RELIABLE PRODUCTION SYSTEMS FOR THE GROWTH OF HYDROGEN

Joint Industry Project is shaping the future for global risk management of clean hydrogen production systems via internationally accepted certification scheme.
INTRODUCTION

Hydrogen is emerging as a vital energy carrier globally when it comes to providing a sustainable solution for the reduction of CO2. The reliable and efficient production of hydrogen is crucial for its widespread adoption and integration into hard-to-abate sectors. DNV predicts that the share of hydrogen in the energy mix will only be 0.5% in 2030 and 5% in 2050. However, to meet Paris Agreement targets, hydrogen uptake needs to triple to meet 15% of energy demand by mid-century.

To grow confidence in the market, electrolyser systems in particular need further standardization and certification to reduce uncertainties and risks in industrializing large hydrogen projects. DNV is tackling this challenge by joining forces with major industry partners1 to work towards a new certification scheme and industry best practice for clean hydrogen production systems.

The Joint Industry Project (JIP) “Certification of Hydrogen Production Systems by Electrolysis” is delivering the first global and industry originated set of knowledge required for the certification of hydrogen production equipment. This lays the foundation to combine the high safety standards of the established oil and gas industry with the experience of the rapidly growing renewable energy generation sector. Such an approach is unique in the world, and necessary to reduce uncertainties and risks in the rapid industrialization of large-scale hydrogen projects.

The following content gives a first insight on results of the JIP and the upcoming DNV certification scheme for hydrogen production systems.

OVERVIEW

The JIP was initiated and managed by DNV providing the basis for a certification scheme of hydrogen production systems which is essential to ensure safety, performance, and environmental sustainability of hydrogen as a clean energy carrier. It involves a comprehensive assessment of the design, construction, operation, and maintenance practices employed by hydrogen production facilities.

---

1 government, regulators and authorities
manufacturers (electrolyser, wind turbines, solar plants, battery, pipelines)
power plant developers, owners and operators
H2-processing industries
gas and electrical grid operators
Industrial automation company
financial institution and insurance companies.
A certification process provides stakeholders, including investors, regulators, and end-users, with the confidence that the certified systems meet internationally accepted standards and deliver high-quality hydrogen projects. Certification of hydrogen production systems is typically carried out by independent third-party organizations with expertise in hydrogen technologies and relevant standards. These certification bodies like DNV assess the compliance of the system with applicable regulations, technical standards, and best practices.

CERTIFICATION APPROACH

To reach a broad agreement between all relevant stakeholders, the resulting DNV certification scheme considers applicable requirements of other international recognized certification schemes like ISO, IEC, ASME etc.

Therefore, the JIP approach included the following steps:

- Reviewing and collecting of aspects needed to be certified according to existing regulations and standards
- Identifying gaps in the existing regulations and standards
- Providing feedback to fill the identified gaps

The partners have identified three main levels for approaching the certification of hydrogen production systems (Figure 1):

- **Component certification**: covering the assessment of individual components such as stacks, pipework and pressure vessels intended for use in an electrolyser system. This can also cover a sub assembly system where a collection of components is integrated, which however do not have the functionality to perform electrolysis alone.

- **Assembly certification**: covering the assessment of a combination of components into a working unit, that when integrated with equipment outside of the scope of the certification scheme, form a functional electrolysis unit. This will typically take the form of a containerized or ‘skid mounted’ system.

- **Project certification**: covering the assessment of integration of electrolyser systems into a specific application, within the scope of the certification scheme.
To develop these three certification levels, different insights on the regulatory, geographical and safety and reliability level have been taken into account.

1. **Regulatory Insights**

Technical and environmental performance, as well as safety and reliability have been identified and evaluated as key areas for the certification of hydrogen production systems. International and regional requirements have been identified and extensively listed, whether for onshore or offshore application, fixed or floating (Figure 2).
2. Performance Insights

On performance and testing of electrolyser systems, the JIP covers:

- Proposed system boundary limits and scope of performance parameters to allow for testing electrolysers on an equal and comparable base.
- Indicators to express the performance of an electrolyser, and an extensive list of variables affecting these indicators was established. Methods for testing and any limitations to consider are also described.
- Conditions that should be met during testing. It covers the input conditions, the operational conditions, measurements and safety requirements that should be met during testing.
- Methodology for conducting various tests including applicable measurement technologies.
Methodologies for determining performance based on verification, including availability and sustainability.

- Hydrogen production applications involve complex systems and the inherent complexities and uncertainties associated with such systems must be considered in conjunction, rather than separately. This can be achieved through the use of appropriate risk management and performance forecasting tools.
- To assess the sustainability of a hydrogen production system, a framework is provided for evaluating the operational impact of different electrolysers, including life cycle assessments and recyclability.

3. Safety and Reliability Insights

The JIP partners have defined the technical criteria to manage the hazards for an electrolyser system. The system level hazard management is based on the Safety and Environmental Critical Element (SECE) barrier model approach. The criteria for system safety have been defined, and the regulatory requirements for each region based upon SECE barriers have been mapped.

CONCLUSIONS AND NEXT STEPS

As an outcome of this JIP, DNV perceived the urgency for a holistic and internationally recognized certification approach in a time of global energy transition to boost confidence and international cooperation. Ensuring safety is paramount to protect lives and the environment, while performance evaluation drives efficiency and technological advancements.

A global certification scheme will assure safe and efficient production practices and promote sustainability, enabling the global adoption of hydrogen as a key renewable energy solution. To get this started, DNV is working on service documents based on the JIP results which will be published in Q4 2023.

Furthermore, each JIP partner will independently analyze and incorporate the results into their respective business objectives. This includes ensuring the safety of production, storage, and transport systems, as well as assessing the service life of electrolysers for developers and owners and evaluating performance through testing conducted by test institutes and verification of long-term performance. Thus, Fraunhofer will initiate a project for performance testing. The core of the project idea is the comparison of the performance of an alkaline and an PEM electrolyser under dynamic load conditions, whereby the evaluation will be strongly oriented towards the JIP results.
LET’S TALK TO GET IT STARTED

Are you working on a hydrogen project and want to certify it for the market and grow confidence between all of your stakeholders? Contact us now to discuss your needs and scope.

Contacts:
Axel Dombrowski
Director of Innovation and Digitalization, Renewables Certification.
Email: axel.dombrowski@dnv.com
Phone: +49 1776756134

Alessandro Singlitico
Senior Business Developer and Sales Engineer for Hydrogen Applications, Renewables Certification.
Email: alessandro.singlitico@dnv.com
Phone: +45 51755017

DNV thanks all Industry partners who have contributed to the Joint Industry Project: