**Presentation 2.8:** Program for the conversion of Russian municipal boilers with 20MW maximum capacity to biofuel due to funds from the emissions reduction units sell, under the Kyoto Protocol

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**Abstract**

Energy sector is one of the main industrial sectors influencing a country economy state. The vexed problem existing in Russia is the significant consumption of fixed capital because of the long-term lack of investments needed. This problem is much more vital for the municipal boilers located in some remote areas. The fact that sites of fuels consumption are at the long distance from those of their processing is considered as disadvantage whereas the source of power, the wood can be found nearby. It is feasible to use annually 34m tons of logging wastes in Russia and yet they have not been used so far.

In order to solve these problems we have developed the program for the conversion of boilers to biofuel using the procedures of the Kyoto Protocol. According to the developed mechanism, a state agency is to be established. When the reconstruction is fulfilled and the boilers start the state agency gets emissions reduction units, has them confirmed, sums them up and sells to a foreign customer.

Realization of the program for the boilers conversion to wood chips shall make it possible to reconstruct up to 9362 boilers with 18724 MW aggregate capacity. The boilers reconstruction costs (for the conversion to wood chips) shall be equal to 1872.34m Euro according to the preliminary estimation. They shall be completely paid off due to 696.1m tons CO2 emissions sell. There can be some variants of development depending on the emissions reduction units price. At the price of 12 Euro per 1 ton CO2 the pay-off period shall amount to 3 years and the earnings shall equal to 8353.31m Euro whereas the revenue expected (not including the reconstruction costs) shall amount to 6480.98m Euro. More pessimistic scenarios imply longer pay-off period.
The Member of the Russian Federation State Duma,  
Benin Andrey Alexandrovich

Realization of the Program on Russian boilers with 20 MW maximum capacity conversion to wood chips

Due to funds from the emissions reduction units sell, under the Kyoto Protocol

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Russian municipal heat energy economy in XXI century

- High consumption of basic and service equipment
- Low efficiency of equipment operation
- Challenges in maintenance and modernization of out-of-date equipment
- Increasing heat deficit
- Distance between places of fuel resources processing and places of consumption
Sources of secondary raw materials and residues of the forest products industry

Structure of the forest fund biomass

Tree biomass

- Stem of a tree: 65%
- Branches, tops and knots: 9.8%
- Green part of a tree: 12.3%
- Stumps and roots: 5.2%
- Bark: 7.7%

Recoverable wood resources and residues being perfect raw-materials for heat energy branch have the significant potential.
Structure of the forest fund biomass

Considering inevitable losses there are appr. 34 min. t of logging residues suitable for processing emerging annually in Russia.

Chip processing technology chain

1. Wood harvesting
2. Collecting and packaging of logging residues
3. Logging residues transportation for temporary storage
4. Residues storage
5. Residues transportation
6. Utilization for chips, heat power production
Bioenergy use in European countries

Russian producers of boilers operating wood-fuel

According to the data based on inquiry March 01-31, 2006
Boiler reconstruction in Krasnoozernoye settlement, Leningrad oblast

Total operation cost: 3.3 mln. roubles.  
Reconstruction period: 3 months  
Basic results:  
• Increased boiler’s efficiency factor from 50-55% to 80-85%,  
• Increased dependability of heat supply,  
• solving the problem of settlement heat supply.

List of operations done:  
• installation of 2 wood chip boilers of 1 MW each,  
• maintenance and replacement of pump equipment,  
• installation maintenance and replacement,  
• electrical facilities checkout,  
• boiler maintenance,  
• fuel storage and feed system.

Boiler reconstruction in Shpankovo settlement, Leningrad oblast (4 MW)

<table>
<thead>
<tr>
<th>No</th>
<th>Estimated cost, US dollars</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Preliminary work (geodesic survey)</td>
<td>98</td>
</tr>
<tr>
<td>2.</td>
<td>Woodchip boiler construction in Shpankovo settlement</td>
<td>206 552</td>
</tr>
<tr>
<td>3.</td>
<td>Exterior heating systems</td>
<td>22 666</td>
</tr>
<tr>
<td>4.</td>
<td>Exterior water-supply systems</td>
<td>10 214</td>
</tr>
<tr>
<td>5.</td>
<td>Domestic sewage</td>
<td>2 626</td>
</tr>
<tr>
<td>6.</td>
<td>Exterior electricity grids</td>
<td>28</td>
</tr>
<tr>
<td>7.</td>
<td>Provision of urban amenities</td>
<td>23 216</td>
</tr>
<tr>
<td>8.</td>
<td>Costs for temporary constructions and buildings 1.5% including refunds 15%</td>
<td>4 243</td>
</tr>
<tr>
<td>9.</td>
<td>Supplementary costs for operating in winter period 1.5%</td>
<td>657</td>
</tr>
<tr>
<td>10.</td>
<td>Project works</td>
<td>4 041</td>
</tr>
<tr>
<td>11.</td>
<td>Other costs</td>
<td>14 762</td>
</tr>
<tr>
<td>12.</td>
<td>Emergent operations receive 3%</td>
<td>24 074</td>
</tr>
<tr>
<td>Total</td>
<td>Total estimated cost, US dollars</td>
<td>582 833</td>
</tr>
</tbody>
</table>

Total costs acc. to consolidated estimation: 281 689 | 42 285 | 216 728 | 40 131 | 582 833
Implementation of the Program on Russian boilers fuel conversion to the wood chips

- The number of boilers to be reconstructed: 9,362 with the capacity of 2 MW each
- Total capacity of the boilers to be reconstructed: 18,724 MW
- Total reconstruction expenditures: 1,872,34 mln. Euro
- Avoided emissions in CO\textsubscript{2} equ: 696.1 min.t

The expected program results

- Reduction of coal consumption
- Thermal plants modernization in the remote settlements
- Secured heat supply system of the remote areas
- Heat production reduction costs
- Increased efficiency of forest industry enterprises
- Increased reduction of greenhouse gases emission
- Russian carbon market development under the Kyoto Protocol
- Transaction costs reduction at the carbon market
- Decreased load on Russian transportation system
- Contribution to the forest fund improvement
Mechanism of the Program realization

1. Search for Managing bioenergy companies
2. "Umbrella" climate projects development
3. Summarizing and selling of emissions reduction units
4. Monitoring of operating boilers

The number of boilers to be reconstructed

- more than 500
- from 230 to 500
- from 100 to 250
- from 50 to 100
- less than 50

Totally in Russia - 9902
Financial results of a boiler of 2MW maximum capacity conversion to biofuel

Capacity of the boiler being reconstructed 2 MW
Reconstruction expenditures: 200 000 Euro.
Reconstruction total pay-off period: less than 3,4 years
Emissions avoided: 74,4 T.T. CO₂ equivalent.

Financial indicators of a boiler reconstruction considering various ERU prices in mln. Euro.

<table>
<thead>
<tr>
<th>Assets</th>
<th>4€/tCO₂</th>
<th>8€/tCO₂</th>
<th>12€/tCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction costs</td>
<td>200,00</td>
<td>200,00</td>
<td>200,00</td>
</tr>
<tr>
<td>Emissions trading earnings</td>
<td>297,00</td>
<td>595,00</td>
<td>892,00</td>
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<tr>
<td>Revenue expected</td>
<td>97,00</td>
<td>395,00</td>
<td>692,00</td>
</tr>
<tr>
<td>Pay-back terms</td>
<td>10 years</td>
<td>5 years</td>
<td>3,4 years</td>
</tr>
</tbody>
</table>

The program pay-off period for 9 362 boilers conversion to wood chip
**Financial results of the Program**

9 362 boilers of 2 MW with aggregate capacity 18 724 MW are being reconstructed

Reconstruction expenditures: 1 872,34 mln.Euro

Program total pay-off period: from 6,5 years

Emissions avoided: 696,1 mln.t CO₂ equivalent

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**The Program efficiency considering various ERU prices in mln.Euro.**

<table>
<thead>
<tr>
<th>Assets</th>
<th>4€/tCO₂</th>
<th>8€/tCO₂</th>
<th>12€/tCO₂</th>
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</thead>
<tbody>
<tr>
<td>Reconstruction costs</td>
<td>1 872.34</td>
<td>1 872.34</td>
<td>1 872.34</td>
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<tr>
<td>Crediting funds required</td>
<td>1 515.43</td>
<td>1 158.53</td>
<td>874.55</td>
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<tr>
<td>Emissions trading earnings</td>
<td>2 784.44</td>
<td>5 688.88</td>
<td>8 383.31</td>
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<tr>
<td>Revenue expected</td>
<td>912.10</td>
<td>3 696.54</td>
<td>6 480.98</td>
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<tr>
<td>Pay-back terms of the Program</td>
<td>13.5 years</td>
<td>8.5 years</td>
<td>6.5 years</td>
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**Financial results of boilers operating coal conversion to wood chip in some regions of Russia**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement unit</th>
<th>Karelia</th>
<th>Komi</th>
<th>Novgorod oblast</th>
<th>Arkhangelsk oblast</th>
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</thead>
<tbody>
<tr>
<td>Reconstruction costs</td>
<td>Euro</td>
<td>14 246 130</td>
<td>26 563 934</td>
<td>8 854 927</td>
<td>91 763 548</td>
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<tr>
<td>Emissions avoided</td>
<td>t CO₂/year</td>
<td>542 104</td>
<td>530 440</td>
<td>280 056</td>
<td>1 192 216</td>
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<tr>
<td>Emissions reduction units selling earnings, at the price of:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4 Euro/tCO₂</td>
<td>Euro/year</td>
<td>2 168 416</td>
<td>2 121 759</td>
<td>1 120 225</td>
<td>4 768 864</td>
</tr>
<tr>
<td>8 Euro/tCO₂</td>
<td>Euro/year</td>
<td>4 336 833</td>
<td>4 243 518</td>
<td>2 240 450</td>
<td>9 537 728</td>
</tr>
<tr>
<td>12 Euro/tCO₂</td>
<td>Euro/year</td>
<td>6 505 249</td>
<td>6 365 276</td>
<td>3 360 675</td>
<td>14 306 592</td>
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<td>Pay-off period, at the price of:</td>
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<td></td>
<td></td>
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<tr>
<td>4 Euro/tCO₂</td>
<td>years</td>
<td>7</td>
<td>13</td>
<td>8</td>
<td>19</td>
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<tr>
<td>8 Euro/tCO₂</td>
<td>years</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>12 Euro/tCO₂</td>
<td>years</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>
Thank you for your attention!

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