

2013 Korea Update

Hydrogen and Fuel Cells in Korea

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2013 Energy R&D Project's Plan

"Supporting more than 1000 million \$ to energy R&D department this year"

2013 energy R & D business support budget

Field of support	Technology Development	Manpower	International Cooperation	Standardization	Affiliated institutes support	Total	
The amount of support (million dollar)	624.8	37.0	18.7	40.6	201.1	922.2	

Hydrogen & Fuel-Cells R&D Budget : **31.2 million Dollar**

	★Development of fusion technology base of energy resources			
	★Resource development technology development			
	★Development of global expertise			
7	★ Development of fusion technology infrastructure of renewable energy			
	Development of fusion technology base of power industry			
	24.0 million \$			



Strategy for securing of core Fuel cell and Bio-technology.

HYUNDAI MOBIS, World's first mass production of key components for FCEV

Production Statue of Components for FCEV



Key components such as motor, electric parts, Li battery package and fuel cell stack is applied to Hyundai Tucson iX(FCEV).

FCEV Development – Tucson ix (2013)

FCEV – Tucson ix

'Tucson ix' which is equipped with independently developed 100KW Fuel Cell System with 2 H₂ containing tank(700 atm)
Driving 594km by charging once, Fuel Efficiency 27.8km/L
Start-up Ability with under -20 °C
Total 1000 H2 Fuel Cell will be produced until 2015

Tucson ix Fuel Cell Vehicle Spec				
제원	Fuel-Cell Stack	100KW		
	Motor(Fuel Cell Power)	100KW		
	H ₂ Tank	700atm(H ₂ storage:5.6kg)		
	Energy Storage	24KW Li-Ion Polymer Batt.		
성능	Max. Speed	160 km/h		
	Acceleration(0→100km)	12.5 S		
	Driving Range(maximum mileage/Cruising range by 1 charge)	594km		
	Gasoline equivalent fuel- efficiency (NEDC*)	27.8km/L(0.95kg • H2/100km)		





Green Hydrogen Town Demonstration project

- Period : 2012.9 ~ 2018.5 (68 month) Construction period : 2012.9.10 ~ 2013.5.9 (8 month) Operating period : 2013.5.10 ~ 2018.5.9 (60 month)
- Burget: 87.7 billion won (Government: 52, Local-government; 18.5, Private: 17.2)
- Consortium : Ulsan city, Ulsan Technopark
 - Hydrogen production : Petrochemistry complex business
 - Hydrogen supply/management : SPG CO., LTD.
 - Manufacture of fuel cell : Fuel Cell Power Inc., GS Caltex CO., LTD., Hyosung CO., LTD., Hyundai HYSCO CO., LTD.

[Concept of Hydrogen Town in Ulsan]

Fuel cells (Install two on each home) supply electricity by using H₂



[Ref.]Korea Energy Management Corporation

'Hydrogen Town' project's expected effects.

The total capacity of Fuel cell facilities

- About 200kW

Yearly domestic power output

- 1662MWh(Average monthly amount is that

400 households consisting of 4 persons per family used for 1year.)

Yearly heat production

- 2025Gcal(Amount that 12,700 households consisting of 4 persons per family are using 60 $^\circ\!\!\!\!C$ water for a day)

The total capacity of Fuel cell facilities

- 358TOE (The value is conversion as Tons of oil equivalent \cdot Oil calorific value.

Scale of decreasing CO₂

- 1088t



Achievements in

Hydrogen Energy R&D in Korea

Achievements in Hydrogen Energy R&D in Korea

Current status of PEM type electrolyser



 Life time was estimated from long term operation data (2,000 hr~5,000hr)

Item	Present	Future (Target)	
H ₂ Delivery Pressure	150 bar	350 bar	
System Cost	10 million KRW/NM ³ /hr	5million KRW/NM ³ /hr	
Stack Efficiency	84% @1A/cm ²	90% @3A/cm ²	
Durability	25,000 hr @1A/cm ²	40,000 hr @ 3A/cm ² (PEM type)	

Achievements in Hydrogen Energy R&D in Korea Hydrogen Production using high temperature steam electrolysis



[Performance test equipment of THE]



[Cell stack (50)]

- High Temperature Electrolysis (HTE) is the most clean and efficient method for hydrogen mass production.
- Key technologies for tubular SOEC (extrusion, coating, sintering, sealing, stacking, etc.)were developed.
- 4.2 liter/h of hydrogen production rate can be achieved using 3-cell short stack and total 181 liters of hydrogen was produced for 40h. Scale-up is under progress.
- Future works are focused on the development of highly durable advanced materials and high reliable pressurized system for long life and mass production of HTE system.

Chemical hydrogen storage

Fuel Cell System



1. hydrogen storage capacity : 4.5 wt%

2. test with FC > 100W class 6hrs (600 W-h)

3. UAV test

Achievements in Hydrogen Energy R&D in Korea

Chemical hydrogen storage



Summary

✤ <u>Fuel cells</u>

- > Dissemination: FCEV, FC for residential, commercial and distributed power
- Improve performance of fuel cells (cost, durability, compactness, weight reduction)

* Hydrogen station

- > SMR and Electrolyzer using electricity from renewables
 - Integration with renewable energy (Wind/Solar) for energy storage and FCEV
- > Surplus Hydrogen gas from industry

✤ <u>Hydrogen storage</u>

- > High pressure gas cylinder (700bar) for onboard hydrogen storage
 - Manufacturing process, carbon fiber \rightarrow cost reduction
- > Chemical hydrogen storage for special application such as UAV
- Improve Performance of hydrogen storage and systems- "Back to the basic research" on storage material and system

* Hydrogen distribution

Pipeline, Tube trailer

System integration

Hydrogen Refueling Station

Standardization of station design and technology cost, licensing, maintenance and reliability