QualyGridS

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Standardized qualifying tests of electrolyzers for grid services

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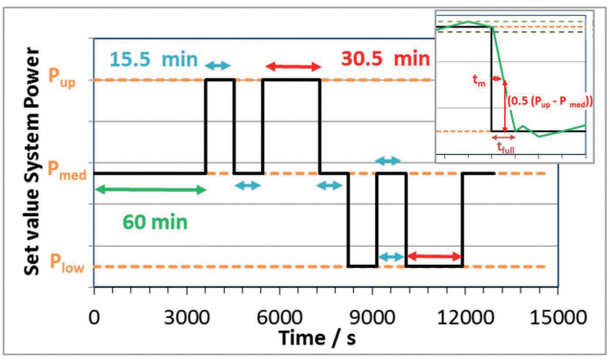
SHORT PROJECT DESCRIPTION / PROJECT GOAL

Sustainable production of hydrogen is a key element of the European energy transition agenda, especially for seasonal and mobile energy storage purposes. Water electrolyzers producing hydrogen from renewable electricity for decarbonization in various sectors can improve their revenues by providing electricity grid services. The project QualyGridS develops new standard and unified testing protocols and demonstrates that state-of-the-art low temperature electrolyzers can perform these services. It analyzes business cases of electrolysers performing grid services.

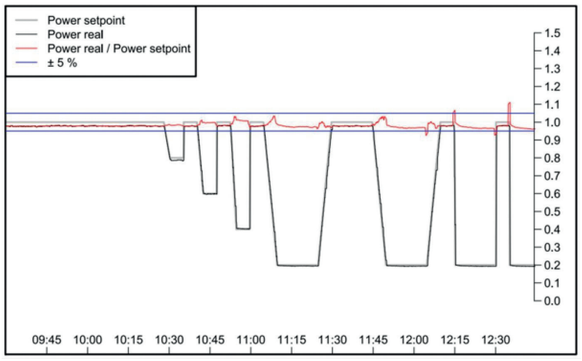
WHAT HAS BEEN DONE

Based on literature research, a survey and interviews with relevant TSOs (Transmission system operators) and DSOs (Distribution system operators), the technical and economic aspects of the existing electricity grid services in European countries were composed and published in two reports. Four different grid services are primarily well defined: FCR (frequency containment reserve), aFRR and mFRR (frequency restoration reserve with automatic or manual activation) and RR (replacement reserve). Based on the range of requirements of these services in the different countries, testing protocols were set up that should allow a qualification of a water electrolyzer system for this service in all European countries and be submitted as an international standard. At the same time, the test results can be used to assess the suitability of the water electrolyzer (WE) system for other, not as well defined services. These draft tests protocols were applied to the project's state of the art alkaline and PEM (polymer electrolyte membrane) WE systems, up to 300 kW in size, to get feedback on the testing protocols' applicability, as well as the suitability of the WE systems for the service. It has been found that with the right setting of the system components both types of WE system can perform all services. In parallel the economic parameters of present and future business cases were analyzed.

ITM power PEM electrolyser used for grid service tests at DTU



Example testing protocol for FCR with data evaluation (inset). Source: DLR



aFRR test result with NEL 300 kW alkaline electrolyser. Source: NEL

WORK PACKAGES

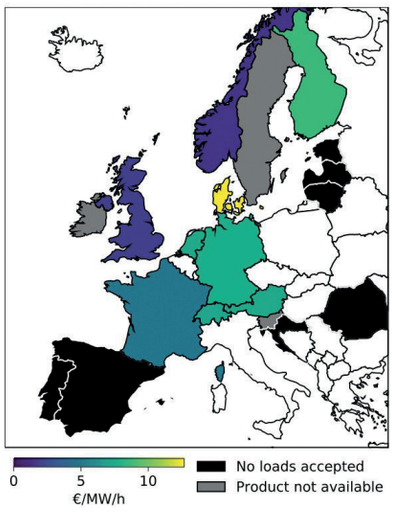
WORK PACKAGE 1, 2
GRID SERVICES REQUIREMENTS AND DEFINITION OF TESTING PROTOCOLS

European countries' electricity grid services still show many variations between countries with only some harmonization. An overview report of the most important electricity grid services in European countries including their prequalification procedures was composed including their timing and volume requirements. Based on the services FCR, FRR and RR that can be offered by loads in many European countries, this project has developed unified testing protocols that include the variations and uniqueness of the services in different countries. They can be used to qualify the system for a single service or for all services. Feedback from the experimental application of the tests gives a final draft that is being submitted as a proposal for standardization.

WORK PACKAGE 3-5
PROTOCOL VALIDATION AND ELECTROLYZER QUALIFICATION FOR PEM AND ALKALINE ELECTROLYZER

The final definition of the testing protocols is being achieved after the iterative definition and experimental validation of the methodology proposed. QualyGridS partners are dedicated to implement these protocols in alkaline and PEM WE systems that range from pilot up to industrial scale. The main objectives are to verify the minimum system requirements and capabilities to test grid services, the definition of environmental and safety conditions and the validation in near to real grid service mode.

High dynamics of state of the art WE systems allows for successful provision of grid services. As results of this work, the analysis of both testing methodology and experimental validation will be available in two public reports.

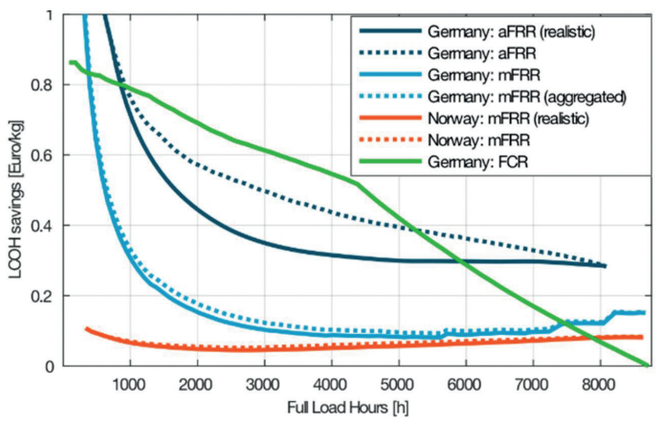


Results of the survey on business logic data: average availability prices for FCR (symmetrical) of 2016. Source: HSLU

WORK PACKAGE 6
TECHNO-ECONOMIC ANALYSIS AND BUSINESS CASES

Best opportunities for European grid service markets to be served by WEs are identified. Financial and business logic data is available for 25 European countries incl. Norway and Switzerland for TSO and DSO services. With eight highly promising cases a more detailed economic analysis is made for a WE with daily storage capacity. Offering the WE's flexibility to the grid service markets can reduce the levelized cost of hydrogen at the WE outlet (LCOH) by up to 10% under ideal conditions. Dynamic simulations with optimization of the operating strategy and of the size of the system were performed.

A second part of the analysis studied the potential future evolutions that could change the current picture. Simulations were done on prospective scenarios, highlighting notably the potential impact of electricity prices evolution on the results. For the DSO grid service case, a future congestion management case is analyzed. A feasible operation in that case can be achieved for high curtailment scenarios only.



Hydrogen-cost-savings due to grid services for alkaline WE considering different grid services in Germany and Norway. Source: HSLU

Container-integrated PEM electrolyzer linked to a H2 refuelling station used at DLR for grid service testing

GET INVOLVED

Our activities need information input and the feedback from the actors in the field like WE manufacturers, grid service responsible parties, owners of WE systems and users of hydrogen to develop the most appropriate testing protocol that can be transferred into an international standard. An advisory board from the field supports the project. A series of symposia was established: **www.gridservicemarkets.com**. However we are very interested in further interactions with you. Get in contact with the project! See **www.qualygrids.eu** or contact project coordinator Ms Regine Reißner: **Regine.Reissner@dlr.de** for more information about the project and its standardization initiatives.

PROJECT CONSORTIUM

DLR · Lucerne University of Applied Sciences and Arts HOCHSCHULE LUZERN · ITM POWER Energy Storage | Clean Fuel · Ha FUNDACIÓN PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGÍAS DEL HIDRÓGENO EN ARAGÓN · cea · nel · DTU Denmark Technical University · NEN · EFCF EUROPEAN FUEL CELL FORUM · iht INDUSTRIE HAUTE TECHNOLOGIE

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