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EXPERIMENTAL ANALYSIS OF A SOLID OXIDE FUEL CELL STACK COUPLED WITH BIOMASS GASIFICATION

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Thermal gasification and solid oxide fuel cell (SOFC) technologies represent an interesting combination for power generation, as high fuel flexibility and high electric efficiencies are expected. The TwoStage gasifier is a high-efficient downdraft gasifier fueled by wood chips that produces a very clean product gas with virtually no tar – see Figure 1. This study operated an 800 W_e SOFC stack (Figure 2) with product gas from the TwoStage gasifier for a total of 145 hours. Only minimal gas conditioning was used, including a bag filter, carbon filter, humidifier and desulphuriser. The obtained results show excellent part-load performance at 55% flow for the SOFC, with no loss in efficiency. High SOFC electric efficiencies up to 46.4% were measured at a fuel utilisation up to 90%, the highest reported values of such a system. The gasifier-SOFC system efficiency was estimated to 38-43%. No significant losses in SOFC performance were observed during the hours of operation.

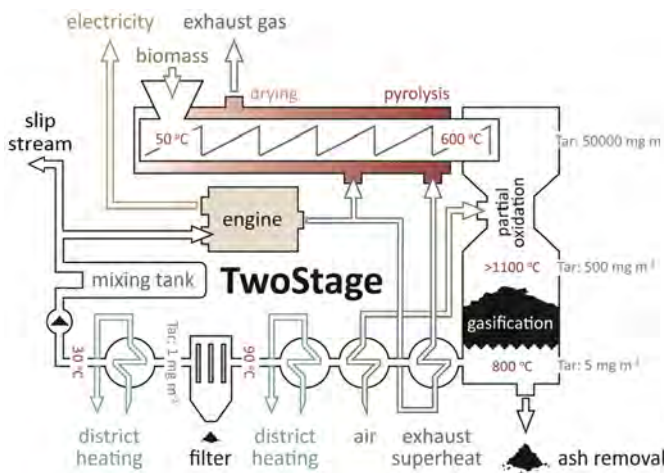


Figure 1: Flow diagram of TwoStage gasification with an engine.



Figure 2: Solid oxide fuel cell stack