

| RESEARCH LINE 6B | |
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| COMPANY | Iberdrola |
| PhD THESIS SUPERVISOR (UPM) | <p>Prof. Dr. Carlos del Cañizo <i>Solar Energy Institute</i> <i>Telecommunications Engineering School</i></p> <p>Prof. Dr. Alejandro Datas <i>Solar Energy Institute</i> <i>Telecommunications Engineering School</i></p> |
| PhD THESIS CO-SUPERVISOR (COMPANY) | <p>Mr. Samuel Pérez de Ramírez <i>Iberdrola</i></p> |
| DESCRIPTION OF THE PhD THESIS PROJECT | <p>The main objective of the proposed thesis project is the modelling of power-to-heat-to-power storage (PHPS) systems to identify its potential role in future low-carbon energy systems and quantify the characteristics needed for this technology (efficiency, cost, ramping capabilities) to be cost-competitive. Two kinds of analyses will be implemented to this end. First, a detailed model of the technology will be built to investigate its potential use in large buildings (administrative, services and industry sector). Second, a state-of-the-art network energy model of the sector-coupled European energy system will be upgraded to include PHPS technology and evaluate its role as the system decarbonizes.</p> <p>PHPS is an emerging category of technologies that store electricity in the form of heat and converts it back to electricity on demand. During this conversion, waste heat is also generated and supplied to satisfy the heating demand (cogeneration). The very low cost (about 100 times lower than electrochemical batteries) and the high global efficiency of the system (> 80%) are the two main advantages compared to other energy storage systems. PHPS can be also integrated in a more complex cogeneration (heating and power) or trigeneration (cooling, heating, and power) systems that include other technologies such as solar thermal, hybrid PV / thermal, absorption chillers, heat pumps, etc. The thesis project will be aligned to the previous research activities of the Solar Energy Institute, which in recent years has proposed and developed a new kind of high temperature PHPS system that stores energy in molten Silicon at temperatures above 1000°C and converts stored heat into electricity through thermophotovoltaic (TPV) devices. The main advantage of this system is its high energy density, higher than 1 MWh per cubic meter. The system has been developed within the framework of several national and European (www.amadeus-project.eu) projects, which have led to the development of a first laboratory-scale prototype that is available at our facilities.</p> <p>The PhD thesis project will be conducted in the frame of the Official UPM Doctoral Degree in “Photovoltaic Solar Energy”, which is an initiative aiming to train experts in all areas related to Photovoltaic Solar Energy, which has resulted in the graduation of more than 130 Doctors. The selected candidate will have access to all laboratories of the Solar Energy Institute of UPM (IES-UPM), including the experimental PHPS prototype.</p> |
| SECONDMENT(S) | <p>The thesis project has a planned research visit of 4 months at the Department of Mechanical and Production Engineering of Aarhus University (Denmark). The objective of this visit will be to deepen the aspects related to the role of PHPS on the sector-coupled networked European energy system. This work will be carried out in collaboration with Prof. Marta Victoria. The PhD student will benefit from the large experience of Prof. Victoria and her research group on large-scale energy systems modelling.</p> |

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| REQUIREMENTS FOR CANDIDATES | <p>Degree: MSc in Mechanical, Electrical, Electronics, Energy Engineering or similar.</p> <p>Skills: written and oral communication, teamwork, initiative, programming.</p> <p>Experience with Python, open-software development in Github, and high-performance computing clusters is not mandatory but will be positively evaluated.</p> <p>Background: No professional experience is needed.</p> |
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