

Potential contribution of EP BiH as a partner to Biomass research (Biomass Co-firing, cultivation of fast-growing energy plants)

Background: Along hydro-power plants, EP BiH at present operates with two large coal-based power stations; the Kakanj power station (2x110 MWe, 1x230 MWe) which uses low-rank brown coal and the Tuzla power station (1x100 MWe, 2x200 MWe, 1x215MWe) which uses mostly lignite. There is official plan to build 5 new thermal power plants till 2030 with total capacity of about 2000 MW. Kakanj power station has experienced co-firing operation of coal and woody biomass - sawdust, on its unit 5 (110 MWe). The introduction of biomass in existing and new coal power plants is the long term commitment of EP BiH with the primary aim of reducing CO₂ emissions. In this way the conventional coal-based thermal power plants of EP BiH converted into so-called power plants using solid fuel.

Capacity and Capability: Before introducing co-firing into regular operation of thermal power plants, two groups of experimental tests are performed in EP BiH: laboratory testing of co-firing and the trials on existing large-scale plants.

Laboratory experiments of co-firing are carried out using a Lab-scale furnace *electrically heated and entrained pulverized-fuel flow furnace*. The main feature of the experimental facility is ability to change the process temperature at desire in the range from the ambient to 1560 °C. It is provided by SiC-type electric heaters controlled by a central PLC and thiristor units connected at PLC digital outputs for each heating zones of the furnace. Various types of coal and biomass can be used, processed to appropriate particle size by a laboratory hammer mill. Co-firing trials were conducted over a range of the following process variables: process temperature, excess air ratio and air distribution. Full suport of thermal power plants and coalmines to this laboratory tests is realized, providing reliable coal and biomass samples etc.

Trial runs on real large plants in existing thermal power plants of EP BiH are carried out under full supervision of Researchers from Development department of EP BiH and with strong support of managment, operational engineers and other stuff of thermal power plants.

After cofiring tests performed and results obtained, researchers of EP BiH analise influence of the cofiring scheme in effective CO₂ emissions, reduction in SO_x and often NO_x emissions and dust, technical issues associated with cofiring included fuel supply, handling and storage challenges, potential increases in corrosion, ash deposition issues (slagging and fouling), carbon burnout, decreases/increasing in overall efficiency, and, impacts on ash marketing, impacts on SCR performance, societal benefits, and overall economics. Furthermore, there are activities of EPBiH directed to the mapping of biomass potential in this region. Also, there are R&D plans to investigate energy potential of the fast-growing energy plants, grown on own-land surfaces at closed coal-mines.

Activities on introducing biomass in thermal power plants of EP BiH are managed by Development department of EP BiH - group for development of Generation, with highly competent stuff: two more experienced researchers (PhD researchers with more than 10 years of full equivalent experience), two experienced researchers (PhD researchers with 4-10 years of full equivalent experience and three young researchers (PhD candidates).

Contribution to the European research community in the field: Up to 20% by weight of biomass in Coal-biomass blends were tested so far, and EP BiH has plan to perform both laboratory and large-scale tests with 40-50% of biomass or even more, for operation in its thermal power plants. This is in line with the target of EU regarding the plan of increasing use of biomass and regarding the intentions of EU to investigate possibilities of co-firing in large power plants with a larger percentage of biomass against today usual percentage of biomass of 10-30%.

Furthermore, performing these cofiring investigations of various types of biomass with a specific low rank brown coal and lignite, significant expirience can be provided which will be usefull in future use of these specific coals, with a huge potential in the region of South East Europe (Bosnia and Herzegovina, Serbia, Kosovo, Grece...), in co-firing operation, or in use biomass with any other similar low-rank coals allaround Europe and World.

References: Several research works and practical applications of co-firing on thermal power plants of EP BiH have been carried out in last three years by reasearchers of Development department of EP

BiH. These results were presented in respectable energy journals and cited more times. Some of those papers are:

1. Kazagić A., Smajević I., Experimental investigation of ash behavior and emissions during combustion of Bosnian coal and biomass, *Energy* (Elsevier), Volume 32, Issue 10 (October 2007), p. 2006-2016., [doi:10.1016/j.energy.2007.03.007](https://doi.org/10.1016/j.energy.2007.03.007).
2. Kazagić A., Smajević I., Synergy Effects of Co-firing of Woody Biomass with Bosnian Coal, *Energy* (Elsevier), Volume 34 (May 2009), p. 699–707, [doi: 10.1016/j.energy.2008.10.007](https://doi.org/10.1016/j.energy.2008.10.007).
3. Kazagić A., Smajević I., Evaluation of Ash Deposits During Experimental Investigation of Co-firing of Bosnian Coal with Woody Biomass, *Tagungsband, Kunftiges Brennstoff- und Technologieportfolio in der Kraftwerkstechnik*, 40. Kraftwerkstechnisches Kolloquium, Dresden, 14-15. October 2008., Band 2, p. 238-249.
4. Kazagić A., Smajević I., Duić N., Selection of sustainable technologies for combustion of Bosnian coals, *International scientific journal Thermal Science*, Volume 14, No. 3 (Year 2010), p. 715-727.
5. Smajevic I., Kazagic A., Music M., Becic K., Hasanbegovic I., Sokolovic S., Delihanovic N., Skopljak A., Hodzic N., Co-firing Bosnian Coal with Woody Biomass: Experimental Studies on a Laboratory-Scale Furnace and 110 MWe Power Unit, *International scientific journal Thermal Science*, volume 16, issue 3, year 2012., p. 789-804.