



| Your Partner along the Hydrogen Value Chain

[siemens.com/H2](https://www.siemens.com/H2)

Agenda

1 Introduction and Hydrogen Market

2 **Measurement Intelligence Portfolio (H₂ Ready Solution)**

3 Application

4 **References**

5 Summary



MI offers a concise portfolio for a wide range of applications and industries with good product fit for Hydrogen applications

MI Focus Industries



Chemical/PetroChem



Environmental



Power



Oil & Gas



OEM

- Food & Beverage
- Glass & Solar
- Mining
- Metals
- Pharma
-

Measurement Technologies



Flow



Pressure



Temperature



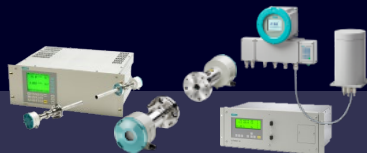
Weighing



Positioner



Level

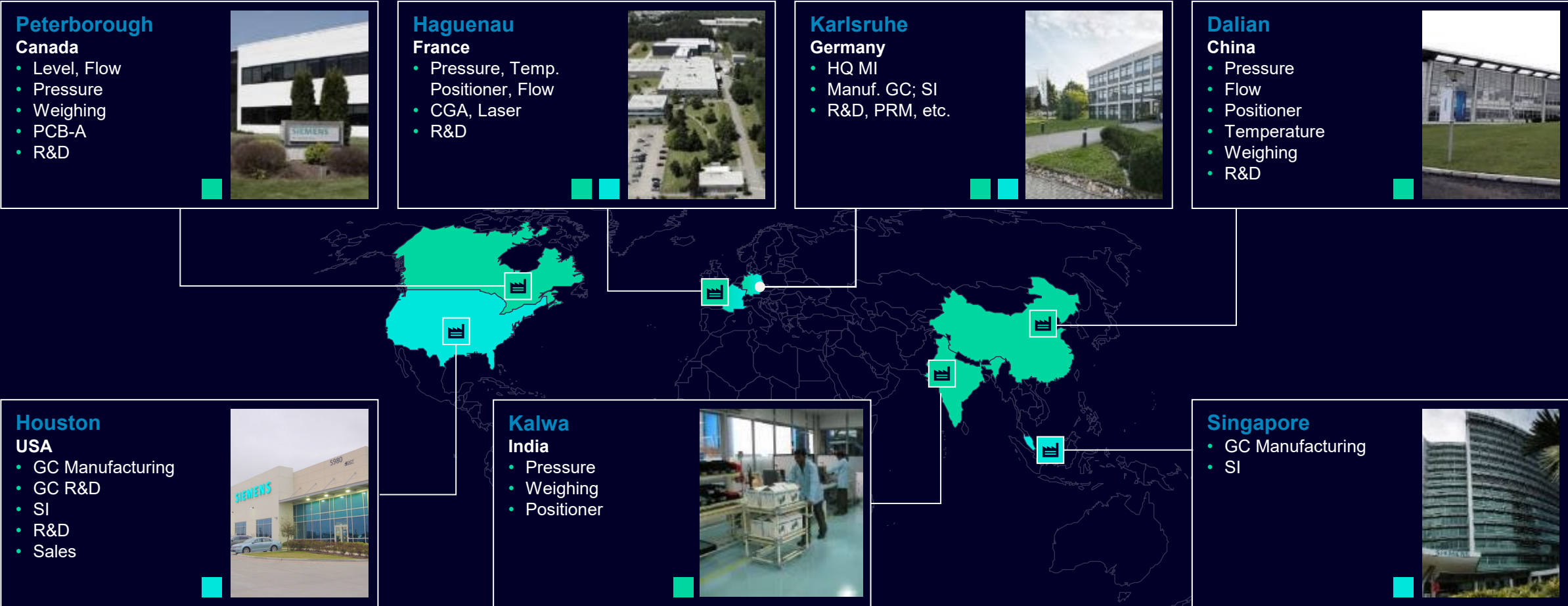


Continuous Gas Analysis



Gas Chromatography

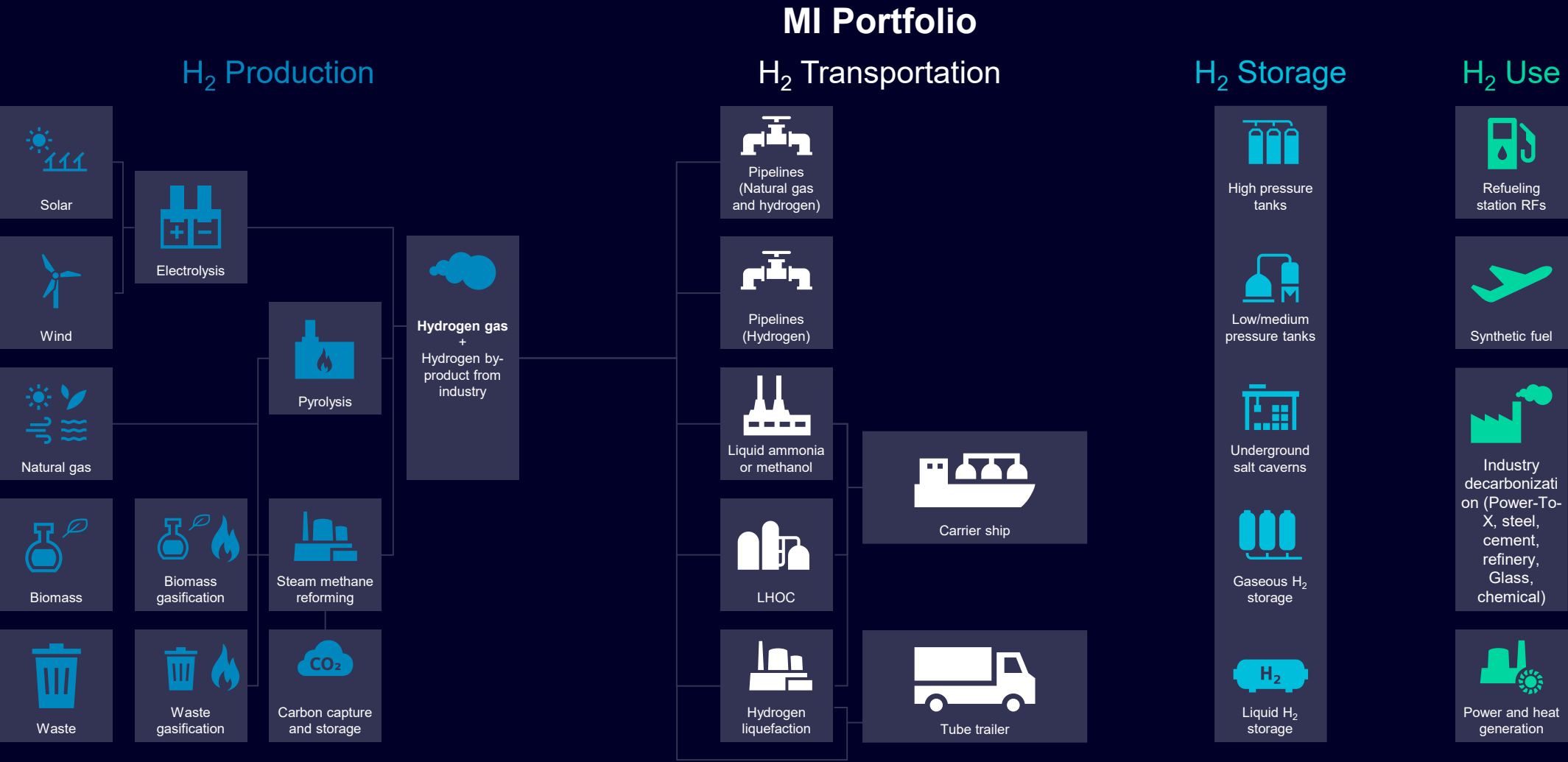
Global manufacturing footprint of Measurement Intelligence



Process Analytics Process Instrumentation

Hydrogen Ecosystem

For a more sustainable world



| Product Portfolio

Measurement Intelligence

Siemens Measurement Intelligence offers a portfolio for a wide range of applications in Hydrogen related industries



Pressure

SITRANS P320/420

- Reduced commissioning time
- Suitable for harsh conditions
- User-friendly (large display)
- Low Maintenance cost due to proof test interval up to 15 years
- Fast response time



Membrane options to avoid Hydrogen Permeation effect:

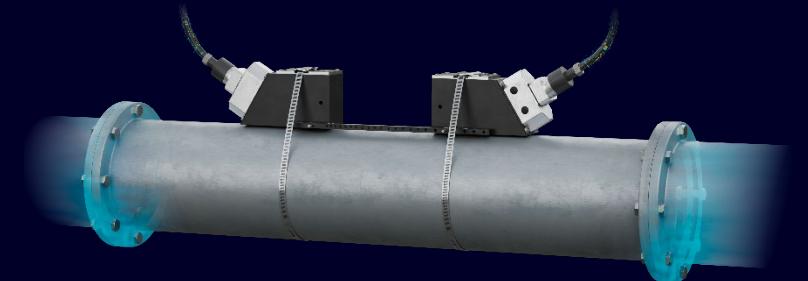
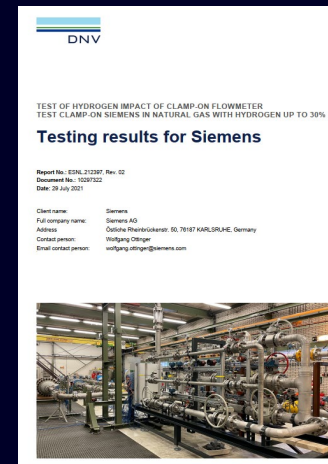
- SS (316L) cell
- SS (316L) 25 µm gold coating



Flow

SITRANS FS230

DNV-GL tested and qualified gas clamp-on flowmeter for **hydrogen pipeline monitoring**



SITRANS P320/P420 Features at a glance



Improved HMI display



New larger and improved display with Namur NE107 support and quick start wizard

H2 Ready



Wide variety of membrane material such as SS316L, Hastelloy C276, Monel 400, tantalum or gold

Safety integrated



Developed according to IEC61508 standards for SIL2/3 applications

Unique safety start-up



Simple and advanced commissioning, patented Remote safety handling



Reduced response time



Speeds up control for more efficient processes

Communication



State of the art communication protocol with HART7, including Long tag support

SITRANS FUS: FS230 Clamp on ultrasonic flowmeter



Key Features

- **High 0.5% accuracy** of flow rate with 0.25% repeatability according to ISO 11631
- **High zero stability** with no need to set a zero point
- **WideBeam® transit-time technology** for market-leading handling of moderate aeration or suspended solids
- **Patented pipe configuration menu** automatically adjusts for unfavorable upstream conditions with SensorFlash® microSD card for data storage/collection and easy firmware updates



Siemens Measurement Intelligence offers a portfolio for a wide range of applications in Hydrogen related industries



Temperature

SITRANS TS500

Modular concept for wide range of applications



SITRANS TS300

Noninvasive technology for small pipe



Rack or head or field mounted temp-transmitters

Valve Positioner

SIPART PS2 – PS100

Most widely used positioner for linear and part –turn actuators in hydrogen applications.

Asset Monitoring

Monitoring and controlling the behavior of controls valves + maintenance scheduling performance

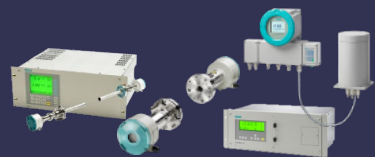
Level

SITRANS L

Main product and technologies used for H2 applications

- Radar - LR250
- Guided wave radar - LG250
- Point level - LVL200

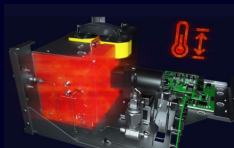
Siemens Measurement Intelligence offers a portfolio for a wide range of applications in Hydrogen related industries



Continuous Gas Analysis

SIPROCESS GA 700 – One platform, many combinations

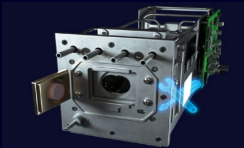
The modular system can accommodate up to two modules in one housing: Wall mounting, or 19" rack housing



OXYMAT 7
Paramagnetic
Safety-relevant O_2
Measurement



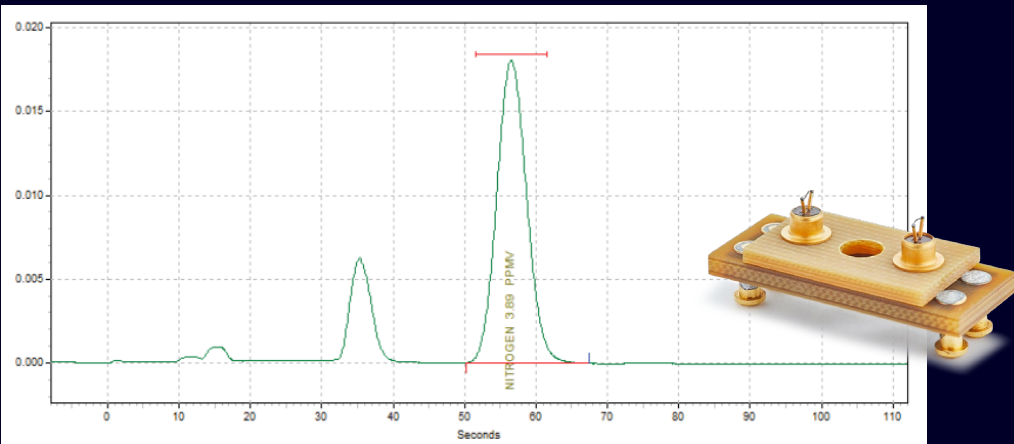
CALOMAT 7
Thermal
Conductivity
 H_2 Measurement



ULTRAMAT 7
NDIR
 CO , CO_2 , CH_4 ,
 SO_2 , NO etc.

Online Gas Chromatography

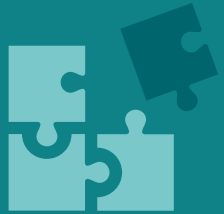
MAXUM ed II



Online Gas Chromatography for Hydrogen impurities monitoring (N_2 , CO , CO_2 , CH_4 , O_2 , Ar , He etc.)

SIPROCESS GA700

Modular configuration



**Modular
configuration**

Full modular
flexibility

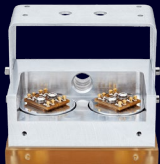


Online Gas Chromatography MAXUM ed II

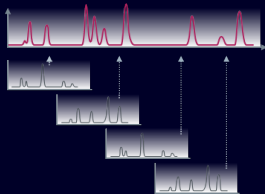
Key features



Multiple Oven Configuration



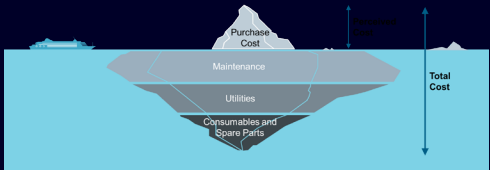
Multi-Sense TCD



Parallel Chromatography



Best-in Class Valves



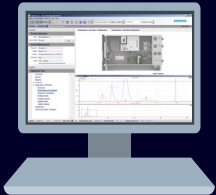
Low OPEX & CAPEX



Modular Concept



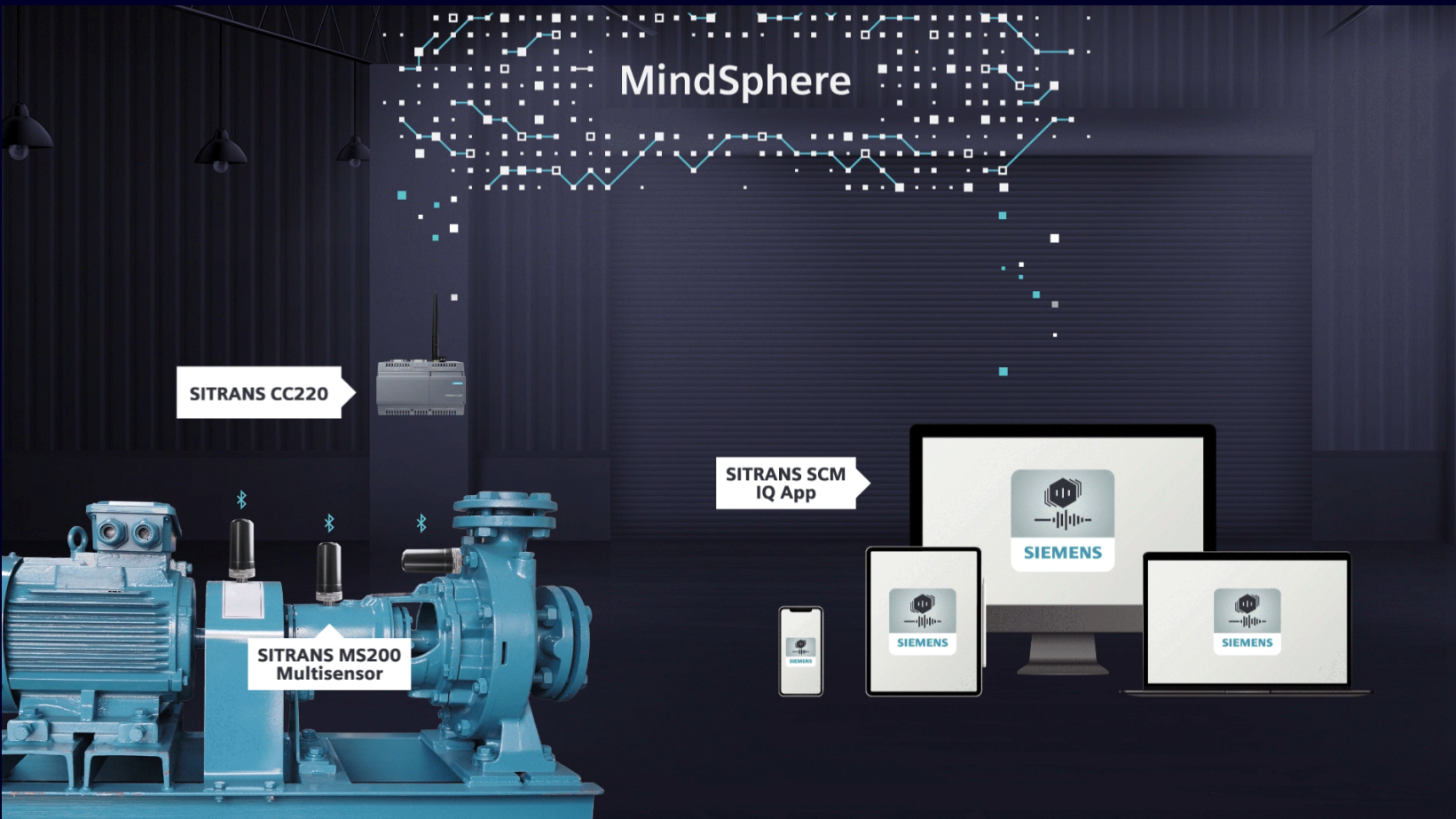
Smart Sampling System



Powerful Software

Asset Condition Monitoring Solution for your H₂ applications

SITRANS SCM IQ + MultiSensor MS200



Smart condition monitoring and predictive maintenance for rotating equipment are critical to avoid unplanned downtime and improve productivity.

AI (Artificial Intelligence) based SITRANS SCM IQ is analyzing vibration data analysis and can detect impending asset failures.

It can be utilized on any rotating machinery such as pumps, compressors etc. in any hydrogen production plant.

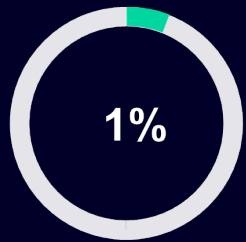


Siemens Analyzer System Manager (ASM)

Optimized & profitable process

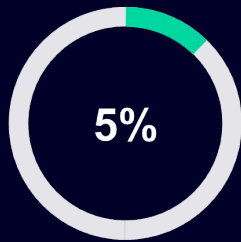
Do you want to achieve

the highest process performance at minimized OpEx?



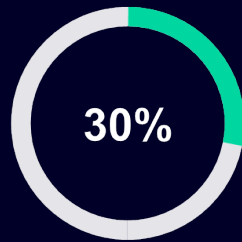
Improvement of product quality

Better production output of up to 0,5 Mio € per analyzer per year



Improvement of analyzer availability

1000 days more total availability per year



Maintenance cost-savings

150.000€ cost-savings per year

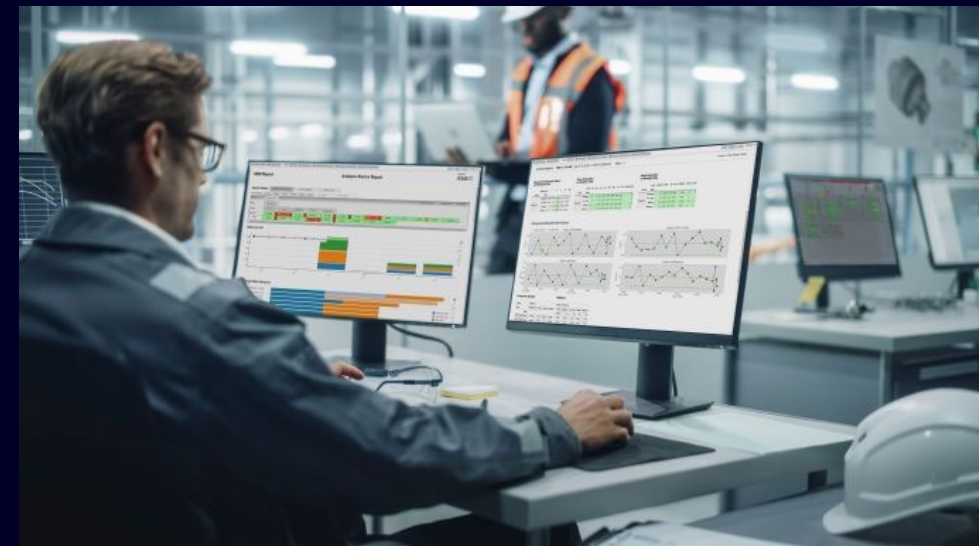
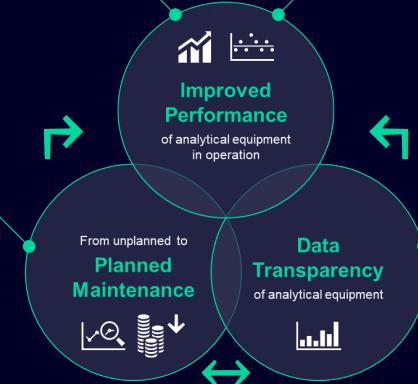
Results of petrochemical plant using Siemens solution for 100 process analyzers

Reliability

Availability

Predictive & Smart Maintenance

Plant Optimization



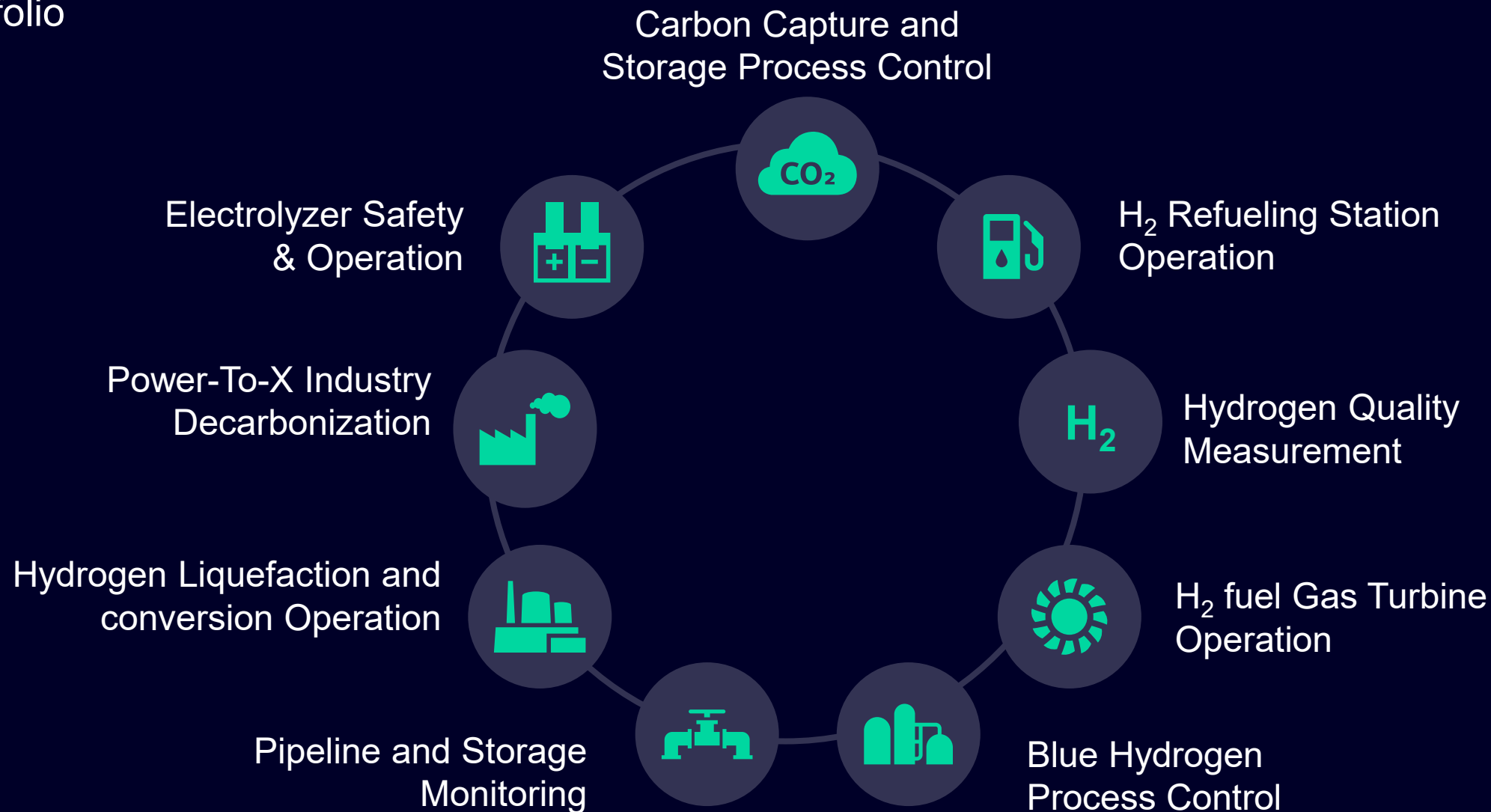
| H₂ Applications

Measurement Intelligence



Hydrogen Ecosystem Applications

MI portfolio





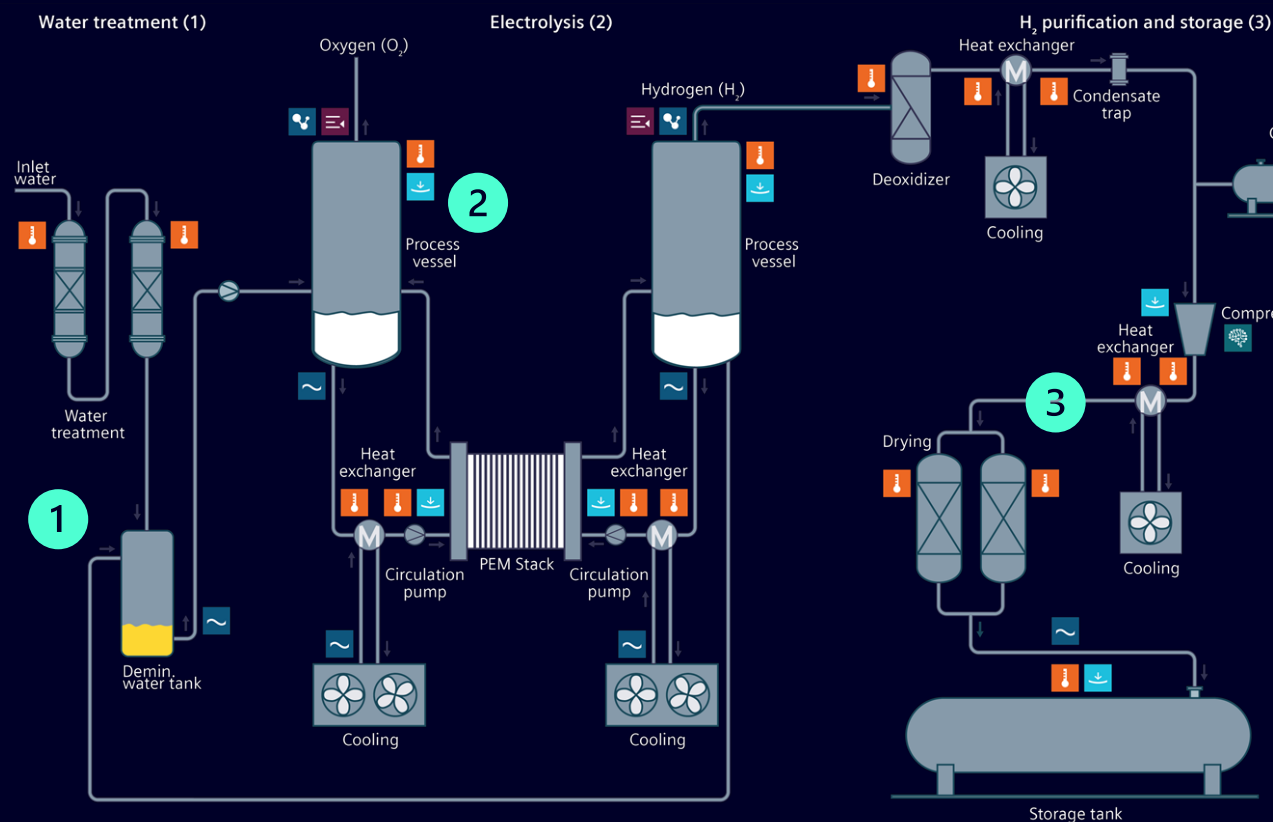
Hydrogen Ecosystem Applications – MI portfolio

Are we ready? - Deep Dive on Portfolio Fit

Application	Process	Instrumentation/Analytical content
✓ Electrolyzer	Production of green hydrogen with electrolysis	Pressure, Temperature, Level, Positioner, CGA
✓ Carbon Capture (CCUS)	CO ₂ Capture, liquefaction and storage or use	Focus on CGA, GC Positioner, Pressure, Temperature, Level, Flow Coriolis
Refueling station	Hydrogen Refueling for mobility applications	Pressure, Flow Coriolis, Temperature, Positioner
✓ Quality Measurement	Control of Hydrogen purity (trace measurement)	GC
✓ Turbine / Boiler Operation	H ₂ / NG Mix in gas turbines to reduce CO ₂ footprint	Pressure, CGA, GC
✓ Blue Hydrogen Process Control	Production of blue hydrogen with biomass or carbon capture	Focus on CGA, GC Pressure, Temperature, Positioner, Level
✓ Pipeline and Storage	Monitoring of H ₂ transportation	Focus on Flow (Clamp On (FS230) GC (quality, inline)
✓ Liquefaction	Liquefaction of Hydrogen for usage in mobility application	Focus on CGA, GC Pressure, Temperature, Positioner
✓ Power to X (Decarbonization)	Production of Green Steel, Green Ammonia	Pressure, Temperature, Level, Positioner, CGA, GC

Green Hydrogen

MI Content Overview – PEM Electrolyzer Plant



Continuous Gas Analyzers Flow Level Pressure Temperature Digitalization

1 Water supply
Flow, level (tank) and temperature monitoring



2 PEM-stack
Electrolysis efficiency depends on keeping optimal pressure and temperature. H_2 and O_2 are checked for Purity/Safety.



3 H_2 Purification/Compression/Storage
Temperature and pressure monitoring are used to facilitate downstream processes such as compression, purification and dryer.



Hydrogen Market – Electrolyzer

Measurement Intelligence Solution



Challenges



Solution



Benefits

Instrumentation

- Field instrumentation measurement for the electrolysis, gas removal process, water supplied and discharged and Storage
- High Reliability (Safety integrity level) and Accuracy
- Potential H₂ permeation issue on pressure measurement

- SITRANS P pressure transmitters with standard SS 316L, Hastelloy and gold-plated diaphragm
- SITRANS FP orifice plate, SITRANS FC Coriolis, SITRANS FS Ultrasonic, MAG Flow
- SITRANS T (temperature) and SITRANS L (Level)

- Easy to install, commission and maintain
- Wide selection of diaphragm material for pressure measurement
- **High accuracy Instrumentation suitable for all Hydrogen application**



Process Analytics

- O₂ traces in H₂ product and H₂ traces O₂ vent
- Reliability (Safety integrity level) and Accuracy (traces measurement)
- Ex Zone 1 or 2

- Modular SIPROCESS GA700 with CALOMAT 7 (Thermal Conductivity Technique) and OXYMAT 7 (Paramagnetic) modules

- Simple analytical configuration with long-term repeatability and minimum maintenance
- Detection limits in the range of 100 ppm
- Turnkey solution from a single source



Hydrogen Market – Other Applications

Measurement Intelligence Solution



Challenges



Solution



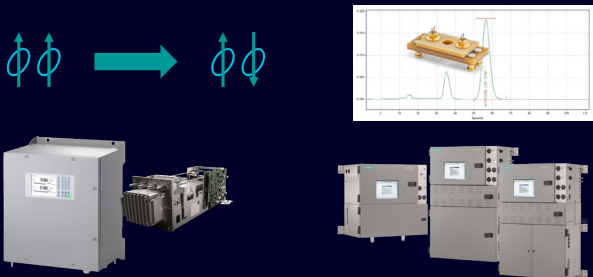
Benefits

Hydrogen Liquefaction

- Hydrogen impurities measurement
- Ortho/Para H₂ Conversion

- Siemens MAXUM ed II for trace analysis
- SITRANS GA700 Calomat

- Simple analytical configuration with long-term repeatability and minimum maintenance
- Modular analyzers ...



Blue Hydrogen (SMR Plant)

- Process and Environmental Monitoring
- Harsh Conditions

- CGA & Process Gas Chromatography
- Flow, Pressure, Temperature and Positioner

- Easy to install, commission and maintain
- Wide selection of diaphragm material for pressure measurement
- Low Analyzer system CAPEX with multi-components modular analyzers

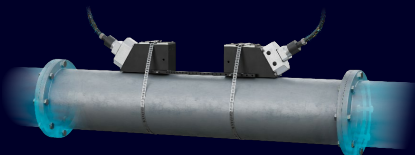


Pipeline Monitoring

- Mix hydrogen with natural gas
- Changing conditions of Hydrogen content

- SITRANS FS230-Gas Clamp-on Flowmeter
- FST030 transmitter and 2 path sensors with Digital Sensor Link (DSL)

- System designed according to NAMUR requirements and Industry 4.0
- Easy installation with one solution for all pipeline's diameter
- No moving parts, wetted parts, no pressure drop
- Proven solution certified by DNV GL Laboratory



Hydrogen Market – Other Applications

Measurement Intelligence Solution



Challenges



Solution



Benefits

Hydrogen Purity

- Complex analysis very challenging
- Impurities may vary depending on the H₂ production method

- Process Gas Chromatograph Maxum ed II that can be used in laboratory or in the field
- Measurement of most critical impurities (Ar, CH₄, CO, CO₂, N₂, O₂ Total Hydrocarbons, He, H₂O)

- Standard proven technique with long-term repeatability and minimum maintenance
- Lower CAPEX and OPEX than other laboratories techniques



Hydrogen Fuel Gas

- Hydrogen/NG mix with higher diffusivity and lower volumetric energy content
- Gas turbine Test bed application

- SITRANS T and P series with gold-plated diaphragm
- SIEMENS SIPROCESS GA700 – CALOMAT 7

- Fast BTU measurement with SIPROCESS GA700 CALOMAT 7 with automatic compensation algorithm for hydrocarbons matrix changes
- Wide selection of diaphragm material for pressure measurement



Industry Decarbonization/ Power-to-X – Green Steel

- Natural Gas replaced by hydrogen in Steel production by direct reduced iron and use of electrical arc furnace

- Siemens SIPROCESS GA700 Calomat/Ultramat/Oxymat
- SITRANS Instruments (pressure, temperature, Level and flow sensor) suitable for all Hydrogen application

- High accuracy Instrumentation suitable for all Hydrogen application
- Low Analyzer system CAPEX with multi-components modular analyzers



Use Case Wunsiedel, Germany

Siemens as Supplier, Partner and Operator



The Project: 6 MW Green Hydrogen production for Stadtwerke Wunsiedel and Riessner-Gase

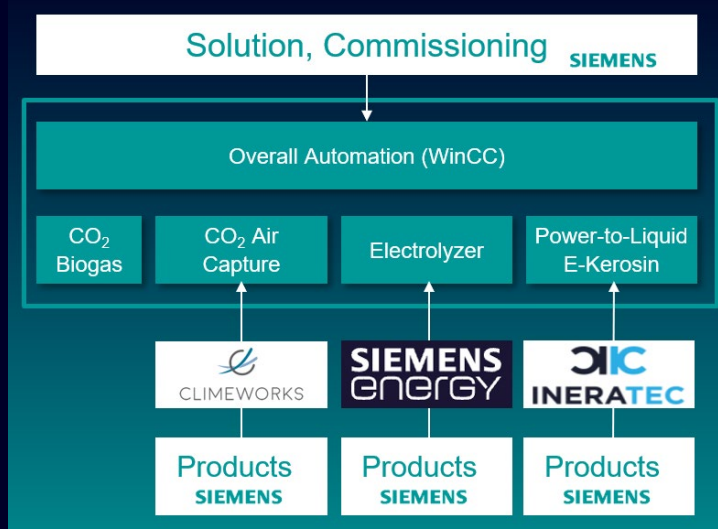
- Electrolyzer Silyzer 300 by Siemens Energy
- PCS 7, Process Analyzers, Instrumentation

Highlights

- Operator model by Siemens Financial Services and SI
- Standardized solution for Instrumentation/Analytics
- Global service support set-up for future project

Use Case Solarbelt Fairfuel eKerosin Werlte, Germany

Sustainable airfuel from Wind Power, Biomass and Air



The Project: Power to liquid plant, turning CO₂ from a biomass plant and the atmosphere together with green H₂ to synthetic fuel (eKerosin)

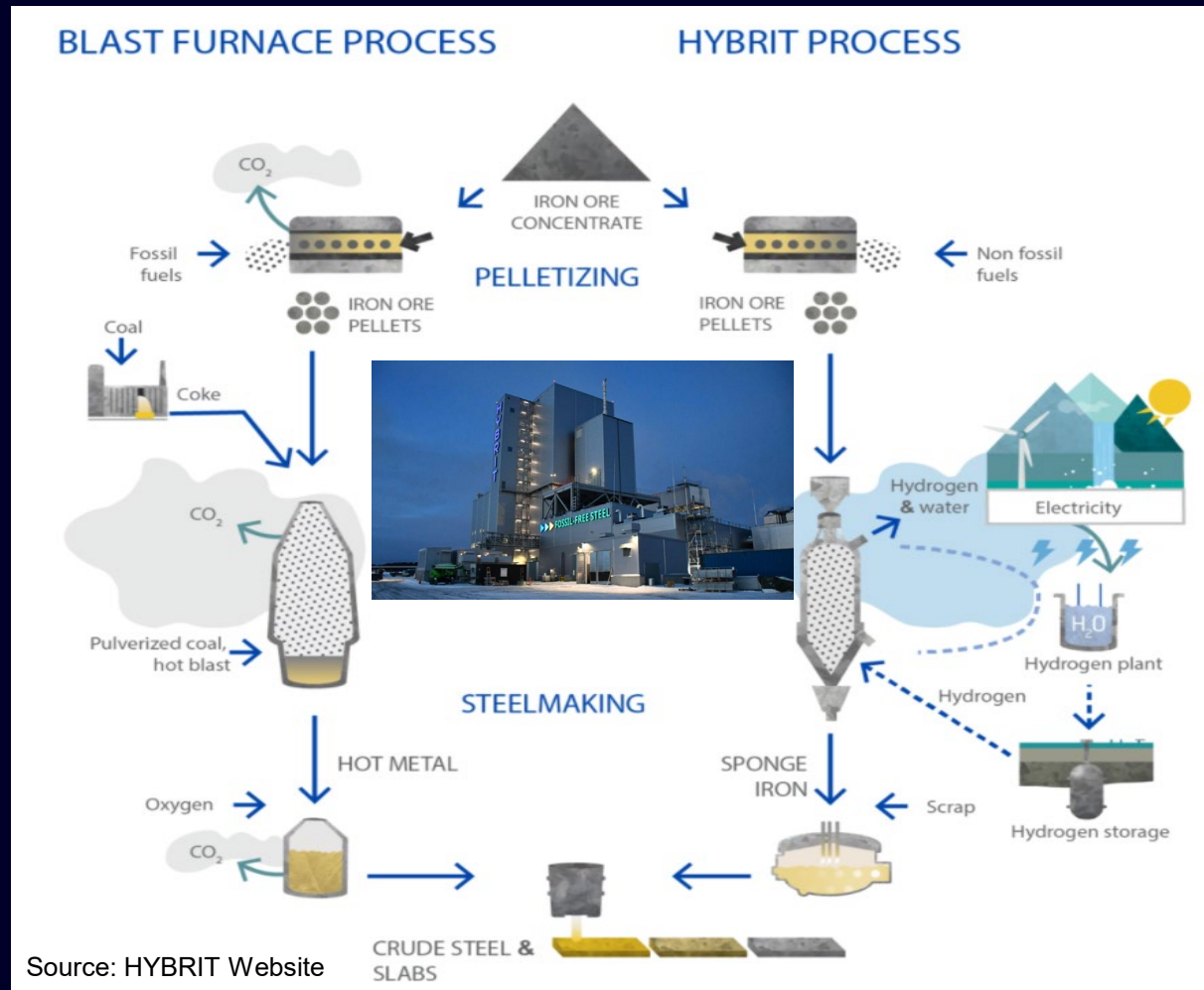
- Operator is an NGO (atmosfair / solarbelt)
- PCS 7, Process Instrumentation

Highlight

- Collaboration with package unit builders (Siemens Energy, Ineratec, Cimeworks)

Use Case HYBRIT, Green Steel (DRI with EAF), Sweden

First Project of steel decarbonization











The Project: Green Steel Production (DRI – EAF) – Analyzer Package (SIPROCESS GA700)

Highlights

- **Growing investment** from all major steel producer (e.g. ArcelorMittal, ChinaSteel)
- **Complete solution from Siemens** – Instrumentation, Analyzer and Automation

Siemens, Your Trusted Partner for your Hydrogen applications

<p>Specific instrumentation and analyzers solution For H₂ application</p> 	<p>Large installed base and know-how about Hydrogen Applications</p> 	<p>Standardized solution for H₂ Plants</p> 	<p>Your one stop shop solution provider for automation, instrumentation, and process analytics</p> 
<p>Digitalization/ IOT offering</p> 	<p>High-quality instrument and analyzers with long-term stability</p> 	<p>Modular Concept for Analyzers with low CAPEX/OPEX</p> 	<p>Global service support at your doorstep</p> 

Thank you for your attention!



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