Joint ICTP-IAEA Workshop on Vulnerability of Energy Systems to
Climate Change and Extreme Events

19 - 23 April 2010

Impacts of extreme weather events on energy infrastructure in the Republic of
Moldova

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Republic of Moldova.

- Location: East Europe, northeast of Romania
- Total area: 33845 km²
- Population: 3.39 million
- Capital: Chisinau, 716 thousands inhabitants, area 120 km²
- Moldova has NO fossil fuels resources
Major Trends and Current Situation in the Energy Sector

Energy and fuel supply

- Others
- Hydro energy production
- Fuel extraction
- Storage at the beginning of the year
- Import
1. PP Moldova – 2500 MW
2. HPP Dubasari – 48 MW
3. HPP Costesti – 16 MW
4. CHP 1 Chisinau - 54 MW
5. CHP 2 Chisinau - 240 MW
6. CHP Balti – 20 MW
Documents that are representing the position of the Republic of Moldova in climate change and adaptation.
Republic of Moldova and Copenhagen Accord

MINISTERUL MEDIULUI
AL REPUBLICI MOLDOVA
MINISTRY OF ENVIRONMENT
THE REPUBLIC OF MOLDOVA

Nr. 03-08/246
29 January 2010

Mr. Yvo de Boer
UNFCCC Executive Secretary
Haus Curstjen
Martin-Luther-King-Strasse 8
D-53175 Bonn
Germany

Subject: Association of the Republic of Moldova to the Copenhagen Accord

Dear Mr. de Boer,

Taking note of the Copenhagen Accord and in accordance with the UNFCCC Executive Secretary’s Notifications to Parties of 18 and 25 of January 2010,

Being guided by the principles and provisions of the Convention, the Republic of Moldova expresses its willingness to associate with the Accord.

Pursuant to paragraph 5 of the Copenhagen Accord on implementation the mitigation actions to combat climate change, the support of the Republic of Moldova on respective issue for the 2013-2020 period is presented in the Appendix II „Nationally appropriate mitigation actions of developing country Parties”.

Along with those exposed, we conclude that the Copenhagen Accord may serve as a basic framework for continuing the negotiation process on achieving the Convention’s objectives on reducing the greenhouse gas emissions and maintaining the global climate system within its natural balance.

On behalf of the Government the Ministry of Environment of the Republic of Moldova avails itself of this opportunity to renew to the Secretariat of United Nations Framework Convention on Climate Change the assurance of its highest consideration.

Sincerely,

Gheorghe ŠALARIU
Minister

APPENDIX II

<table>
<thead>
<tr>
<th>Non Annex I</th>
<th>Actions</th>
</tr>
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<tbody>
<tr>
<td>Republic of Moldova</td>
<td>A reduction of no less than 25% of the base year (1990) level total national GHG emissions have to be achieved by 2020 year through implementation of global economical mechanisms focused on the climate change mitigation, in accordance with the Convention’s principles and provisions.</td>
</tr>
</tbody>
</table>
Strategy of assessment of vulnerability and adaptation on climate change.

Climate Change
- Temperature increasing, sea level raised, changing of precipitation patterns, droughts, floods

Impact on human population and natural systems
- Food resources, water supply, ecosystems & biodiversity, human settlements, public health

Socio-economic development programs
- Economy development Technologies Population Management

Impact mitigation

ADAPTATION

GHG emissions
Scenarios of power sources development

- **BLS - Base Line Scenario**
  rehabilitation of CHP-1, CHP-2, CHP-North, without construction of other power plants (energy supply will be provided from imports gradually).

- **HAS - High Alternative Scenario**
  energy supply from local sources combined with import. To get this scenario it was analyzed separately the following scenarios:
  a) energy supply only from local sources
  b) energy supply only from import
  c) combined option a) and b) – resulted in HAS.

- **MRS - Medium Realistic Scenario**
  intermediate scenario between HAS and BLS, lower efficiency of 42%
Scenarios of power sources development (cont.)

• **A – according to scenario”limited development of new capacities” from Energy Strategy till 2020**
  operation of existing power plants for study period, and construction of mini-CHP of distributed generation of 179MWinst in 2020

• **B - according to scenario”moderate development of new capacities” from Energy Strategy till 2020**

• **C - according to scenario”extended development of new capacities” from Energy Strategy till 2020**
  the same as scenario B, but CHP-1 by 24 MW in 2010; CHP-North by 72 MW in 2015; CHP-2 by 200 MW in 2020.
Methodology

- Application of ENPEP program developed by IAEA: WASP, IMPACT, etc.
- with WASP are obtained the optimum scenarios of power sources development.
- Results from WASP are imported in IMPACTS and emissions are calculated.
Power demand forecast
## Input data for calculations

<table>
<thead>
<tr>
<th>Unit</th>
<th>Investment cost, $/kW</th>
<th>Pnom, MW</th>
<th>Efficiency, %</th>
<th>Construction period, years</th>
<th>Life, years</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTRR, Gas turbines Rolls-Royce</td>
<td>500</td>
<td>51</td>
<td>35</td>
<td>2</td>
<td>25</td>
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<tr>
<td>CB1N, new unit at CHP-1</td>
<td>544</td>
<td>10</td>
<td>41</td>
<td>1</td>
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<tr>
<td>CB2N, new unit at CHP-Balti</td>
<td>495</td>
<td>37</td>
<td>36</td>
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<tr>
<td>CCSS, combined cycle</td>
<td>738</td>
<td>100</td>
<td>52</td>
<td>3</td>
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<tr>
<td>CCWE, combined cycle Westinghouse Electric</td>
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<tr>
<td>CETS, mini CHP</td>
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<td>CETM, combined cycle Check</td>
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<tr>
<td>CC2M, combined cycle ABB</td>
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<tr>
<td>GCAR, coal PP</td>
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<td>36</td>
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<tr>
<td>Nuclear unit</td>
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<td>700</td>
<td>42</td>
<td>6</td>
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HAS: 50% import and construction of new gas-fired units

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<tbody>
<tr>
<td>Nr and power, MW</td>
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<td>50</td>
<td>2x179</td>
<td>3x5</td>
<td>50</td>
<td>1x100</td>
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<td>2x5</td>
<td>1x179</td>
<td>1x100</td>
<td>50</td>
<td>1x100</td>
</tr>
<tr>
<td>Type of unit</td>
<td>Import</td>
<td>Import</td>
<td>CCWE</td>
<td>CETS</td>
<td>Import</td>
<td>CCSS</td>
<td>Import</td>
<td>CETS</td>
<td>CCWE</td>
<td>CCSS</td>
<td>Import</td>
<td>CCSS</td>
</tr>
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Results

Investment required
Results

Fuel costs

![Diagram showing fuel costs from 2005 to 2033 for different categories: HAS, MRS, BLS, A, B, and C. The costs are measured in millions of USD.]
Results

GHG emissions

No GHG emissions from import
Results

Emissions per 1 kWh
Conclusions

In the conditions of the Republic of Moldova it should be evaluated the emissions per kWh not only absolute values of emissions:

- **HAS** - 8,3 Tg CO2 equivalent,
- **C** - 6,2 Tg CO2 equivalent,
- **MRS** - 2,7 Tg CO2 equivalent,
- **B cu** - 2,6 Tg CO2 equivalent,
- **A cu** - 2,4 Tg CO2 equivalent.
Conclusions

HAS is the preferable scenario from the point of view of lowest GHG emissions and from emissions/kWh. If average cost for import of electricity is 50 $/MWh then average price for electricity for study period is 69.2 $/MWh in HAS, in MRS is 63.9 $/MWh.
Measures for adaptation

R&D

- It is necessary to create a capacity building network in order to promote utilization of computer tools for evaluation of vulnerability of energy systems to climate change
- External costs of energy generation are to be considered in order to evaluate damage cost of GHG emissions
Thanks for Your Attention

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