The 11th NEDO-CDTI Joint Workshop
“Technologies for Hydrogen Valley in Spain and Japan – Regional H2 Value Chain”

Providing high value-added hydrogen by taking advantage of our high technological capabilities related to hydrogen compressors

Yasutaka NAKATANI

General manager

Engineering department,

KAJI TECHNOLOGY CORPORATION

NEDO GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN CDTI INNOVACIÓN CO_2 FREE FUEL H_2YES Yamanashi Hydrogen Energy Society AeH2 ASOCIACIÓN ESPAÑOLA DEL HIDRÓGENO

Company profile

NAME OF COMPANY	KAJI TECHNOLOGY CORPORATION (KAJI)
FOUNDED	1905
CAPITAL	JPY 1,440,000,000.-
ANNUAL SALES	Approx. JPY 5,000,000,000.-
HEAD OFFICE	6, BODAI, MIHARA, SAKAI, OSAKA, JAPAN
SALES DIV.	HULIC KASAI RINKAI 4F. 3-6-4, RINKAI-CHO, EDOGAWA-KU, TOKYO
NO. OF EMPLOYEE	Approx. 200
MAJOR PRODUCT	Reciprocating Compressor, Pressure Vessel, Heat Exchanger
AFFILIATED COMPANIES	Mitsui E&S Machinery (Marin diesel engine, Port crane, Large size compressor, etc.)

Organization

- GENERAL MEETING OF SHAREHOLDERS
  - BOARD OF CORPORATE AUDITORS
  - BOARD OF DIRECTORS
  - PRESIDENT
    - AUDIT DEPT.
    - CORPORATE PLANNING DEPT.
    - HUMAN RESOURCES & GENERAL AFFAIRS DEPT.
    - FINANCE & ACCOUNTING DEPT.
    - SALES DEPT.
      - OVERSEAS SALES SECTION
      - DOMESTIC SALES SECTION
      - CARBON NEUTRAL SALES SECTION
    - TECHNICAL SERVICE DEPT.
    - ENGINEERING DEPT.
      - DEVELOPMENT SECTION
      - ENGINEERING SECTION-1
      - ENGINEERING SECTION-2
      - ENGINEERING SECTION-4
      - ELECTRICAL, INSTRUMENTATION & CONTROLS SECTION
    - PRODUCTION CONTROL DEPT.
    - PRODUCTION DEPT.
    - QUALITY ASSURANCE DEPT.

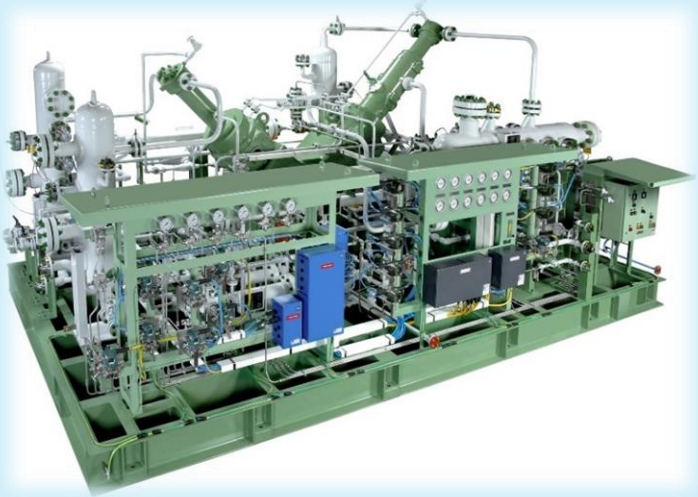
KAJI's compressor business

KAJI's compressor for…

Hydrogen gas business

PET bottle molding

Plant-related business



Other products

KAJI's representative compressor model
- For hydrogen refueling station -

Representative model	VT5-110GH-OL
Series	HyKom340
Applications	FCV Refueling
Compression Stage	5
Inlet Press.	0.6 MPa
Supply Press.	～82 MPa
Flow rate	～340 Nm^3/h
Motor Power	110 kW

✓ Features

- Pressurize hydrogen from 0.6 MPa to 82 MPa by one compressor
- Adapt oil free cylinders with all compression stage including 82 MPa discharge to eliminate oil contamination to downstream
- Apply vent free system to piston rod sealing
- Apply piston rings and compressor valves suitable for high pressure by our own design
- Sold 46 units in total from start of sales in 2015 (as of December 2022)

KAJI's representative compressor model - For hydrogen supply chain -

Representative model	VD4-150GH-OL
Applications	Hydrogen supply chain
Compression Stage	4
Inlet Press.	0.3 MPa～
Supply Press.	～19.6 MPa
Flow rate	～400 Nm^3/h
Motor Power	160 kW

✓ Features

- Adapt oil free cylinders with the technology of the high pressure compressor for hydrogen refueling stations
- Take measures for consumption of wear parts, gas leakage, hydrogen embrittlement

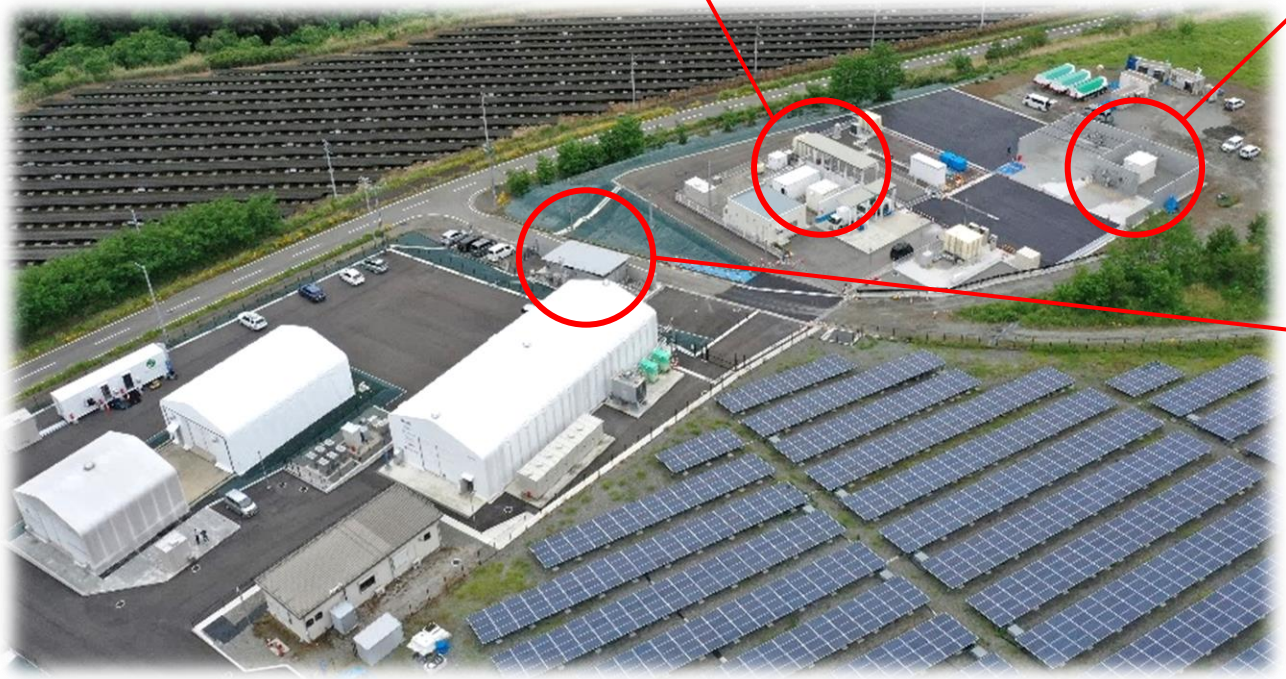
✓ <Other experience for Carbon Neutral>

- High pressure compressor for hydrogen delivery at Fukushima Hydrogen Energy Research Field (FH2R)
- Hydrogen compressor for Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD) using the organic chemical hydride method
- Hydrogen compressor for the Hydrogen Smart City Kobe for hydrogen power generation

Hydrogen compressors in Komekurayama site

KAJI's high pressure compressors have been operated in Komekurayama Electric Power Storage Technology Research Site.

- 87.5 MPa FCV refueling compressor for HySUT
- 19.6 MPa trailer filling compressor for Hydrogen from P2G
- 19.6 MPa Electrochemical hydrogen pump in previous NEDO project

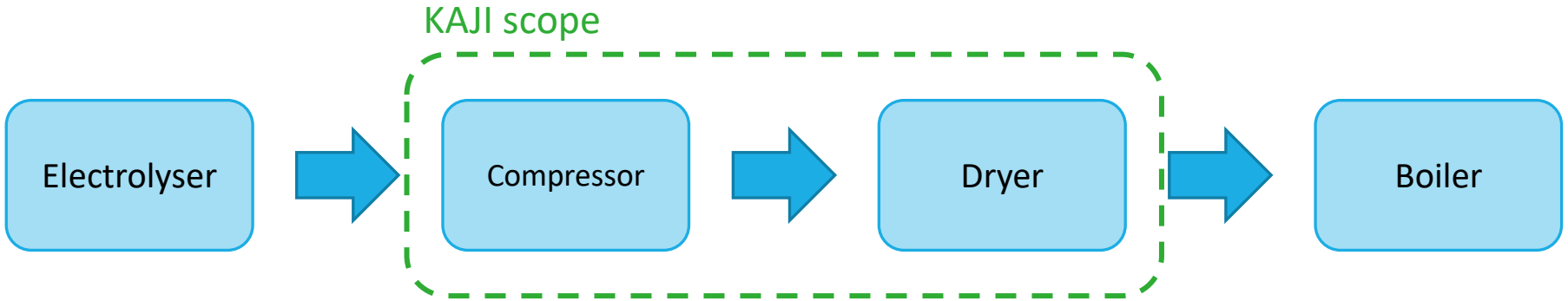


Bird' eye view of Komekurayama Electric Power Storage Technology Research Site

Electrochemical hydrogen pump

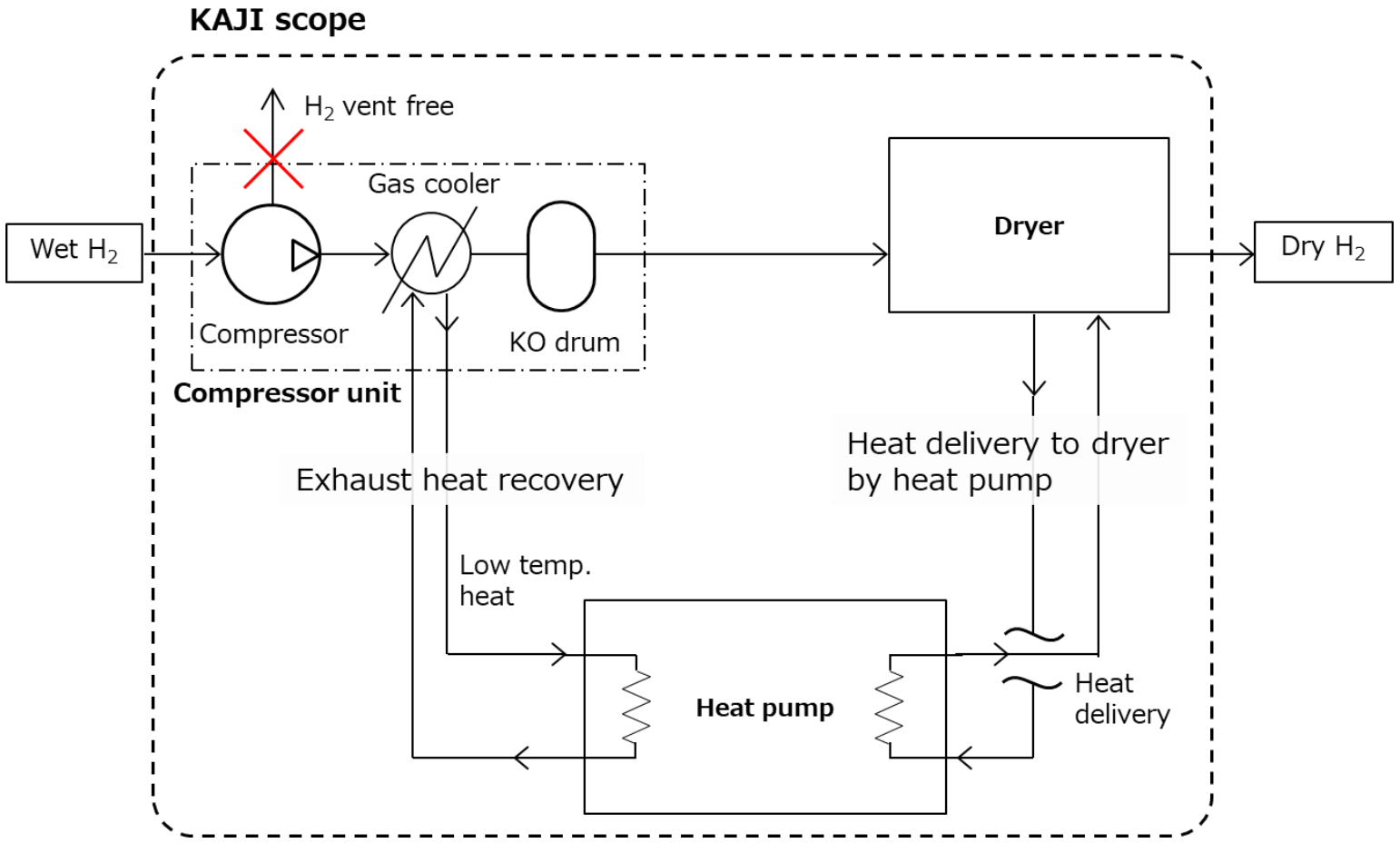
Main challenges in the NEDO P2G project - KAJI's position -

Technology development for increasing the size of water electrolysers, and Power-to-X large-scale demonstrations in a consortium



- ✓ Pressurize wet hydrogen from electrolysers for suppling to the boiler / storing to the storage tank
- ✓ Dehumidify wet hydrogen
  ⇒Aim for the atmospheric pressure dew point of -66 ℃, available for fuel cell vehicle
- ✓ Improve efficiency of the entire P2G system by the complex system with the compressor and the dryer

Main challenges in the NEDO P2G project
- System with compressor and dryer -



- ✓ Utilize waste heat from the gas cooler of the compressor to the dryer using for recovery of adsorbent by a heat pump

Main challenges in the NEDO P2G project
- Hydrogen compressor -

Reference image: Horizontally opposed type compressor

Model	MK-A-2
Applications	Full-wet H_2 compression
Compression Stage	2
Inlet Press.	0 MPa
Supply Press.	0.85 MPa
Flow rate	2000 Nm^3/h
Motor Power	280 kW

- ✓ Adapt a vent free system to the piston rod sealing
  ⇒Make P2G system more efficient by eliminate waste of hydrogen from the compressor
- ✓ Improve lifetime of piston rings
  ⇒Contribute to extend maintenance interval and reducing operating cost

Ideas for a Japan – Spain collaboration

- ✓ Collaborate on acceleration of the construction of hydrogen supply chains and Expansion of hydrogen utilization
  - Accelerate the spread of Hydrogen refuelling station
  - Make P2G system efficient and reduce hydrogen cost
  - Diffuse P2G system