A review of solar energy based heat and power generation systems - DTU Orbit (15/12/2018)

**A review of solar energy based heat and power generation systems**

The utilization of solar energy based technologies has attracted increased interest in recent times in order to satisfy the various energy demands of our society. This paper presents a thorough review of the open literature on solar energy based heat and power plants. In order to limit the scope of the review, only fully renewable plants with at least the production of electricity and heat/hot water for end use are considered. These include solar photovoltaic and solar thermal based plants with both concentrating and non-concentrating collectors in both solar-only and solar-hybrid configurations. The paper also presents a selection of case studies for the evaluation of solar energy based combined heat and power generation possibility in Denmark. The considered technologies for the case studies are (1) solar photovoltaic modules, (2) solar flat plate collectors, (3) a ground source heat pump, (4) a biomass burner, and (5) an organic Rankine cycle. The various cases are compared on the basis of economic profitability and environmental performance. The results from the case studies indicate that it is economically and environmentally beneficial to invest in both small and large capacity solar-biomass hybrid plants for combined heat and power production in the Nordic climatic conditions. The results also suggest that the configuration with an organic Rankine cycle with solar thermal collectors and a biomass burner is particularly attractive for large capacity plants.

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