



TÜV Rheinland One-Stop Solutions for Hydrogen

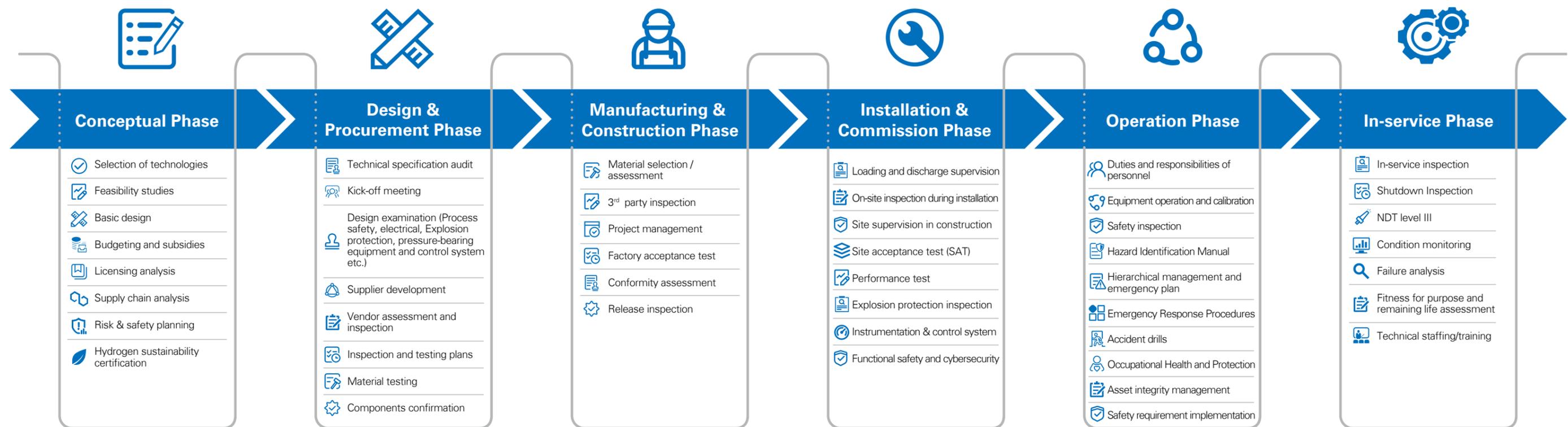
www.tuv.com/hydrogen

 **TÜVRheinland[®]**
Precisely Right.

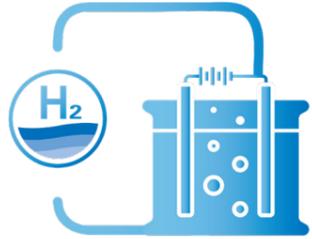


Your Reliable Partner with global experience in hydrogen solutions Today for Tomorrow.

Comprehensive Technical Services for Every Stage of Your Hydrogen Project



Water Electrolysis



Full-spectrum technical support for your hydrogen project — ensuring compliance, safety, and performance.

PRODUCT

- ALK Cell stacks and system
- PEM Cell stacks and system
- AEM Cell stacks and system
- SOEC Cell stacks and system

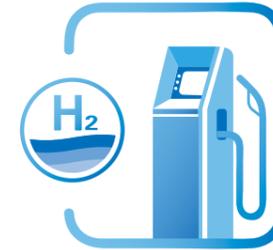
TESTING AND INSPECTION

- Startup performance
- Dynamic response
- DC Energy consumption
- Shutdown curve
- Holding test
- Polarisation curve
- Accelerated stress
- Durability test
- Load test
- Coupling test
- 3rd party inspection
- Material test
- Vendor assessment

CERTIFICATION SERVICE

- CE certificate (PED, ATEX, MD, LVD, EMC)
- ASME & CRN
- DOSH / MOM / CU-TR / MHLW / AS & NZW etc.
- ISO 22734 certificate
- Certification based on industry / GB / international standards
- TÜV Rheinland 2pfg CH0031 safety certificate
- TÜV Rheinland H2.22 certificate
- Functional safety certificate
- Hydrogen sustainability certification
- CertifHy EU RFNBO certification

Hydrogen Refueling Station



Our experts can provide overseas market access certification services for hydrogen refuelling station equipment, as well as technical services for all stages of hydrogen refuelling station design, construction, installation and commissioning, and operation and maintenance.

PRODUCT

- Valves and Fittings
- Filter
- Heat exchangers
- Sensors
- Unloading columns
- Compressors
- Sequence control
- Dispenser
- Nozzle
- Dispenser Hoses
- Other Products

TESTING AND INSPECTION

- Hydrogen compatibility testing
- Type testing
- Risk analysis and control
- Design examination
- Construction process management
- Installation inspection and testing
- Hydrogen safety training
- System audits
- Advanced NDT
- Technical expertise

CERTIFICATION SERVICE

- CE certificate (PED, ATEX, MD, LVD, EMC)
- Brazil, Japan, Korea, India, South Africa, Singapore, Australia, Malaysia certificate etc.
- Certification based on ISO 19880 series, CSA/ANSI series, NFPA 2, SAE, Vdtuv etc
- Fuelling protocol (SAE J2601, GB)
- Functional safety assessment of control systems
- Conformity assessment based on GB and local standards



Hydrogen Blending in Nature Gas Pipeline



We ensure safe hydrogen blending in natural gas pipelines, defining maximum hydrogen concentration based on system conditions and materials.

Key Phases and Tasks in a Gas Pipeline Hydrogen Blending Project

Phase 1

- Project initiation
 - Data acquisition
 - Data assessment
 - Preliminary concept
 - Risk assessment
- Determination the actual state of the pipeline, potential obstacles and all tasks for further work.

Phase 2

- Material and component evaluation
 - Lifetime and deficiency assessment
 - Design / component / seal changes (if any)
 - Instrumentation / Monitoring concept
- Determination all pipelines and gas installations are suitable for temporary pilot operation with H₂.

Phase 3

- Stepwise introduction of H₂-admixture
 - Effects monitoring
 - Laboratory testing of samples (if required)
 - Measurement adjustment on H₂-admixture
- Completion report the safety requirements for the H₂-admixture are fulfilled and that all gas devices work safely with the mixed gas

Phase 4

- Target admixture achieved
 - Operation monitoring
- Project completion report

Phase 5

- Normal operation
- Normal operation or the restoration of the status quo prior to the H₂ project.

Hydrogen Storage and Transportation



We offer design examination, type approval, and initial inspection services for all types of hydrogen storage systems – including steel, composite, cryogenic vessels, and metal hydride solutions.

PRODUCT

- Seamless steel gas cylinders
- Composition gas cylinders
- Cylinder bundles
- Seamless steel tubes
- MEGC
- High pressure hydrogen storage vessels
- Metal hydride storage system
- Liquid hydrogen storage vessel
- Liquid hydrogen tankers
- Valve and fittings

TESTING AND INSPECTION

- Hydrogen compatibility testing
- Mechanical properties of materials
- Witness performance test
- Vendor assessment
- RBI inspection
- Anti-corrosion inspection
- Advanced NDT
- Quantitative risk analysis

CERTIFICATION SERVICE

- TPED/UN type approval
- TPED/UN batch/period inspection
- IMDG type approval and batch inspection
- TPED in-house inspection certificate
- PED certificate and inspection
- DOT/TC/UN type approval and inspection
- E/e Mark type approval certificate



Hydrogen Gas Powered Vehicles



PRODUCT

- Hydrogen cylinder (Type III & IV)
- Assembly valve
- Nozzle
- Pressure regulator
- Automatic valves
- Manual valves
- Pressure relief valves
- Pressure relief device
- Excess flow valves
- Sensors
- Filter assemblies
- Fittings and pipes
- Hydrogen injectors
- Control system

TESTING AND INSPECTION

- Hydrogen compatibility test
- Type testing
- Control system SIL assessment
- Hydrogen storage system risk analysis

CERTIFICATION SERVICE

- e/E mark type approval and testing
- Type approval as per EC79/2009, GTR13, ISO 19887, SAE 2600, HGV 3.1 etc

We offer E/E Mark type approval for hydrogen storage systems and key components, supported by certification and testing services aligned with global standards.

Hydrogen Blending Combustion Laboratory



PRODUCT

- Water heater
- Heating furnace
- Heater
- Gas appliances
- Gas steamer
- Gas oven
- Ovens
- Seals
- Components

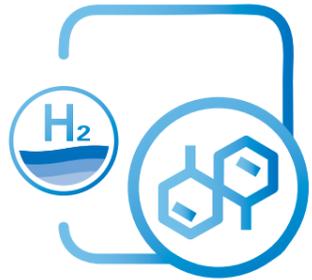
TESTING AND INSPECTION

- Gas tightness testing
- Gas component testing
- Combustion condition test
- Thermal load test
- Temperature rise test
- Performance test
- Safety performance test
- Energy efficiency test
- CO and NO_x concentration test in flue gas
- Durability testing
- Other manufacturer R&D tests

Hydrogen blending changes the properties of natural gas, impacting combustion performance and emissions. The laboratory of TÜV Rheinland studies these effects across different hydrogen concentrations to support safe and efficient appliance operation.



Material Testing



We offer core material testing services and partners with leading universities to deliver specialist in-situ hydrogen testing and failure analysis.

MATERIAL CATEGORY

- Metal material
- Non-metal material
- Cell stacks material

METAL MATERIAL

- Chemical composition analysis
- Mechanical property testing
- Metallographic examination
- Hydrogen compatibility test
- Hydrogen embrittlement sensitivity test
- Stress corrosion test
- Creep test
- Corrosion test

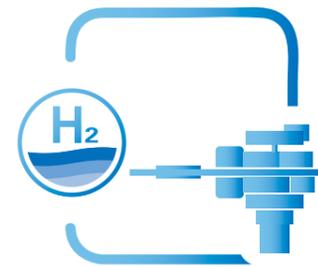
NON-METAL MATERIAL

- Tensile test
- Compression permanent deformation test
- Hardness change test
- Temperature retraction test
- Oxygen ageing resistance test
- Hydrogen compatibility test
- Hydrogen permeation test
- Ozone compatibility test

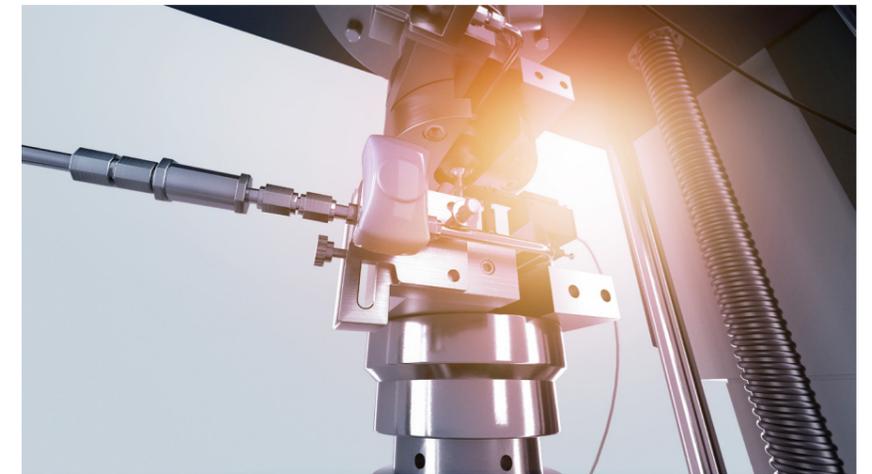
CELL STACKS MATERIAL PERFORMANCE TESTING

- Chemical Properties: Metal Solubility, Oxidative Stability, Ion Exchange Capacity, Reaction Kinetics.
- Electrical Properties: Electrical conductivity, contact resistance, ionic conductivity.
- Physical Properties: Tensile strength, elongation at break, Young's modulus, porosity and void structure, hydrolytic stability, surface roughness, microstructure, etc.
- Thermal Properties: Thermal conductivity, thermal expansion, thermal decomposition, glass transition temperature.

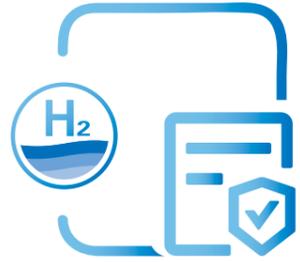
Hollow Specimen Testing



TÜV Rheinland Shanghai Metallic Materials Laboratory can provide hollow specimen testing services, include slow strain rate tests (SSRT) and creep tests which used for material hydrogen compatibility studies in the fields of hydrogen storage containers, gas cylinders, fittings and valves, natural gas hydrogen blending pipelines, and pure hydrogen pipelines



Risk & Safety Management



- Risk analysis: risk identification and assessment according to recognized methods such as Bowtie, FMEA / HAZOP / HAZID / PAAG / ROGA, LOPA, QRA, ALARP Demonstrations
- Risk management: safety management system, Disaster Management (DISMA), support with SIL classification, project management, Asset integrity management, Process safety management, PIMS, BCM, ERM, HSSE MS/cases, Risk management system documentation etc.
- Quantitative Risk Assessment(QRA) and Consequence modelling
- Fire and explosion risk analysis
- Hazardous area classification and Dangerous Substances and Explosive Atmospheres Assessments (DSEAR)
- Escape, Evacuation and Rescue Analysis(EERA)
- Emergency response procedure development
- Engineering design: FEED and detailed design, pressure relief design and verification, process safety owners engineering
- Full lifecycle management of Safety Instrument System (SIS)
- RAMS assessment service for hydrogen system



Hydrogen Safety Training



TÜV Rheinland delivers site-specific training solutions to meet the individual needs of companies across the hydrogen value chain.

BASIC PROPERTIES AND APPLICATIONS OF HYDROGEN HYDROGEN SAFETY REGULATIONS AND STANDARDS

HYDROGEN PRODUCTION, STORAGE, TRANSPORT AND REFUELLING SAFETY REQUIREMENTS

- Safety requirements for hydrogen storage systems
- Hydrogen and oxygen safety requirements at hydrogen production sites
- Safety requirements during hydrogen transport
- Safety requirements during hydrogen loading, unloading, compression and refuelling

EXPLOSION PROTECTIVE TRAINING

- Hazardous area classification
- Ignition source analysis
- Release source analysis
- Ventilation requirements and design
- Selection, installation and maintenance of electrical equipment
- Explosion-proof requirements for non-electrical mechanical
- IECEx 05 Certificate of Personnel Competencies (CoPC)

HYDROGEN SAFETY MANAGEMENT

- Hydrogen safety management system
- Safe operation procedures
- Hierarchical control and emergency plan procedure
- Emergency rescue procedures

CASE STUDIES AND PRACTICAL EXERCISES

- Hydrogen accident case studies
- Periodic inspection and maintenance
- Hydrogen leakage detection and preventive measures
- Emergency response and accident handling procedures
- Accident drills

RISK ANALYSIS AND MANAGEMENT

- Hazard Identification for Hydrogen-Related Sites
- Hazard and operability analysis (HAZOP)
- Safety instrumented system design requirements and implementation level calculations
- Quantitative risk assessment and risk management



Renewable Hydrogen & Its Derivatives Certification (RFNBO)



ABOUT RENEWABLE HYDROGEN

- The priority for the EU is to develop renewable hydrogen.
- The REPowerEU Strategy of 2022 set out the aim of producing 10 million tonnes and importing 10 million tonnes by 2030. By 2050, renewable hydrogen is to cover around 10% of the EU's energy needs, significantly decarbonising energy intensive industrial processes and the transport sector.

WHAT IS RFNBO?

- Renewable hydrogen is produced through the process of **electrolysis**, is therefore a 'renewable fuel of non-biological origin' (RFNBO).
- Also applicable to renewable hydrogen derivatives such as **E-ammonia, E-methanol**

ABOUT CERTIFHY

- CertifHy: Powering Compliance and Market Access for RFNBO and Renewable Hydrogen Certification
- CertifHy is a European certification system for sustainably produced hydrogen and e-fuels. The CertifHy EU RFNBO Voluntary Scheme was officially recognized by the European Commission at the end of 2024.

QUALIFICATIONS AND CAPABILITIES

- At the end of March 2025, TÜV Rheinland officially became one of the first certification bodies authorised to operate under the CertifHy EU RFNBO Voluntary Scheme.
- TÜV Rheinland provides CertifHy certification to a wide range of stakeholders, sharing its own accumulated experience in the RFNBO sector to help you unlock market value, comply with regulations, and receive incentives in Europe.

CERTIFICATION SCHEME & BASIS

- CertifHy EU RFNBO Voluntary Scheme
- RED II (EU) 2018/2001
- Delegated Act (EU) 2023/1184
- Delegated Act (EU) 2023/1185

OUR CERTIFICATION LOOKS AT

We offer both certification and an upstream pre-certification (design stage). As with other certifications, the latter involves the collaboration between the operator (e.g. the hydrogen producer), an external consultant (e.g. Hincio or LBST) and the certification body (TÜV Rheinland) even before the plant goes into operation. The initial certification is performed in line with the commissioning of the plant, followed by ex-post certification six months later. Thereafter, a re-certification is required at least annually.

WE SUPPORT YOU THROUGHOUT THE ENTIRE CERTIFICATION PROCESS:



CertifHy or H2.21 – Which standard is right for your market?

Are you active outside regulated EU markets? If so, our TÜV Rheinland Standard H2.21 could be the best solution for you. It offers a flexible framework for the certification of green and low-carbon hydrogen in unregulated or international markets



Ask our experts about hydrogen.

ONLINE CONTACT

TÜV Rheinland Industrial Services
Global Hydrogen Competence Center
Am Grauen Stein
51105 Cologne, Germany
industrial-services@tuv.com

www.tuv.com/hydrogen

 **TÜVRheinland**®
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