Status-quo of Hydrogen Utilization in NG COM Member Countries

Roundtable input by Mongolia

Erdenetsetseg Bayarsaikhan
ERC, Licensing department

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Policy Level

- *Does your country/organization have a strategy regarding hydrogen?*

Category	Description	End-use
1	End-use applications with no or few known and feasible decarbonisation alternatives besides green hydrogen	Heavy duty mining trucks
2	End-use applications with various known and feasible decarbonisation options, of which green hydrogen could have strategic advantages	Public transport (buses) in Ulaanbaatar
3	End-use applications with various known and feasible decarbonisation options, of which green hydrogen is currently not the most advantageous option	Space heating

- Remote locations
- Few other decarbonization options
- Technical advantages
- Energy security aspect

- Other potential decarbonization options (battery)
- Technical advantages

Not viewed as a feasible option at present, but additional research looking at various other decarbonization option is requested.
This should particularly further investigate the decoupling of the heat and power sectors

Industry/Market Level

- *What is the general interest in developing hydrogen networks/markets in your country from the supply side and how many companies have been involved (in rough terms)?*

- Energy sector >> **largest contributor** to GHG emissions (54% in 2018)
  - The heat & power sector is the main energy consuming sector

- Power and heat sectors are **closely coupled**
  - Dominated by coal-fired CHP plants (90.6% of electricity in 2019)
  - Heat and power demand is not necessarily aligned >> technically challenging to integrate renewables to the power system >> leads to curtailments even at low shares of RE

- Green hydrogen **could play a role** in the gradual decoupling of the heat and power sectors

Industry/Market Level

Green hydrogen production potential

- Division of four geospatial regions
  - Full load hours for wind and solar considered
- Wind results
  - Larger potential in the south (up to 4200 load hours)
  - ➡ generation costs as low as 3.7 $cent/kWh
- PV results
  - More homogenous
  - ➡ generation costs as low as 4.9$cent/kWh

Green hydrogen production costs

	MNG1	MNG2	MNG3	MNG4
Full load hours (PV and wind)	2,800	3,600	5,000	4,200
Electricity cost ($/kWh)	0.058	0.044	0.041	0.043
Demineralised water cost 2020 ($/m^3)	30	40	40	25
Expected H_2 cost ($/kg)	4.73	3.83	3.30	3.40

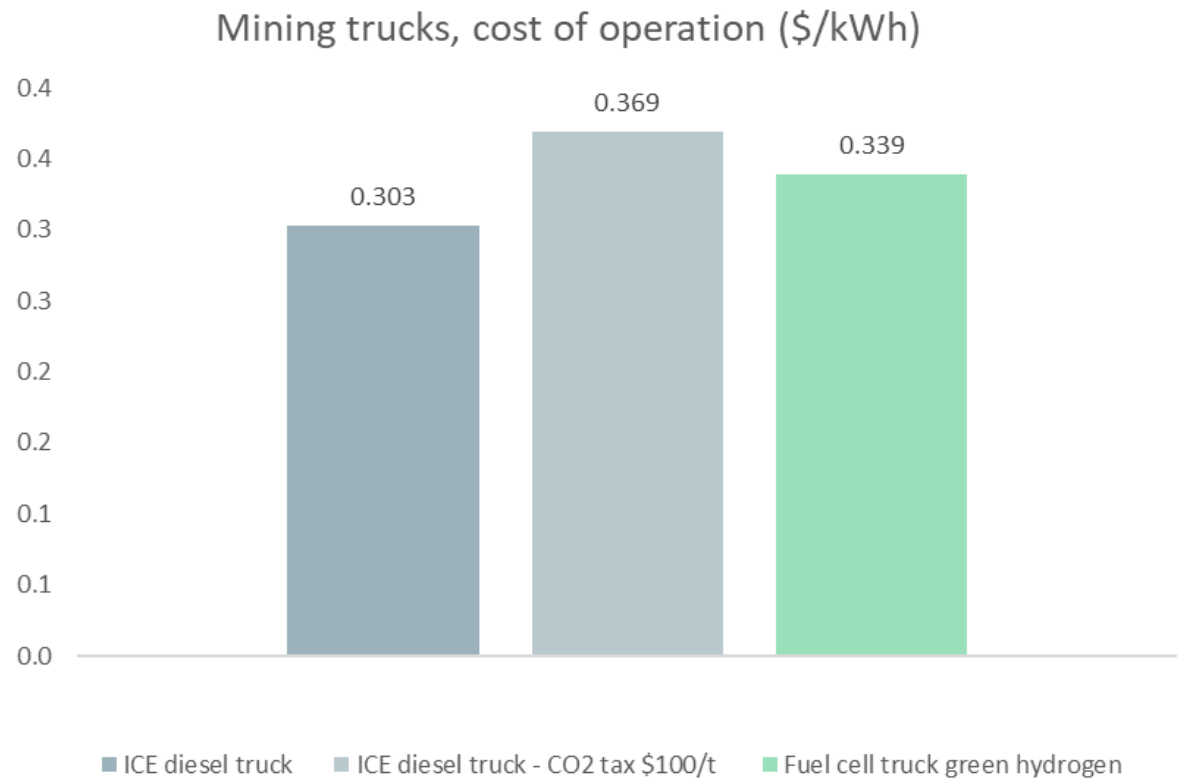
The demand side

Sector	Technology	Reference
Heavy duty transport in the mining sector	Hybrid dumper trucks in a copper mine	Diesel trucks
Public transportation	Hybrid buses in Ulaanbaatar	Diesel buses
Heating sector	Decentralized heating (H_2 boilers)	LPG

The demand side

Feasibility in hard-to-abate sectors

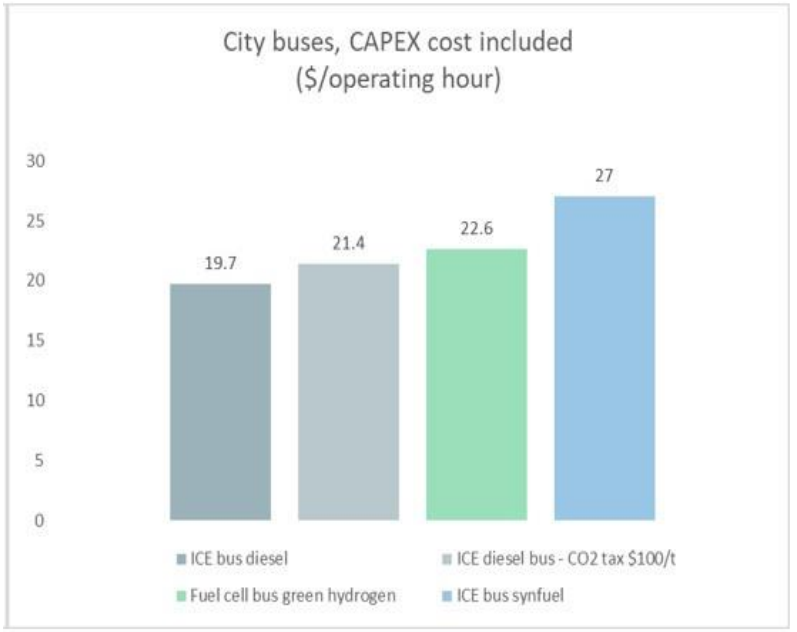
- Assumed region 3 (mining region)
  - H_2 cost of $3.3/kg
- Reference: new diesel trucks
- Comparison: energy delivered to the wheel
- Hybrid truck is **12% more expensive**
  - Assuming a **CO_2 tax of $100/t$CO_2$**, hybrid truck becomes **9% cheaper** than diesel trucks
- Production sufficient to supply six trucks



The demand side

Feasibility results: public transport

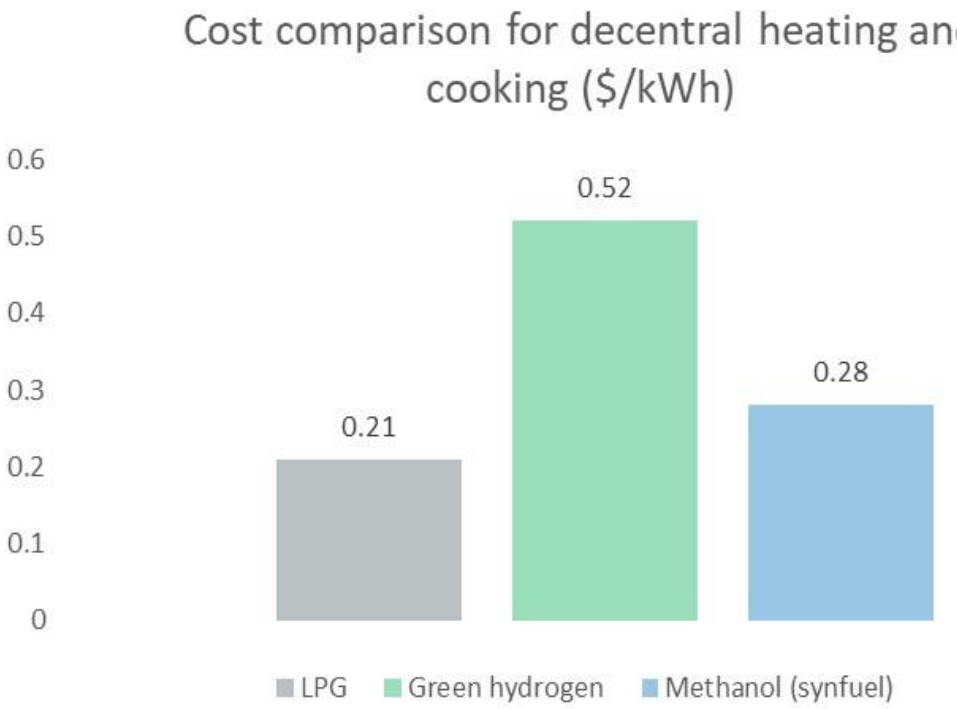
- Reference: new diesel buses
- System can supply 450 buses (1/2 of current fleet)
- OME considered as a second alternative
  - Not economically feasible
- Hybrid bus is
  - **28% more expensive** than diesel in terms of delivered energy
  - **15% more expensive**, also considering CAPEX
- A CO_2 tax of $100/t$CO_2$ makes the hybrid bus **close to cost competitive**



The demand side

Feasibility results: decentralized heating

- H_2 must be pressurized at 200 bar and stored in gas cylinders
- Comparison: energy delivered to the stove
  - Includes cost for filling, storing and distribution
  - >> disadvantage for H_2
- In terms of delivered energy, H_2 is **148% more expensive** than LPG
- Synfuel is **33% more expensive** than LPG
- The lower energy density of H_2 limits its potential



Suggestions for Upcoming Benchmarking Study

Suggestions related to the upcoming benchmarking exercise – scope, questionnaire, paper

- Future areas of research
  - More robust water availability analysis
  - Further comparisons with other decarbonization options
  - Preparation of specific projects (mining sector)
  - Analysis on decarbonization options for the heating sector and the decoupling of the power and heat sectors

THANK YOU
FOR YOUR ATTENTION!

erdenetsetseg.b@erc.gov.mn