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Presentationtitle:	**Techno-Economic Assessment of a Solar Electric Cooling/Heating System in Europe**	

The fossil fuel depletion along with the growing concerns on the environmental impact of conventional systems for residential heating and cooling has turned attention towards renewable driven alternatives. Solar photovoltaic (PV) driven systems offer a viable solution, being in fact the most competitive –both from energetic as well as economic viewpoint- amongst the solar driven systems for cooling/ heating applications. This study conducted year round simulations, with an hourly step, to evaluate the techno- economic performance of a coupled photovoltaic (PV)-vapor compression cooling/ heating system (VCC) on residential scale; weather data for a single city per European country from NREL's database was used. A reference 80 m^2 residential building was considered on all cases in order to focus on the direct effects of the system's performance in correspondence with the meteorological data of each location. As reference heating system was considered a 95% efficiency natural gas fired boiler while for the cooling case, single split air conditioning units were considered, with a seasonal COP of 3.28. The savings of the proposed PV-VCC system were derived from the savings of the natural gas and the electricity of the reference systems, based on the national prices per case. The results of the analysis showed that the system achieves its highest economic performance in the southern regions, thanks to the high solar availability throughout the year, with a minimum payback period of less than 4 years reported for Portugal, considering a 19.9 m^2 gross PV area, corresponding to a 3.3 kW_p. The implementation of solar utilization technologies, on the other hand, results in very low exergy efficiencies leading to overall system's efficiencies in the range of 1-5%.

CV:

Katerina Mavrouli was born in 1993. She studied Physics at the University of Patras and obtained her degree in 2017. During her undergraduate studies she specialized in the field of Energy and Environment and she successfully completed her thesis with title; "Electrochemical characterization of recycled powder WO_3 for use in electrochromic devices".

Currently, she is attending and completing the Inter-Departmental Postgraduate Course "Energy Production and Management", coordinated by the National Technical University of Athens (NTUA).

Finally, in the beginning of September 2019 she started working for Eunice Energy Group, a company that develops and invests in a wide range of renewable energy projects and solutions in Greece and abroad.