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Elaborato di Laurea

**BIOMASS POWERED MICRO-CHP: MODELLING OF THE ENERGY CONVERSION
PROCESS AND INCREASING THE FLEXIBILITY TO CHANGE IN BIOMASS
COMPOSITION.**

Relatore:

Ch.mo Prof. Ing. Raffaele Tuccillo
Dip. di Ingegneria Industriale

Candidato:

Rita Villani
matr. M65/675

Correlatore:

Ing. Michela Costa
CNR IM
Ing. Domenico Cirillo
CMD S.p.A.

SOMMARIO

The present work of thesis focuses the attention on the respect of the COP21 principles concerning the improvement of the energy efficiency, the reduction of the greenhouse gas emissions and the dependence on the deciduous traditional energy sources, considering the possibility to use biomasses as renewable energy source. After a brief analysis of all the processes and technologies for biomasses conversion, the main section of the work is focused on the study of a real micro-CHP plant fed by lignocellulosic biomass, the ECO20 m-CHP developed by the Italian Company CMD located in Caserta. It is characterized by the coupling between a gasifier, addicted to the biomass conversion, and an internal combustion engine that processes the deriving syngas. A model of this system, with its most important components, is firstly realized with *Thermoflex*[®] and *GT-Power*[®] and then validated on the experimental data. The improvements realized on the plant during the study period are also shown and so the current performances are described. In the last part of the dissertation, a parametric analysis shows the trend of the syngas quality varying the gasifier operating parameters and the biomass composition, in order to put in evidence the possibility to increase the performances and the flexibility of the system. All these analyses allow to evaluate the possibility to realize an omnivorous plant, exploiting the coupling between the ECO20 system and an hydrothermal carbonization process that provides to the pre-treatment of the organic fraction of the municipal solid waste.

