

# Our Gas Measurement Solutions for Alternative Fuel Combustion

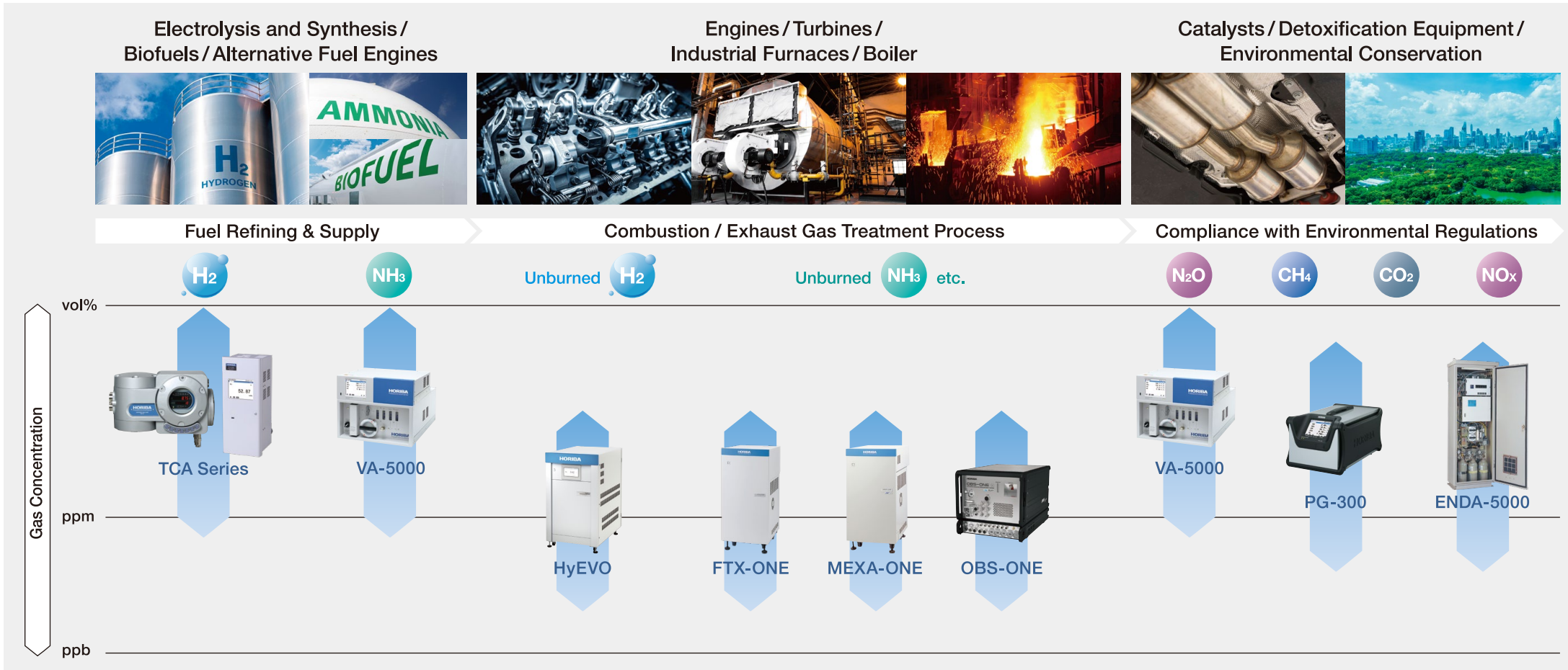
(Mono-fuel combustion, mixed combustion / H<sub>2</sub>, NH<sub>3</sub>, etc.)

Hydrogen and ammonia are essential energy sources for decarbonization in various fields such as transportation, power generation, and various industries.

Therefore, the implementation of alternative energies is accelerating to achieve carbon neutrality toward 2050.

HORIBA is contributing to the "Carbon Neutrality" effort through our leading-edge measurement solutions.

**HORIBA**



## Highly-sensitive Measurement of Nitrogen Compound Gases

### MEXA-ONE IRLAM\* Absorption Method Exhaust Gas Measurement System

[WET] [High-Speed Response]

New "IRLAM" technology developed by HORIBA improves robustness, fast response (on the order of msec), and high sensitivity measurement (minimum range: 10 to 20 ppm) for understanding the combustion process.

\*IRLAM is the measurement principle of NH<sub>3</sub> and N<sub>2</sub>O.

NH<sub>3</sub> NO NO<sub>2</sub> N<sub>2</sub>O etc.



## Continuous Measurement up to 28 Gases

### FTX-ONE-CS/RS FTIR Exhaust Gas Analyzer

[WET] [High-Speed Response]

Continuous and high-speed measurement of concentrations of up to 28 components such as NO, NO<sub>2</sub>, N<sub>2</sub>O and other nitrogen oxides, NH<sub>3</sub>, and H<sub>2</sub>O contained in exhaust gas.

NH<sub>3</sub> NO NO<sub>2</sub> N<sub>2</sub>O CH<sub>4</sub> CO<sub>2</sub> etc.



FTIR

## High-precision, High-resolution Hydrogen Gas Analysis

### HyEVO Hydrogen Gas Analyzer

[WET] [Fast Response]

Hydrogen gas analyzer capable of measuring gases containing high humidity with high accuracy and resolution without moisture removal. Response time of less than 1 second is realized, enabling measurement of even transient concentration changes.



Mass spectrometry

## Hydrogen Gas Measurement in the 100% Range

### TCA Series Explosion-proof Gas Analyzer

[Explosion-proof] [DRY]

Continuous measurement of hydrogen gas in various plants with a measurement range up to 100%.



Thermal conduction method

## Various Gas Components

### VA-5000 Series Multi-component Gas Analyzer

[DRY] [General Purpose]

This gas analyzer meets diverse needs from various types of combustion exhaust gas analysis to support new energy development, and is applicable to various gas component measurement such as NH<sub>3</sub>, N<sub>2</sub>O, etc.

NH<sub>3</sub> NO<sub>x</sub> N<sub>2</sub>O CH<sub>4</sub> CO<sub>2</sub> etc.



NDIR

## Continuous Measurement

### ENDA-5000 Series Stack Gas Analysis System

[DRY] [Continuous Measurement]

Ideal for monitoring of stationary installations for stable measurement of gases after separation and treatment. We also offer the ENDA-C9000 series for power plants which supports continuous monitoring of NH<sub>3</sub>.

NO<sub>x</sub> N<sub>2</sub>O CH<sub>4</sub> CO<sub>2</sub> etc.



NDIR

## For Gas Flow Measurement

### EXFM-ONE Ultrasonic Exhaust Flow Meter

Directly measures exhaust gas flow from vehicles and engines using an ultrasonic method. Combined with exhaust gas concentration measurement, the weight of each gas component in the exhaust gas can be calculated in real time.



## Lightweight, Portable and Compact

### PG-300 Series Portable Gas Analyzer

[DRY] [Continuous Measurement]

Portable gas analyzer capable of measuring each component in combustion exhaust gas with high accuracy, also applicable to N<sub>2</sub>O and CH<sub>4</sub> measurement.

NO<sub>x</sub> N<sub>2</sub>O CH<sub>4</sub> CO<sub>2</sub> etc.



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## Measuring Exhaust Gas during Real Road Driving

### OBS-ONE GS/IRLAM Portable Emission Measurement System (PEMS)

[WET] [High-speed Response]

Portable Emission Measurement System (PEMS) for real-driving emissions which measures the gases such as NH<sub>3</sub> and N<sub>2</sub>O in the exhaust gas.

NH<sub>3</sub> NO NO<sub>2</sub> N<sub>2</sub>O CH<sub>4</sub> CO<sub>2</sub> etc.



IRLAM™ (Infrared Laser Absorption Modulation) is a next-generation infrared gas analysis technology originally developed by HORIBA.



<https://www.horiba.com/int/irlam/>

IRLAM is a registered trademark or trademark of HORIBA, Ltd. in Japan and other countries.

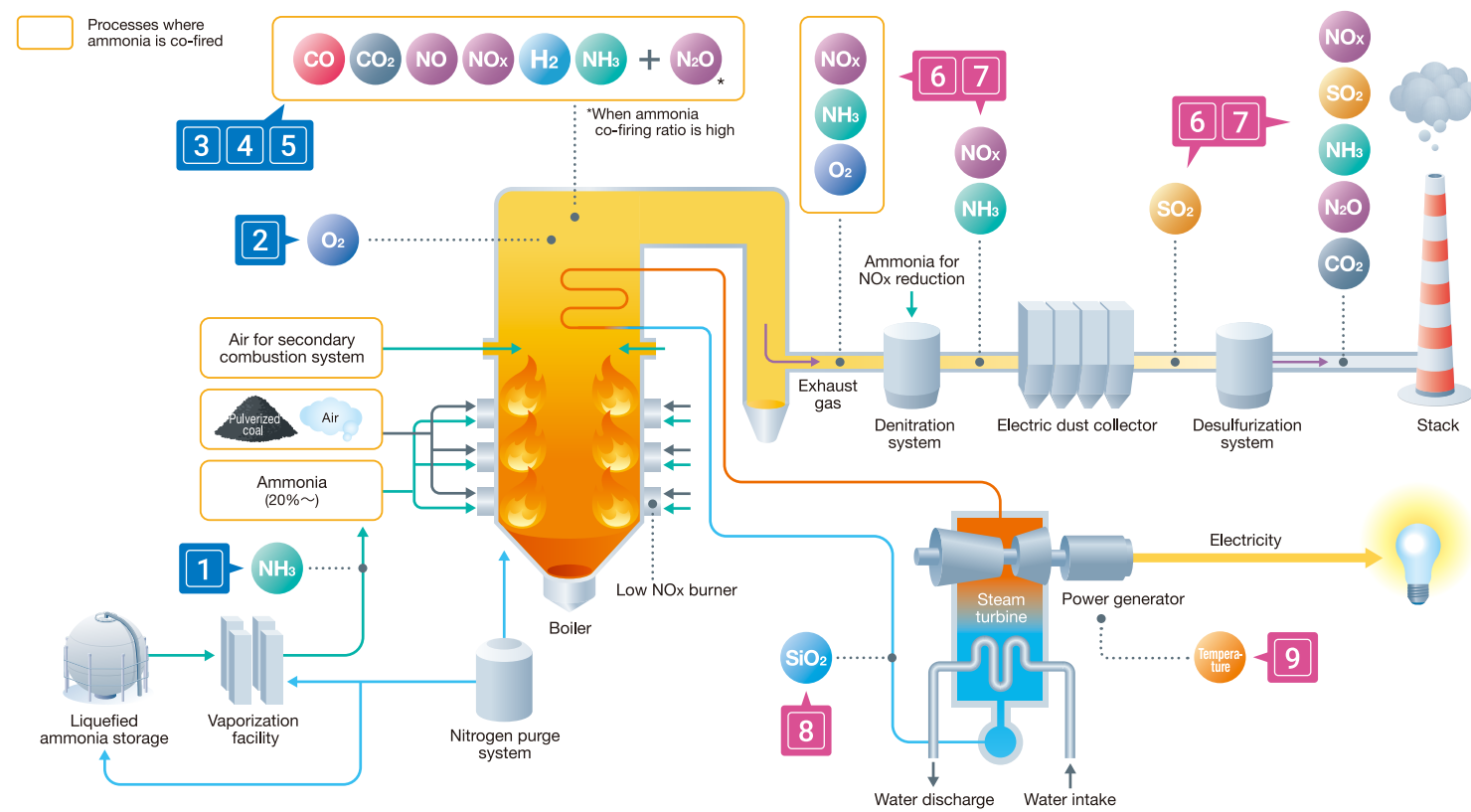
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### For R&D / demonstration system

#### Power generation by ammonia co-firing / 100% firing

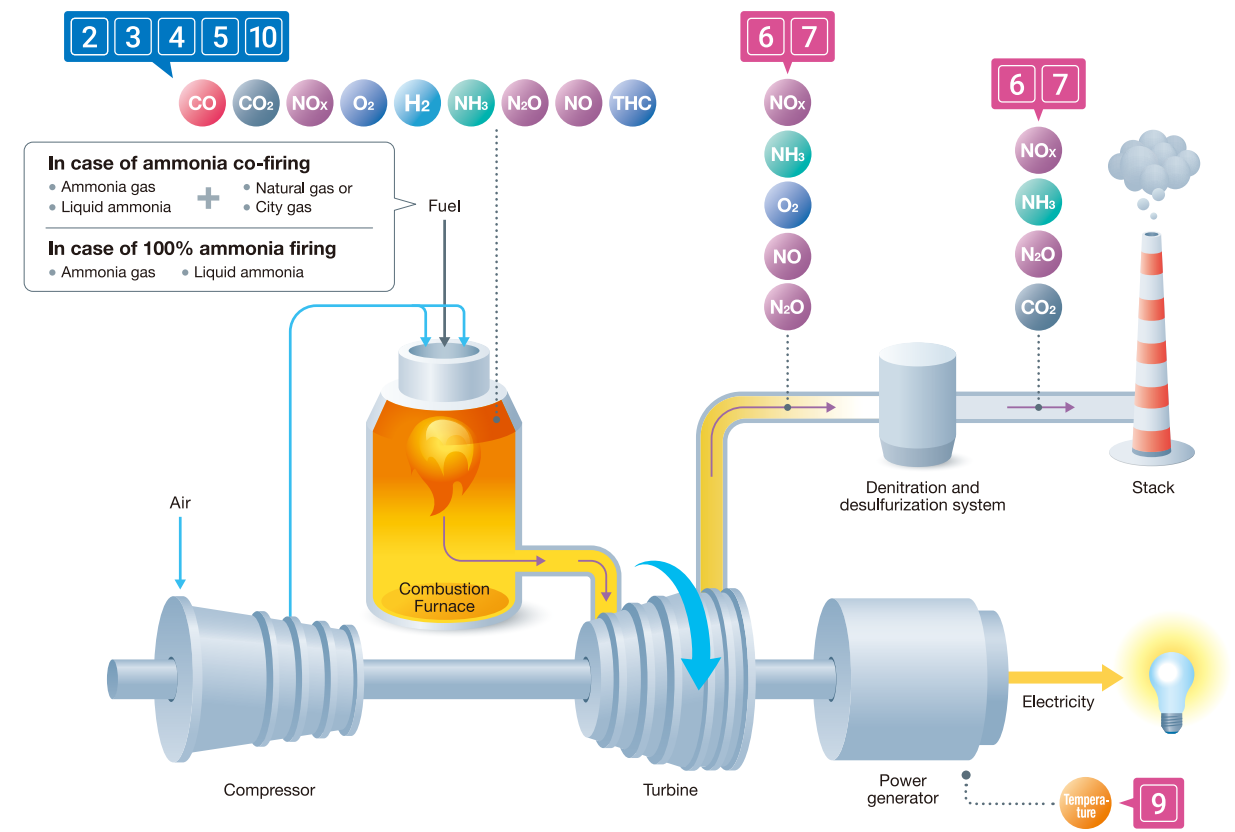
R&D of burners for higher rate of ammonia co-firing / 100% ammonia firing in coal-fired power generation facilities is underway, aiming to improve combustion methods and gas treatment facilities' operation methods in order to realize the social implementation of ammonia co-firing/ full-firing systems. Currently, practical tests are ongoing with a 20% ammonia co-firing pulverized coal boiler. Furthermore, endeavors are in progress to elevate the co-firing rate, with the aim of achieving 100% ammonia firing by the 2030s.



### For R&D / demonstration system

#### Gas-turbine power generation by liquid ammonia with direct spray method

100% liquid ammonia firing technology to reduce greenhouse gas (GHG) emissions from conventional gas turbine power generation systems is under development. Given that liquid ammonia has lower flammability than gases, it is necessary to stabilize the flame and reduce harmful substances in the exhaust gas. In addition to conventional air pollutants such as NO<sub>x</sub>, there is a particular need to measure unburned NH<sub>3</sub> and N<sub>2</sub>O.



#### Performance Evaluation of Burner / Boiler / Combustion Furnace

<p><b>1</b> Monitoring the concentration of fuel NH<sub>3</sub> for enhancing combustion efficiency</p> <p>Multi-Component Gas Analyzer VA-5000</p>	<p><b>2</b> Monitoring of O<sub>2</sub> concentration for prevention incomplete combustion</p> <p>Multi-Component Gas Analyzer VA-5000</p>
<p><b>3</b> Monitoring of NH<sub>3</sub> concentration for detection unburned NH<sub>3</sub> and misfires in NH<sub>3</sub> co-firing burners</p> <p>Laser Spectroscopic Exhaust Gas Analyzer MEXA-ONE-IRLAM</p>	<p><b>4</b> Nitrogen oxide emissions and unburned NH<sub>3</sub> monitoring in combustion exhaust gas, when NH<sub>3</sub> co-firing ratio is high</p> <p>Multi-Component Gas Analyzer VA-5000</p> <p>Stack Gas Analysis System ENDA-5000</p> <p>Nitrogen Oxides Monitor APNA-380</p> <p>Optimized internal structure enables rapid switching between NO<sub>x</sub> and NO lines, allowing real-time continuous measurement</p>
<p><b>5</b> Monitoring the concentration of CO / H<sub>2</sub> for grasping combustion conditions</p> <p>Hydrogen Gas Analyzer HyEVO</p> <p>Multi-Component Gas Analyzer VA-5000</p>	<p><b>10</b> Monitoring the concentration of THC for fuel combustion efficiency control</p> <p>Stack Gas Analysis System ENDA-5000</p> <p>Hydrocarbon Monitor APHA-380</p> <p>Flame ionization detector with selective combustion provides simultaneous measurement of THC, CH<sub>4</sub> and NMHC</p>

#### Environmental Assessment Evaluation / Efficient Facility Management

<p><b>6</b> Monitoring of NO<sub>x</sub> and SO<sub>2</sub> concentrations before and after denitration and desulfurization systems</p> <p>Stack Gas Analysis System ENDA-5000</p> <p>Sulfur Dioxide Monitor APSA-380</p> <p>Long-term stable continuous measurement with eliminating interference from moisture and coexisting components</p>	<p><b>7</b> Monitoring whether GHG emissions from the stack comply with environmental regulation thresholds</p> <p>Multi-Component Gas Analyzer VA-5000</p> <p>Stack Gas Analysis System ENDA-9000 series</p>
<p><b>8</b> Silica measurement for sludge control</p> <p>Silica analyzer SLIA-5000</p> <p>Obtain highly repeatable measurement results in 5 minutes</p> <p>Sensitivity range: 0 to 10 µg/L</p> <p>Concentration range: 0 to 5.0 mg/L</p>	<p><b>9</b> Temperature measurement for condition monitoring of turbines, bearings, etc.</p> <p>Infrared Thermometers IT-480 series</p> <p>A built-in/installable infrared thermometer with industry's highest level of accuracy* For temperature control of various systems and plants.</p> <p>*According to our investigation, as of 2023.</p>