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Fuji Electric Group

Outline of Phosphoric Acid Fuel Cell (PAFC) Package by Fuji Electric

13th December 2017

Fuji Electric Co., Ltd.

How was Fuji Electric founded?

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"Fuji Electric Co., Ltd." was established as a capital and technology alliance between Japan "Furukawa Electric Co., Ltd." and German "Siemens AG“ in 1923.

Fu rukawa Electric Co., Ltd. FURUKAWA ELECTRIC

Si emens A.G. SIEMENS

Fuji Electric Fuji Electric

The company name derived from these two companies' first sound "**Fu**" and "**Si**“ and the highest mountain in Japan, **Mt. Fuji**.

Fuji Electric's business

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Power Electronics Systems


Factory energy management systems (FEMS)

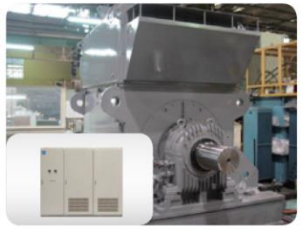

Uninterruptible power systems


Substation equipment


Magnetic switches


General-purpose inverters


Gas analyzers


Industrial drive systems


Passenger door systems

Power and New Energy

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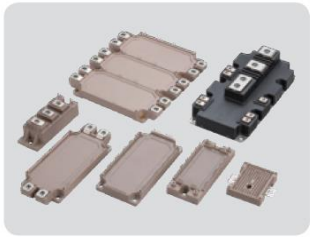
Steam turbines

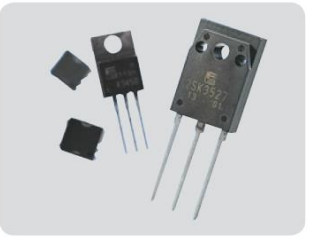

Geothermal power generation


Fuel cells

Electronics Devices


IGBT modules


SiC modules


Power MOSFETs

Food and Beverage Distribution


Can and PET bottle vending machines


Vending machines for food and other goods (models for China and other Asian markets)


Freezers and refrigerated showcases

Development of PAFC at Fuji Electric

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1973 1990 1998 2010

Field tests → Commercialization → Business expansion

☆Development of fuel-cell stacks

☆Achievement of long lifetime (40,000h)

☆Extension of lifetime (60,000h)

☆Shipment of "FP-100i"

Field tests
over 90 sites

All-in-one packaging
Operable in cold climates
[-20 to +40 deg. C]

Focused on 100kW PAFC fuel cells, because of prospects for a large market and for cost reduction by mass-production.

Installed Fuel Cell Packages

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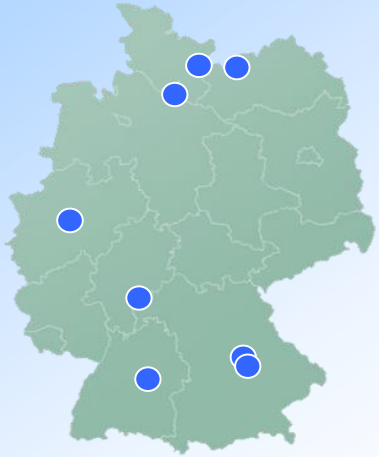
Germany 8 units
(one is before site test)



Korea 6 units

USA 2 units

France 1 unit
(Before site test)

South Africa 1 unit

Japan 67 units

As of December 2017

Biogas
Natural Gas
Hydrogen

Delivered by N2 telligence Fuji Electric Group

Major Specifications of FP-100i

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FC Type	PAFC / Phosphoric Acid Fuel Cell
Rated output power	AC 105 kW [at generating point]
Output voltage	AC 400V, 3-phase and 3-wire
Output frequency	50 Hz
Electrical efficiency	42 % [LHV] [at generating point]
Thermal output and efficiency	High temperature recovery at 105kW operation: 45 kW (90℃) Low temperature recovery at 105kW operation: 78 kW (45℃) Total efficiency: 91% when all recovered heat is used
Exhaust gas	NOx: less than 5 ppm [O_2 0 %] SOx, dust: less than the detection limit
Consumption of gas	Natural gas: 26 m^3N/hour
Operating system	Fully automated / Grid-connected and Standby
Dimensions	2.2m (W) x 5.9m (L) x 3.5m (H)
Weight	14.5 ton

Features of fuel cell

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1. **Distributed power source**
   "100kW" is optimal capacity to small and medium-sized building.
2. **Combined heat and electricity**
   FC generates both electricity and heat.
3. **Environmentally friendly power source**
   FC has low emissions of toxic substances, a low noise level and no vibration as well.
4. **High efficiency**
   Total efficiency including electricity and heat reaches more than 90%.
5. **Fuel flexible**
   FC has flexibility in applicable fuel including natural gas and biogas.
6. **Application of "low-oxygen exhaust air"**
   Low-oxygen exhaust air from FC is applicable to preventive fire protection in facilities.

Environmentally friendly power source

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Features of Phosphoric Acid Fuel Cell

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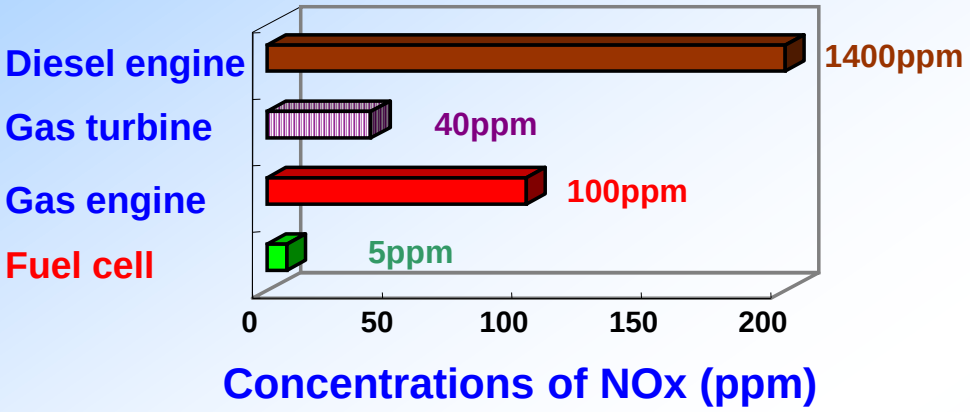
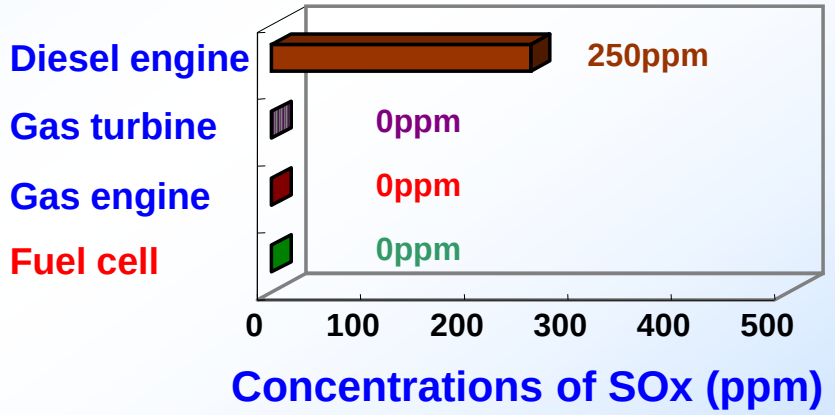
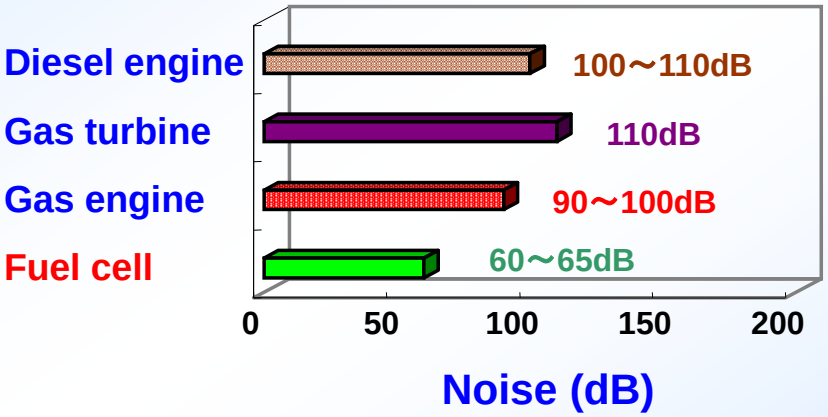
NOx emissions



SOx emissions



Noise



- ✓ **Exhaust gas is clean.**
- ✓ **Noise level is low.**

Configuration of FP-100i package

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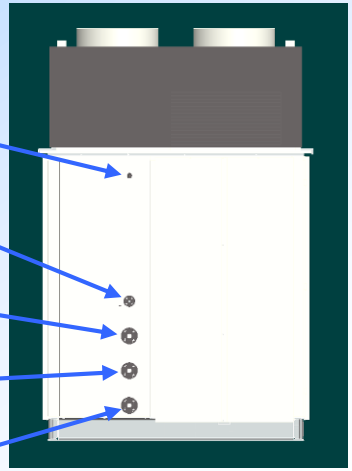
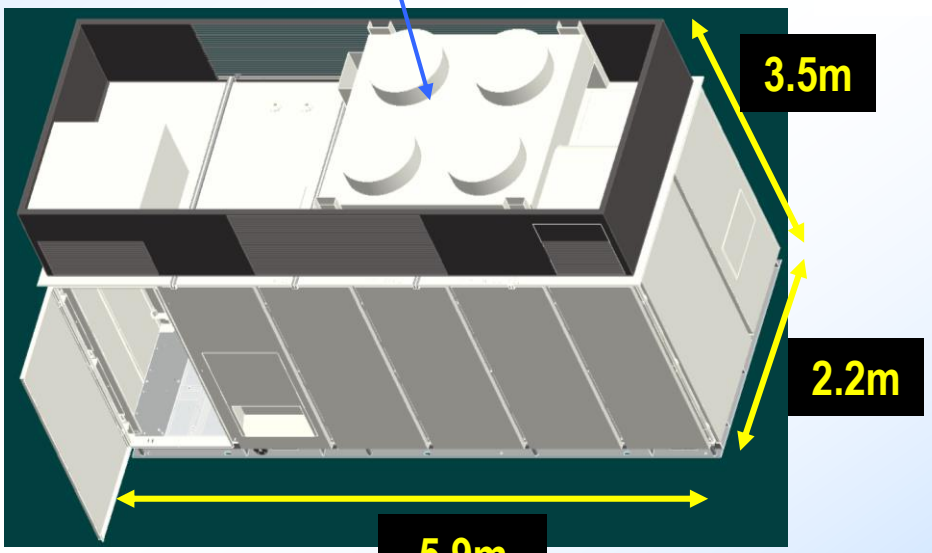
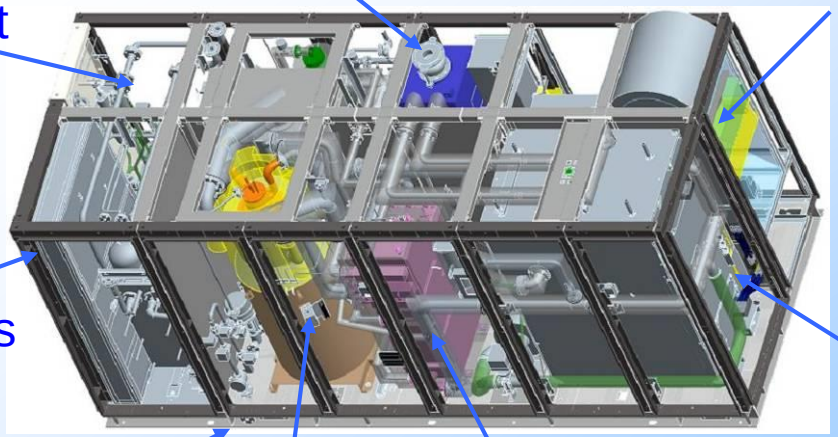




Fuel-cell stack

Reformer



Target market

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Our PAFC packages are capable of performing functions conventional power plants cannot perform.

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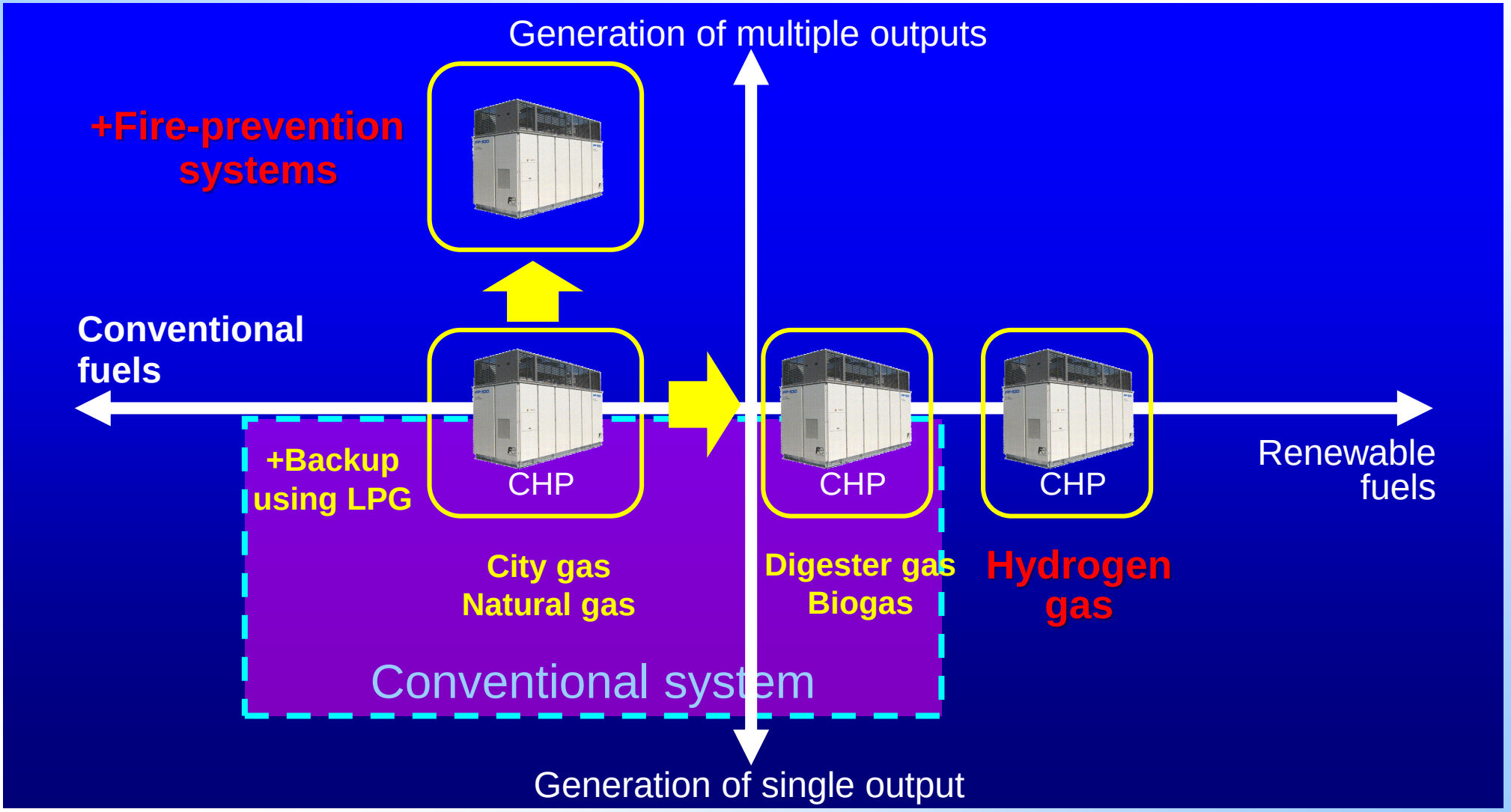

Fuel-cell package application

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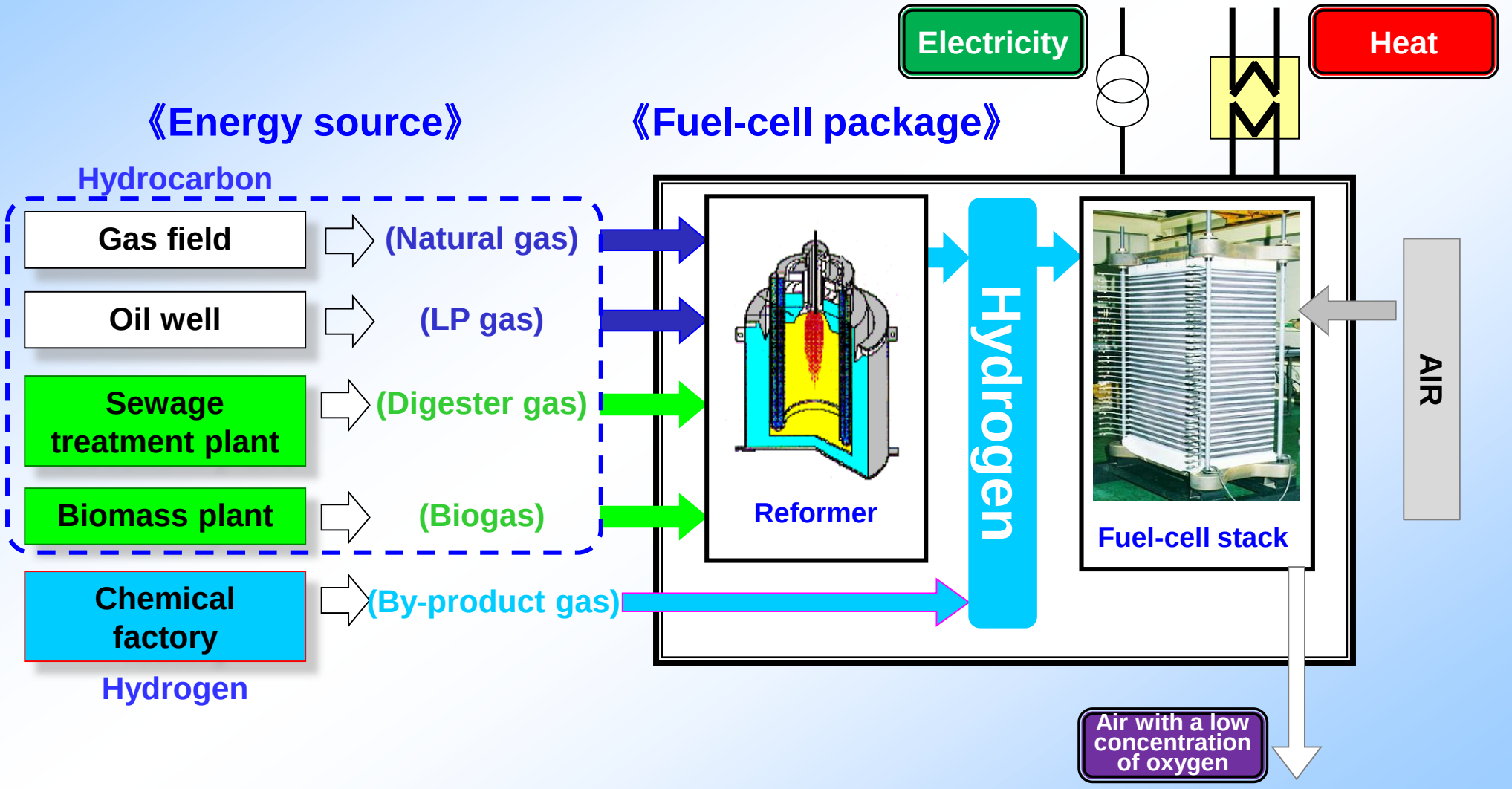

Application of hydrogen-fed FC

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Highly efficient power generation with hydrogen

- ◆Electrical efficiency is high: 48%.
- ◆Steelworks supplies hydrogen gas through a pipeline.
- ◆The first package began to operate in 2011.

KITAKYUSHU MUSEUM OF NATURAL HISTORY & HUMAN HISTORY

This fuel-cell package was installed by the Research Association for Hydrogen Supply/Use Technology (HySUT) as a part of proof-of-concept tests funded by the Ministry of Economy, Trade and Industry (METI).

Pure hydrogen gas-fed fuel-cell systems

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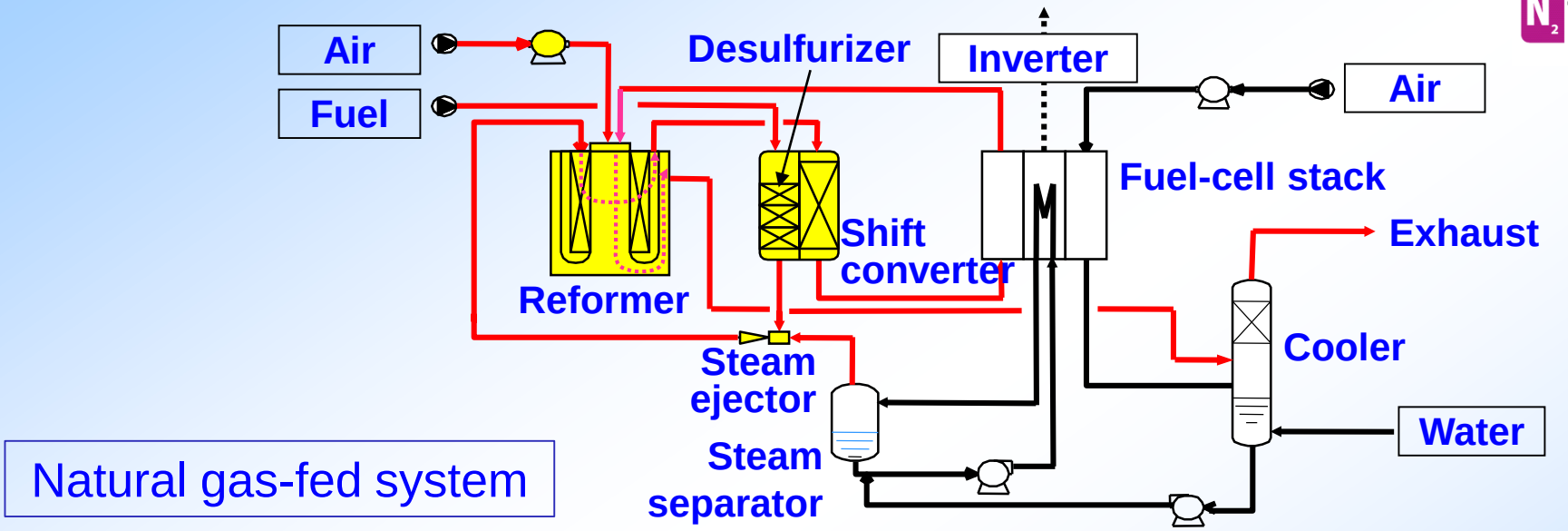
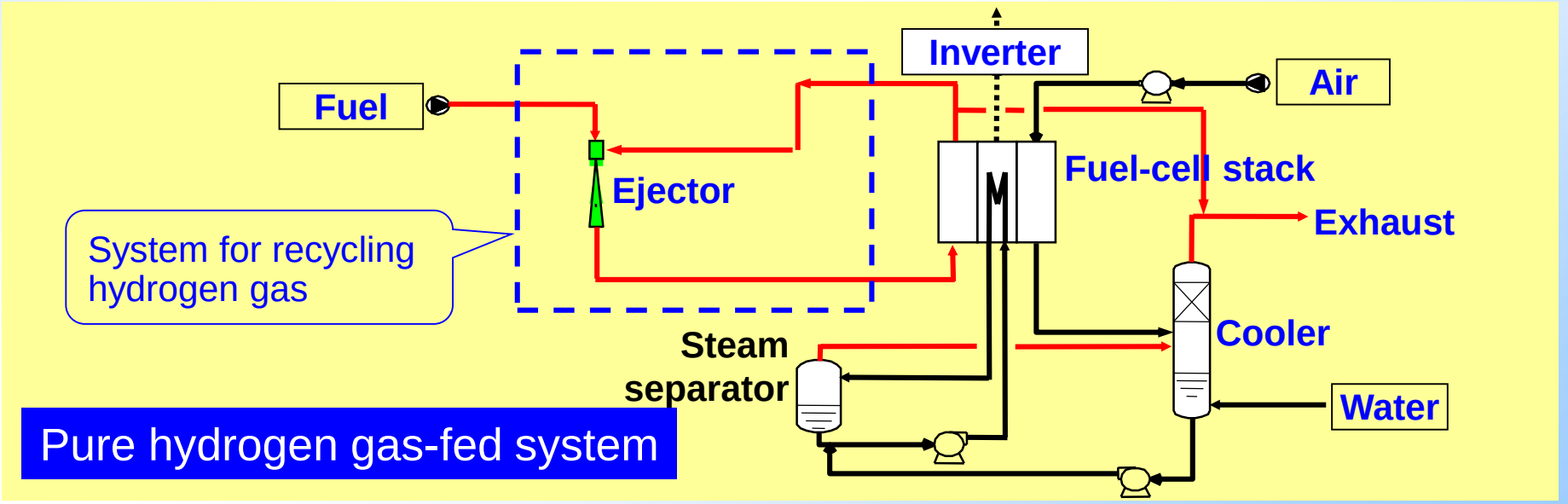


Natural gas-fed system



Pure hydrogen gas-fed system

Application of Fire-prevention

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Fire-prevention of a tire warehouse with our 100kW fuel cell system.

Application of Fire-prevention

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Fire prevention of a 30.000 m3 deep freezing warehouse with our 100kW fuel cell system.

Theory of Fire-prevention

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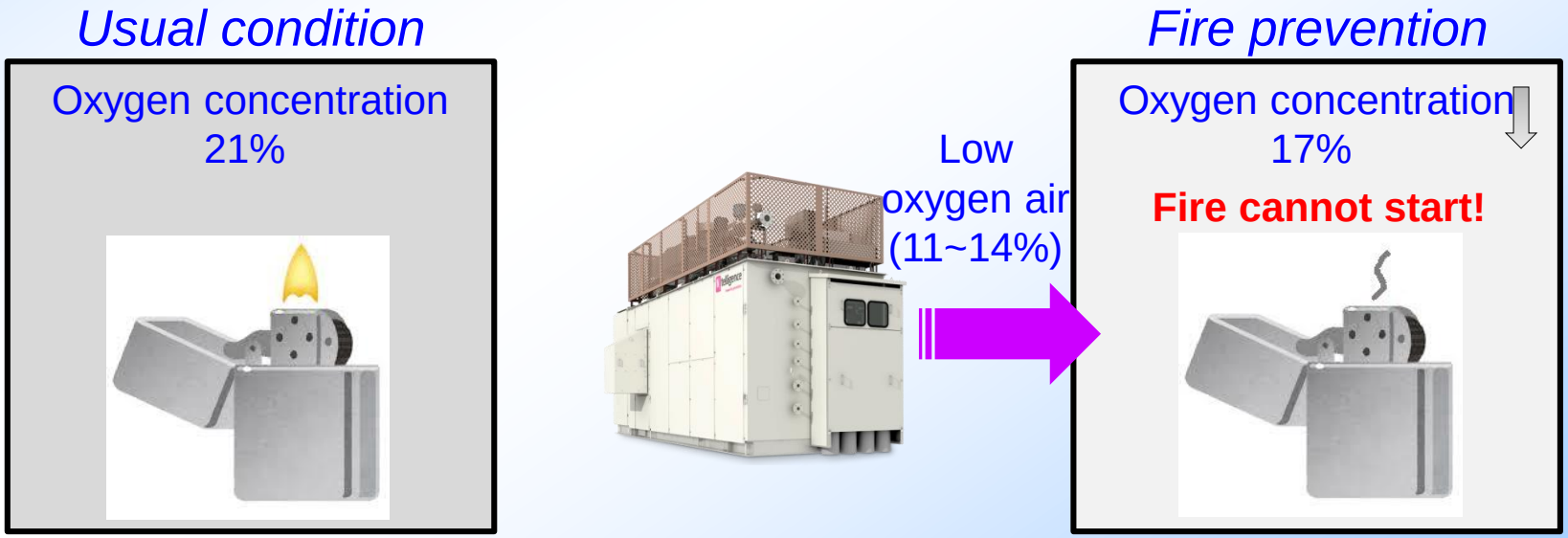
Hypoxic air technology for fire prevention

Hypoxic air technology for fire prevention, also known as oxygen reduction system, is an active fire protection technique based on a permanent reduction of the oxygen concentration in the protected rooms. Unlike traditional fire suppression systems that usually extinguish fire after it is detected, hypoxic air is able to prevent fire.



Required O2 concentration for Fire-prevention

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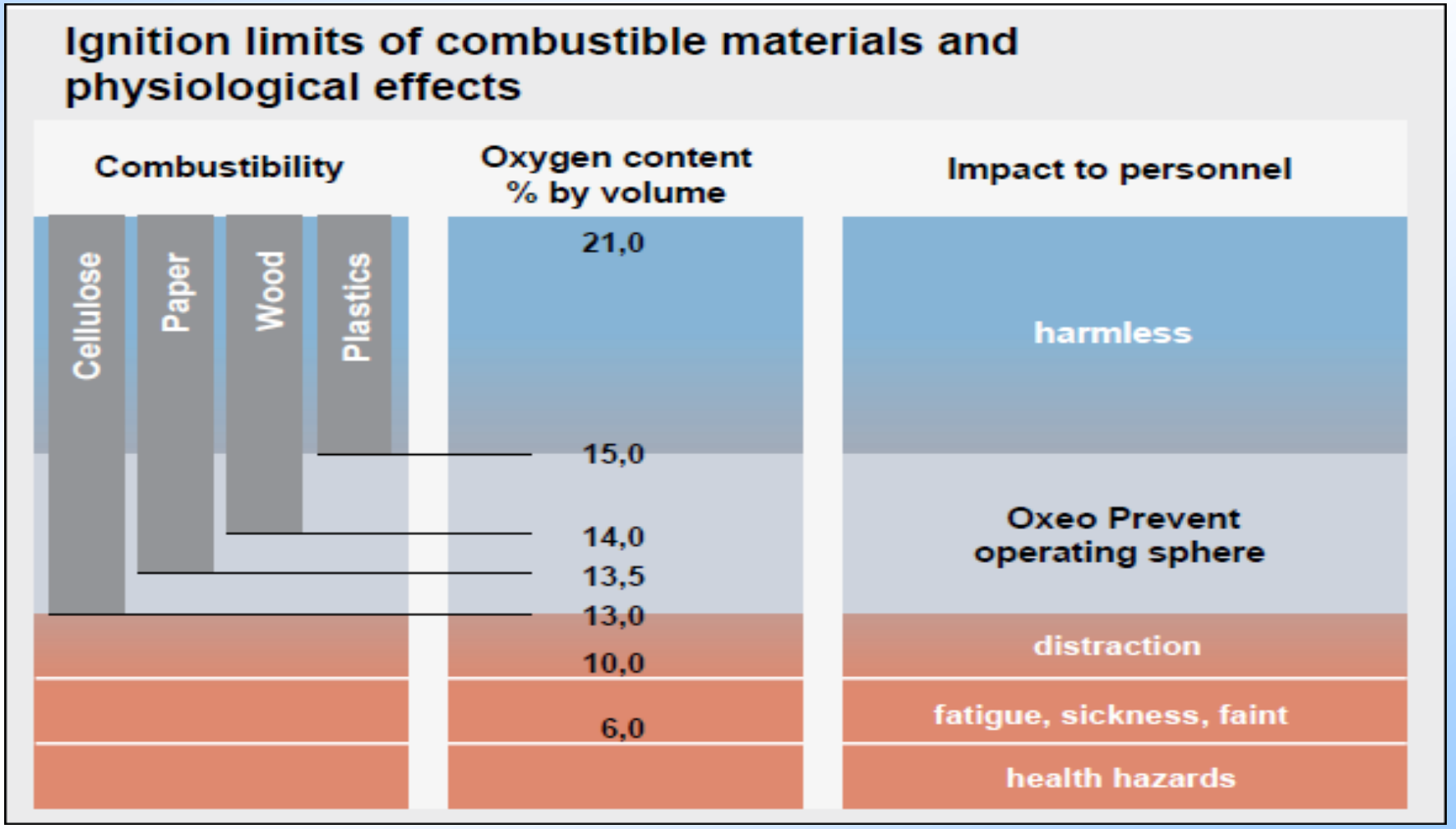
Food: Ignition limit is 17% of oxygen concentration
Fire prevention system will be built by cooperation with MINIMAX.



1st fire prevention system with a Return On Invest

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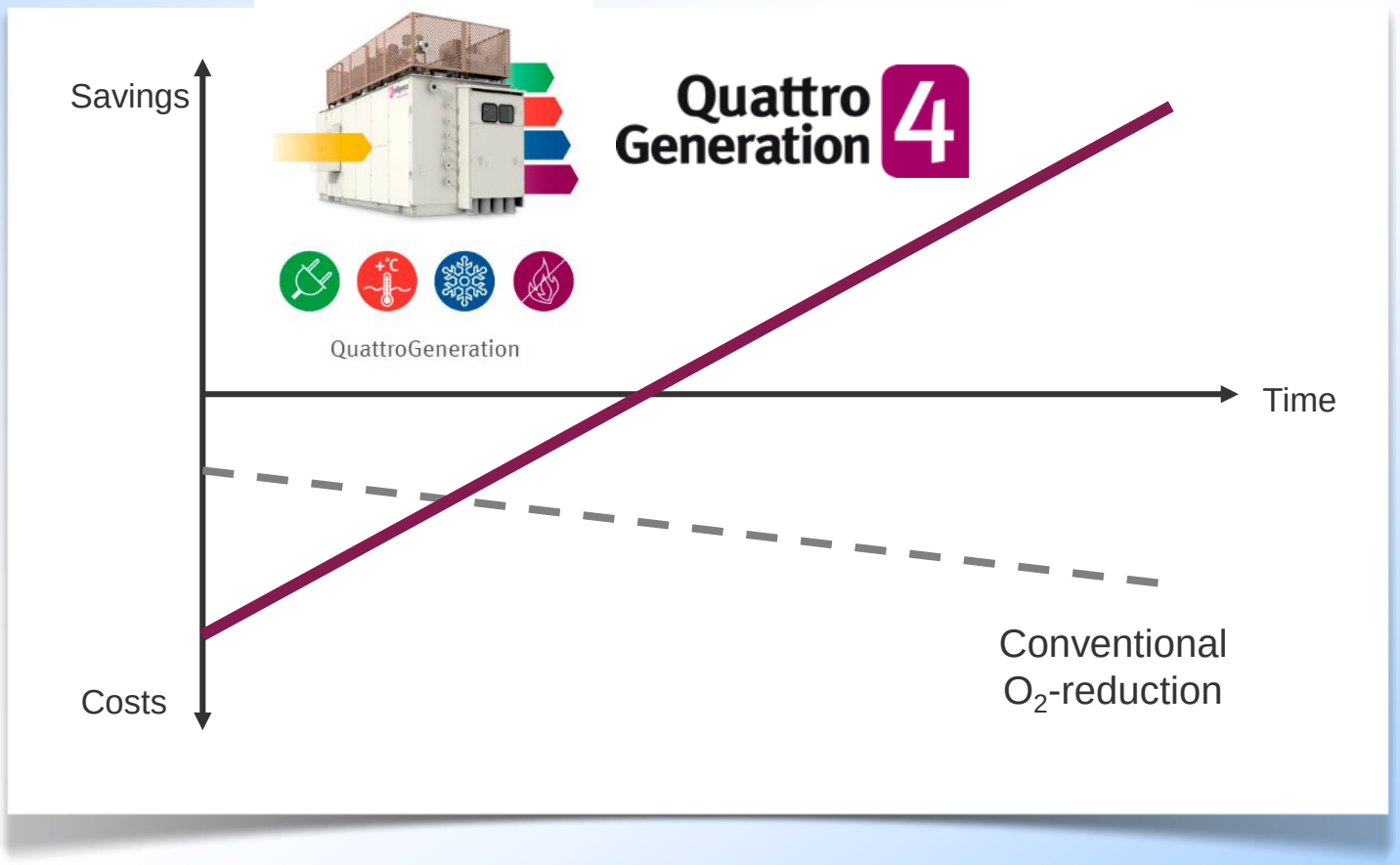
Conventional fire prevention and extinguishing systems never show a ROI.



Summary

- We will create larger markets by providing customers with additional value;
- We will increase our production capacity to satisfy the increasing demand for fuel-cell packages;

Information and contact

You can also find all the information about our products in our brochures.
Or simply get in touch with us.
We would be happy to answer your questions about our fuel cell technology or specific projects.
Give us a call, or write to us.

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