Mr Gas and little miss Biomass
- a hot Spanish love story

The efficient use of biomass is an important means in attaining a sustainable energy system. Erik Pihl and Stefan Heyne have investigated the possibilities to integrate biomass power generation with the existing power generation system. Their work indicates the potential for biomass power generation if co-located with natural-gas fired CCGT plants.

Efficiently used forest residues can facilitate compliance to 20-20-20-targets

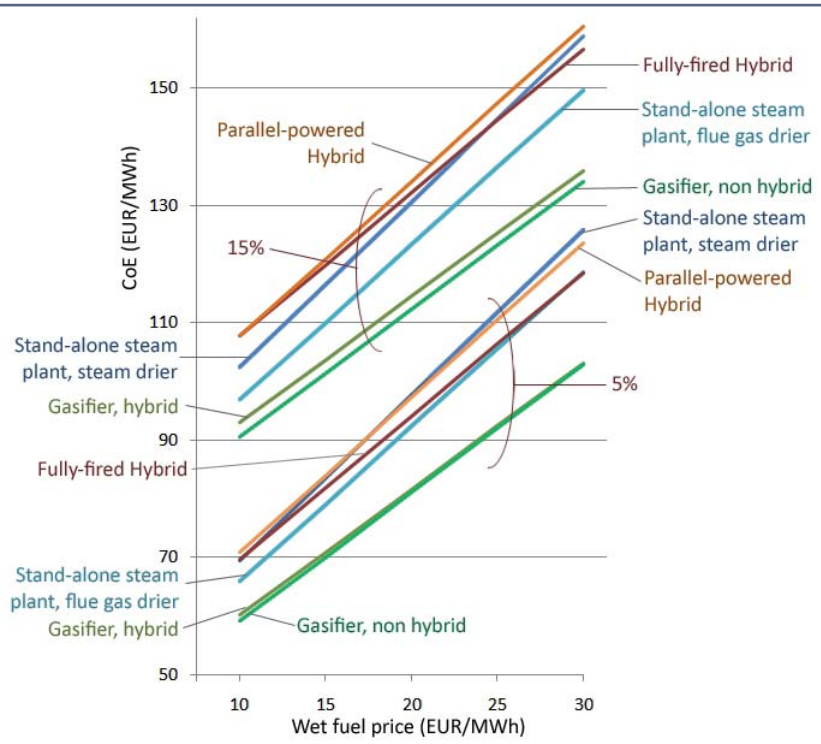
Biomass for energy offers commercially available solutions for dispatchable renewable power generation. With the "20-20-20" goals of the European Union stating, amongst others, 20% less CO_2 emissions and 20% renewable power to 2020, there is a window of opportunity for development of biomass use for power within the Union. In Spain, it is estimated that unused forest residue resources exist, and there is a need for more efficient and cost competitive solutions for power generation from biomass in order to facilitate compliance with current and future climate and energy goals. At present, the Spanish electricity generating system is dominated by natural gas combined cycle plants. An integration of biomass power generation in connection to CCGT plants, in Spain, as well as in many other countries, is therefore of high interest. The study by Pihl and Heyne has explored various options for biomass power generation integrated with existing combined cycle gas turbine (CCGT) power plants. Studied options include hybrid combined cycle and gasification technologies.

Biomass power can compete with conventional power

The study shows that there can be increased efficiency for integration of biomass based power with both the studied CCGT plants, compared to stand-alone steam plants. Using flue gases from the CCGT for biomass fuel drying is seen as a clear, cost effective way to improve efficiencies. A hybrid combined cycle concept where biomass is used in the bottoming cycle can increase efficiencies further; at least with a fully-fired hybrid, but with large increases in investment costs. Yet larger efficiency increases can be found for gasification of biomass, where the syngas is used as supplement for natural gas in the CCGT. The lowest cost of electricity is generally found for gasification concepts and stand-alone steam plants with flue gas drying.

Costs will vary greatly with discount rates and fuel costs, see Figure 1. The best hybrid options only give good cost competitiveness, compared with other biomass power alternatives, at low discount rates and high fuel costs, and it is questionable if a hybrid solution will be worth the price in the cases studied for this work. This also applies to the gasification configurations with combustion section as hybrid, compared to that with air-blown combustion.

CCGT plants can supply a biomass thermal conversion unit with large amounts of heat for fuel drying, and efficient disposal of biomass syngas. These advantages lead to improved efficiency and lower cost of electricity for biomass power generation. If fuel costs and discount rates are low, the improvements suggested in this work could mean a move for biomass-based power from barely to fully competitive with fossil-based power, even in a non-CO_2 trading regime.



Cost of Electricity (CoE) in EUR/MWh as function of wet fuel cost in EUR/MWhth for selected configurations. Results are shown for interest rates of 5% (lower six lines) and 15% (higher six lines). As reference, current conventional power generation cost in the range of roughly 45-80 EUR/MWh.

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