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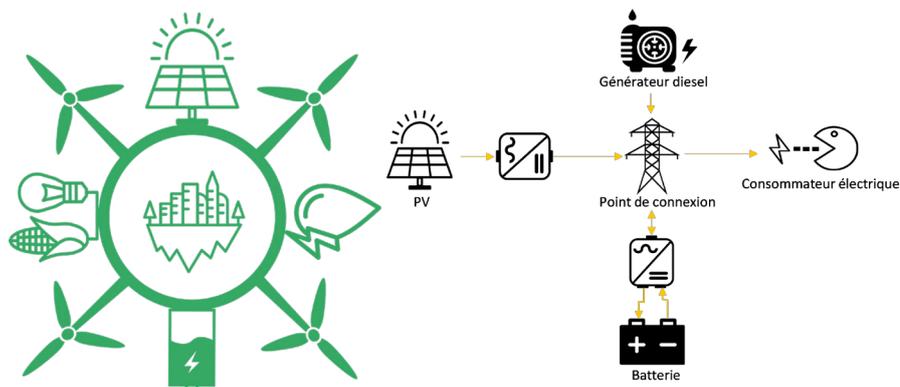
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DEVELOPMENT OF GENERIC METHODOLOGIES FOR THE OPTIMAL AND SUSTAINABLE DESIGN OF HYBRID RENEWABLE ENERGY SYSTEMS

Développement de méthodologies génériques pour la conception optimale et durable de parcs hybrides d'énergies renouvelables

Within the context of Sustainable growth issues and climate change, we propose a methodology for the sustainable development and design of renewable infrastructures, with the support of the company VALOREM. By using a Model Driven Engineering approach, several viewpoints on renewable energy issues are considered. First, we develop a conceptual framework for land settlement development process. Modelled with UML2 and a combined with a process sustainability assessment method, it can be used to analyze the trajectory of sociotechnical systems, for example the success of El Hierro hydrowind power plant implementation in Canary Islands and the failure of the Sivens dam project in the south of France. Their comparison shows that implication of stakeholders during the whole development process is crucial for the success of the project. We further propose to implement the conceptual framework as a software tool for the monitoring of land settlement project in real time, with the help of artificial intelligence concepts. Second, we focus on a technical instantiation of the framework for Hybrid Renewable Energy Systems (HRES), part of VALOREM's activity. To identify new HRES opportunities, a software prototype for the grassroot optimal design of HRES is developed, offering flexibility in terms of modelling, setting constraints and defining objective functions. We show its relevance on four HRES case studies: two related to electricity market and two for self-supply of energy (one isolated and the other grid-connected). The results show that battery costs are too high to be profitable in HRES and that grid-connected systems seems to be a good alternative. Finally, we carry out an environmental impact assessment of several sources of electricity production to find out which are the "cleaner" ones. The results show that biomass, wind turbines and ground PV are those that should be considered for a sustainable energy transition.



Hybrid Renewable Energy systems. Idealized picture and real implementation