

SURVEY OF EXISTING CHP PLANTS WITH SOLID BIOMASS IN EUROPE

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ABSTRACT: The purpose was to analyse a survey of existing CHP plants with solid biomass in Europe. This work was part of the EU project Biomass Cogeneration Network (BIOCOGEN). The aim was to summarize European experiences and the actual performance of the various existing biomass CHP applications in different countries. Based on an extensive collection of existing information of 157 CHP plants with solid biomass in Europe, these CHP biomass plants were documented in a database. The relevance of presenting the survey is to document the actual performance, characteristics and experiences of CHP plants based on solid biomass in Europe. With this reliable information stakeholders are supported for further decisions for the future necessary increasing of biomass CHP applications. In addition areas of lacking information are identified to stimulate further research and development. A large number of about 90 commercial CHP plants with solid biomass already exist in Europe, whereas the other 70 plants are demonstration, pilot or testing plants. Most solid biomass CHP plants are located in countries of considerable forest industry, whereas CHP plants with smaller capacities (<1 MW_{el}) are more dominant in central Europe and larger capacities (>20 MW_{el}) in Northern Europe. The largest plant is in Jakobstad, Finland with 210 MW_{el}, 100MW process steam and 60 MW district heating. The main solid biomass fuels are wood chips from forest residues (60 CHP plants) and from industrial residues (36 CHP plants). The most dominating CHP technology are steam based systems: steam turbine (92 CHP plants) and steam engine (28 CHP plants). But there are also some outstanding examples for successfully proven innovative CHP systems like Organic Rankine cycle (ORC) gasification with gas engine and gas turbine as well as Stirling engine. The electric efficiency ranges between 6% for very small application up to 37% of large applications, where the total fuel efficiency is in the range between 70% and 92%, whereas larger applications have a lower total efficiency because only a part of the total heat produced is actually used. The specific investment costs for steam cycle based technologies are in the range of 8 Mio €/MW_{el} for small CHP applications down to 5 Mio €/MW_{el} for larger applications. In Europe there are already many successfully operating CHP plants with solid biomass on a high common technical level based on steam cycle technologies. New innovative CHP technologies like ORC, gasification are already demonstrated successfully on industrial level. Main future trends must lead to a further decrease of the investment costs to further stimulate activities in the field of CHP plants with solid biomass to support highly sustainable development of the European electricity and heat system.

Keywords: combined heat and power generation (CHP), electricity sector, heat sector.