Biofuels retrofitting at the Tuzla and Kakanj power plants on the track of decarbonizing the EPBiH power utility

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 817999.
1. Briefly about EPBiH power utility.
2. RD&D Bioenergy activities for TPP Tuzla and TPP Kakanj.
3. Biofuels retrofitting projects for Tuzla TPP and Kakanj TPP.
- 2 coal-based power plants, Tuzla TPP and Kakanj TPP.
- 3 large hydro power plants on rever Neretva.
- 6 sHPP.
- 1 Wind power park (48 MW).
- Annual generation 7,500 GWh of power and 350 GWh of heat.
- Installed capacity Fossil/RES = 66/33.
- Generation ratio Fossil/RES = 75/25.
EPBiH - key energy indicators

- Coal consumption cca 5,000,000 tonnes per year.
- Average net efficiency of thermal power plants (condensing regime) is 31.0%.
- Annual CO2 emissions cca 5,000,000 tonnes per year.
- Avr. (5Y) CO2 emission factor of thermal power plants is 1,000 kgCO2/MWh.
- CO2 emission factor of EPBiH in 2021 is 770 kg/MWh.
- Avr. (5Y) EPBiH net emission rate (incl. RES accepted) is 670 kgCO2/MWh.
How to achieve sustainable CO₂ cut until 2050?

Three CO₂ cut targets are set (ref. 2017):

- 2030: 30% CO₂ cut
- 2040: 55% CO₂ cut
- 2050: 80% CO₂ cut

Key measures being undertaken:

- Increase RES
- Increase TPP efficiency and coal-phase out
- Biofuels co-firing
EPBiH – 2050 technological mix

![Graph showing the energy balance and technological mix for EPBiH (BiH) from 2016 to 2050. The graph includes data on consumption, new RES (renewable energy sources), existing TPP (thermal power plants), and existing HPP (hydropower plants).]

![Another graph showing the technological mix for 2050 with categories such as Solar power plants, small hydro, Larg Hydro, Wind parks, and Thermal, coal, biomass, RDF.]

Bioenergy Retrofits for Europe's Industry
✓ Energy transition from fossils to RES.
✓ Decarbonization and coal-phase out until 2050.
✓ Just transition of coal regions.
✓ Bioenergy is part of solution!
1. Briefly about EPBiH power utility.

2. RD&D Bioenergy activities for TPP Tuzla and TPP Kakanj.

3. Biofuels retrofitting projects for Tuzla TPP and Kakanj TPP.
Waste woody biomass

SRC and bioenergy crops

Waste-to-energy (RDF/SRF)
R&D - Lab-scale tests; from 2006

1. TET5:WB = 93.7%w
2. TET5:WB = 85.15%w
3. TET5:M = 93.7%w
4. TET7:WB = 85.15%w
5. TET7:WB:M = 80.13:7%w
6. TET7:WB:M = 75.15:10%w
7. TEK6:WB = 85.15%w
8. TEK6:WB = 75.25%w
9. TEK6:M = 93.7%w
10. TEK8:WB = 75.25%w
11. TEK8:WB:M = 85.8:7%w
12. TEK8:WB:M = 75.15:10%w
Characteristics of wooden biomass supplied:
- Particle size: max 8 mm (wooden sawdust)
- Hd = 12-14 MJ/kg, W = 20%, A = 0.3%
Bioenergy plantations on former coalmines – from 2020
Project of production of bioenergy crops (SRC Willow - Salix viminalis) on former EPBiH coalmines land

Hints:

✓ Project was initiated by E3 International and EPBiH Power utility, Agreement signed in February 2021.
✓ Background of Project is Decision of EPBiH power utility to go into plantation of bioenergy crops on its former coalmines land and SLLE Initiative of E3 International.
✓ SSLEI is being realised in Serbia (3 locations) and Bosnia (2 locations), while North Macedonia is the next country in Balkan region who is going to join SSLEI.
✓ SSLEI is supported by CIFOR-ICRAF, Resilient Landscapes, Olaf Palme Center and Austrian Development Cooperation.
Establishing EPBiH’s test bioenergy crops plantations

**Preparation activities:**

- Program of Work.
- Sampling and chemical analysis of soil.
- Guidelines for soil preparation, irrigation, planting, maintenance, harvesting.
- Soil preparation:
  - treating the land with herbicides.
  - plowing, harrowing.
  - application of mineral fertilizer.
  - establishment of an irrigation system.
Plantation of bioenergy crops on Kreka and Breza sites

Hints:

• Planting was made by EPBiH coalminers with supervisory of EPBiH professional team and E3 International experts
• Training of coalminers ("farmers") was done before sowing.
• 14 000 seedlings of Willow go to each 1 ha.

Transport and storage of seedlings  
Training  
Planting
Monitoring and maintenance of the bioenergy crops plantations on Kreka and Breza sites

**Hints:**

- Test plantations established in May 2021.
- Two employees are engaged every day to maintain the plantations on both sites.
- Maintenance includes watering, herbicide treatment, weeding, etc.

![Average height of plants – Breza site](image)
Promotion and cooperation:

- Promotion plan is being realised, covering different stakeholders incl. Municipalities, Ministries, Agencies, International organizations (UNDP, GIZ), financial institutions (Funds, Banks - e.g. EBRD) etc.
- Cooperation with E3 International and CIFOR is continued.

Funding applications and opportunities:

- USTDA fund – application of EPBiH and E3 International
- EUKI fund – application of CIFOR, E3 International and EPBiH
- Other EU funds?

Replication plans:

- In Business plan of EPBiH 2022-2024, for 2022 it is planned new 3 x 5 ha of energy crops plantations on three coalmines: Kreka, Breza and Djurdjevic. Preparation activities already launched.
- In 2023-2024 planned much bigger plantations.
Agrotechnical measures, Harvesting, Transportation and Use optimization

Optimization of watering system

Biomass cofiring in CHP (10-30% biomass cofiring - Trial run in Tuzla and Kakanj CHP - ongoing).
Costs of the plantations and preliminary profitability analysis

Kreka site

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>(EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Soil / land preparation</td>
<td>400</td>
</tr>
<tr>
<td>2.</td>
<td>Material costs (seedlings, herbicides, fertilizer etc.)</td>
<td>3000</td>
</tr>
<tr>
<td>3.</td>
<td>Labor costs</td>
<td>1700</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>5100</strong></td>
</tr>
</tbody>
</table>

---

**Net calorific value of biomass vs. moisture content**

- Wood type: CW/Whole
- Value: MWh/ha

<table>
<thead>
<tr>
<th>Wood Moisture Content %</th>
<th>Net Caloric Value MWh/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>5.3</td>
</tr>
<tr>
<td>5%</td>
<td>5.0</td>
</tr>
<tr>
<td>10%</td>
<td>4.8</td>
</tr>
<tr>
<td>15%</td>
<td>4.7</td>
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<tr>
<td>20%</td>
<td>4.5</td>
</tr>
<tr>
<td>25%</td>
<td>4.3</td>
</tr>
<tr>
<td>30%</td>
<td>4.1</td>
</tr>
<tr>
<td>35%</td>
<td>3.9</td>
</tr>
<tr>
<td>40%</td>
<td>3.7</td>
</tr>
<tr>
<td>45%</td>
<td>3.5</td>
</tr>
<tr>
<td>50%</td>
<td>3.3</td>
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<tr>
<td>55%</td>
<td>3.1</td>
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<tr>
<td>60%</td>
<td>2.9</td>
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<td>65%</td>
<td>2.7</td>
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<td>70%</td>
<td>2.5</td>
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<tr>
<td>75%</td>
<td>2.3</td>
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<tr>
<td>80%</td>
<td>2.1</td>
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<tr>
<td>85%</td>
<td>1.9</td>
</tr>
<tr>
<td>90%</td>
<td>1.7</td>
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<tr>
<td>95%</td>
<td>1.5</td>
</tr>
<tr>
<td>100%</td>
<td>1.3</td>
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</table>

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**Safix virginalis**

<table>
<thead>
<tr>
<th>S20 ha Safix plantation</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
<th>Year 11</th>
<th>Year 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical preparation</td>
<td>€ 200</td>
<td>€ 200</td>
<td>€ 200</td>
<td>€ 200</td>
<td>€ 200</td>
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<td>€ 200</td>
<td>€ 200</td>
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<tr>
<td>Land lease</td>
<td>€ 1500</td>
<td>€ 1500</td>
<td>€ 1500</td>
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<td>€ 1500</td>
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<td>€ 1500</td>
<td>€ 1500</td>
<td>€ 1500</td>
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<tr>
<td>Cutting</td>
<td>€ 300</td>
<td>€ 300</td>
<td>€ 300</td>
<td>€ 300</td>
<td>€ 300</td>
<td>€ 300</td>
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<td>€ 300</td>
<td>€ 300</td>
<td>€ 300</td>
<td>€ 300</td>
</tr>
<tr>
<td>Irrigation</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
<td>€ 500</td>
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</tr>
<tr>
<td>Total</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
<td>€ 5100</td>
</tr>
</tbody>
</table>

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**Safix virginalis Energy Production Costs**

- No subsidy
- 1t wet 25% = € 18.3
- 1t dry 25% = € 20.5
- 1t dry 25% = € 20.5
- 1t dry 25% = € 20.5
- 1t dry 25% = € 20.5
**Sustainability analysis for Bioenergy crops on EPBiH coalmines vs PVs**

**Specific sustainability indicator groups**

<table>
<thead>
<tr>
<th>Indicator group</th>
<th>Single indicators</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>CO₂ emissions saved</td>
<td>AEA - €/MWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCA - t/MWh</td>
</tr>
<tr>
<td>Economic</td>
<td>CAPEX</td>
<td>AEA and MCA - €/MWh</td>
</tr>
<tr>
<td></td>
<td>OPEX</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yearly balancing power costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual revenue</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>Number of employees</td>
<td>AEA - €/MWh</td>
</tr>
<tr>
<td></td>
<td>Cost of retraining</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severance package/employees wage</td>
<td>MCA – number of employees</td>
</tr>
</tbody>
</table>

**Analysis of sustainability has been performed twofolds:**

- Aggregated Economic Analysis (AEA).
- Multi Criteria Analysis (MCA).

**Basis: 50 ha, LT: 20 years**

\[ SR_{MCA} = w_{feC} \times EcIn + w_{fen} \times EnIn + w_{fsc} \times ScIn \]

**Multicriteria sustainability analysis**

**Aggregated economic analysis**
SRF/RDF waste-to-energy options

- R&D programm developed during 2021.
- Activities planned to be completed 2022-2024:
  - Feasibility Study with Conceptual Design and ESIA with 3.5-12% SRF cofiring Lab-scale tests, 2022.
  - Trial run in Tuzla (unit 6) and Kakanj (unit 7) power stations, 2022.
  - Permiting and Investment decision, 2023.
  - Installation of SRF feed system in Tuzla and Kakanj, 2023/2024.
- Operation of SRF cofiring planned to start in 2024.
- Option of full conversion of one unit to waste&biomass co-firing or waste incineration?

www.biofit-h2020.eu
1. Briefly about EPBiH power utility.
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Horizon 2020 project BIOFIT, 2018-2022 - ongoing

JP Elektroprivreda BiH – 2 case-study:

- Biomass co-firing on unit 6, 223 MWe in Tuzla CHP
- Full biomass repowrering on unit 5, 118 MWe in Kakanj CHP
EPBiH Case-Study 1: Biomass co-firing on existing brown coal unit in Tuzla TPP (CHP Unit 6 - 226 MWe) – **up to 0.3 biomass cofiring (avr. 0.15t)**
- **Biomass type:** waste wood, *agricultural biomass and energy crops for co-firing on Tuzla TPP Unit 6*

EPBiH Case-Study 2: Biomass repowering of one unit in Kakanj TPP (CHP Unit 5 - 118 MWe/150 MWt) – **full biomass conversion.**
- **Biomass type:** waste wood 90%, *energy crops + RDF 10%*
- Unit put into operation in 1978, modernized in 2013.
- Two pass boiler of Unit 6 (223 MW) is water wall type boiler with PC combustion. Coal milling is performed by six ventilator mills.
- The PC boiler with dry bottom furnace is equipped with 12 burners arranged in two levels, two burners from front and back side and one burner from left and right side. Temp. In furnace 1150-1200 °C.
- Jet low-NOx burners. OFA System. NOx emissions is app. 200-250 mg/mn³ at 6% O2 dry.
- Turbine LP and HP modernized.
- MP turbine reconstruction in preparation with steam extractions for co-generation (220 MWt).
- ESP modernized (PM <30 mg/mn³ at 6% O2 dry. DeSOx in preparation.
- deSOx plant under preparation (tendering stage).
- Brown Coal is used from two nearby coalmines, LHV: 14-16 MJ/kg.
- 15-30% biomass cofiring planned.
## Tuzla Unit 6 – 0.15 biomass co-firing, input

<table>
<thead>
<tr>
<th>Inputs / Outputs</th>
<th>Unit</th>
<th>Reference (coal-firing)</th>
<th>Retrofit Scenario A</th>
<th>Retrofit Scenario B</th>
<th>Retrofit Scenario C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input - Coal</td>
<td>t</td>
<td>830,000</td>
<td>821,107</td>
<td>741,071</td>
<td>705,500</td>
</tr>
<tr>
<td>Input - Coal</td>
<td>GJ</td>
<td>13,371,300</td>
<td>13,228,036</td>
<td>11,938,661</td>
<td>11,365,605</td>
</tr>
<tr>
<td>Input - Biomass fuel</td>
<td>t</td>
<td>0</td>
<td>8,893</td>
<td>88,929</td>
<td>124,500</td>
</tr>
<tr>
<td>Input - Biomass fuel</td>
<td>GJ</td>
<td>0</td>
<td>106,714</td>
<td>1,067,143</td>
<td>1,494,000</td>
</tr>
<tr>
<td>Output - fossil CO₂ emissions</td>
<td>tCO₂</td>
<td>1,062,400</td>
<td>1,051,017</td>
<td>948,571</td>
<td>903,040</td>
</tr>
<tr>
<td>Output - Electricity (coal)</td>
<td>MWh-e</td>
<td>1,249</td>
<td>1,236</td>
<td>1,099</td>
<td>1,046</td>
</tr>
<tr>
<td>Output - Electricity (biomass)</td>
<td>MWh-e</td>
<td>0</td>
<td>10</td>
<td>98</td>
<td>137</td>
</tr>
<tr>
<td>Output - Electricity (total)</td>
<td>MWh-e</td>
<td>1,249</td>
<td>1,246</td>
<td>1,197</td>
<td>1,183</td>
</tr>
</tbody>
</table>

### Current situation

Lignite (~13,453 TJ)

- Coal mills
- Coal burners
- Pulverized fuel boiler
- Steam turbine
- Generator

223 MWe

- Electricity (~223 GWh)
- Heat (~13 GWh)

### Retrofit Scenario C

Lignite (~11,890 TJ)

- Coal mills
- Coal burners
- Pulverized fuel boiler
- Steam turbine
- Generator

223 MWe

- Electricity (~183 GWh)
- Heat (~13 GWh)
Tuzla unit 6 biomass cofiring-next steps

- **Type of biomass:**

- **Share of biomass to be used:**
  0..30%w biomass co-firing (avr. 15%w).

- **Trial run (ongoing):** Planned in order to investigate behavior of transport system and boiler performance with use of 10%, 15% and 20% biomass co-firing.
  
  *Option:* 0..15%w biomass co-firing with no or minimal adaptation of transport/Boiler equipment. Only adaptation of depo (or silos?) and crash/cutting machines included in Investment.

- **Completion of BIOFIT Study of Tuzla unit 6 - case-study:**
  
  *Option:* 0..30%w biomass co-firing with adaptation of transport/Boiler equipment (along adaptation of depo or silos and crash/cutting machines, a dedicated biomass transport line from depo/silos to boiler as well as biomass mill/burners are included in Investment). CAPEXup to 10 MEur.
TPP Kakanj – Unit 5, 118 MWe - description

- Unit put into operation in 1969, modernized in 2003.
- Cogeneration unit (electricity + heat for district heating)
- PC Boiler with slag tap furnace, temp. in furnace 1450-1500 °C.
- 6 Hammer mills. 12 low-NOx swirl coal burners, placed in two rows.
- OFA system (placed in two rows).
- 91% Boiler efficiency.
- LP and HP Turbine modernized.
- 33% net efficiency of the unit (in condensing regime).
- Hybrid ESP-Buggy dust filter (<10 mg/mn³).
- Brown coal used from nearby coalmines, LHV: 12-13 MJ/kg.
- Biomass repowering planned to continue operation.
## Kakanj unit 5 - full repowering, input

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Condensing (CWTH 15 °C)</th>
<th>Condensing / CWTH 32 °C</th>
<th>CHP (max heat output) / CWTH 15 °C</th>
<th>CHP (actual heat output) / CWTH 15 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass fuel input</td>
<td>MW-fuel</td>
<td>213</td>
<td>213</td>
<td>213</td>
<td>213</td>
</tr>
<tr>
<td>Boiler Capacity</td>
<td>MWth</td>
<td>187</td>
<td>187</td>
<td>187</td>
<td>187</td>
</tr>
<tr>
<td>Electrical Power, gross</td>
<td>MWe</td>
<td>77.4</td>
<td>72.8</td>
<td>56.7</td>
<td>72.7</td>
</tr>
<tr>
<td>Electrical Power, net</td>
<td>MWe</td>
<td>68.9</td>
<td>64.3</td>
<td>48.2</td>
<td>64.2</td>
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<tr>
<td>Heating Capacity</td>
<td>MWth</td>
<td>0</td>
<td>0</td>
<td>80</td>
<td>18</td>
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<tr>
<td>Operating regime</td>
<td>h/a</td>
<td>2,000</td>
<td>1,500</td>
<td>-</td>
<td>3,500</td>
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</table>

### Inputs / Outputs

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>Condensing Operation (CWTH 15°C)</th>
<th>Condensing Operation (CWTH 32°C)</th>
<th>CHP mode (CWTH 15°C)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input - Biomass fuel</td>
<td>GJ</td>
<td>1,533,600</td>
<td>1,150,200</td>
<td>2,683,800</td>
<td>5,367,600</td>
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<tr>
<td>Output - Electricity</td>
<td>MWh-e</td>
<td>137,800</td>
<td>96,450</td>
<td>224,700</td>
<td>458,950</td>
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<tr>
<td>Output - Heat</td>
<td>MWh-th</td>
<td>0</td>
<td>0</td>
<td>63,000</td>
<td>63,000</td>
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<tr>
<td>Net electrical efficiency</td>
<td>%</td>
<td>32.3%</td>
<td>30.2%</td>
<td>22.6%</td>
<td>30.1%</td>
</tr>
<tr>
<td>Net thermal efficiency</td>
<td>%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>37.6%</td>
<td>8.5%</td>
</tr>
</tbody>
</table>

- Sand particle size 0.5 - 1.5 mm
- Static bed height 40-60 mm
- Fluidizing velocity 0.8 - 1.2 m/s
- Bed temperature 700 – 950 °C
- Pressure drop 6 – 9 kPa
Kakanj unit 5 repowering – next steps

• **Type of biomass:**
  - Woody biomass (residues: sawdust, chips, bark, stump..) 90%. RDF up to 10%.
  - Biomass LHV in range 6-15 MJ/kg. RDF LHV in range 10-17 MJ/kg.

• **Share of biomass to be used:**
  0..100%w – full conversion to biomass.

• **Trial run** (1Q this year): planned in order to investigate behavior of existing transport system and boiler performance of Kakanj Unit 5 with use of 10%, 20% and 30%w of biomass.

  *Option:* 0..30%w biomass co-firing with partial adaptation of transport/Boiler equipment. Along adaptation of depo or silos and crash/cutting machines, focus is on adaptation from PC coal combustion to PC biomass co-firing.

• **Completion of BIOFIT Study of Kakanj unit 5 - case-study:**

  *Option:* 0..100%w biomass co-firing with full adaptation of transport/Boiler equipment. Along adaptation of depo or silos and crash/cutting machines, focus is on full conversion of boiler furnace from PC coal combustion to BFB biomass firing or CFB multi-fuel firing. Installed power reduction from 110 MWe/150 MWt to 77 MWe/80 MWt. Estimation of CAPEX: 30 MEur (BFB).
Tuzla unit 3 is cogeneration unit (100 MWe / 220 MWt).

- Tuzla unit 3 ends its operation on coal by end of 2023. (Opt-out).
- Tuzla unit 3 has 2 x 50 MWe boilers and one 100 MWe turbo-generator.
- Tuzla unit 3, for operation 6,000 h/y (350 GWhe) spends 500,000 t of coal.
- Coal is lignite (80%) and brown cola (20%) of total LCV cca 10.5 MJ/kg.
- Coal can be fully replaced by sustainable biomass (waste wood, agricultural biomass, energy crops) of LCV cca 8-16 MJ/kg (cca 80-90%) and RDF of LCV cca 12-17 MJ/kg (cca 10-20%).
- Annual biofuels consumption on retrofitted Tuzla unit 3 for operation 4,500 – 6,000 h (300-400 GWhe) is cca 300,000 - 400,000 t (avr. net efficiency 33%).
- Replacement of boiler (on biofuels) is required and full revitalization of the turbo-generator set and auxiliary equipment for extension of LT until 2050.
- Wood preparation infrastructure (silos, cut machines…) should be installed.
- Project contributes to energy transition of both electricity and heat sector in Tuzla region.
Benefits of Biofuels retrofits

- Biomass use is cost-beneficial in case of Tuzla and Kakanj compared to the coal only operation, considering CO2 tax.
- Carbon cut is significant (e.g. 100,000 t/y for Tuzla 6 and 500,000 t/y for Kakanj unit 5 and 500,000 t for Tuzla unit 3).
- Pollutant emissions are decreased.
- Increase of Electricity price and ETS price play in favour of biomass use.
- There is compliance with GHG criteria from RED II.
• **Commercial**: (in)sufficient biomass quantities mobilized to ensure the operation of the unit as foreseen by the economic analysis.

• **Regulatory/Technical**: RED II is implemented and co-firing operations are not considered as producing renewable energy since biomass is not the main fuel in case of co-firing.

• **Regulatory/Technical**: RED II is implemented and the net electrical efficiency criterion (min. 36 %) is difficult to be met either in case of Kakanj or Tuzla. Derogation is necessary in Bosnian RED II or replacement/modernization of Turbine set to increase net efficiency.

• **Regulatory/Technical**: Both Tuzla unit 6 and 3 and Kakanj unit 5 are co-generation units providing significant amount of heat to local people (250,000) and industry in Tuzla, Lukavac and Kakanj. RED II itself does not recognize importance of social-environmental aspect of large-scale co-generation, only supporting high-efficient cogeneration, which is difficult to achieve for any operator.

• **Regulatory/Technical**: Otherwise, according to the „SURE scheme in cogeneration & co-firing plants“, since the repowering units Kakanj 5 and Tuzla 3 cogenerate electricity and heat, they do not have to meet the 36% net electrical efficiency level. Since the co-firing unit Tuzla 6 will cogenerate electricity and heat, the minimum share of at least 51 % sustainable biomass on energy level does not apply.
THANK YOU FOR YOUR ATTENTION

On behalf EPBiH Team,
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