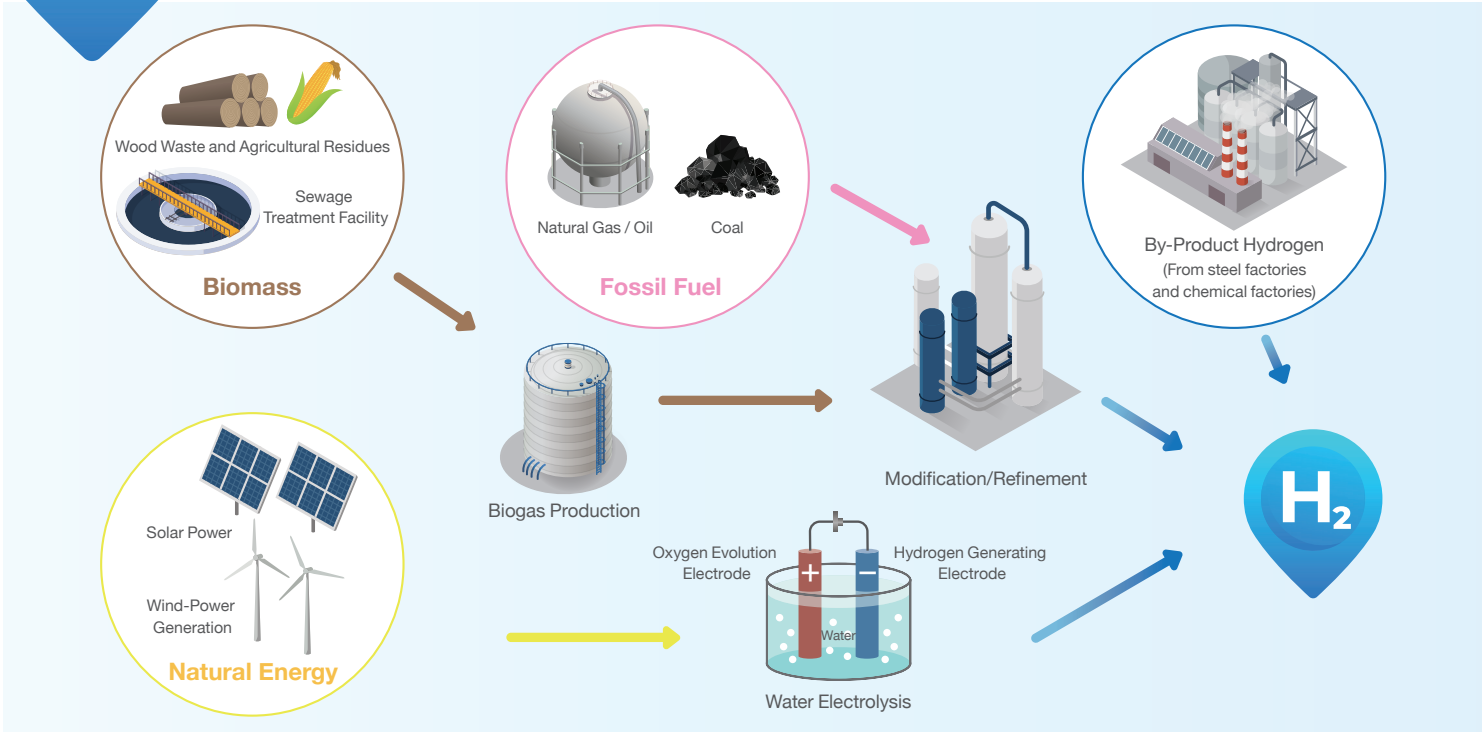


Realize a Smart  
Hydrogen Energy  
Society by

# Application Navi Hydrogen

HORIBA Contributes to a Hydrogen Energy Society  
with Analysis Technology from Research & Development  
to On-Site Measurement

## Hydrogen Production



### Impurity Monitoring in High-Purity H<sub>2</sub>

Measures impurities such as CO and CO<sub>2</sub> during H<sub>2</sub> purification, which can lead to catalyst deterioration.

Trace Gas Monitor  
GA-370



### Generated Gas Monitoring

Measures CH<sub>4</sub> and CO<sub>2</sub> during biogas production and refining to optimize the production process.

Multi-Component Gas Analyzer  
VA-5000



### Water Electrolysis Cell/Stack Evaluation

Optimizes water temperature and flow rate, and evaluates performance/efficiency of water electrolysis cells and stacks.

Water Electrolysis Cell/Stack Evaluator  
Evaluator EC/ES



## Hydrogen Production & Utilization - Stationary Application -

### Residential and Commercial Fuel Cells



### Evaluation of Fuel Cell Catalysts

Quantitatively analyzes S and C, which are catalyst poisons for fuel cells, from the ppm level.

Carbon/Sulfur Analyzer  
EMIA Series



### Gas Monitoring in the Reforming Process

Real-time monitoring of desulfurization and CO removal performance in processes such as those that produce hydrogen from city gas.

Multi-Component Gas Analyzer  
VA-5000



### On-Site Hydrogen Station



### SOFC Evaluation

Performs evaluation tests from single cells to full stacks.

\* SOFC: Solid Oxide Fuel Cell

SOFC & SOEC  
Test Station  
Evaluator HT Series



### Monitors Exhaust Gas from FC Stacks

Monitors CO and CO<sub>2</sub> in exhaust gas in real time for R&D on FC stacks.

Portable Gas Analyzer  
PG-300 Series



### Impurity Monitoring in High-Purity H<sub>2</sub>

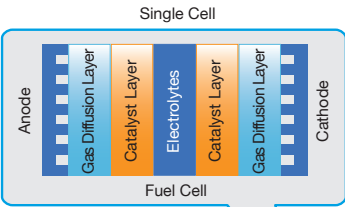
Accurately measures impurities such as CO and CO<sub>2</sub>, which can lead to deterioration of fuel cell, during H<sub>2</sub> production at H<sub>2</sub> station.

Trace Gas Monitor  
GA-370



## Hydrogen Utilization - Mobility Application -

### Fuel Cell Vehicles



Evaluates H<sub>2</sub> distribution from the material surface in the depth direction.

Glow Discharge  
Optical Emission  
Spectrometer  
GD-Profiler2



### Hydrogen Embrittlement Evaluation

Detects H<sub>2</sub> in metals at the ppm level.

Hydrogen Analyzer  
EMGA-921



Generates gas of any gas concentration and enables precise gas mixing control of up to six components.

Multi-Component  
Gas Analyzer  
MU-3000



### Catalyst/Electrolyte Evaluation

Nondestructive analysis of catalyst crystallinity that can lead to catalyst degradation.

Raman Microscope  
XploRA PLUS



### Electrolyte Evaluation

Mapping of radical quencher distribution in electrolyte membranes.

X-ray Analytical  
Microscope  
XGT-9000



### PEFC Evaluation

Performs evaluation from single cells to full stacks.  
\* PEFC: Polymer Electrolyte Fuel Cell

PEM Test Station  
Evaluator LT Series



### Battery Evaluation

Meets stringent battery test requirements and enables highly accurate performance and cycle evaluation.

Battery Test Station  
Evaluator B



### Catalyst Performance Evaluation

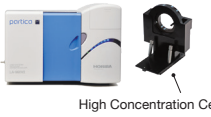
Analyzes gas concentration before and after catalyst.

Multi-Component  
Gas Analyzer  
VA-5000



Measures the particle size and analyzes the aggregation state of undiluted catalytic ink.

Laser Scattering  
Particle Size  
Distribution Analyzer  
Partica Series



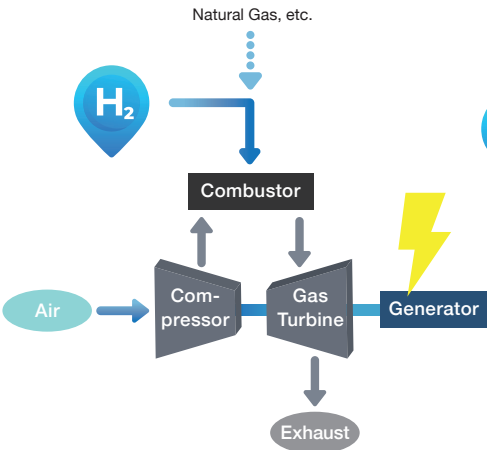
Nano Particle Analyzer  
nanoPartica Series



## Hydrogen Utilization - Industry Application -

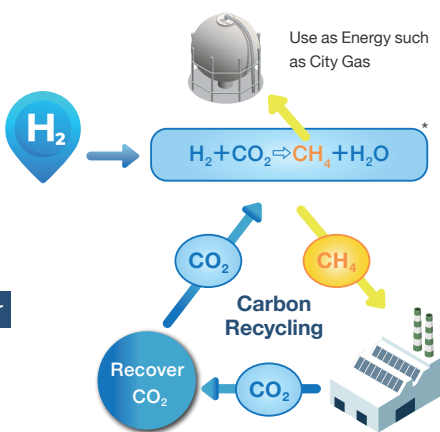
### Hydrogen Power Generation (Mixed Firing and Exclusive Firing)

Generates electricity by burning "H<sub>2</sub> and other fuel" or "H<sub>2</sub> only"



### Methanation

Contributes to carbon recycling by synthesizing "H<sub>2</sub>" with "CO<sub>2</sub>" emitted from factories for reuse in city gas and plastic materials

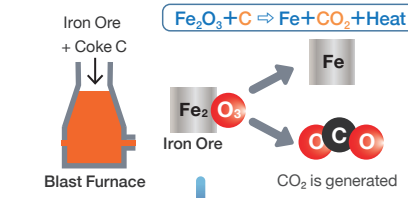


\* Explaining concepts, not exact chemical reaction equations.

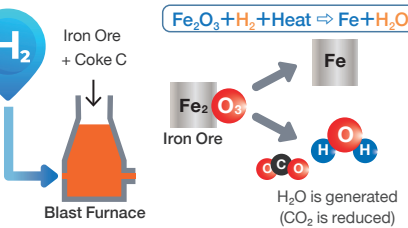
### Hydrogen Reduction Steelmaking

**Reduction Technology Using H<sub>2</sub>**  
Achieves CO<sub>2</sub> reduction by using not only coke but also H<sub>2</sub> as a reductant

#### Conventional Method (CO Reduction)



#### Hydrogen Reduction



### Denitrification, Desulfurization/Flue-Gas Monitoring

Monitors denitrification and desulfurization controls as well as exhaust gas subject to environmental regulations.

Stack Gas Analysis System  
ENDA Series



### Generated Gas Monitoring in Various Processes

Monitors gases generated in various processes, with specifications matching applications.

Multi-Component Gas Analyzer  
VA-5000



Bulletin: HRE-0072B