Renewable Energy in Albania

National Agency of Natural Resources

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**Workshop:** “Renewable Energy UNDA project conclusions and way forward”

13-14 December 2017, Lancaster Plaza Hotel, Raouche - Beirut, Lebanon
Population 2.95 million

Land area of 28,745 km$^2$

77% of the country is mountainous

Administratively divided into 12 prefectures, 36 districts, 315 communes and 2900 villages

95% of Electricity produce by Hydro

GDP 2016 is 10.5 Billion Euro
Energy Sector Policy

Policies and Objectives will focus on:

- Reduced energy imports and increased domestic energy generation to meet future energy demand
- Improved energy efficiency in the household, services and industrial sectors
- Increased use of RES technologies, based on least-cost planning and environmental protection principles
- Development of mechanisms to encourage foreign direct investment in the Albania energy sector.
- Increased competition in the energy market while preserving customer interests and without impairing the government’s responsibilities on energy system functioning and security of supply;
- Improved alignment and integration of Albanian energy-sector policy and regulation with the EU’s energy acquis and regional and EU energy markets.
- Development of a more consumer-oriented and decentralized future Albanian energy system.
- Focused activities regarding the use, remediation energy infrastructure that adversely impacts environment and potentially high value areas for other development sectors, i.e. tourism, agriculture, etc.
RES Policy


2. Increased competition in the energy market while preserving customer interests and without impairing the government’s responsibilities on energy system functioning and security of supply;

3. Three key laws: for power sector, for renewable, and for energy efficiency approved by the Government;

Those laws intend to liberalize the electricity market, increase competition, promote efficiency, boost renewable development, and attract foreign investment in the sector.
Renewable Energy Target for 2020

The Energy Community Secretariat (ECS) has adopted the Renewable Energy Directive methodology for allocating targets of Albania for 2020, 38% of Gross Final Energy Consumption and with biofuels assumed to contribute 10% of transportation sector energy.

The policies of Renewable Energy show strong synergies with a goal of moving to a lower carbon footprint for the Albanian energy economy. Renewable Energy policy leads to cumulative reductions of 15.3% in CO$_2$ emissions.

Implementation of a renewable energy target by 2020 for Albania, is in line with the Energy Community, based on the approach used for setting the EU member state targets under the Renewable Directive.
MEASURES FOR ACHIEVING THE INDICATIVE OBJECTIVES

Albania has taken good steps to implement renewable energy

Hydro Power Plants (HPP)

December 31, 2013, the Albanian Government, based on the Concession Law has issued up to about 200 concession contracts for building different categories of HPPs. Analysis shows that the total projected installed capacity is 1500 MW, and the part for SHPPs is about 48%, with total cost of investment 2.8 billion Euro.

Wind

Albania has issued licenses for several companies to develop this resource with capacities 2000 MW.

Solar

Many companies has prepared the documentations for investment in energy photovoltaic with capacity 50 MW.
Investment needs to 2020

To reach Renewable Energy Target:

Energy system in Albania will continue expansion of hydropower, with cumulative additional capacity of 1270 MW by 2020. Wind with an important contribution 150 MW and PV 40 MW.

<table>
<thead>
<tr>
<th>Hydro</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &lt;1MW</td>
<td>120 MW</td>
</tr>
<tr>
<td>2 1MW–10 MW</td>
<td>400 MW</td>
</tr>
<tr>
<td>3 &gt;10MW</td>
<td>750 MW</td>
</tr>
<tr>
<td>4 Wind</td>
<td>150 MW</td>
</tr>
<tr>
<td>5 PV</td>
<td>40 MW</td>
</tr>
</tbody>
</table>
HYDRO ENERGY

- The hydrographic territory of Albania has a surface of 44,000 km\(^2\) or 57% more than the national area of our country.
- The total reserves of the hydro power make possible the installation of a capacity of about 4500 MW with an annual potential of production may amount to 16-18 TWh.
In Albania, average solar radiation is 1500 kWh/m² per year and Maximal radiation is 2200 kWh/m² per year.

In 2016, a total of 160 000 m² were installed (60% by services, 40% by households), bringing total installations to 160 000 m² (equivalent to around 55 GWh/y or 1.1% of electricity consumed by households in 2016).
The average speed of wind, is around 4-6 m/s and the average energy density is 150 W/m².

Albania have average 4200 hours with wind per year. Actually in Albania Territory in under survey for potential of wind energy form different companies.
“Biomass Potential in Albania”

- Forests cover 36% of the land area of Albania. Total proven reserves on wood as fuel is about 6 Mtoe.
- Wood production for energy in 2016, is 190 Ktoe
- Agricultural biomass
- Agriculture is a source of considerable biomass quantities that can be used for bioenergy production.
Albania, actually is in the feasibility phase of assessment of the geothermic energy use potential.

The geothermic situation of Albania presents two directions for use of geothermic energy:
- The thermal sources with low enthalpy
- The usage of the depths of the abandoned wells
RES project in Albania

Malsia Solar 3 x 2.5 MW

**Project**: Three PV parks with combined DC-Power of 7.5MWp

**Progress**: Majority of project documentation is completed and construction permits will be received within months

**Solar Radiation**: 1,450 full load hours per year

**Ownership Stake**: 34% and 100% ownership with Albania partners

**Financials**:
- IRR 9-10%
- Repayment period 10 years

**Shkel PV park Coordinates**: 42°13'35" North, 19°26'44" East, Elevation:

**Shkel Solar Parks**
PHOTOVOLTAIC PARK
Shkel 1,2,3 - Location description

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area</strong>: The 3 solar parks are situated in a plot of total 25 ha. The ground is flat with excellent ground structure for constructing solar plants.</td>
</tr>
<tr>
<td><strong>Electrical grid proximity</strong>: The park connection point is the next electrical column, which is Apr. 400m. from the plot. The closest transform station is located Apr. 4 km from the site.</td>
</tr>
<tr>
<td><strong>Accessibility</strong>: A first (local nomenclature) class road is connecting the site to the near village and the 1st class highway.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Connection Point Image]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Road Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Road Infrastructure Image]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substation</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Substation Image]</td>
</tr>
</tbody>
</table>
Shkel 1 – 2,5 MW project
Solar Radiation in Shkel 1, 2, 3
Adequate solar radiation is a prerequisite for the development of Photovoltaic systems’ investments

- **Solar radiation database used**: PVGIS-CMSAF estimated at the following coordinates: 42°13'35" North, 19°26'44" East, Elevation: 100 m a.s.l

- **Nominal power of the PV systems**: each about 2.5 MW (crystalline silicon)

- Shkel 1, 2, 3 each park is 2.5 MW

### System information – 2.5MW solar plant

<table>
<thead>
<tr>
<th>Overview</th>
<th>System information – 2.5MW solar plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Array Gross Surface</strong></td>
<td>16,387.1 m²</td>
</tr>
<tr>
<td><strong>Array Solar Surface</strong></td>
<td>18,042.69 m²</td>
</tr>
<tr>
<td><strong>PV Output</strong></td>
<td>2520.0 kWp</td>
</tr>
<tr>
<td><strong>PV Array Irradiation</strong></td>
<td>27,399,824 kWh</td>
</tr>
<tr>
<td><strong>Energy Produced by PV Array (AC)</strong></td>
<td>3,453,830.0 kWh</td>
</tr>
<tr>
<td><strong>Grid, Feed-in</strong></td>
<td>3,453,830.0 kWh</td>
</tr>
<tr>
<td><strong>CO2 Emissions</strong></td>
<td>3,059,053 kg/a</td>
</tr>
<tr>
<td><strong>System Efficiency</strong></td>
<td>12.6%</td>
</tr>
<tr>
<td><strong>Performance Ratio</strong></td>
<td>81.9%</td>
</tr>
<tr>
<td><strong>Specific Annual Yield</strong></td>
<td>1,370 kWh/kWp</td>
</tr>
<tr>
<td><strong>PV Array Efficiency</strong></td>
<td>13.0%</td>
</tr>
<tr>
<td><strong>Inverter Efficiency</strong></td>
<td>97.1%</td>
</tr>
</tbody>
</table>

**Energy from Inverter (AC) 3,453,830 kWh**

**Solar Radiation and system efficiency**

- [Graph of solar radiation and system efficiency](image-url)
### System in grid connection operation and connection schema

#### Array 1: Shkel 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>2520,00 kW</td>
</tr>
<tr>
<td>Gross/Active Solar Surface Area:</td>
<td>16399,0 m / 16387,1 m</td>
</tr>
<tr>
<td>PV Module</td>
<td>10080 x</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>ReneSola Ltd.</td>
</tr>
<tr>
<td>Model</td>
<td>JC250M-24/Bbv (2012 Virtus)</td>
</tr>
<tr>
<td>Nominal Output</td>
<td>250 W</td>
</tr>
<tr>
<td>Power Rating Deviation</td>
<td>0 %</td>
</tr>
<tr>
<td>Efficiency (STC)</td>
<td>15,4 %</td>
</tr>
<tr>
<td>No. of Modules in Series</td>
<td>20</td>
</tr>
<tr>
<td>MPP Voltage (STC)</td>
<td>604</td>
</tr>
<tr>
<td>Orientation</td>
<td>0,0 °</td>
</tr>
<tr>
<td>Inclination</td>
<td>25,0 °</td>
</tr>
<tr>
<td>Mount</td>
<td>with Ventilation</td>
</tr>
<tr>
<td>Shade</td>
<td>No</td>
</tr>
<tr>
<td>Ground Reflection</td>
<td>20,0 %</td>
</tr>
<tr>
<td>Output Losses due to deviation from AM 1.5</td>
<td>1,0 %</td>
</tr>
<tr>
<td>deviation from Manufacturer's Specification:</td>
<td>2,0 %</td>
</tr>
<tr>
<td>in Diodes:</td>
<td>0,5 %</td>
</tr>
<tr>
<td>due to Soiling</td>
<td>0,0 %</td>
</tr>
<tr>
<td>Inverter</td>
<td>84 x</td>
</tr>
<tr>
<td>Power-One</td>
<td></td>
</tr>
</tbody>
</table>

#### Inverter

- **Model:** TRIO-27,6-TL-OUTD
- **Output:** 27,60 kW
- **Efficiency (STC):** 98,0 %
- **Inclination:** 25,0 °
- **No. of MPP Trackers:** 2
- **Mount:** with Ventilation
- **MPP Tracking:** 200 V To 950 V
- **Shade:** No

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**Connection schema**

- Connection point
- Road
- Connection in grid connection operation
Financial and Investment Data

### Basic Project Data

**Project**: 2,520 MW PV Albania  
**Type**: Ground Mounted  
**Country**: Albania

### Results

- **IRR flow to equity (CFATE) - DEPT financed**: 9.38%  
- **IRR CFATE - EQUITY financed**: 8.39%  
- **DSCR min.**: 0.99  
- **DSCR average**: 1.05

### Financial Data

- **Currency**: EUR  
- **Corporate Tax Rate (in %)**: 16.0%  
- **Leverage**: 70%  
- **Project Life (Years) - max. 35 years**: 15  
- **Depreciation (Years) - max. 35 years**: 15

### Project Data

- **Rated Output**: 2,520 kW  
- **Area**: 0 m²  
- **Irradiation**: 0 kWh/m²/y  
- **Productivity**: 1370 kWh/kWp

### Operating Expenses (yearly)

- **Insurance**: 12,600 per MW  
- **O & M, Security**: 30,240 per MW  
- **Others**: 0 per MW

### Investment - Onetime

- **Project Rights incl. Real estate purchase**: 378,000 per MW  
- **Rent**: 0 per MW  
- **Equipment Costs**: 2,898,000 per kW

### Investment Sum

- **Total Investment**: 3,276,000 per MW

### Loan Repayment Profile

- **Dept Service Cover Ratio (DSCR)**: 1.25  
- **Repayment Duration (Years)**: not possible

### Cashflow Available to Equity (CFATE)

- **Dept Balance**: 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000

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*This document includes data on project details, financial metrics, and various economic indicators related to a PV project in Albania.*
Construction process

- Clear and equalization of PV park land
- Piling and mounting of substructure
- Excavation of cable trenches
- Montage of PV modules
- Covering of cable trenches
- Installation of grounding installation
- Laying of cables in cable trenches (low voltage, medium voltage and data cable)
- Installation of solar cables
- Installation of inverters
- Installation of transformer stations
- Tests of cables
- Construction of roads
- Installation of grounding installation
- Connection of PV park with ERP with medium voltage cable
- Starting O&M activities
- Putting in operation
- Tests of cables
- 72 hours tests
- Connection of PV park with ERP with medium voltage cable
- O&M activities
3D of Malsia project
Infrastructure of the project
Model of Project
Thank you for your attention!

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