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-
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Micro Gas Turbine Operation with Kerosene and Ammonia

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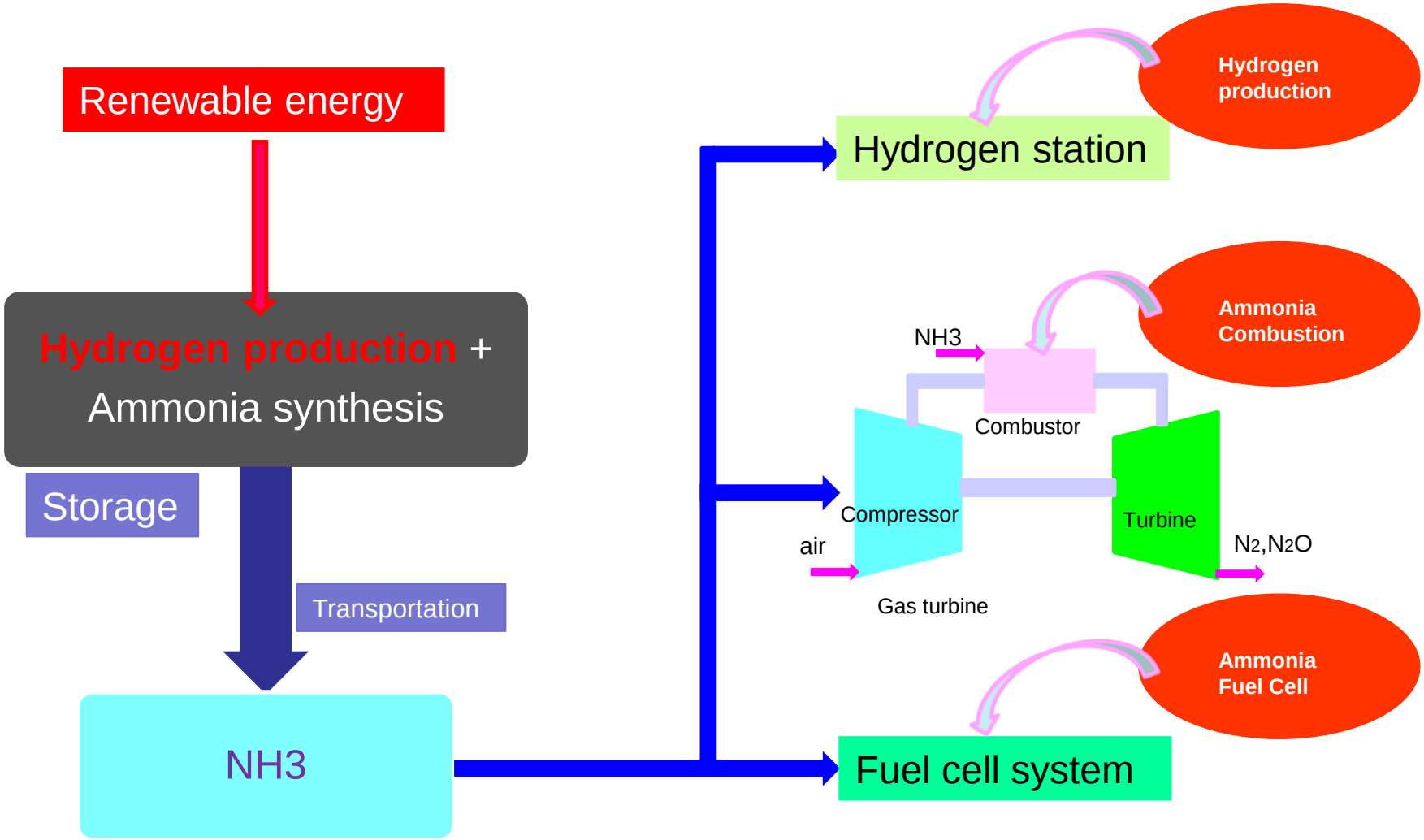
Renewable energy
Hydrogen production +
Ammonia synthesis
Storage
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NH3
Hydrogen station
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Turbine
air
N2,N2O
Gas turbine
Ammonia Combustion
Ammonia Fuel Cell
Fuel cell system

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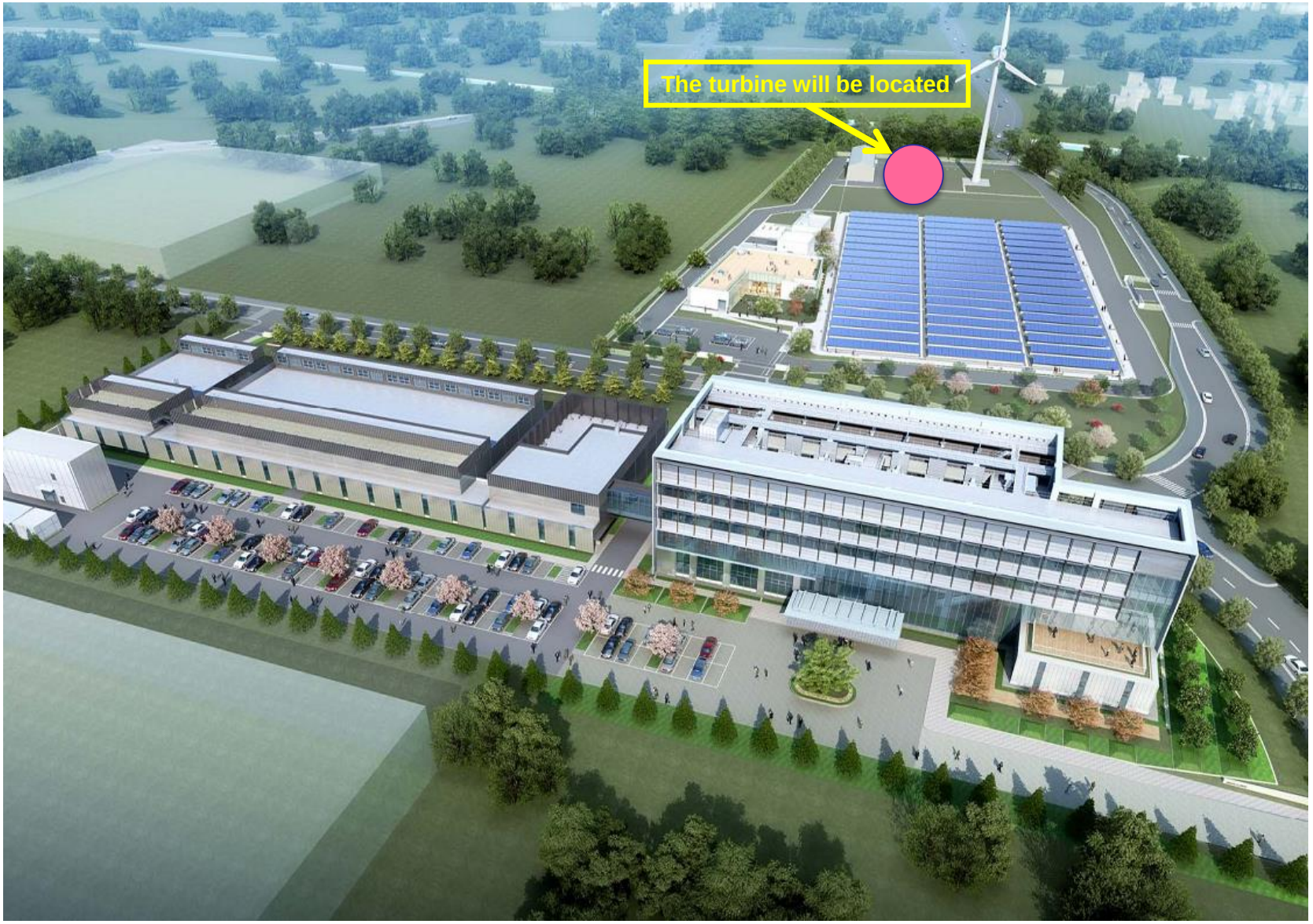
Fukushima Renewable Energy Institute (FREA), AIST

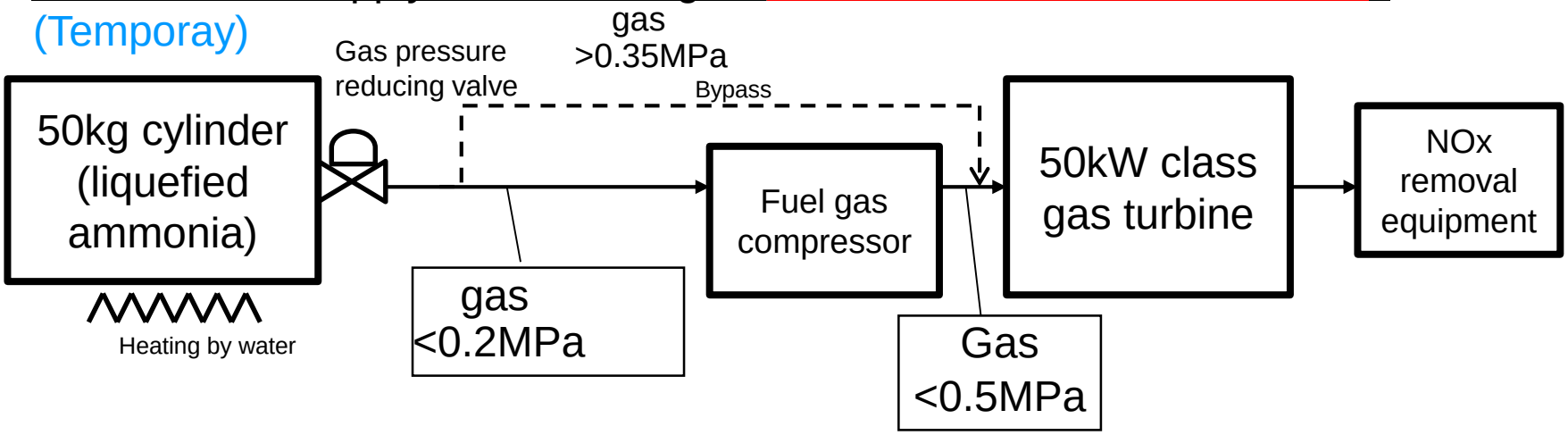


50kW class micro gas turbine set in FREA

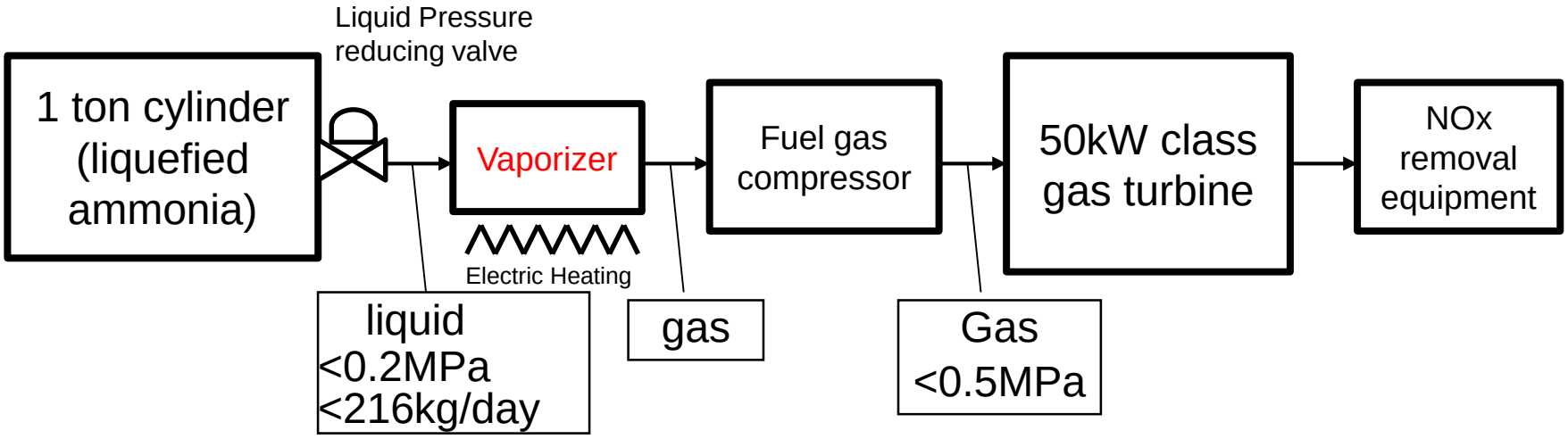
50kW class micro gas turbine firing kerosene was remodeled for power generation firing ammonia.
A standard combustor is replaced with a prototype combustor which enables a bi-fuel supply of kerosene and ammonia gas.
Diffusion combustion is employed to the prototype combustor due to its flame stability.

Plan of Ammonia Supply

- Small amount supply of ammonia gas（Kerosene ammonia combustion）
  (Temporay)



- Large amount supply of ammonia liquid and vaporizer（Ammonia combustion）
  (Under construction)



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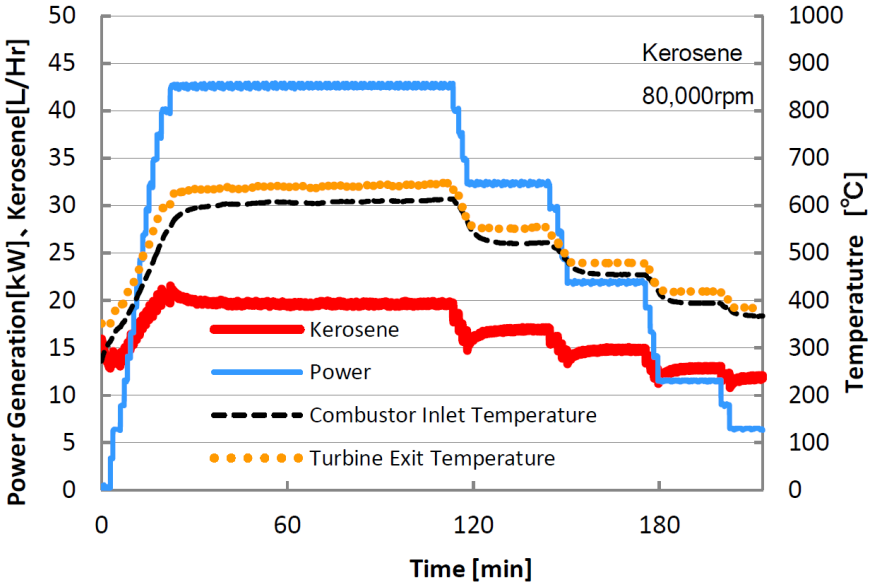
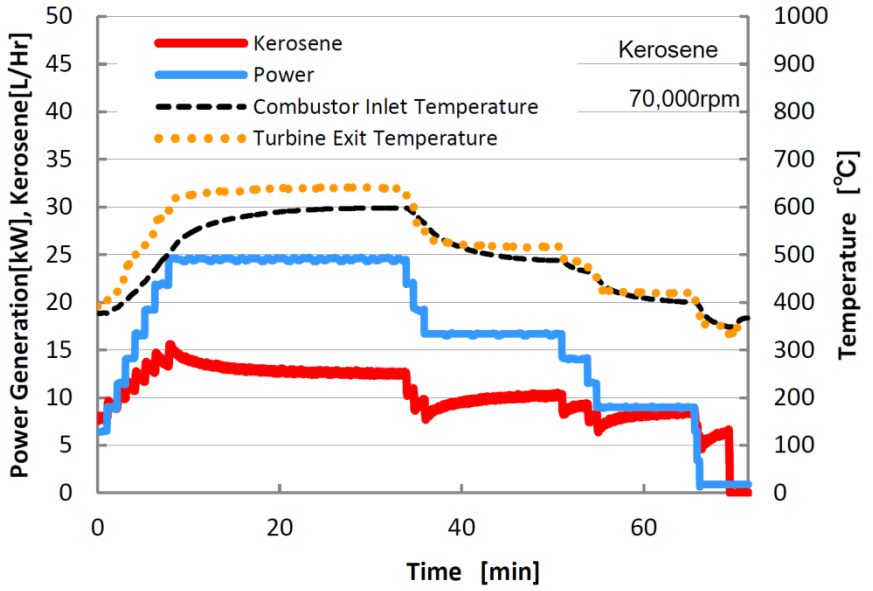
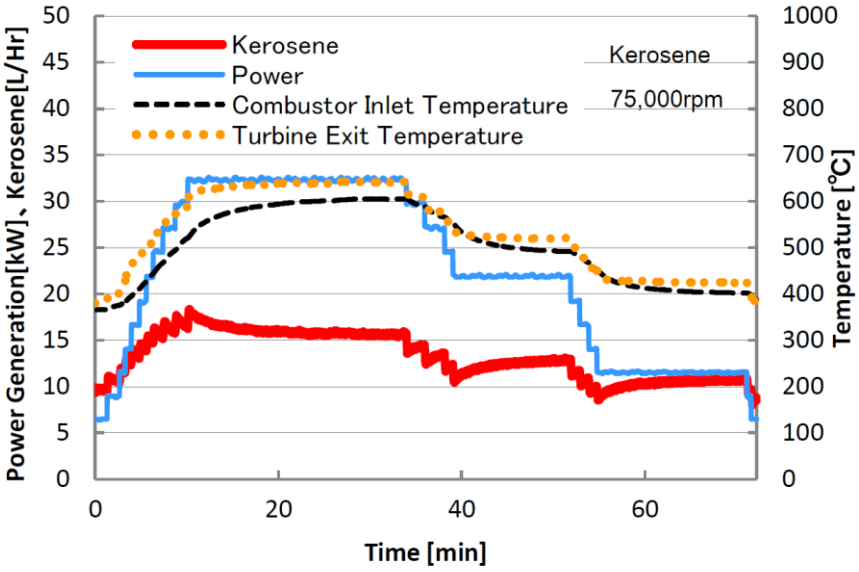
Test facilities for micro gas turbine power generation

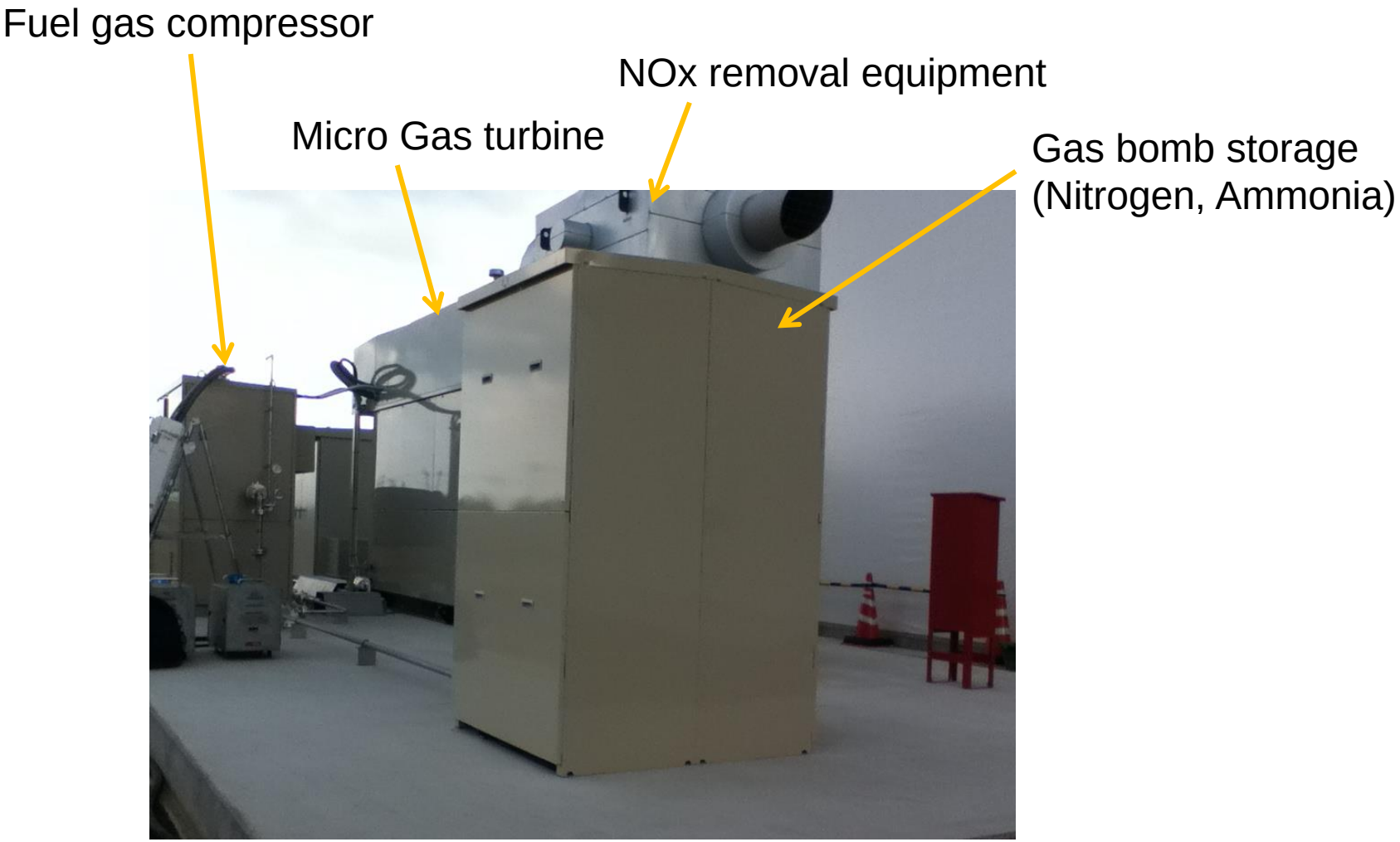
Performance test firing kerosene in the standard combustor



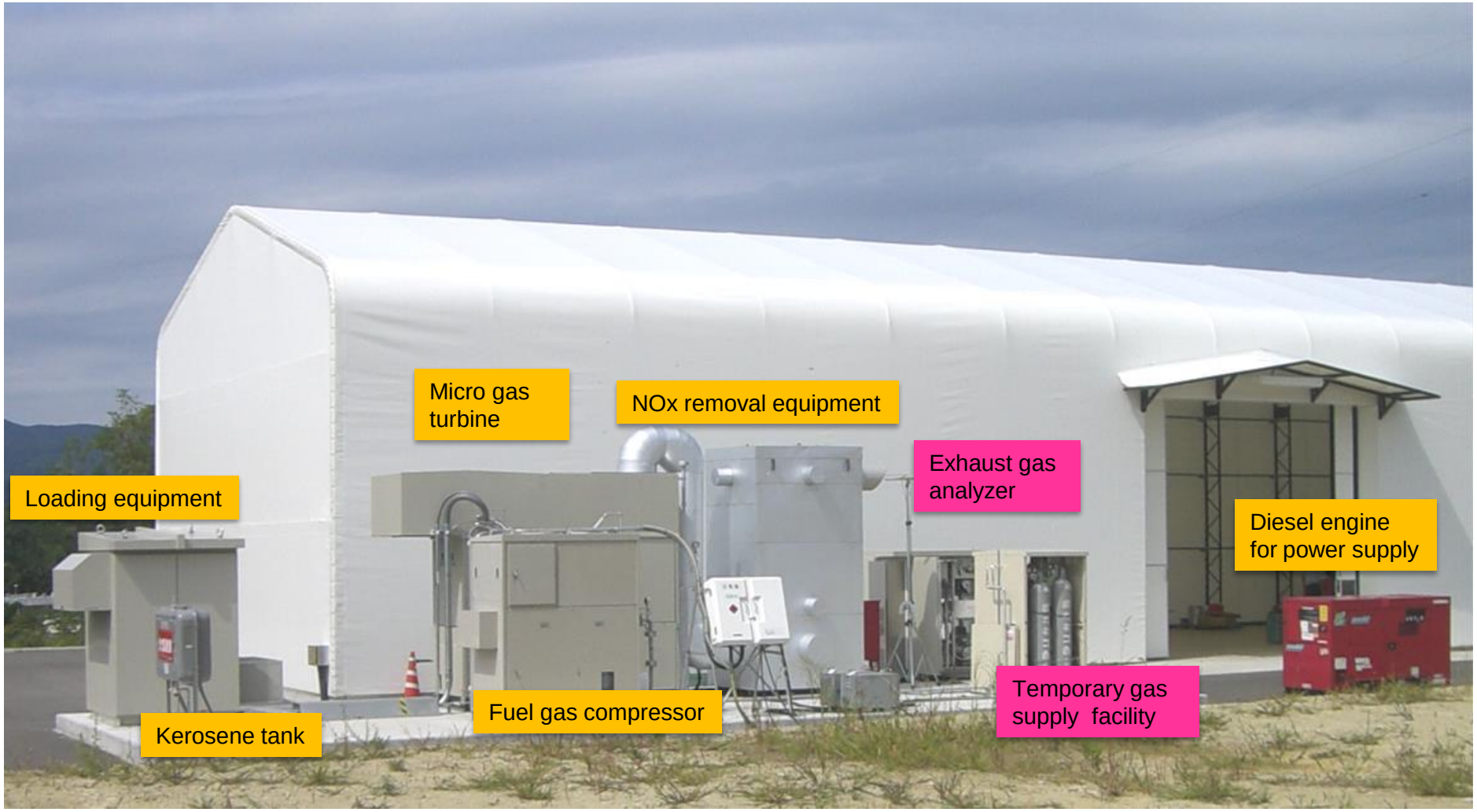




Temporary facilities for ammonia gas fuel supply



Test facilities for micro gas turbine power generation with temporary gas supply facility



Exchange of Combustor

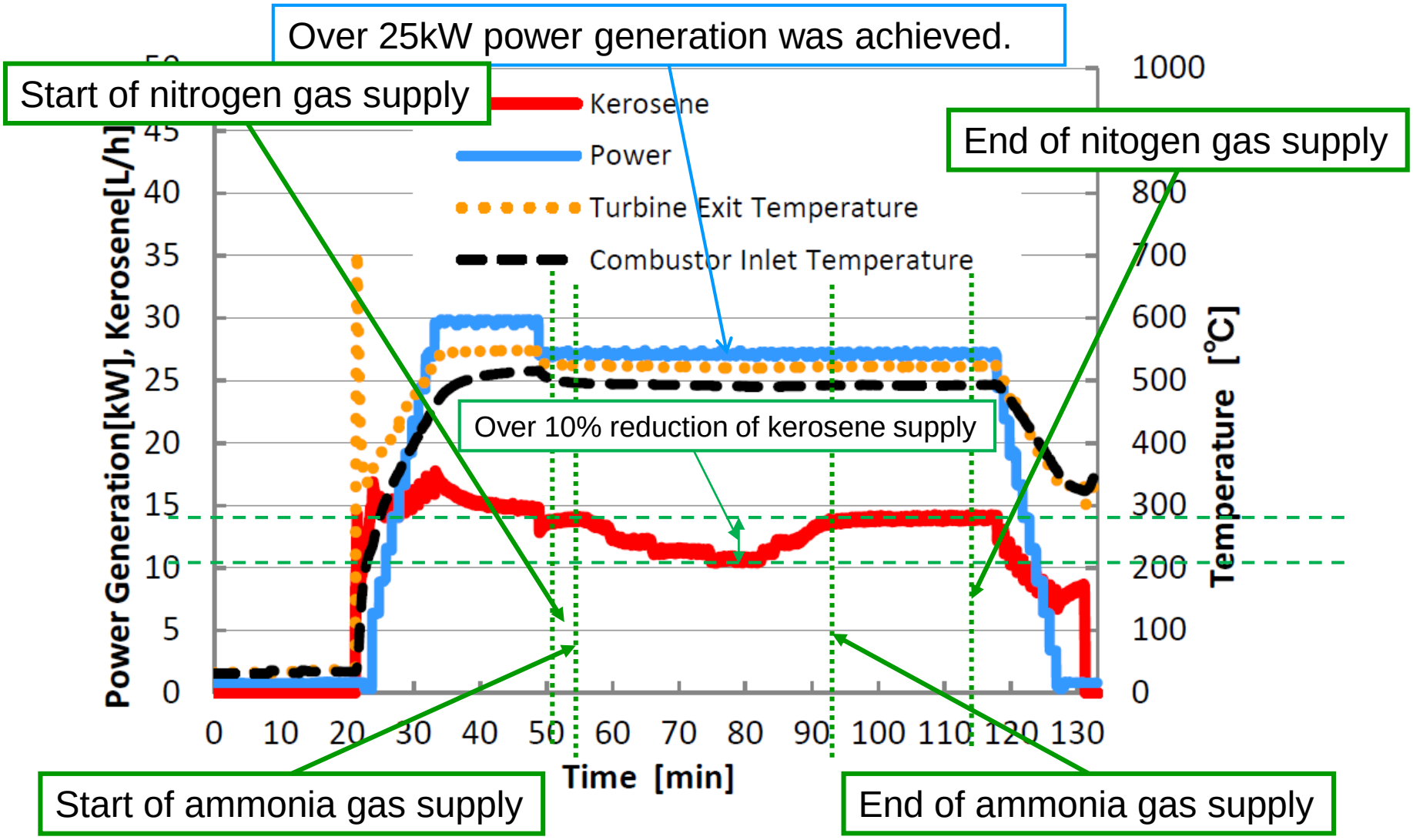
Micro gas turbine

Removed standard combustor for kerosene

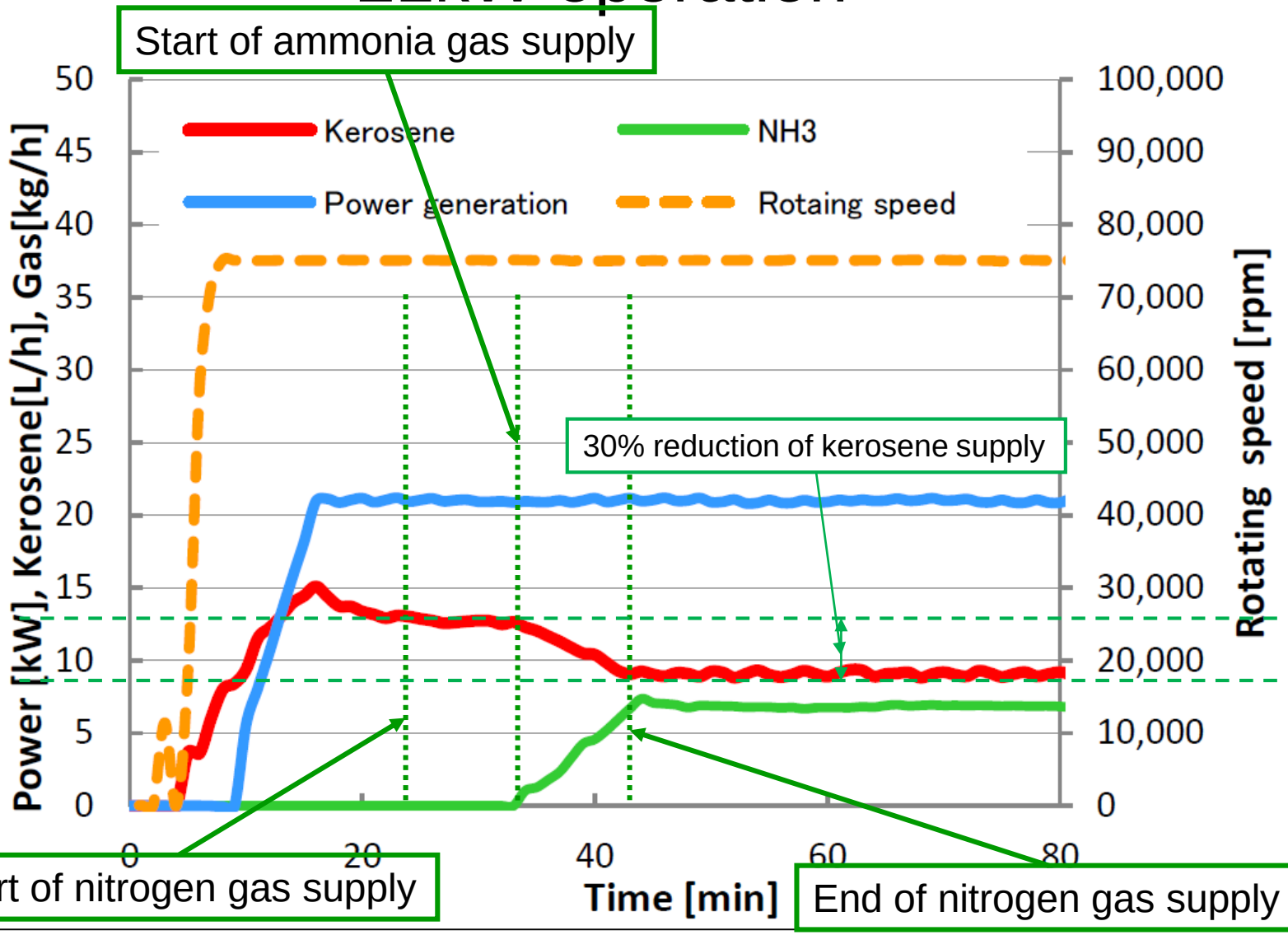
Installation of the prototype combustor for ammonia

The prototype combustor for ammonia

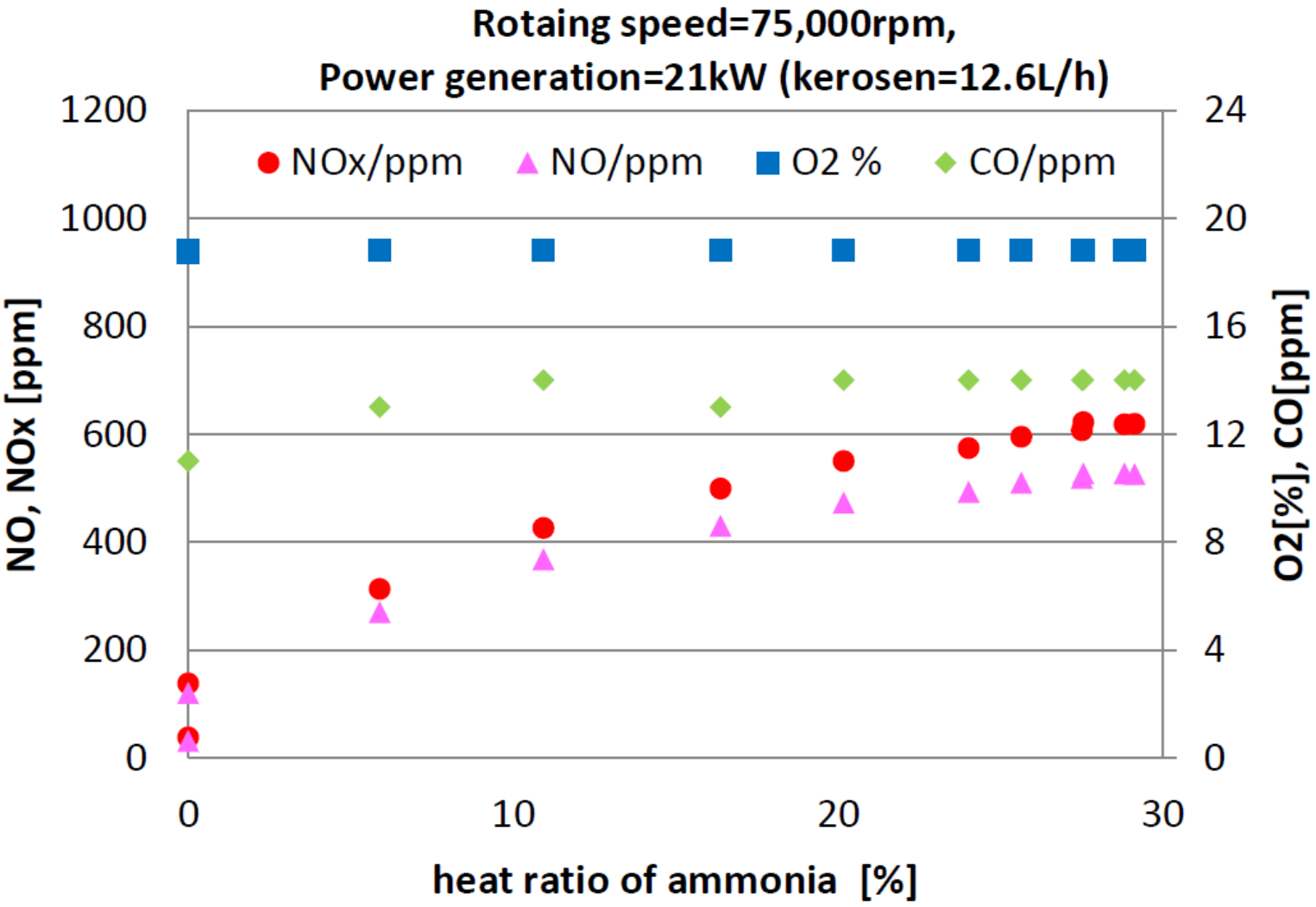
Co-firing Kerosene and Ammonia (1)
25kW operation



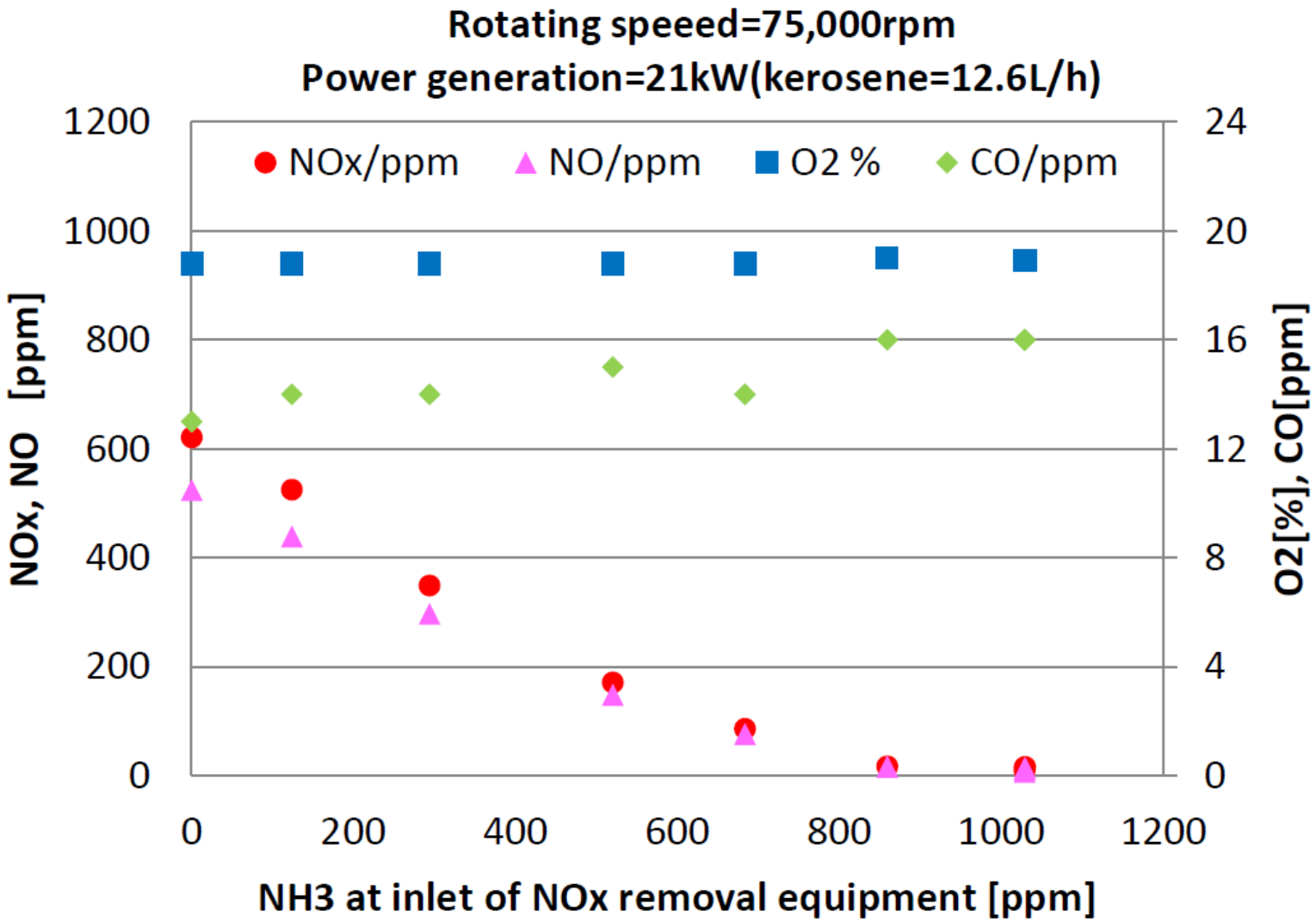
Co-firing Kerosene and Ammonia (2)
21kW operation



Co-firing Kerosene and Ammonia(3) Emission



Co-firing Kerosene and Ammonia(4) NOx reduction



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Future task

Near future

- Increasing of supplying ratio of ammonia gas for power generation firing kerosene-ammonia
- Increasing of power generation
- Trial of power generation firing ammonia gas only

Future task and under planning

- Methane-ammonia firing
- Development of low NOx combustor by cooperation with Tohoku university

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Summary

- 50kW class micro gas turbine firing kerosene was remodeled for power generation firing ammonia.
- A standard combustor is replaced with a prototype combustor which enables a bi-fuel supply of kerosene and ammonia gas.
- Diffusion combustion is employed to the prototype combustor due to its flame stability.
- Demonstration test of co-firing of kerosene and ammonia gas was achieved to check the functionality of the each component of the micro gas turbine.
- The gas turbine started firing kerosene and increased its electric power output.
- After achievement of stable power output, ammonia gas was started to be supplied and its flow rate increased gradually.
- Over 25kW power generation was achieved by supplying about 10% heat from ammonia gas in HHV.
- 21kW power generation was achieved by supplying about 30% heat from ammonia gas in HHV.

Acknowledgement

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