

The 11th NEDO-CDTI Joint Workshop

“Technologies for Hydrogen Valley in Spain and Japan – Regional H2 Value Chain”

Hydrogen



Development of hydrogen
roasting machine for
realization of hydrogen society

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Production of Division





UCC group overview

Our purpose

Unlocking the power of coffee for a better world.



- ✓ Founded in 1933
- ✓ \$2B sales globally
- ✓ The largest coffee company in Japan, the 5th largest coffee company globally
- ✓ Operating the entire coffee-related value chain globally

Our business



Climate change and coffee

Due to changes in weather patterns...



Unproductive Land

It is estimated that by 2050, about half of the land used for high-quality coffee will be unproductive.



Coffee Bean Shortage

By 2050, land suitable for Arabica production is projected to decline by 49-56% and for Robusta by 55%, with Brazil, Southeast Asia, and West Africa being the most affected.



Pests, diseases, and decreased yield

Example: Coffee leaf rust is widespread in Central America.



Background of hydrogen heat-use for coffee roasting

What can we do through coffee for a decarbonized society?

- ✓ Challenge “carbon-neutral coffee production” through the development of a hydrogen roasting machine.
- ✓ Targeted carbon-neutral coffee production by 2040.

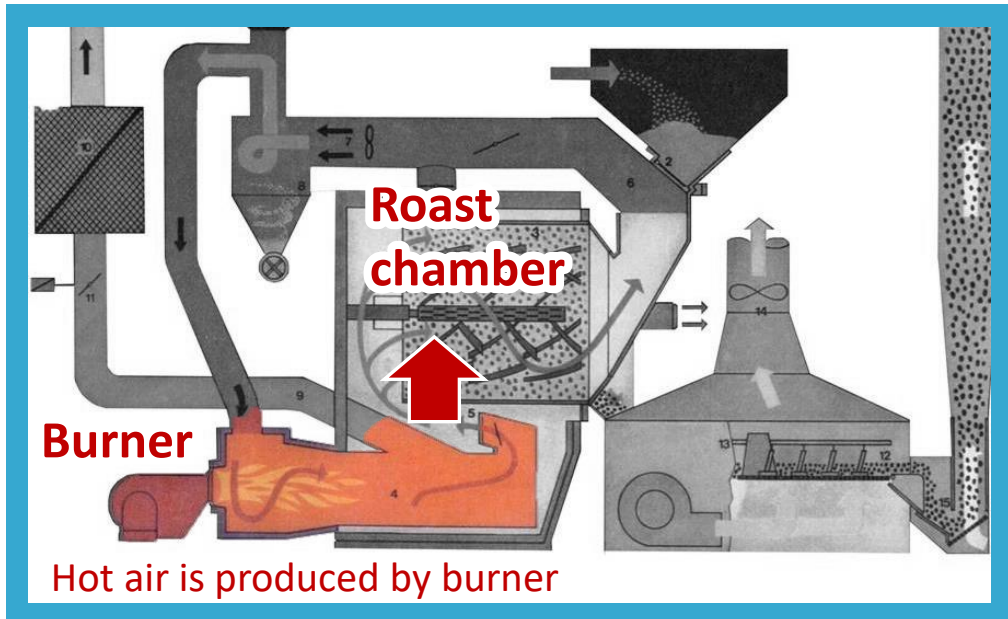




Roasting machine structure and issues

Roasting is the most important part of coffee production, but it is difficult to electrify at industrial level, so we focused on the hydrogen flame.

Roasting machine structure



The flame produced hot air, which is supplied to the roasting chamber to heat coffee

- ✓ CO₂ emissions per roasting machine

1,400 tCO₂/year

- ✓ Difficult process to electrify, requiring delicate and rapid hot air temperature control



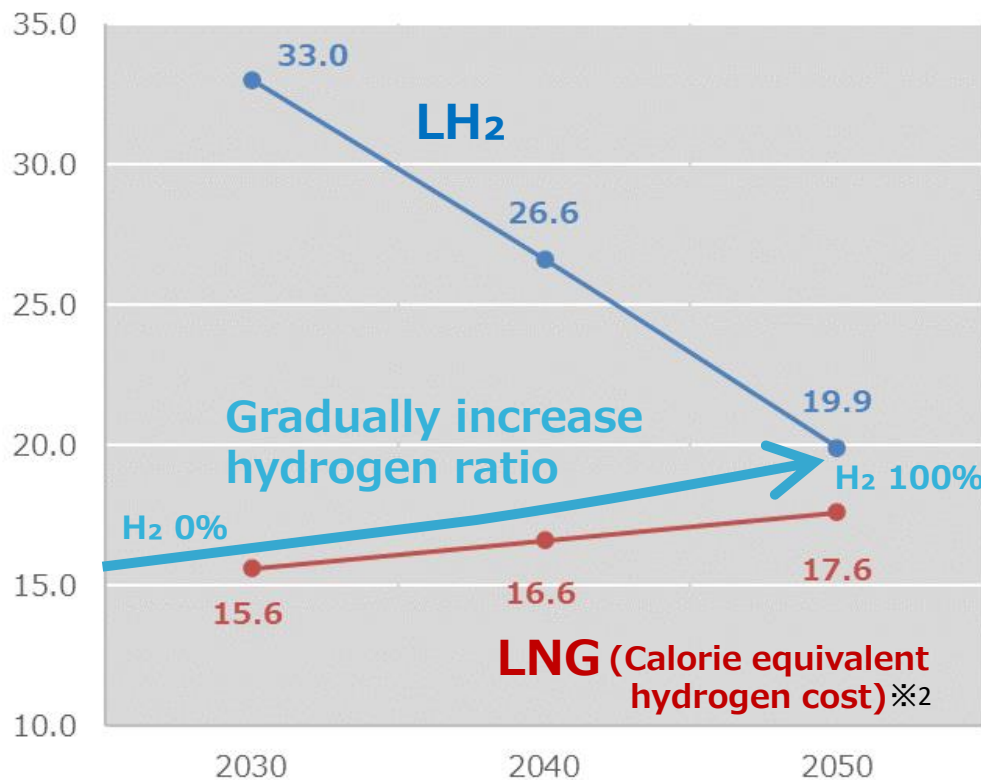
Focusing on hydrogen flames that do not emit CO₂



Challenges in Hydrogen Supply

Immediate conversion from conventional fuel (e.g. LNG) to 100% hydrogen is problematic in terms of price and stable supply

(¥/Nm³) Hydrogen price forecast for combined hydrogen^{※1}



- ✓ Hydrogen prices are expected to gradually decline toward 2050 and beyond as the hydrogen society spreads. Rapid increase in cost can be suppressed by gradually increasing the hydrogen ratio.
- ✓ In addition, there are concerns about the stable supply of hydrogen derived from renewable energy, so we will aim for stable operation by combining conventional fuels.



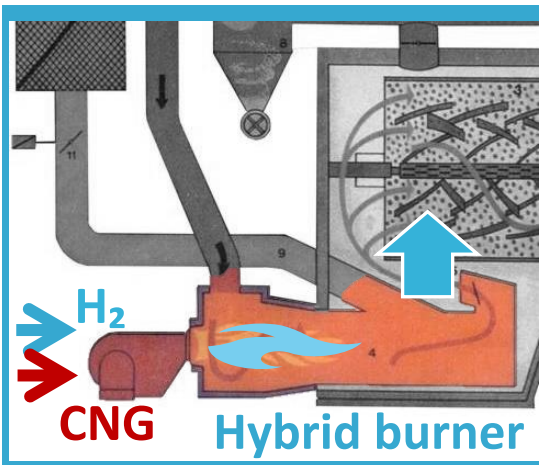
Burner that can use both hydrogen and conventional fuel is essential

※1 : The Institute of Applied Energy (一財) エネルギー総合工学研究所
CO₂フリー水素普及シナリオ研究 総括報告書 (2021年)
※2 : Mid-to-low LNG price 10 US\$/MMBtu + carbon price



Specifications of hydrogen roasting machine

Newly developed roasting machine combine hydrogen & conventional fuel

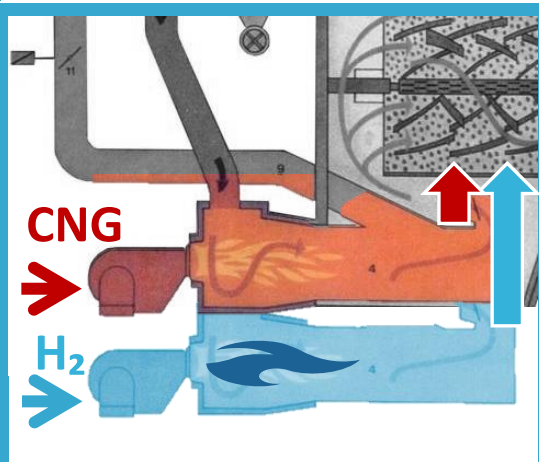


Single burner concept

- ✓ Combustion while mixing H₂ and CNG in one burner / furnace
- ✓ Need a burner that can finely control two fuels (Hybrid burner)

Double burner concept

- ✓ Combustion with dedicated burners for H₂ and CNG / furnace
- ✓ Requires technology to control hot air with different characteristics



H₂ & CNG pilot roasting machine



- ✓ Roasting capacity : 5 kg/batch
- ✓ Hot air output : 40,000 kcal/h
H₂、CNG、H₂ & CNG



Hydrogen support for coffee production

Through verification with a pilot roaster, develop of industrial roasting machine and applicate to deodorizer. Promote the use of hydrogen in coffee production.

Issues in hydrogen handling

- ✓ Risk of flashback
- ✓ Occurrence of Nox
- ✓ Low calorific value (compared to CNG)
- ✓ Moisture content in exhaust gas
- ✓ Temperature control equal to CNG flame

Pilot roasting machine



Hydrogen combustion capacity
15 Nm³/h

Medium
roasting machine
200 Nm³/h

Application of burner to deodorizer



- ✓ Combustion type deodorizer is required to deodorize odors
- ✓ Consider hydrogenation of deodorizer by applying hydrogen burner

Large roasting machine



550 Nm³/h

Verification

- ✓ Safe handling of hydrogen equipment
- ✓ Taste evaluation
- ✓ Flavor analysis
- ✓ Exhaust gas measurement



Toward a decarbonized society

Contribute to global coffee industry
by hydrogen heat-use system



Contribute to global food industry
by hydrogen heat-use system

We are UCC.
Our purpose is unlocking the power of coffee for a better world.

Hydrogen

水素が
次世代エネルギー
社会を切り拓く！



UCC

Every coffee,
every moment