Cockerill Jingli Hydrogen

Focused on Alkaline Water Electrolyser hydrogen system for over 30 years

John Cockerill

Agenda

Focused On Alkaline Water Electrolysis Hydrogen Production Equipment For Over 30 Years

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How we’re recognized

Who Are We

John Cockerill

About
John Cockerill

John Cockerill, headquartered in Seraing, Liege, Belgium, is an multinational corporation with more than 200 years of industrial equipment production and operation experience.

John Cockerill Group develops large-scale technological solutions to meet the needs of its time: facilitating access to low carbon energies, enabling sustainable industrial production, preserving natural resources, contributing to greener mobility, enhancing security and installing critical infrastructures.

Its offer to companies, States and communities consists of services and associated equipment for the sectors of energy, defence, industry, the environment, transports, and infrastructures.

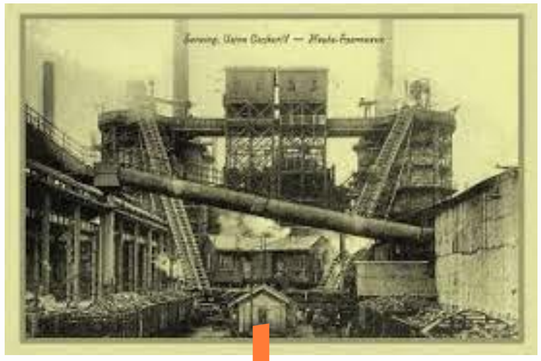
A strong history, resolutely looking to the future

More than 200 years of technological innovation

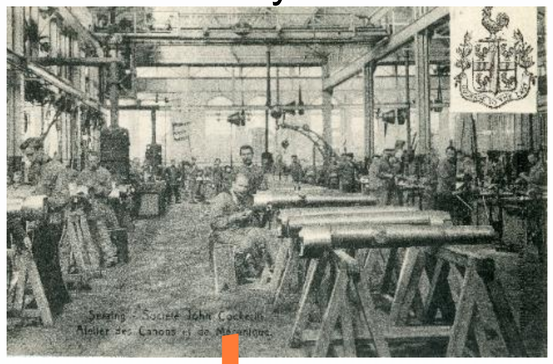
1817

Castle, former summer residence of the prince-bishops of Liege
HQ John Cockerill Group

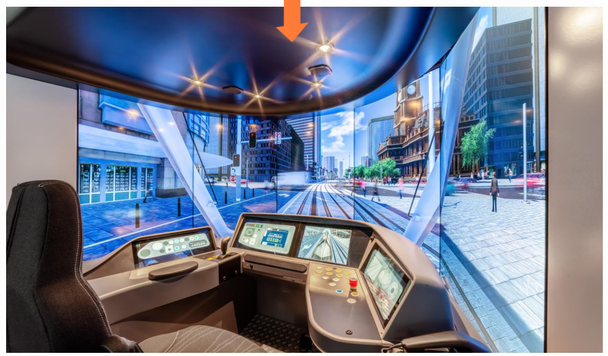
1st coke oven



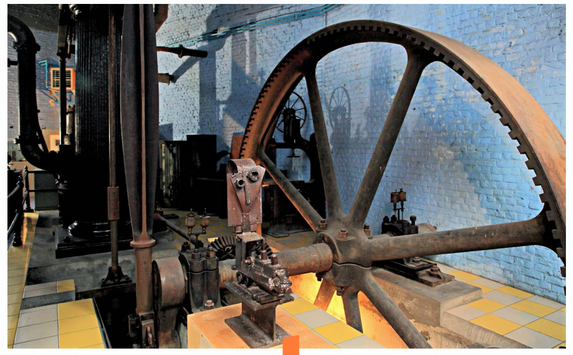
Cannon factory



Locomotives

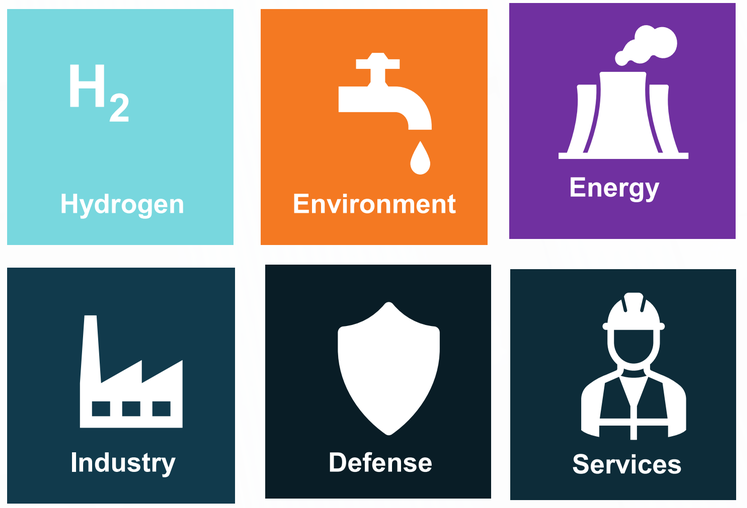


Steam generator



A Mission: meeting the needs of our time

Managed through operational



John Cockerill Group – A leading technology partner to industrial companies

200+ years
delivering industry technologies

91+
worldwide subsidiaries locally anchored

>€1,1 billion
in annual turnover

2002
the Group is privately held since 2002

7200+
motivated talents worldwide

TOP
Energy transition

60
nationalities

30+ years
experience and expertise in hydrogen solutions

Resolutely committed to an ESG approach

ENVIRONMENT

- **Improving the environmental footprint of our projects, products and services (Eco-efficient design)**
- **Improving the environmental footprint of our organization (Eco-working)**

- Evolution of the carbon balance (in t of CO_2 equivalent, HQ perimeter): **-35%** (2020 vs. 2019)

SOCIAL

- **Improving the experience of our employees**

- Sustainable commitment rate of employees*: **79%**
- Frequency rate of accidents with lost time*: **2.75**
- Proportion Women / Men (in %)*: **13 / 87**

- **Being a committed corporate citizen**

- Number of solidarity projects supported by the John Cockerill Foundation*: **22**

GOVERNANCE

- **Deploying exemplary governance**

- Board of Directors attendance rate*: **95.4%**

* Base year: 2021

John Cockerill Hydrogen - A leading provider of large-scale green hydrogen production solutions

Overview

- Among the leaders in pressurized alkaline
- Unparalleled experience for 100MW+ projects
- Global player with multi-local presence
- Partnership for innovative turnkey solutions
- Hydrogen refueling solutions for mobility
- Backing of strong industrial partners

Key figures

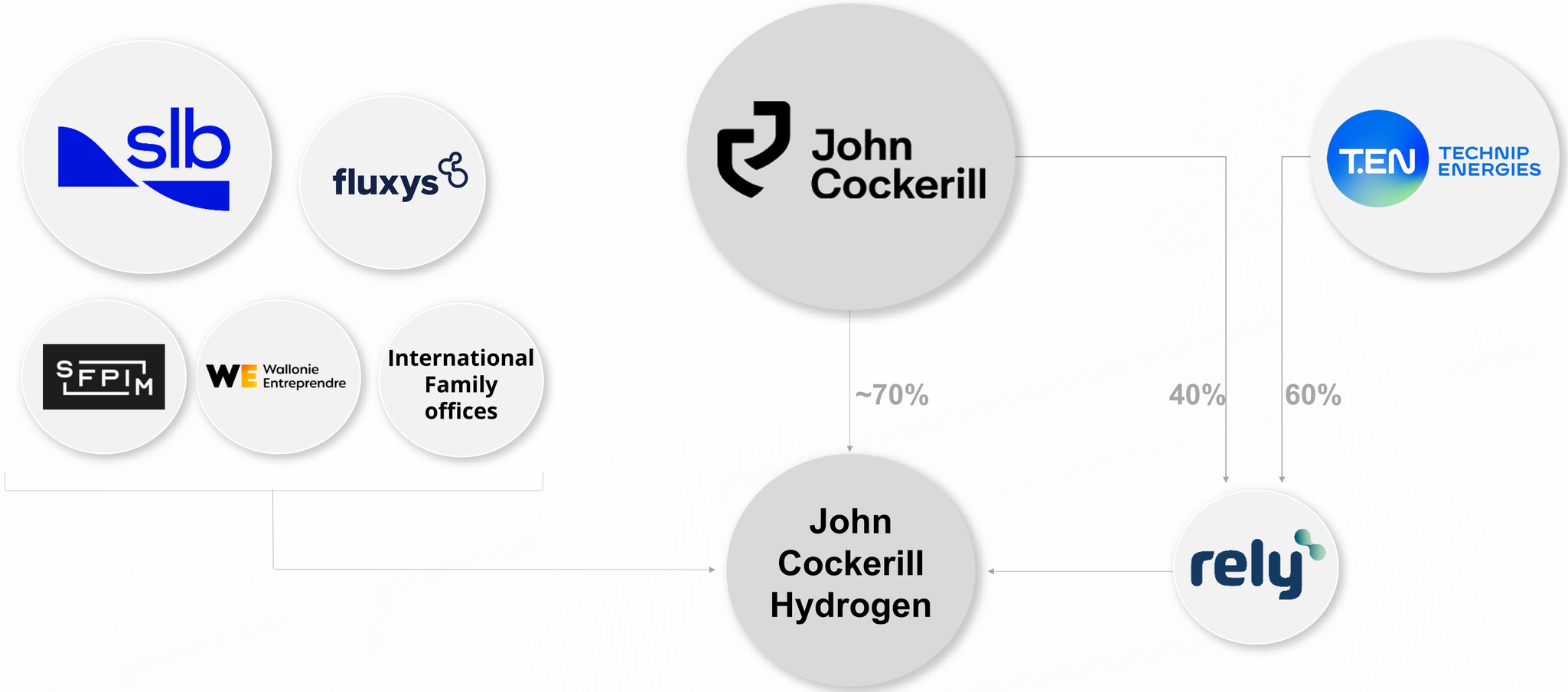
>600 MW / >1300 electrolyzers delivered in 30 countries since 1993

>80 stacks of 5 MW delivered since 2018 (among the largest on the market)

>500 employees globally

30+ years of experience in the manufacture of electrolyzers

John Cockerill Hydrogen raised €230m equity in 2024 and €116m in 2025 - backed by leading industrial companies and public investment funds



From its Belgian headquarter, John Cockerill Hydrogen implements regional manufacturing hubs with strategic partners, close to its customers

Headquarter
- Seraing, Belgium

Gigafactory in operations
- **Europe**
  Aspach, France
  Seraing, Belgium
- **China**
  Suzhou, China

Gigafactory in construction
- **United States of America**
- **India**

Gigafactory in development
- **United Arab Emirates**

Partnerships
- Vietnam
- Morocco

John Cockerill Hydrogen Gigafactories overview

	GF1 | China	GF2 | Europe	GF3 | USA	GF4 | India
Location	Suzhou (China)	Aspach (France) + Seraing (Belgium)	Houston, Texas (USA)	Kakinada (India)
Ownership	100% (since 2022)	100%	100%	60% (Joint venture with greenko)
Nominal capacity	1GW/year	1GW/year (to be achieved by 2026)	1GW/year	1GW/year
Factory status	**Operational** since 2019	**Operational** since 2024	**In construction** start in 2025	**In construction** start in 2025
Scope of activities	Cell manufacturing + Stack assembly	Cell manufacturing + Stack assembly	Stack assembly only (initially)	Stack assembly only (initially)

Local cell manufacturing will be added as soon as market demand is confirmed

John Cockerill Hydrogen has roots dating back to 1817 and 30+ years of experience in the manufacture of electrolyzers

1817
Founding of the company John Cockerill

1993
Founding of Suzhou Jingli Hydrogen, a company dedicated to the manufacture and sale of hydrogen electrolyzers

2018
Creation of Cockerill Jingli Hydrogen (JV held at 56% by John Cockerill)

2021
John Cockerill Hydrogen is incorporated

2022
- Cockerill Jingli Hydrogen becomes a 100% subsidiary of John Cockerill Hydrogen
- Joint venture with greenko for the Indian market

[20-30%] global market share during this period

2023
- Creation of rely, a joint venture between Technip Energies and John Cockerill
- Acquisition of brownfield site in Houston to launch US gigafactory

2024
- €230m fundraising and new external shareholders (SLB, SFPIM, WE, …)
- First European stack produced
- Construction of a Gigafactory in India

2025
- €116m fundraising and new external shareholder (Fluxys)
- Acquisition of key assets from McPhy

About

Cockerill Jingli Hydrogen

Cockerill Jingli Hydrogen is a wholly-owned subsidiary of John Cockerill Hydrogen. It is focused on design, research and develop, manufacture and sales of Alkaline Water Electrolyser hydrogen system for over 30 years, and it is rated as a national high-tech enterprise.

With China Europe Dual R&D Center, and CE and ASME Certification on products, products of Cockerill Jingli Hydrogen are widely used in new energy, chemical, hydrogen, metallurgy, hydrogenation station, electric power and other industries. Cockerill Jingli Hydrogen’s customers are in over 30 countries in the world.

Cockerill Jingli Hydrogen at a glance

Focused On Alkaline Water Electrolysis Hydrogen Production Equipment For Over 30 Years

Bird's-eye view

Workshop

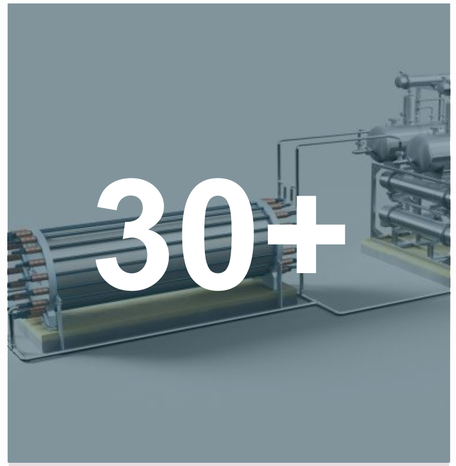
Testing laboratory

Laboratory

Showroom

Core competitiveness

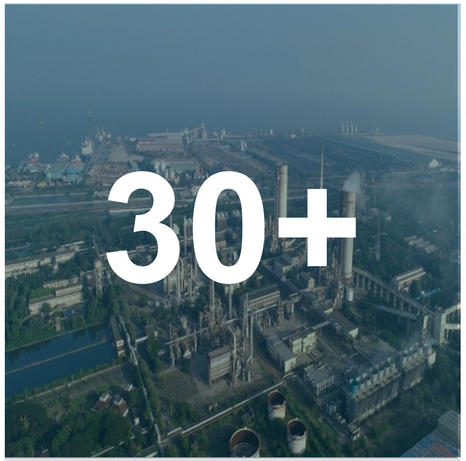
Leader in China's alkaline water electrolysis hydrogen production



Since 1992, Cockerill Jingli Hydrogen has been dedicated to producing hydrogen through alkaline electrolysis of water for over 30 years.

Cockerill Jingli Hydrogen has shipped over 1300 units of products, with customers including leading enterprises in industries such as petrochemicals, power, polysilicon, metallurgy, gas and etc.

Cockerill Jingli Hydrogen have dual R&D centers in China and Europe, with over 50 technical R&D personnel in China and over 100 in Europe.



Cockerill Jingli Hydrogen’s sales network has spread to more than 30 countries and regions. The products have been certified by multiple qualifications such as ASME, CE, ISO, and etc.

As a leader in the green hydrogen industry, Cockerill Jingli Hydrogen’s projects have verified that the longest operation life of Cockerill Jingli Hydrogen’s products has exceeded 25 years.

Why Partner With Us

John Cockerill

An R&D Steering Committee has been established to assist each party in setting clear R&D directions, as well as serve as a communication platform

R&D Steering Committee

Composition of **R&D Steering Committee:**

- Selective technicians from Cockerill Jingli Hydrogen and Cockerill Jingli Hydrogen's R&D team
- External sponsors from leading universities

Cockerill Jingli Hydrogen will establish a **technology innovation R&D center with Tongji University**

- ✓ Research Topics: mainly include electrodes, power stacks and systematization
- ✓ Research Direction: improve the electrolysis efficiency and study the power supply volatility of renewable energy water electrolysis

Role of the **R&D Steering Committee:**

- Evaluate feasibility of project initiatives
- Alignment of R&D directions
- Discuss technical trend
- Discuss technical challenges during project development

Regular meetings between John Cockerill hydrogen and Cockerill Jingli Hydrogen team

Belgium's R&D team will hold a **monthly meeting with John Cockerill Hydrogen's R&D team** to align development roadmap and exchange findings, focusing on two aspects:

- **Fundamental R&D** at the stack level
- **Applied R&D and engineering** specifics including conception, design-to-cost, mechanical resistance

Further deepen the communication

John Cockerill hydrogen and Cockerill Jingli Hydrogen will further deepen the communication of the R&D contents through:

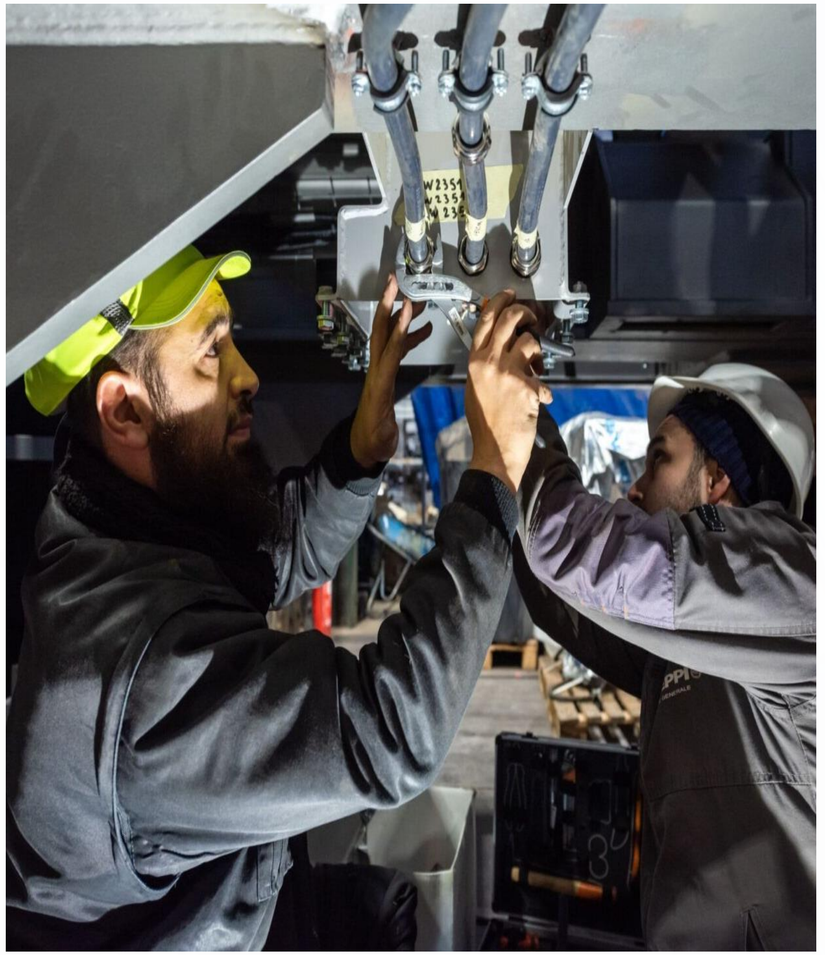
- Providing **training sessions** on each party's respective areas of expertise
- **Send R&D and technical staff to each other facilities** for in-depth learning and exchange
- Parties are discussing to send **2 electrochemistry PhDs from Cockerill Jingli Hydrogen to John Cockerill Hydrogen** to support

Continuous R&D efforts with the aim to improve efficiency, reduce consumption and deliver new products

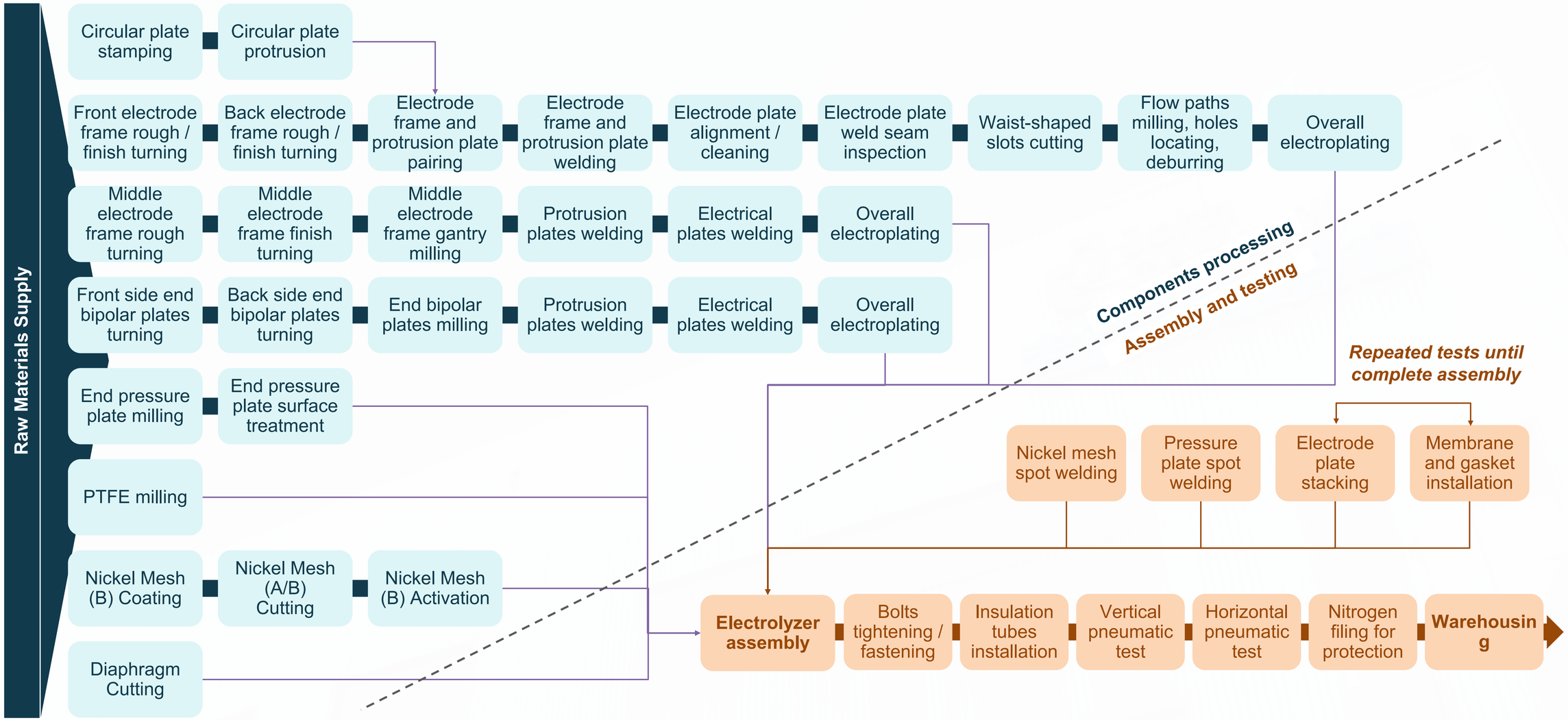
Project Name	Description
1 Verification of the **adaptability** of electrolyzers and systems	Adaptability of electrolyzers and the entire system to **different scenarios under various inputs (sources of electricity)** and **outputs (downstream applications)**
2 Response analysis of **electrolyzer system** under complex working conditions	Mitigate the impact of the **instability** of renewable power intermittency (due to **fluctuations in voltage and current inputs**) along two main directions: • Improvement of the **system design** • Improvement of the **materials used, structural design of equipment set** and **control design**
3 **Materials, structural design and optimized control** adapted to fluctuating inputs	
4 **N-to-1 module design** of electrolyzers to an integrated system set	Capability to build **2 electrolyzers or 4 electrolyzers** in one integrated system. Aim to design N-to-1 module, depending on customers' requirements

Continuous R&D efforts with the aim to improve efficiency, reduce consumption and deliver new products

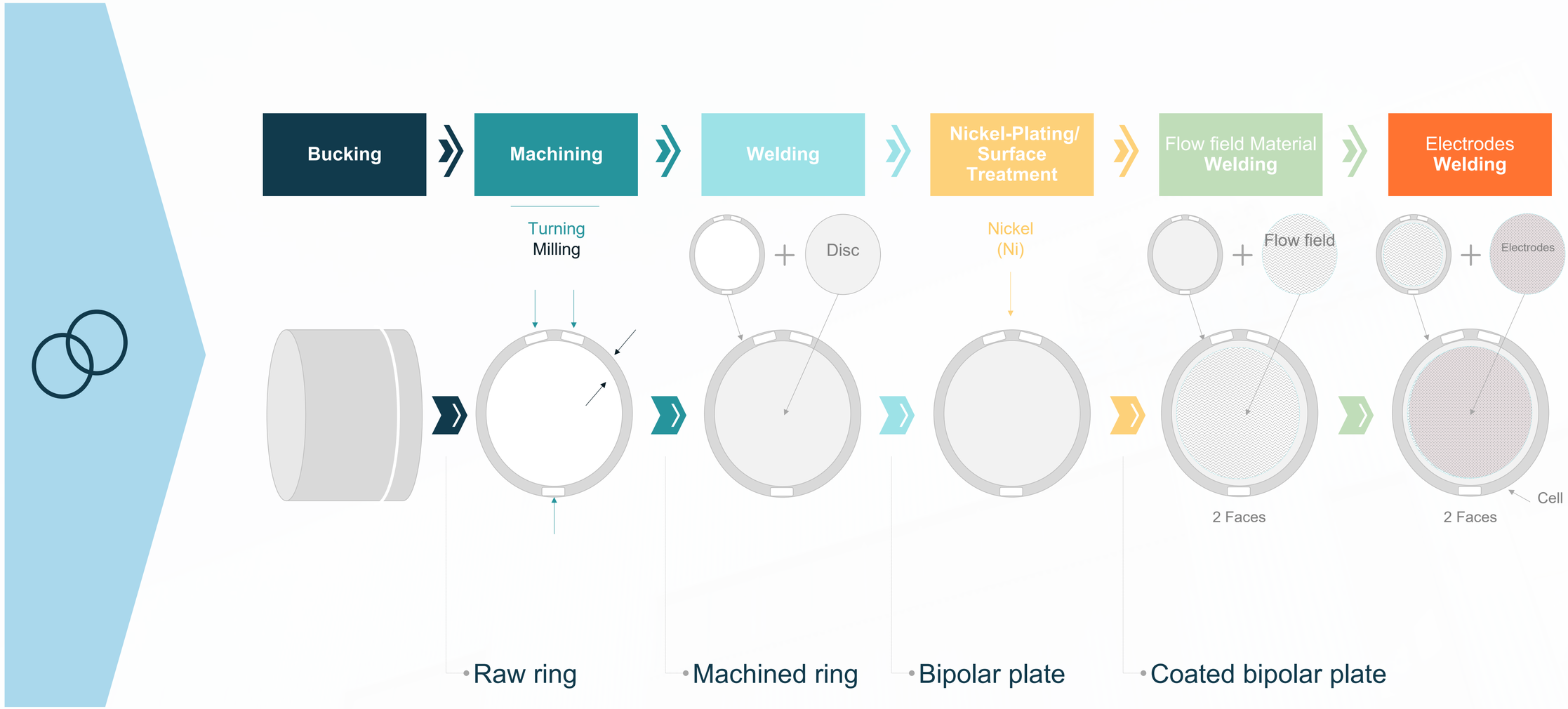
Project Name	Description
5 Solution for Lye heat exchanger and system leakage problem	Apply new materials and design new structures to solve the leakage problem from corrosion caused by **stress during the manufacturing process**, as well as the problem of **leakage caused by the structure itself**
6 Structural design and materials selection for 2000Nm³/h electrolyzer	Designing an innovative structure for a 3000 Nm³/h electrolyzer and apply superior core materials to achieve the required technical parameters: • **Structure:** optimized flow channels and selection of superior structural materials • **Membranes:** experimentation of new membranes • **Electrodes:** testing of new electrode • **New materials:** corrosion-resistant plastics
7 Design of optimized size and reliable separation and purification frameworks	Realize more **effective separation and purification result, and low pressure drop** through process optimization and structural optimization, **reducing energy loss and increasing efficiency**



Manufacturing & Assembly process



Cell manufacturing process

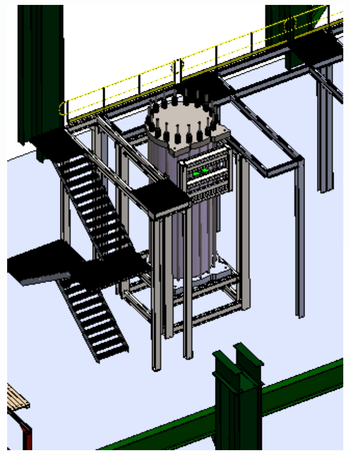


Stack assembly process

Assembly

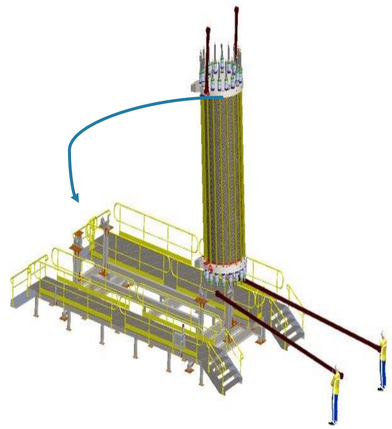
The [20-400] cells that compose the stack are stacked vertically, one piece at a time. In this crucial step, ensuring perfect alignment is key

Tightening



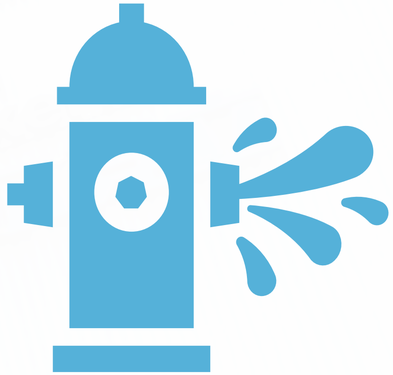
The assembled stack is then tightened through a process of heating the stack, tightening it, letting the stack cool down, and then starting again.

Tilting



Once ready, the finished stack is then tilted using powerful cranes

Tests & packaging



Before packaging & shipping, our teams proceed to a thorough testing of the stack :

- Hydrotest (using pressurized water at 1,5 design pressure)
- Leakage (using helium)
- CC test (no short circuit)
- Passivation (chemical treatment for transport)

Lead time [13] days

[2] [5] [1] [5]

Improvements efforts with the aim to improve quality, cost and delivery

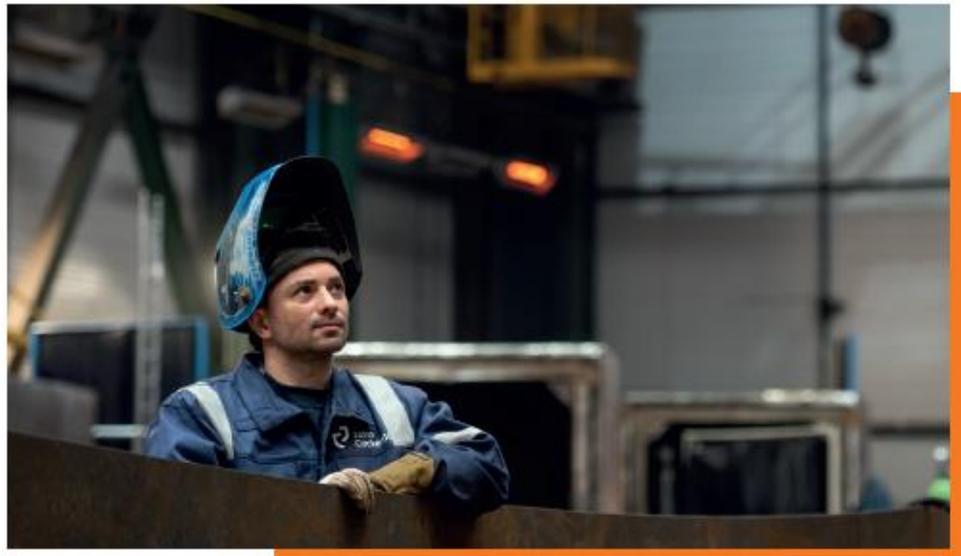
- Cross functional safety committee
- 5S/QA inspection tools on Phone (Before/After in workshop)

- Weekly Quality meeting
- Inspection & Testing Plan
- Trainings
- Streamlined procedures

- Reliability Analysis with feedback from aftersales.
- TOP 20 Issues analysis classified by Risk grade= frequency x severity
- Product FMECA on Stack to highlight priorities in the Quality Control plan

- Operational improvements
- Cost saving pipeline
- Value Stream mapping
- Pay per pieces including Quality

Customer Support at our core



We provide you with end-to-end customer support in every project phase

- **200 years of experience** at Group level in servicing demanding industries
- **A full suite of after-sales services and technical support** to ensure the optimal performance of your projects
- **Long-term service agreements** to maintain best performance levels
- **Remote monitoring:**

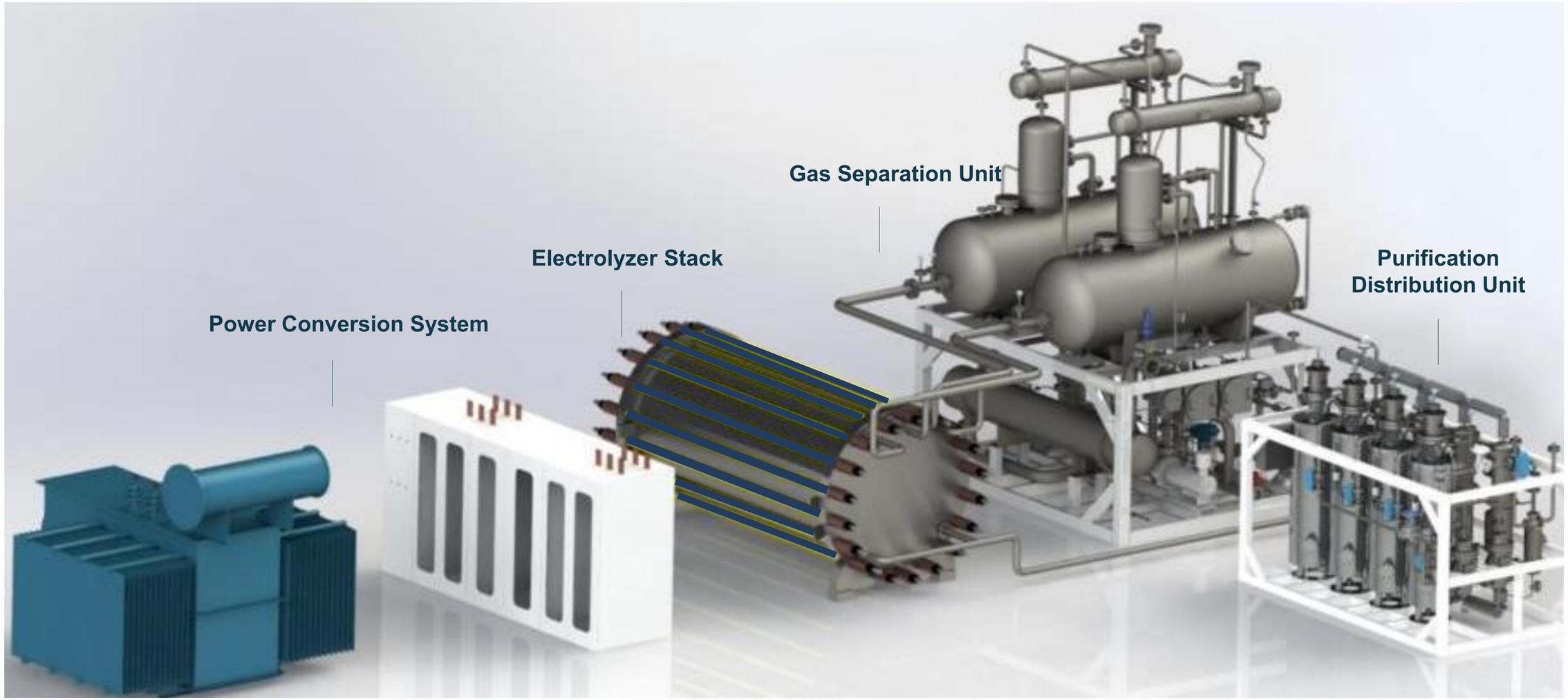
  Proactive and real-time actions on your operations

  John's Cockpit: an in-house software to process your data and monitor your operations

What We Offer

John Cockerill

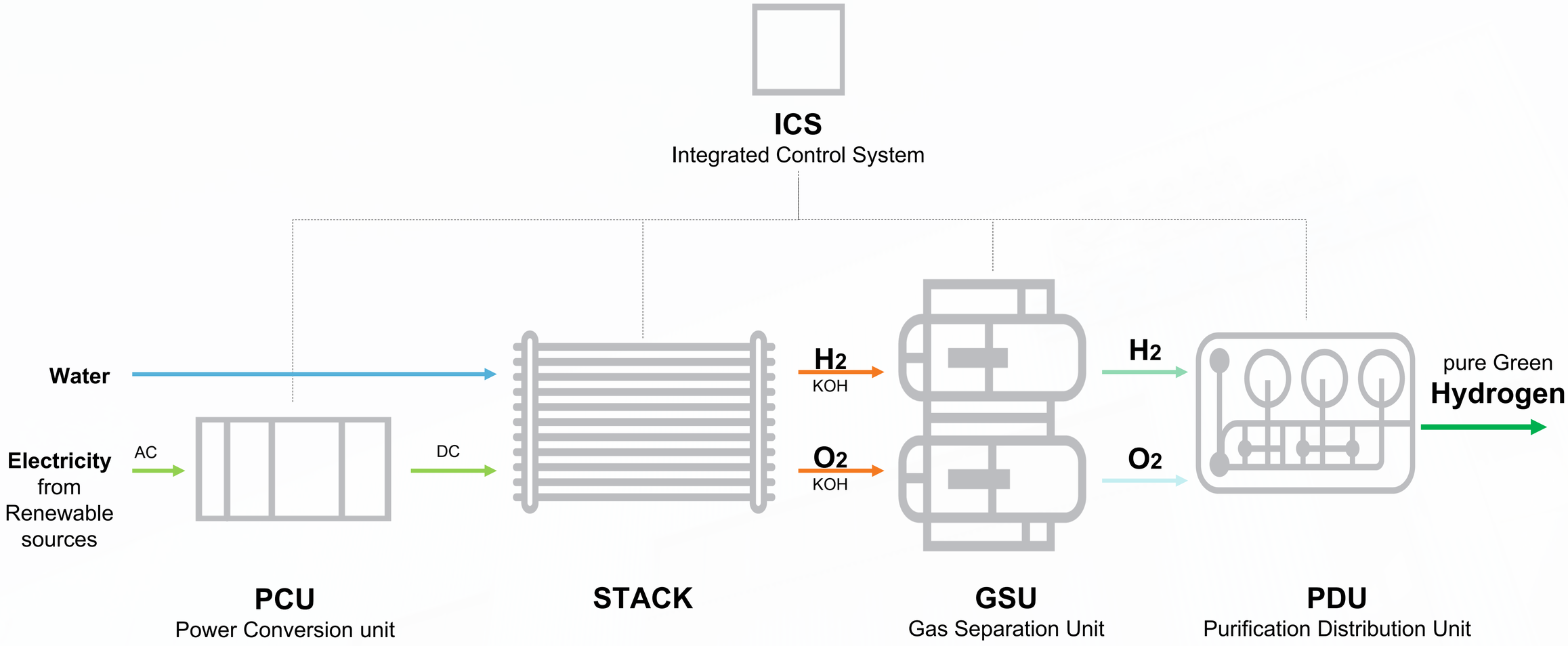
Alkaline Water Electrolyser hydrogen system



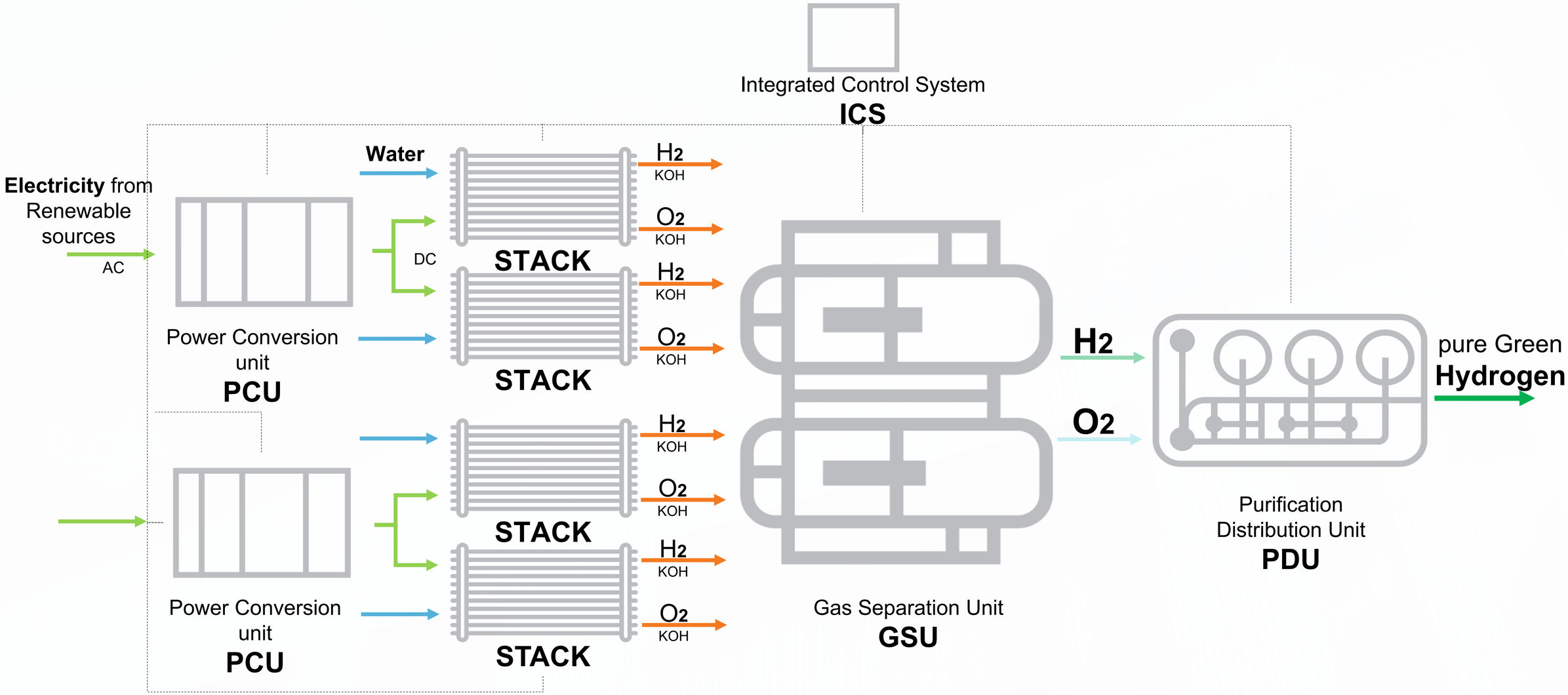
Each Series is composed of different products design, capacity of the system and the norm/standard in which it is available

Our flagship 5MW stack

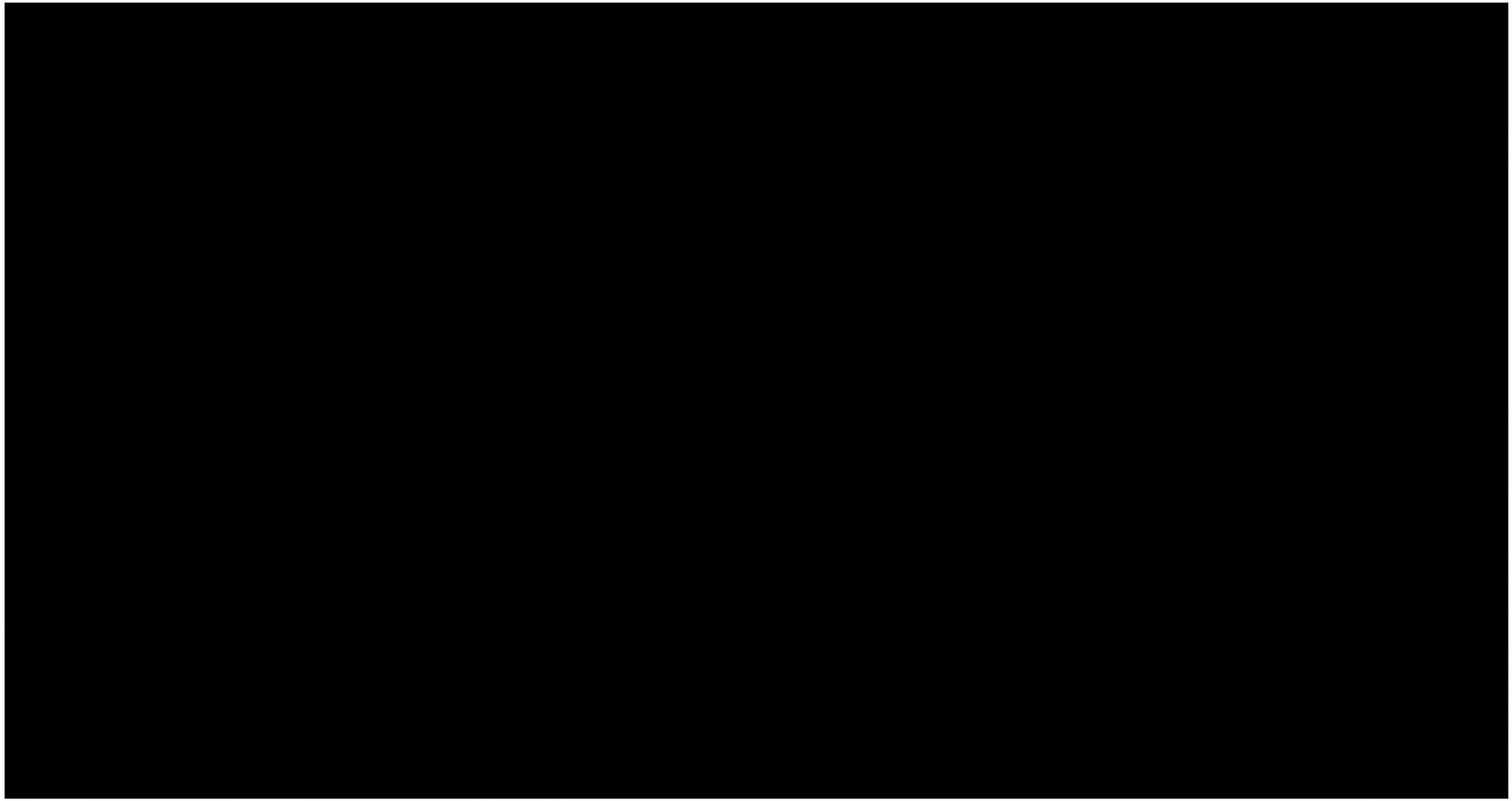
5MW electrolyser system overview



20MW electrolyser system overview



Our flexible & scalable green hydrogen solutions



Equipment offer completed by a wide range of services from (pre)-FEED support to maintenance contracts

Project development phase

Engineering support

- Pre-FEED studies (allowing a concept validation, budget offer)
- FEED studies (allowing to quote a binding offer)
- Partial turn-key project execution
- Full turn-key project execution to offer and execute complex integrated projects (>100MW)

Operations phase

Long-term service offering

Various levels of offering, from basic maintenance of equipment to extended maintenance of plants

- Full preventive and corrective maintenance
- Spare parts and consumables
- Local and remote operation
- Guaranteed availability of components
- Statutory and regulatory inspections
- > 8 years contracts

Showcases	Lanzhou	Baofeng	Sinopec
Illustration			
Description	**First solar fuel production demonstration project**	**Largest renewable energy hydrogen project in the world, helps achieve the transformation of coal from fuel to chemical raw materials**	**China's first large-scale project to directly produce green hydrogen from photovoltaic power generation**
Key Facts	• **Customer**: Lanzhou New Area Petrochemical Industry Investment Group • **Location**: Lanzhou, Gansu Province • **Volume**: 10MW • **Delivery**: 2 sets of DQ1000 • **Delivery time**: by July 2019	• **Customer**: Baofeng Energy • **Location**: Yinchuan, Ningxia Province • **Capacity**: 110MW • **Delivery**: 22 sets of DQ1000 • **Delivery time**: by November 2021	• **Customer**: Sinopec Star CO., LTD • **Location**: Kuqa, Xinjiang Uygur autonomous region • **Volume**: 120MW • **Delivery**: 24 sets of DQ1000 • **Delivery time**: by October 2022
Comments	• **High efficiency with low cost**: an example of direct hydrogen production using photovoltaic power generation. Energy consumption per unit of hydrogen reduced from c. 5 degrees to c. 4.3 – 4.5 degrees of electricity, a major breakthrough in energy-consumption saving, creating the highest efficiency of large-scale alkaline water electrolysis hydrogen production in the world • **Environment-friendly**: carbon dioxide used as a carbon resource to achieve CO_2 reduction and produce solar fuel methanol as green methanol • **Carbon Capture Storage**	• **Large scale**: 22 sets of large-scale 1000Nm3/h water electrolysis hydrogen production equipment / 180m Nm3 of green hydrogen per year for methanol workshops • **Zero CO_2 emission** : green hydrogen used as fuel instead of coal to directly supply chemical systems which produces polyethylene, polypropylene and hundreds of other high-end chemical products	• **Large scale**: 24 sets of equipment will supply Sinopec Tahe refinery with green hydrogen instead of natural gas, and help Sinopec Tahe refinery reduce the emission of 224000 tons of carbon dioxide each year. • **High system integration**: four sets of 1000Nm³/h electrolyzer corresponds to one modular hydrogen production system of gas-liquid separation equipment, with one hydrogen production system's capacity of 4000Nm³/h. Single purification capacity up to 8000Nm³/h.

Baofeng Energy Project

Sinopec Xinjiang Kuqa Project

AM Green Kakinada Project

Description

640 MW, One of the world's largest green ammonia projects

Capacity

640MW

Location

Kakinada, Andhra Pradesh India

Delivery

128 sets of DQ1000

Delivery Time

2026

Comments

India’s first one-million-ton green ammonia project

The argest electrolyzer order in India

How we’re recognized

John Cockerill

Production-learning-research Cooperation

Collaborative research with Zhejiang University, Tongji University and established joint provincial key laboratory with Suzhou University, and conduct applied experiments on different types of new technologies and new materials.

Participate in the formulation of national standards

Minimum allowable values of energy efficiency and energy efficiency grades for hydrogen producing systems by water electrolysis.

GB 32311-2015

Specification of water electrolyte system for producing hydrogen

GB/T 19774-2005

Methods for performance evaluation of small-size integrative hydrogen energy system

GB/T 26916-2011

Hydrogen and compressed natural gas (HCNG) blended as vehicle fuel

GB/T 34537-2017

Safety technical regulations for hydrogen refueling station

GB/T 34584-2017

Fuel specification for proton exchange membrane fuel cell vehicles—Hydrogen

GB/T 37244-2018

Technical conditions of pressurized water electrolysis system for hydrogen production

GB/T 37562-2019

Technical conditions of pressurized water electrolysis system for hydrogen production

GB/T 37563-2019

Hydrogen Top Runner Program Evaluation Guidelines of Alkaline Water Electrolysis System for Hydrogen Production

T/CAB 0166-2022

Carbon Footprint Evaluation Methods and Requirements of Alkaline Water Electrolysis System for Hydrogen Production

T/CAB 0245-2023

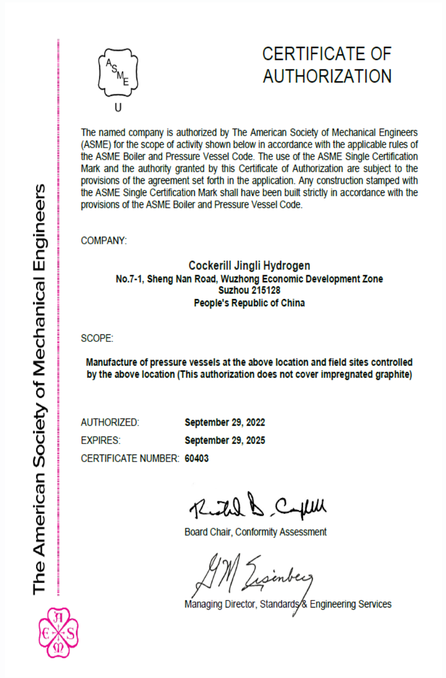
Operation management guide for the industrial water electrolysis hydrogen production system -The pressurized alkaline water electrolysis

TCECA-G 0255—2023

Technical specification for woven mesh electrode for alkaline water electrolysis hydrogen production

T/CAPID 010-2024

Quality Certifications



CERTIFICATE OF AUTHORIZATION

U

The named company is authorized by The American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the ASME Single Certification Mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with the ASME Single Certification Mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

Cockerill Jingli Hydrogen
No.7-1, Sheng Nan Road, Wuzhong Economic Development Zone
Suzhou 215128
People's Republic of China

SCOPE:

Manufacture of pressure vessels at the above location and field sites controlled by the above location (This authorization does not cover impregnated graphite)

AUTHORIZED: **September 29, 2022**
EXPIRES: **September 29, 2025**
CERTIFICATE NUMBER: **60403**

Board Chair, Conformity Assessment

Managing Director, Standards & Engineering Services

The American Society of Mechanical Engineers

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Industrie Service

Certificate of Conformity

ZERTIFIKAT

(EU-Konformitätsbescheinigung)

Conformity based on unit verification (Module G) according to Directive 2014/68/EU

Certificate No.: Z-PRC-21-04-5010766331-001

Name and address of manufacturer: Cockerill Jingli Hydrogen
No.7-1, Sheng Nan Road, Wuzhong Economic Development Zone, Suzhou City, China

We herewith certify that the pressure equipment meets the requirements of the Directive 2014/68/EU. It carries our identification number to the CE-marking as illustrated:

CE 0036

Test report No.: P-PRC-21-04-5010766331-001

Serial No: 10002102-1A

Scope of examination: Drawing No. TDQ1000/1.6(H)-01 Rev.00 dated on 2021-04-14 Electrolyzer

Manufacturing plant: As mentioned above

Shanghai, 2021.04.30
(Place, date)

TÜV SÜD Industrie Service GmbH
Certification Body for pressure equipment

CICC INSPECTION CERTIFICATION

CICC INSPECTION CERTIFICATION

CICC INSPECTION CERTIFICATION

CICC CERTIFICATION

嘉泰认证

OCCUPATIONAL HEALTH&SAFETY

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 18120S10273R1M

We hereby certify that
Cockerill Jingly Hydrogen
Credit No: 91320506MA1XNWUP5H
Registration Add:No. 7-East-1, Shengnan Road, Wuzhong District, Suzhou City
Business Add/Production Add:No. 7-East-1, Shengnan Road, Wuzhong District, Suzhou City
Has implemented and maintains an **Occupational Health & Safety Management System** Which fulfils The requirements of the following standards
GB/T45001-2020/ISO45001:2018

Scope of certification

Design and manufacturing of pressurized alkaline electrolysis hydrogen production equipments and related to occupational health and safety management activities

Initial issuance date: January 16, 2020
Renewal date: January 15, 2023
This certificate is valid during: January 15, 2023 — January 15, 2026
This certificate is invalid without CICC qualified label in the following period

First supervision and audit	Qualified mark	Second supervision and audit	Qualified mark

CICC CERTIFICATION

CNAS

DEKRA

ATTESTATION OF CONFORMITY

Issued to: COCKERILL JINGLI HYDROGEN
No. 7-1 Eastern, Shengnan Road, Wuzhong Economic Development Area, Suzhou, Jiangsu, China

For the product: Hydrogen generators using water electrolysis

Trade name: John Cockerill

Type/Model: TDQ1000/1.6(H)-01-00

Ratings: Hydrogen production: 1000Nm³/h

Manufactured by: COCKERILL JINGLI HYDROGEN
No. 7-1 Eastern, Shengnan Road, Wuzhong Economic Development Area, Suzhou, Jiangsu, China

Requirements: T/CAB 0166-2022

This Attestation is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6137232A.50.

The examination has been carried out on one single specimen or several specimens of the product, submitted by the manufacturer. The Attestation does not include an assessment of the manufacturer's production. Conformity of his production with the specimen tested by DEKRA is not the responsibility of DEKRA.

Arnhem, 9 November 2022 Number: 6137232.01AOC

DEKRA Testing and Certification (Shanghai) Ltd.

C. Lin
Certification Manager

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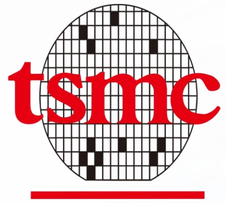
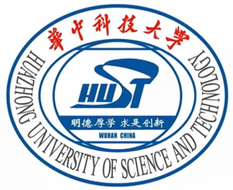
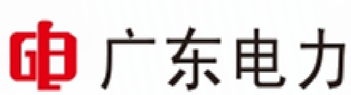
Patents and Honors

Clients served in the Power, energy, steel semiconductor and other industries







Thank you

Cockerill Jingli Hydrogen

Focused on Alkaline Water Electrolyser hydrogen system for over 30 years

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