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# ABB & Hydrogen Optimized collaboration

## Overview



**ABB**

Rectifiers  
Green Production



ABB and Hydrogen Optimized Inc. (HOI),  
collaboration **begun on 21st February 2020.**

Hydrogen Optimized patented **RuggedCell™ high-power water electrolysis technology** and ABB's High-Power Rectifiers are complimentary for **large green hydrogen production.**



**ABB Process Industries** successfully designed, manufactured and commissioned the 100kA transformer-rectifier system for RuggedCell™ Demonstration.

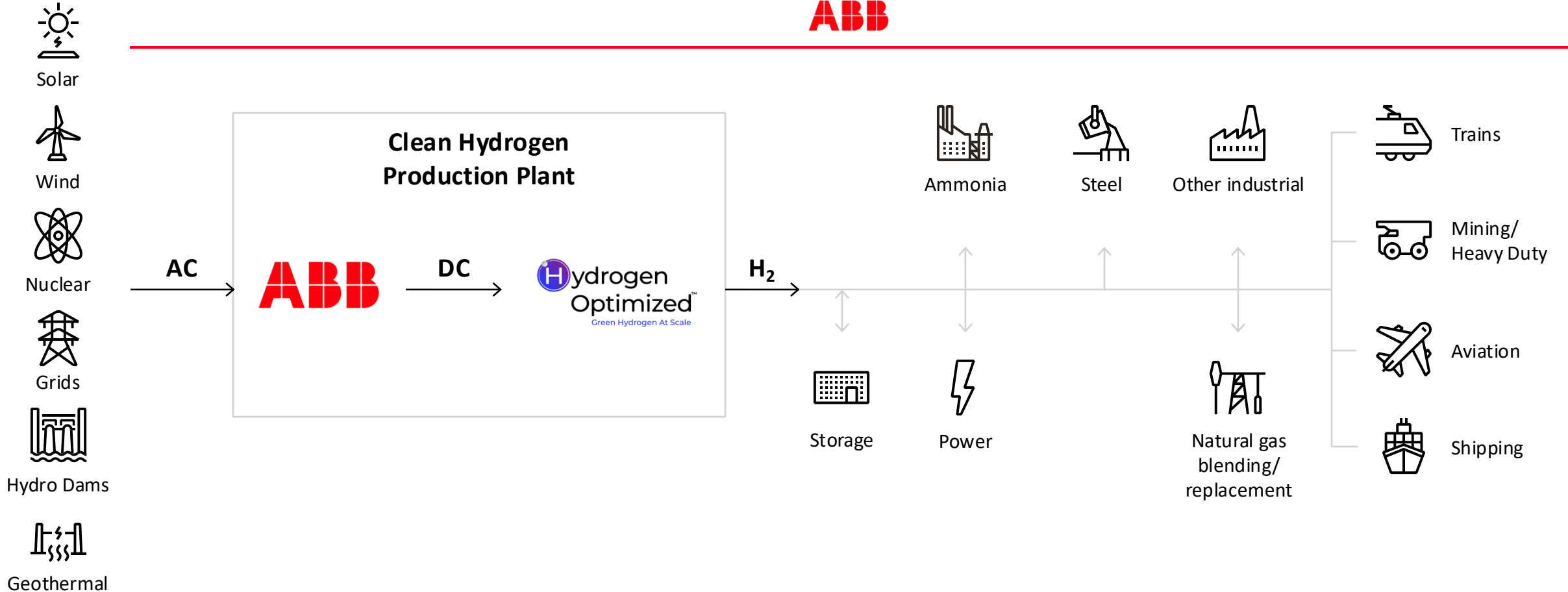
**ABB Energy Industries** offer technologies including the Extended Operator Workstation from.

**ABB Robotics** support Hydrogen Optimized with automated commercial production of RuggedCell™ Electrolysers.

# Our Offering: Large-Scale Hydrogen Production Plants

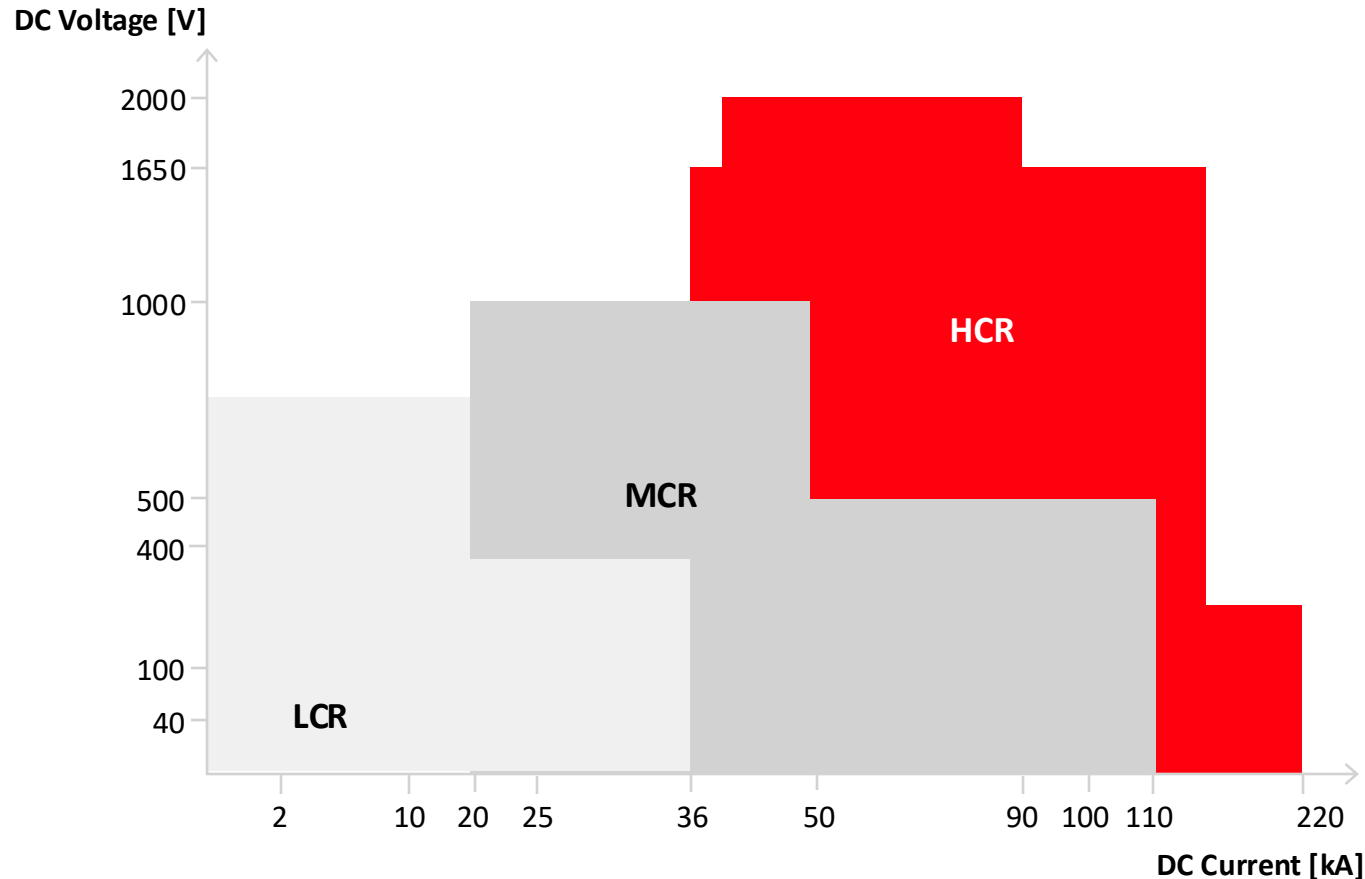


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


# The HPR Global Portfolio

## Product Families – Technical Ranges






The HPR Product portfolio consists of 3 Product families:




### High Current Rectifiers (HCR)

-  The future of Large-scale Hydrogen Electrolysis
-  Aluminum & Graphite
-  Electric Arc Furnaces

### Medium Current Rectifiers (MCR)

-  Chlorine & Hydrogen electrolysis
-  Baking Applications
-  Electrowinning applications

### Low Current Rectifiers (LCR)

-  Hydrogen Pilot Projects
-  Metal Finishing (plating)
-  Pilot Projects

# HCR – High Current Rectifiers

Portfolio: HCR-6000, HCR-8000, HCR-9000



Eg. HCR8000  
Rectifier Cabinet



Eg. HCR9000  
Rectifier Enclosure

## HCR Rectifier

|            |              |
|------------|--------------|
| DC Voltage | Up to 2500 V |
| DC Current | Up to 220 kA |



Solid and self-supporting aluminum main-circuit structure



Double side cooling for semiconductors and fuses and external protection ring furnished for each semiconductor



Flexibility in design, i.e. customized design available to suit customer requirements



Effective, fully integrated and separately fused overvoltage and surge protection with temperature supervision of aluminum heatsink profiles



Small footprint and time saving for onsite installation and commissioning

# MCR – Medium Current Rectifiers

Portfolio: MCR-1000, since 1999 with more than 250 in operation



## CRA/CRW Rectifiers

|            |             |
|------------|-------------|
| DC Voltage | Up to 700 V |
| DC Current | Up to 25 kA |



Complete all-in-one, cabinet-mounted rectifier units including LV-transformer, rectifier, cooling, controller and operator panel facilities



Air & Water cooled options



Flexibility in design for customized design available to suit customer requirements



Small footprint and time saving for onsite installation and commissioning



Customer can purchase, place, connect & run – all testing completed during manufacturing



Typical in Applications

- Chemical Polarization units
- Metal Finishing (metal plating)
- Small Chemical applications (Eg. Hydrogen Pilot Projects)

# LCR – Low Current Rectifiers

## Portfolio: Power Compact Range CRA & CRW



Complete all-in-one, cabinet-mounted rectifier units including LV-transformer, rectifier, cooling, controller and operator panel facilities



Air & Water cooled options



Flexibility in design for customized design available to suit customer requirements



Small footprint and time saving for onsite installation and commissioning



Customer can purchase, place, connect & run – all testing completed during manufacturing



Typical in Applications

- Chemical Polarization units
- Metal Finishing (metal plating)
- Small Chemical applications (Eg. Hydrogen Pilot Projects)



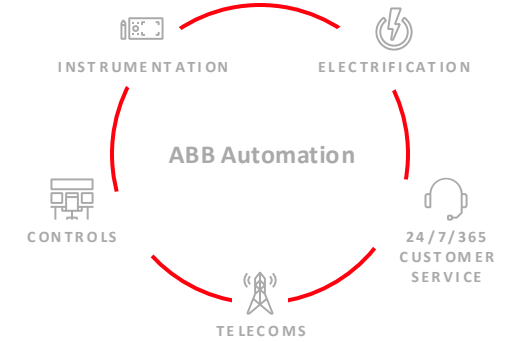
### CRA/CRW Rectifiers

|            |             |
|------------|-------------|
| DC Voltage | Up to 700 V |
| DC Current | Up to 25 kA |



# ABB Energy Industries solutions and services

Innovative and integrated solutions that digitalize, automate and electrify the hydrogen industry



## ABB Integrated Solutions



Main Electrical Contractor (MEC)

Main Automation Contractor (MAC)

Main Information Contractor (MIC)



Site prep



LV/MV/HV power distribution



Intelligent switchgear



Power Management Systems (PMS)



Motors & drives



Control system



Safety systems



Telecom systems



Intelligent field instruments



Analyzers



Third party equipment



Operator mobility



Wiring and cable management



Life cycle support

# ABB Digital Control Room Solutions

Empower your operations team

**The control room** is the most important room in any facility – it's where daily decision-making affects corporate goals and return on plant investment.



**80%** of unscheduled shutdowns are preventable

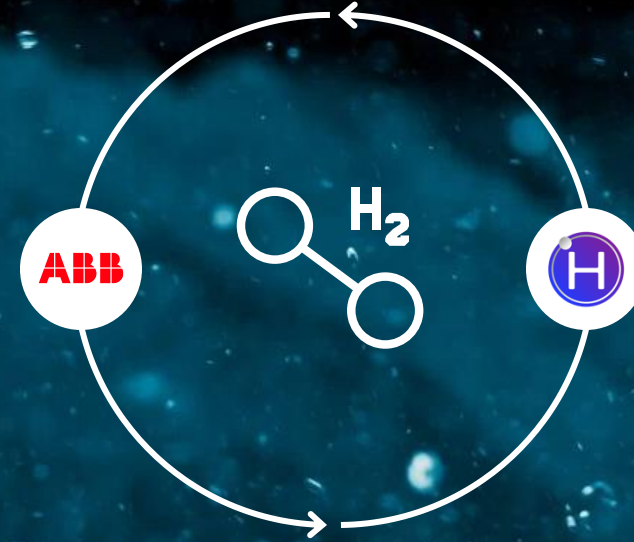
**5%** of approximate global annual production is lost due to unscheduled downtime

**40%** of which are caused by human error

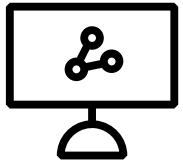
# ABB's fully integrated solution for your green hydrogen project

ABB is helping to create  
an optimized facility

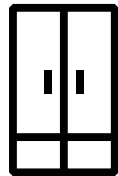
Rectifier



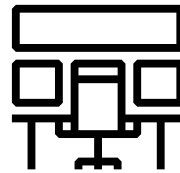
RUGGED  
CELL™



Automation



Electrical



Digital



Telecom



3<sup>rd</sup> party  
integration

30+ YEARS EXPERIENCE

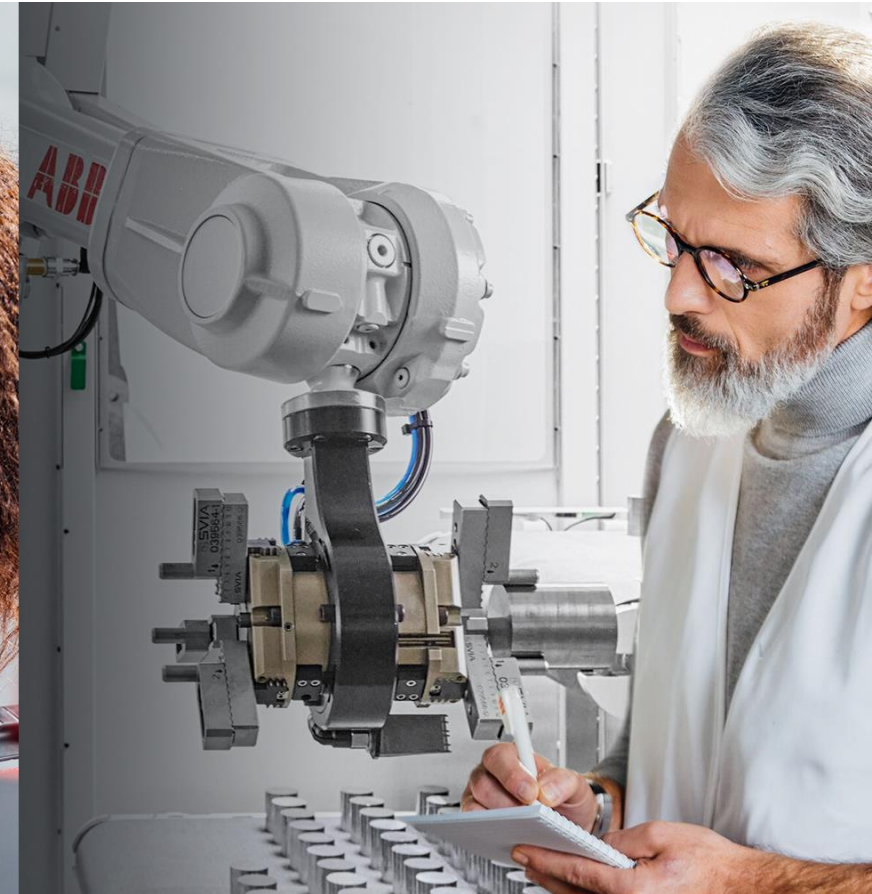
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# ABB Robotics

## Hydrogen Optimized | Green Hydrogen At Scale



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# Articulated Robotics

Comprehensive articulated robot portfolio to deliver the ideal solutions for every need. Reach your automation goals in all segments. Best-in-class motion control enables high speed and path accuracy

## IRB 2600



IRB 2600 cut the cycle times of the industry benchmark by up to 25 % and offers the best accuracy in its class. It helps to increase output with higher process speeds and lower scrap rates, resulting in increased production capacity and high productivity.

Payload: 12 – 20 kg,  
Reach: 1.65 – 1.85 m

## IRB 4600



IRB 4600 is a highly productive general purpose robot optimized for short cycle times where compact robots can help create high density cells. The IRB 4600 enables increased production output and higher quality.

Payload: 40 – 60 kg,  
Reach: 2.05 – 2.55 m

## IRB 6700



This 7<sup>th</sup> generation of large ABB robots features a multitude of next generation improvements derived from intimate customer relationships and exhaustive engineering studies.

Payload: 150 – 300kg,  
Reach 2.6 – 3.3m

## IRB 7600



Characteristics such as high available torque and inertia capability, rigid design, and powerful acceleration have earned this market leader its “Power Robot” title.

Payload: 150 – 500kg,  
Reach: 2.3 – 3.5m

# Robotic Solutions for Weld Applications

Robot-based automation increases the efficiency of welding processes and enables your organization to manufacture more parts in less time, while minimizing scrap, increasing quality and improving the working environment

## OmniVance™ FlexArc® – robotic arc welding cells



ABB FlexArc® robotic welding cells are complete robot systems, available in several flexible, modular packages. Proven in applications worldwide, they offer an outstanding, versatile, flexible, cost-effective and easy to program system that offers the technology you need at the right price.

## Spot Welding Functional Module



ABB Spot Welding Functional Module is a fully configured robot package, ready to use, suitable for ABB GWT 9-series servo guns for spot welding. The system package combines the best hardware, software, and electrical modules available for high quality performance and optimum production in spot welding applications.

## Cobot Arc Welding Package

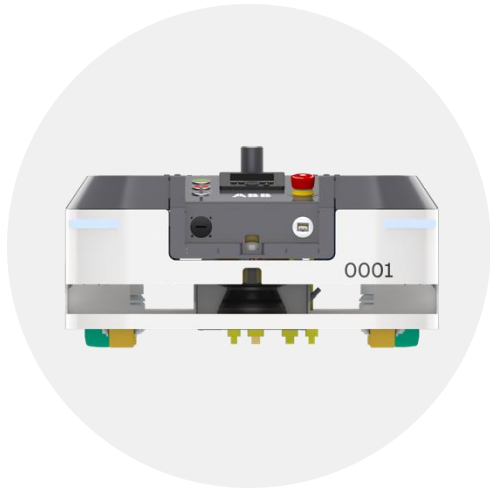


Fitted on ABB's award-winning GoFa™ Cobot, the Cobot Arc Welding Package is the first of its kind to enable users to program a robot without using a teach pendant. With the Easy Teach Device, users can automatically generate the programming code by simply guiding the robot's arm along the welding path.

# Autonomous Mobile Robots (AMRs)

Transport robots specifically designed to move loads autonomously in a diverse range of industries, from automotive to logistics to consumer goods and other industrial processes

## Flexley Tug



**Up to 10000 Kg Payload**

### Magnetic and Visual SLAM navigation

With minimum dimensions, large capacity, and great maneuverability, our Flexley Tug range is a strong, easy, safe, and flexible solution for pulling trolleys. Validated rigorously for performance and safety, they are the 24/7 workhorses of intralogistics towing applications.

## Flexley Mover



**Up to 1500 Kg Payload**

### Magnetic/SLAM/QR Code Navigation

Excellent maneuverability, thanks to its compact design and omnidirectional and turn on spot technology. Our Flexley Mover AMRs are equipped with the latest navigation systems and technologies, enabling greater agility and efficiency in your intralogistics good movements.

## Flexley Stack



**Up to 2000 Kg Payload, 8m lifting height, and Laser Navigation**

High-quality forklift AMRs to improve your productivity and competitiveness. Characterized by its versatility and scalability, our Flexley Stack range provides a powerful performance in palletized loads handling. A robust, compact solution for a smooth and streamlined transportation, and unlimited combinations of loads and applications.

**ABB**