects for another 21,000 MW. Although authorities have granted grid connection permits to an impressive number of projects, specialists say that a large share will remain only on paper, due to lack of financing.
6. MAIN NATIONAL TRADE FAIRS

- **Renexpo® South-East Europe**
  

- **Enreg Energia Regenerabila®**
  

- **RoEnergy Timisoara**
  
  [http://timisoara.roenergy.eu/](http://timisoara.roenergy.eu/)

- **International Fair for Renewable Energy, Conventional Energy, Equipment & Technologies for Oil and Natural Gas**
  
  [http://www.eee-expo.ro/home](http://www.eee-expo.ro/home)

- **Eco Logica**
  
  [http://www.cluj-ecologica.blogspot.ro](http://www.cluj-ecologica.blogspot.ro)
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- KPMG
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- Peli Filip
- The Diplomat
- Business Review
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- Green Energy.org
- Romanian Wind Energy Association
- Photovoltaic Romanian Association
- University of Oradea – Faculty of Energy Engineering
- ec.Europa.eu
- The Wolf Theiss Guide.

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