Investment Project – Wińsko Biomass Power Plant

March 2012
Agenda

- PEP – development vision
- PEP – key competences
- Renewable Energy Sources (RES) market in Poland:
  - regulatory environment – planned regulation changes
  - RES supply and demand structure
  - biomass market
- Location selection
- Technology selection
- Project organisational structure
- Basic investment parameters
- Benchmark comparisons
- Implementation schedule
PEP Vision

PEP will be the leading Renewable Energy company in Poland through expansion in:

- Industrial energy outsourcing (IEO)
- Wind energy (WE)
- Agricultural biomass fuels (ABF).

In all businesses PEP will provide shareholders with minimum 15% return on equity post-tax.
PEP wants to become a leading company in the RES market by developing the following areas:

- Biomass energy
- Wind energy
- Agrobiomass for energetic purposes

All PEP business lines will bring its shareholders at least a 15% net return on the invested equity.
PEP – Key Competences

- Unique know-how on preparation, construction and exploitation of energy facilities based on biomass (the biggest operating in Poland biomass installation in Świecie was constructed and is operated by PEP):
  - modernisation of a 48 MWe extraction condensing turbine (2002)
  - construction of a 164 MWt CFB boiler (2004)
  - construction of a 33 MWe extraction non-condensing turbine set (2007)
  - deep modernisation of a OP140 coal boiler to turn it into a 78 MWt BFB boiler (2009)
  - prepared to be implemented investment in a new 32 MWe turbine set (2012).

- Unique know-how on biomass protection for energy facilities purposes:
  - purchase of forest biomass for Świecie installation purposes (over 500 thousand tons per year)
  - purchase of straw for the purposes of 3 pellet production plants (over 150 thousand tons per year)
  - own energy crop plantations for energy facilities purposes.

- Know-how on obtaining financing for energy projects within the project finance formula.

- Know-how on energy projects implementation.
PEP Vision

PEP will be the leading Renewable Energy company in Poland through expansion in:

- industrial energy outsourcing (IEO)
- wind energy (WE)
- agricultural biomass fuels (ABF).

In all businesses PEP will provide shareholders with minimum 15% return on equity post tax.

Market Environment
The RES sector, despite the current economic slowdown, is growing throughout Europe and in the world – RES became a permanent part of the energy mix.

Factors of RES development in Poland and in the world include:
- energy security
- climate changes and global warming
- increase in demand for energy
- gradual improvement of competitiveness of RES technologies compared to other energy generation technologies.

The potential of RES development in Poland is mainly:
- wind energy (potential estimated at about 15–20% of the total electricity consumption in Poland)
- biomass energy (potential estimated at about 20–25% of the total electricity consumption in Poland).
Generation of electricity from RES is one of the pillars of the EU climate and energy policy. The main objective in this regard is to provide at least 20% share of renewable energy in gross energy consumption in the entire EU by 2020.

Moreover, Directive 2009/28/EC of the European Union imposed on the Member States an obligation of updating the national legislation on support for RES.

Provisions of the projected act on RES and stipulations of its executive regulation will be of crucial importance to RES investments as well. The published draft act involves:

- varied support for different RES technologies
- varied support depending on a facility launch time
- time horizon of support determined as 15 years
- guarantee of a facility connection to the electrical grid
- the replacement fee together with the electricity price amounting to 470 PLN/MWh at constant prices (in practice it means the sum of revenues generated by an installation at the green certificates quantity correction factor amounting to 100%).

The published draft act lacks in turn:
- price guarantees for RES energy sold
- guarantee of correction of the required RES level in case of oversupply
- maintaining support for the ongoing and currently exploited facilities at the current level.
The draft executive regulation envisages:

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</thead>
<tbody>
<tr>
<td>Obligation level</td>
<td>10.4%</td>
<td>10.4%</td>
<td>10.4%</td>
<td>12.0%</td>
<td>13.0%</td>
<td>14.0%</td>
<td>15.0%</td>
<td>16.0%</td>
<td>17.0%</td>
<td>18.0%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Projected electricity sale to final recipients</td>
<td>122 681</td>
<td>123 739</td>
<td>126 944</td>
<td>130 232</td>
<td>132 000</td>
<td>133 440</td>
<td>135 090</td>
<td>136 740</td>
<td>138 380</td>
<td>140 030</td>
<td>141 680</td>
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<tr>
<td>Demand for green energy certificates level</td>
<td>12 759</td>
<td>12 869</td>
<td>13 202</td>
<td>15 628</td>
<td>17 160</td>
<td>18 682</td>
<td>20 264</td>
<td>21 878</td>
<td>23 525</td>
<td>25 205</td>
<td>26 919</td>
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</table>

Agrobiomass amount requirements for energy installations:

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<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>In co-combustion</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>85%</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>In hybrid units</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>In pure biomass units launched after 2015</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>In pure biomass units launched before 2015</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
</tbody>
</table>
In Poland there was 10.7 million MWh of renewable energy generated in 2010 and about 11.8 million MWh in 2011.

At the demand of about 12.5–13 million MWh per year it means a deficit of certificates of about 10–15%.

The generated RES electricity came from:

<table>
<thead>
<tr>
<th>million MWh</th>
<th>2010</th>
<th>2011</th>
<th>2012 (estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>► wind</td>
<td>1.8</td>
<td>2.6</td>
<td>3.8</td>
</tr>
<tr>
<td>► biomass</td>
<td>5.6</td>
<td>5.9</td>
<td>6.9</td>
</tr>
<tr>
<td>► biogas</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>► water</td>
<td>2.9</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>► sun</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>10.7</td>
<td>11.8</td>
<td>14.1</td>
</tr>
</tbody>
</table>
According to our estimation, in 2012 new wind farms of 650 MW are planned to be put into operation, 500 MW in the years 2013–2014, 400 MW in the years 2015–2016 and 500 MW in the next years, which will increase installed capacity to 5.8 GW and wind electricity generation from 1.8 million MWh in 2010 to 12 million MWh in 2020.

According to our estimation, some facilities will increase their biomass energy generation (Dalkia Łódź, Dalkia Poznań, ZEDO, GDF Suez, PAK, Białystok CHP plant, Jaworzno power plant, Tychy CHP plant, Belchatów power plant, Opole power plant, etc.).

According to our estimation, new biomass-based facilities are planned to be put into operation (e.g. Elbląg CHP plant, Gorzów CHP plant, Wińsko power plant).

Pursuant to the new draft act, we assume support for heat generated in pure biomass cogeneration facilities (about 2.0 million MWh of green certificates).

The above-mentioned investments should double the production level in 2020 compared to the present. We estimate an increase in renewable electricity generation in Poland to the levels of approx. 14 million MWh in 2012, 18.5 million MWh in 2015, 23.5 million MWh in 2018 and 27 million MWh in 2020.
Despite the implementation of so many new investments, following the introduction of correction factors from the new act and the objective increase to 20% in 2021, the demand for green certificates will not be satisfied in full:

Assumptions on correction factors:

- onshore wind – 80%
- co-combustion – 50%
- pure biomass and green heat in cogeneration – 100%
- biogas – 140%
- water – 20% (partial capacity modernisation assumed).

It seems that the surplus of the demand for green certificates over their supply will continue, which – as a consequence – means the possibility of obtaining revenues from dedicated biomass facilities at the level of 470 PLN/MWh at constant prices (minus discount for sale).
On the basis of the projected biomass energy generation we determined the demand for biomass in the coming years:

- The demand for forest biomass will remain at the level similar to the level of 2012.
- The demand for agrobiomass will increase from about 5 million tons in 2012 to about 9 million tons in the years 2017–2020 (assuming a relatively moderate decline in co-combustion).
Poland is a country with a relatively high forest cover (approx. 30%). Obtaining wood from forests remains stable at about 35 million m³.

Assuming that about 40–50% of the yield can be used for energetic purposes such as heating, dehydrators, heating plants and energetics. These wastes arise at any stage of timber processing, i.e. felling waste, unclassified timber, sawmill waste, industry waste. This means the potential of about 167 million GJ of fuel, which is about 18 million tons.

A large part of this potential is used in the cellulose and plate industry as well as for heating purposes in households and small heating plants.

The demand of energetics is about 5–6 million tons.
Supply and Demand for Biomass

- Estimation of the agrobiomass supply is mainly based on estimates of availability of different types of straw.

- It is assumed that about 30% of straw production can be managed outside of agriculture (i.e. for energetic needs and substrate for champignons).

- The estimated domestic potential of cereal and rapeseed straw is about 100 million GJ, i.e. about 8 million tons.

- In addition, agrobiomass is obtained from pruning orchards, parks and road trees in the amount of about 6 million GJ, i.e. approx. 0.5 million tons.

- Another source of agrobiomass is agricultural and food industry waste. The estimated potential of this market is approx. 30 million GJ.
To the potential agrobiomass resource there should be added the potential of opportunity for starting an energy plantation.

Currently it is estimated that energy crop plantations are conducted in the area of about 16 thousand ha (willow, miscanthus, etc.). In addition, the area of about 300 thousand ha is occupied by rapeseed cultivation for biofuel, and approx. 200 thousand ha serve maize and energy crops growing. This gives a total of about 3% of the total arable land in Poland.

Assuming that energy plantations can achieve a 10% share of the total arable land, the area of these crops would reach 1.6 million ha and would yield a biomass harvest of 180 million GJ, i.e. about 20 million tons.

Another source of agrobiomass is imports. Nowadays, straw pellet is imported from the eastern border, and small amounts of biomass – from Africa and Asia. The estimated potential of this imports is a 1–5 million tons.

Thus, the total agrobiomass potential is about 32–36 million tons, which – at the projected demand of energetics for agrobiomass at the level of 9 million tons – gives a great potential for agrobiomass purchase.
The final supply and demand balance will depend on factors influencing the potential changes of supply and demand for biomass in the domestic market:

<table>
<thead>
<tr>
<th>Factors influencing biomass supply</th>
<th>Factors influencing demand for biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td>the State Forests policy on wood obtaining</td>
<td>technical ability of agrobiomass co-combustion in the existing coal boilers (required agrobiomass share increase)</td>
</tr>
<tr>
<td>energy crop plantations development</td>
<td>limitations of biomass use in co-combustion due to: (i) corrosion, (ii) alkali sedimentation, (iii) O&amp;M costs, (iv) explosion risks, etc.</td>
</tr>
<tr>
<td>straw collecting process mechanisation</td>
<td>attractive champignon production (mushroom prices and EUR exchange rate)</td>
</tr>
<tr>
<td>availability of straw from farmers owning smallholdings (below 50 ha)</td>
<td>technical abilities of agrobiomass combustion in fluid boilers (dominant in Poland)</td>
</tr>
<tr>
<td>scale of biomass imports to Poland (PKS, shea tree, pellet, etc.)</td>
<td>pellet production size in Poland</td>
</tr>
<tr>
<td>limitation of S1 and S2 class wood use for energetic purposes</td>
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</table>
The regulatory environment (at the domestic and EU level) creates the permanent demand for green energy.

The analysis of supply and demand on the biomass market shows that the potential is not fully used yet.

In the long term (at least 10 years), newly built dedicated installations for biomass combustion will mainly generate the demand for forest biomass (in CFB and BFB boilers that are being constructed the maximum agrobiomass share is 20%, so forest biomass will constitute at least 80%).

The demand for agrobiomass will be created mainly by co-combustion installations the share of which in the general balance will gradually fall. However, it is difficult to estimate the scale and rate of this decrease.

The analysis of supply and demand on the forest and agrobiomass market shows that the agrobiomass potential is used to a lesser extent and it is also harder to use it for energetic purposes.

Basing on PEP competences and on the available market opportunities we propose implementation of a new energy project – Wińsko biopower plant.
Wińsko Biopower Plant Project
Within the preparation for the project there was a search for a location for the new facility that would be optimal from the perspective of the project implementation.

The location selection was based on two main criteria and some auxiliary ones:

- **Main criterion No. 1** – biomass availability – locations with biomass availability appropriate for the project were analysed

- **Main criterion No. 2** – possible connection of the facility to the electrical grid – locations providing a technical opportunity to connect the facility to the electrical grid were analysed;

- **Auxiliary aspects that were analysed:**
  - availability of plots of land with approved local plans giving opportunity to construct such a facility
  - access to water resources and sewerage possible
  - commune size and local authorities engagement in the investment approval process
  - road system.

On the basis of the above-mentioned criteria there were selected three locations in Lower Silesia, and finally a location in Wińsko was chosen.
The facility fuel needs are about 220–240 thousand tons of biomass (straw, forest biomass, energy crop biomass).

Wińsko region is rich in:

► cereal, rapeseed and maize straw; the analysis of the straw market in 70–100 km yield area reveals that a yearly production of cereal and rapeseed straw amounts to 3.25 million tons; we assume that there are 0.2–0.7 million tons to obtain (depending on the minimum size of holdings from which we intend to get straw)
► forest biomass in the form of felling and sawmill waste; in the region of 200 km from Wińsko 5.4 million tons of wood are harvested; wood gaining results in 0.65 million tons of felling waste; nowadays, only 15% of this waste is used; there are 0.55 million tons left
► soil for energy crop plantations; the region has approx. 1.1 million ha of arable land; according to our estimation, we can get about 3–4 thousand ha for energy crop cultivation.

Competition for straw acquisition on the part of pellet plants, champignon growing cellars and energetics is relatively lower than in other biomass-rich regions of the country.

Competition for forest biomass acquisition on the part of paper plate industry and energetics is relatively lower than in other biomass-rich regions of the country.
As for energetic biomass combustion, the market offers fluidisation technologies (CFB and BFB boilers) and stoker-firing technologies.

► CFB boilers: combustion in a fast rotating mass of fuel and sand particles at 850–900°C. Additional recirculation of the bed material for better combustion.

► BFB boilers: combustion in a fast rotating mass of fuel and sand particles at 850–900°C. No recirculation of the bed material, lower speed of the bed particles.

► Stoker-fired boilers: combustion in a layer slowly moving along the boiler grate. It usually takes about 30 minutes to combust at 1100–1300°C.
<table>
<thead>
<tr>
<th>Technology</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluidised CFB</td>
<td>- high efficiency of CFB – 92% (efficiency of BFB and stoker-fired is about 90%)&lt;br&gt;- CFB technology applied for coal combustion or as a coal and biomass boiler fueled mainly with forest biomass&lt;br&gt;- rapid boiler load changes possible&lt;br&gt;- low expenditures on desulphurisation – important for highly sulphated fuels, not for biomass</td>
<td>- CAPEX per MWt&lt;br&gt;- limited to 20% ability of combustion of agricultural fuel with high content of chlorine and alkali&lt;br&gt;- requires fuel fragmentation (chopped straw, pellet, PKS, etc.)&lt;br&gt;- low steam parameters when combusting fuels with high content of chlorine and alkali, low electrical efficiency of a power plant</td>
<td>Foster Wheeler, Austrian Energy, Andritz and Metso, Babcock Doosan, alkali</td>
</tr>
<tr>
<td>Fluidised BFB</td>
<td>- BFB technology generally applied for biomass (with significant restrictions for agrobiomass)&lt;br&gt;- at about 70–130 MWt efficiency comparable to stoker-fired technology</td>
<td>- limited to 20% ability of combustion of agricultural fuel with high content of chlorine and alkali&lt;br&gt;- requires previous fuel fragmentation (chopped straw, pellet, PKS, etc.)&lt;br&gt;- low steam parameters when combusting fuels with high content of chlorine and alkali, low electrical efficiency of a power plant</td>
<td>Foster Wheeler, Austrian Energy, Andritz and Metso, Babcock Doosan, Thermax</td>
</tr>
<tr>
<td>Stoker-fired</td>
<td>- CAPEX per MWt&lt;br&gt;- ability of combustion of a mix of agricultural biomass in the form of bales and forest biomass in the form of wood chips of basically different characteristics, technology applied for combustion of the most difficult fuels, 100% straw combustion possible&lt;br&gt;- possible high steam parameters when combusting fuels with high content of chlorine and alkali&lt;br&gt;- limited costs of preparation of stoker-fired boiler fuel</td>
<td>- lower combustion efficiency in comparison to CFB&lt;br&gt;- limited ability of rapid boiler load changes, two times slower than CFB – not very important, however, for a power plant aimed at electricity generation in a continuous motion</td>
<td>DP Clean Tech, Babcock Volund, BWE, Babcock Doosan, Babcock Power, McBurney, Standard Kessel, Thermax</td>
</tr>
</tbody>
</table>
Due to:

- availability of different biomass types in Wińsko region,
- flexibility of different biomass types application,
- biomass cost (no need for fragmentation or granulation),
- CAPEX per MWt and
- efficiency parameters,

for Wińsko biopower plant project we selected the advanced stoker-fired technology aimed at combustion of a variety of fuel:

- up to 100% of straw (mix of cereal, maize and rapeseed straw),
- up to 100% of energy crop biomass (miscanthus, millet, alcea, hemp, etc.) and
- up to 50% of forest biomass.
Construction of the new biomass facility can be realised for the purposes of a large industrial customer (either for generation of electricity for its own purposes, or for heat and electricity generation).

Another option is construction of the biomass facility generating electricity sold to the electrical grid or to the final recipient.

The analysis of both options can be carried out pursuant to the current regulations concerning RES as well as on the basis of the published draft act on RES.
<table>
<thead>
<tr>
<th>Basic parameters</th>
<th>Condensing facility</th>
<th>Cogeneration facility</th>
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</thead>
<tbody>
<tr>
<td><strong>Energy parameters</strong></td>
<td>78 MWt boiler, 31 MWe turbine set, efficiency 34%, CAPEX 300 million</td>
<td>78 MWt boiler, 25 MWe turbine set, general efficiency 75%, CAPEX 300 million</td>
</tr>
<tr>
<td><strong>Current legislation</strong></td>
<td>generation – gross 230 thousand MWh</td>
<td>electricity generation – gross 120 thousand MWh, heat generation – 1.4 million GJ</td>
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<tr>
<td></td>
<td>revenues – PLN 103 million</td>
<td>revenues – PLN 93 million</td>
</tr>
<tr>
<td><strong>Projected legislation</strong></td>
<td>generation – gross 230 thousand MWh</td>
<td>electricity generation – gross 120 thousand MWh, heat generation – 1.4 million GJ</td>
</tr>
<tr>
<td></td>
<td>revenues – PLN 103 million</td>
<td>revenues – PLN 99–105 million (depending on the amount of benefits from certificates that will disappear with the heat price drop)</td>
</tr>
<tr>
<td></td>
<td>profitability – IRR – 20%, NPV – PLN 100 million</td>
<td>profitability – IRR – 18–22%, NPV – PLN 100 million</td>
</tr>
</tbody>
</table>

- The condensing facility is a better solution for the current regulation on RES and is not worse than the cogeneration one for the projected changes of this regulation. And at the same time, due to lack of heat reception, the facility is not dependent on the local customer for heat.
On the basis of the tender invitation carried out at the end of 2010 referring to the stoker-fired boiler for a variety of biomass it can be stated that the best offer was presented by DP Clean Tech.

DP Clean Tech gathered its experience in construction and exploitation of biomass (straw) stoker-fired boilers over the past 25 years. Its reference list includes 25 facilities in Europe (including 24 in operation and 1 under construction) and 50 in Asia (including 26 in operation and 24 under construction).

Some of the most similar projects are presented in more detail.
<table>
<thead>
<tr>
<th>Plant</th>
<th>Operation Year</th>
<th>Fuel</th>
<th>Mwfuel input</th>
<th>MW(e)</th>
<th>MWthermal</th>
<th>t/hr</th>
<th>°C</th>
<th>Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haraldrud, Norway</td>
<td>2013</td>
<td>Wood pellet</td>
<td>60</td>
<td>0</td>
<td>56</td>
<td>200</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Pannon, Hungary</td>
<td>2012</td>
<td>Straw - Wood</td>
<td>113</td>
<td>25</td>
<td>110</td>
<td>540</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Siauliai, Lithuania</td>
<td>2012</td>
<td>Wood chip</td>
<td>56</td>
<td>9.8</td>
<td>39.7</td>
<td>460</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Fynsværket CHP, Denmark</td>
<td>2009</td>
<td>Straw - Wood</td>
<td>114</td>
<td>35</td>
<td>82</td>
<td>151</td>
<td>540</td>
<td>112</td>
</tr>
<tr>
<td>Berlin-Neuköln, Germany</td>
<td>2006</td>
<td>Bio AI - AIV</td>
<td>97</td>
<td>20</td>
<td>70</td>
<td>450</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Fechenheim, Germany</td>
<td>2006</td>
<td>Bio AI - AIV</td>
<td>42</td>
<td>12.4</td>
<td>25</td>
<td>450</td>
<td>66</td>
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</tr>
<tr>
<td>Dresden, Germany</td>
<td>2003</td>
<td>Bio AI - AII</td>
<td>45</td>
<td>-</td>
<td>27</td>
<td>425</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Sangüesa, Spain</td>
<td>2002</td>
<td>Straw</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>104</td>
<td>542</td>
<td>92</td>
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<tr>
<td>Herningværket, Denmark</td>
<td>2002</td>
<td>Wood-Gas-Oil</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>426</td>
<td>525</td>
<td>115</td>
</tr>
<tr>
<td>Elean Power Station, UK</td>
<td>2000</td>
<td>Straw - Gas</td>
<td>38</td>
<td>-</td>
<td>-</td>
<td>137</td>
<td>522</td>
<td>92</td>
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<tr>
<td>Maribo-Sakskøbing, Denmark</td>
<td>2000</td>
<td>Straw</td>
<td>10</td>
<td>20</td>
<td>-</td>
<td>44</td>
<td>542</td>
<td>92</td>
</tr>
<tr>
<td>Enstedværket, Denmark</td>
<td>1997</td>
<td>Straw - Wood</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>120</td>
<td>542</td>
<td>180</td>
</tr>
<tr>
<td>Norrköbing, Sweden</td>
<td>1996</td>
<td>Wood</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>143</td>
<td>535</td>
<td>108</td>
</tr>
<tr>
<td>Masnedø CHP, Denmark</td>
<td>1995</td>
<td>Straw - Wood</td>
<td>9</td>
<td>21</td>
<td>-</td>
<td>42</td>
<td>522</td>
<td>92</td>
</tr>
<tr>
<td>Gustav Kähr, Sweden</td>
<td>1994</td>
<td>Wood</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enköbing, Sweden</td>
<td>1994</td>
<td>Wood</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranås, Sweden</td>
<td>1993</td>
<td>Wood</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colombier, Switzerland</td>
<td>1992</td>
<td>Waste</td>
<td>2</td>
<td>11</td>
<td>-</td>
<td>14</td>
<td>435</td>
<td></td>
</tr>
<tr>
<td>Biocel Paskov, Czech Republic</td>
<td>1991</td>
<td>Wood chip</td>
<td>42</td>
<td>-</td>
<td>55</td>
<td>525</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Rudkøbing CHP, Denmark</td>
<td>1990</td>
<td>Straw</td>
<td>2.5</td>
<td>7</td>
<td>-</td>
<td>14</td>
<td>450</td>
<td>61</td>
</tr>
</tbody>
</table>
Reference Plant

Rudkøbing Heat and Power Station, Rudkøbing, Denmark

Fuel
- Straw

DPCT supply
- Turnkey (1990)

Boiler Data
- Flow: 13 t/h
- Pressure: 60 bar
- Temperature: 450 °C
- Efficiency: 92.5 %

Plant Data
- Electrical Output, Gross: 2.56 MW
- In-House Consumption: 0.26 MW
- District Heating: 7.0 MW
- Gross Elec. Efficiency: 23.1 %
- Net Elec. Efficiency: 20.8 %
- Net Total Efficiency: 84 %
Reference Plant

Maribo-Sakskøbing CHP Plant, Denmark

Fuel
• Straw (100%)

DPCT supply
• Steam boiler (1999)

Boiler Data
• Flow 43.2 t/h
• Pressure 93 bar
• Temperature 542 °C
• Efficiency 92.9 %

Plant Data
• Electrical Output, Gross 10.6 MW
• In-House Consumption 1.3 MW
• District Heating 20.3 MW
• Gross Elec. Efficiency 32.2 %
• Net Elec. Efficiency 28.2 %
• Net Total Efficiency 89.8 %
Reference Plant

Clean Power Station, Ely, Cambridgeshire, England

Fuel
- Straw (90%) + Gas (10%)

DPCT supply
- Turnkey (2000)
- Operation and maintenance for 13 year
- Staff on-side: 20

Boiler Data
- Flow 143 (149.8) t/h
- Pressure 92 bar
- Temperature 522 °C
- Efficiency 91.7 %

Plant Data
- Electrical Output, gross 40(42) MW
- In-House Consumption 4.0 MW
- District Heating - MW
- Gross Elec. Efficiency 36.6%
- Net Elec. Efficiency 33.0 %
- Net Total Efficiency - %
Reference Plant

Fynsværket Power Station, Odense, Denmark 2009

Fuel
- Straw 100 %
- Straw/wood chip 50/50 %
- Straw consumption 29 t/h

Main Data
- Power/heat output 35/82 MW
- Steam flow 164 t/h
- Steam pressure 112 bar
- Steam temperature 540 °C
- Boiler efficiency 92%
- Plant efficiency >106%
Reference Plant

Pannon Straw Fired Power Plant

Commissioning in 2012

Fuel
- Straw (Miscanthus, wheat, rye, barley, oat, maize, rape, hay)/wood chips

Developer
- Pannon Hő Kft

DP Clean Tech supply
- Steam boiler (2012)
- Flue gas cleaning
- Concept engineering

Boiler Data
- Fuel flow: 30.6 t/h
- Flow: 137.2 t/h
- Pressure: 100 bar
- Temperature: 540 °C
- Efficiency: 92.4 %

Plant Data
- Electrical Output, Gross: MW
- In-House Consumption: MW
- Net Efficiency: %
**Basic Investment Parameters**

- **Boiler technology**: stoker-fired
- **Boiler supplier**: DP Clean Tech
- **Fuel**: straw, energy crops, wood chips
- **Gross boiler power**: 85 MWt
- **Net boiler power**: 78 MWt
- **Turbine technology**: condensing
- **Turbine supplier**: considered suppliers: Alstom, Ekol, Siemens
- **Turbine condensing power**: 31–31.5 MWe
- **Turbine efficiency**: 35%
- **Fuel amount**: 2.45 million GJ
- **Fuel (PLN stable 2012)**: 18 PLN/GJ
- **Investment type**: greenfield
### Basic Investment Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of work</td>
<td>8,000 h</td>
</tr>
<tr>
<td>Gross electricity generation</td>
<td>230,000 MWh</td>
</tr>
<tr>
<td>Net electricity generation</td>
<td>217,000 MWh</td>
</tr>
<tr>
<td>Heat generation</td>
<td>0 GJ</td>
</tr>
<tr>
<td>CAPEX</td>
<td>PLN 300 million, land and connection excluded</td>
</tr>
<tr>
<td>CAPEX per net MWt</td>
<td>PLN 3.8 million</td>
</tr>
<tr>
<td>CAPEX per gross MWe</td>
<td>PLN 9.7 million, land and connection excluded</td>
</tr>
<tr>
<td>CAPEX per MWe</td>
<td>PLN 10.3 million</td>
</tr>
<tr>
<td>Working capital</td>
<td>PLN 57 million</td>
</tr>
<tr>
<td>Estimated annual average revenues in 15 years</td>
<td>PLN 103 million</td>
</tr>
<tr>
<td>Estimated annual average fuel costs in 2015-2030</td>
<td>PLN 51 million</td>
</tr>
<tr>
<td>Margin on fuel cost</td>
<td>PLN 52 million</td>
</tr>
<tr>
<td>CAPEX financing structure</td>
<td>75%/25%</td>
</tr>
<tr>
<td>IRR on equity</td>
<td>20%</td>
</tr>
<tr>
<td>NPV</td>
<td>PLN 102 million</td>
</tr>
</tbody>
</table>
Key assumptions:

Support – green certificates
Pursuant to the act on RES we assume the support in the form of green certificates during the first 15 years of electricity generation in the biopower plant. We assume that the total price of electricity and certificates in real terms will amount to 460 PLN/MWh.

Biomass cost
According to the analysis of biomass in Wińsko region, we assume that the biomass price in 2014 will reach 20.80 PLN/GJ and will grow by 1 p.p. above the inflation in the years 2014–2020. The current prices of straw and forest biomass in Wińsko region are at the level of about 16–18 PLN/GJ. So we assume that over the next 3 years there will be a cumulative growth of the nominal 23% (an increase of 12% in real terms).

Maintenance and operation costs
The biopower plant configuration (a combination of requirements for the operation of the power plant and fuel logistics management) means a necessity to employ 47 people.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline scenario</td>
<td>PLN 101.8 million</td>
<td>19.7%</td>
</tr>
<tr>
<td>Biomass price +2 PLN/GJ</td>
<td>PLN 64.7 million</td>
<td>16.9%</td>
</tr>
<tr>
<td>Biomass price +4 PLN/GJ</td>
<td>PLN 31.6 million</td>
<td>14.1%</td>
</tr>
<tr>
<td>Biomass price -2 PLN/GJ</td>
<td>PLN 135.3 million</td>
<td>21.9%</td>
</tr>
<tr>
<td>CAPEX +5%</td>
<td>PLN 94.3 million</td>
<td>18.6%</td>
</tr>
<tr>
<td>CAPEX -5%</td>
<td>PLN 108.5 million</td>
<td>20.6%</td>
</tr>
<tr>
<td>Efficiency 30.5 MW (-3%)</td>
<td>PLN 80.0 million</td>
<td>17.9%</td>
</tr>
</tbody>
</table>
## Basic Investment Parameters – Sensitivity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline scenario</strong></td>
<td>PLN 101.8 million</td>
<td>19.7%</td>
</tr>
<tr>
<td>Revenues -5 PLN/MWh</td>
<td>PLN 95.8 million</td>
<td>19.1%</td>
</tr>
<tr>
<td>Revenues -10 PLN/MWh</td>
<td>PLN 89.9 million</td>
<td>18.6%</td>
</tr>
<tr>
<td>Availability -100 h/year</td>
<td>PLN 97.7 million</td>
<td>19.2%</td>
</tr>
<tr>
<td>O&amp;M costs +1 EUR/MWh</td>
<td>PLN 95.8 million</td>
<td>19.1%</td>
</tr>
</tbody>
</table>
## Basic Investment Parameters – Sensitivity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline scenario</strong></td>
<td>PLN 101.8 million</td>
<td>19.7%</td>
</tr>
<tr>
<td>&quot;Stress test&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass price +3 PLN/GJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficiency 30.5 MW (-3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange rate PLN/EUR 4.50</td>
<td>PLN 12.2 million</td>
<td>11.9%</td>
</tr>
<tr>
<td>Revenues -5 PLN/MWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs +1 EUR/MWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability -100 h/year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A list of main risks associated with the project implementation and methods of reducing their impact on profitability of the project:

<table>
<thead>
<tr>
<th>Risk area</th>
<th>Risk management method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislation</td>
<td>the project is attractive both in the new one and in the projected RES support system</td>
</tr>
<tr>
<td>Technology</td>
<td>main contractors experience and references, the project team experience</td>
</tr>
<tr>
<td>Delay</td>
<td>contractual penalties, the project team experience</td>
</tr>
<tr>
<td>Facility parameters</td>
<td>contractual penalties, main contractors experience and references, the project team experience</td>
</tr>
<tr>
<td>Biomass availability</td>
<td>multi-fuelling, inventory, imports</td>
</tr>
<tr>
<td>Biomass prices</td>
<td>multi-fuelling, biomass imports, plantations</td>
</tr>
<tr>
<td>Financing</td>
<td>project finance 75/25 formula for investments and 80/20 for the entire project, an alternative is bonds issue at the level of PEP S.A. to complete the project financing</td>
</tr>
</tbody>
</table>
Due to the existing system of grants and subsidies and schemes of support for RES in the European market there are many entities implementing renewable energy facilities.

The installed capacities for biomass combustion in Europe in 2012 are estimated at the level of 6 GW (up from 4.5 GW in 2010). The increase occurred mainly in Finland, Germany, Sweden and the UK. The average size of a constructed facility is 23 MWe.

Advantages of using agricultural and food industry waste (lower fuel cost) still do not outweigh the increased CAPEX. Therefore, traditional fuels in the form of forest and agrobiomass still dominate.

An increase of investments costs connected with biomass facilities still can be observed. The average level of investment costs of facilities implemented in the last 10 years is about 2.3 million EUR/MW, while the estimated cost in subsequent years is about 3.1 million EUR/MW.
Figure 5: Capital costs for commissioned European and US biomass incineration plants, by plant size ($m/MW, MW)

Więsko Biopower Plant
Schedule

- Receiving binding offers for 80% of CAPEX – April 2012
- Banks due diligence completion – April 2012
- Obtaining building permit – April 2012
- Approval of debt financing by banks – May 2012
- Supervisory Board consent – May 2012
- Land purchase – May/June 2012
- Debt financing closing – July 2012
- Signing contracts with suppliers – July 2012
- Construction commencement – August 2012
- Power plant launch – IV quarter 2014
Contact

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fax. (+48) 22 651 89 01

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