DC Number	DC10
Title of the PhD Project	Optimization of costs and availability of green hydrogen production
Keywords	Control Design, Optimization, Distributed Sytems, Software Development, Machine Learning
Recruitment organisation	ENERTRAG SE
Supervisors names and contacts	Dr. Felix Bübl, felix.buebl@enertrag.com Dr. Thomas Frenzel, thomas.frenzel@enertrag.com
Scientific context and objectives	The success of green hydrogen depends on its price and availability. In order to replace fossil fuels on a large scale, green hydrogen needs to get cheaper and more reliable than fossil fuels. We aim for an optimization of the overall benefit for the whole system – the electricity producing plants as well as the hydrogen producing plants. The main output are calculated schedules predicting the near future production of both, hydrogen and electricity, i.e. we plan the control of the connected system at a time scale of days. This control is part of an hierarchical control system. The optimization has several input time series such as prognosis for demand, renewable power or prices. Reduction of uncertainties of the time series will improve results. Due to uncertainties of the schedule prediction criteria are necessary to issue re-optimizations. Our optimization approaches is not limited to one single hydrogen plant. Instead, it optimizes schedules for a fleet of hydrogen plants connected with wind and solar plants. It should be able to cope with hydrogen logistics, such as lorries as mobile storages. Other sector coupling plants such as green district heating or batteries are another use cases. We track and evaluate the results in order to improve the optimization and, thus, minimize the price of green hydrogen. We use our existing distributed system to extract all readable sensor measurements from the different components of the plants such as compressors, electrolysers or hydrogen storages. We both consider real sensor measurements from real plants and simulated sensor measurements from simulated plant models. We analyze these time series values both with statistical methods and with machine learning in order to identify underperformance and to predict future defects.
Required skills	• A degree in the general areas of mathematics, electrical and electronic engineering, computer science and engineering. • Knowledge of optimization methods • Experience in software development with a high-level programming language. • Ability to effectively liaise and collaborate with multinational and multidisciplinary teams. • Ability to work independently and write high quality technical reports. • Demonstrate a flexible approach to working, with the willingness to travel and participate to the project meetings and international events. • Ability to work to deadlines and deliver high quality results on time. • Proven proficiency in spoken and written English.
References	[1] Werner Diwald, “Informations centrale hybride“ at Conférence « Quelles stratégies pour une intégration effective de l'énergie éolienne aux réseaux ? Regards croisés France-Allemagne », Berlin, 2009 [2] ENERTRAG “Green hydrogen and wind-based thermal energy. Keys to the green transition”, Brochure, 2022

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