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FUTURE OF DISTRICT HEATING SYSTEMS – INVESTIGATION OF VARIOUS TECHNOLOGIES IN THE DANISH CONTEXT

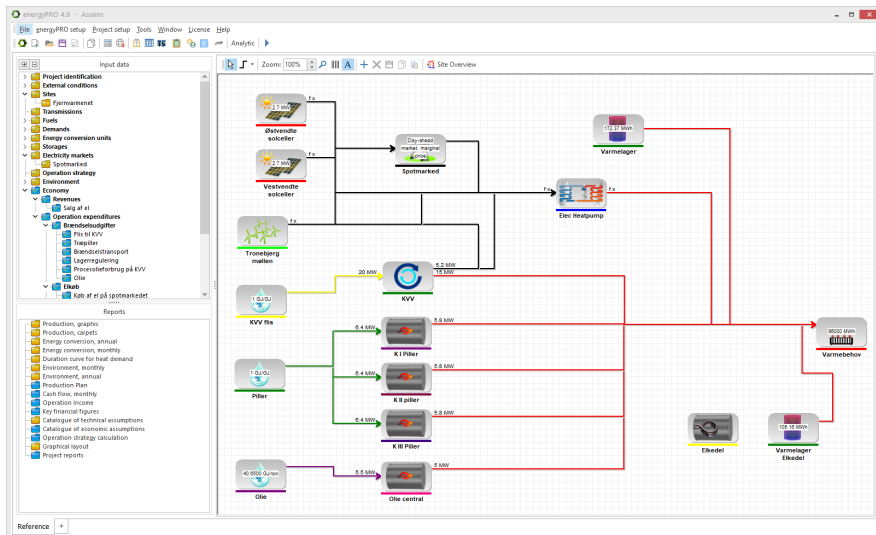
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Abstract – In response to the urgent need for decarbonization, district heating (DH) systems must explore emission-reducing investments that simultaneously lower operational costs of the plant. The recent years with wildly fluctuating gas and electricity prices put even more emphasis on finding the optimal combination of generation units for DH systems. This article aims at investigating which of the available technologies are the future of district heating. Solar collectors, photovoltaics (PV) and wind turbines and their combinations with other technologies are considered. The analysis is done based on Assens District Heating located in Funen, Denmark, where the annual heat production is approximately 96 000 MWh. The plant has already invested in an East-West oriented PV plant and a heat pump. However, for the purpose of this paper, an assumption is made that this investment can be redone based on the present investment costs in Denmark. The analysis is made in the energy system analysis tool energyPRO, where different combinations of technologies are analyzed. The study investigates the operational and investments costs, looking into the influence on Net Heat Production Cost (NHPC) and quantifying the investment yearly benefit. The results demonstrate profitability and feasibility of integrating renewable energy resources into district heating systems within the Danish context. The ambition is to showcase the possibilities and provide decision makers with insight into robust investments in renewable energy systems. Furthermore, by highlighting the success and potential of renewable energy integration in district heating systems in Denmark, this study aims to inspire further research and innovation in the field in other European countries, where the DH systems are primarily based on fossil fuels.

Keywords – District Heating (DH); Net Heat Production Cost (NHPC); Renewable Energy; Photovoltaics (PV); Solar Collectors; Wind Turbines



Model of the Assens District Heating System in EnergyPRO.