Korea Update

Hydrogen and Fuel Cells in Korea

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Korea Hydrogen Town

Demonstration Project for Hydrogen Economy [MKE]

Ministry of Knowledge and Economy in Korea goverment

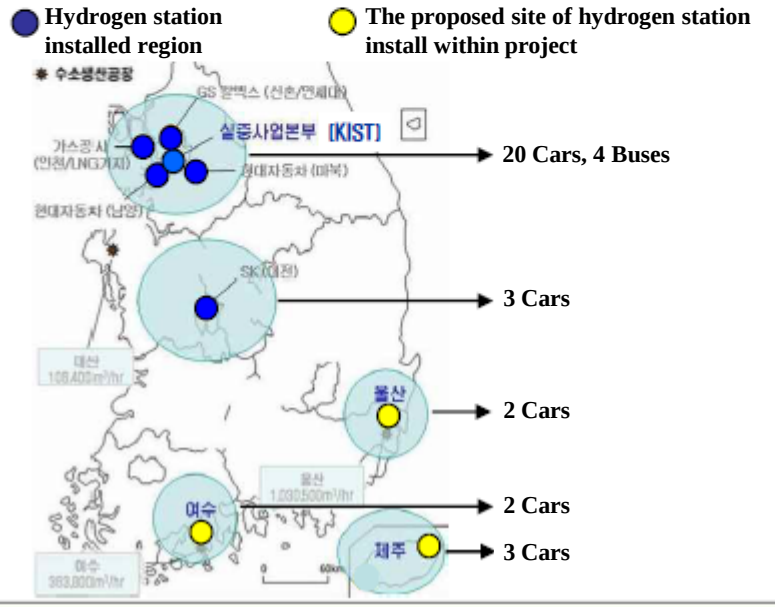
❖ Purpose : Secure data of fuel cell vehicles through actual road service, Corresponding technology development of hydrogen station(Safety/Standard/Rules)

❖ Present status : Internal monitoring business(‘06~’10)-Run of 30 Cars/ 4 Buses, Total mileage about 0.73 million km

Substantiation busiess(‘09~’12)-Substantiation manage of 100 Cars

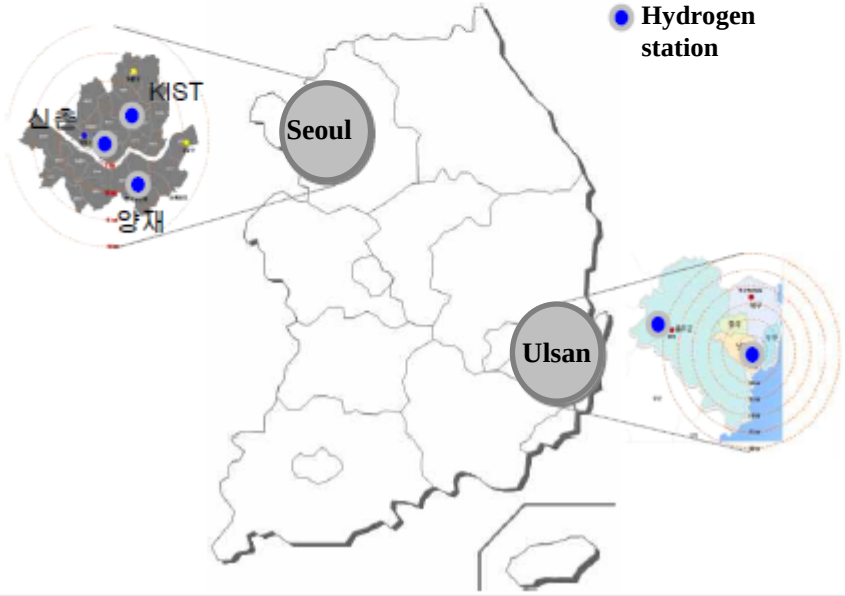
Monitoring project

- Period : ‘06.8 ~ ‘10.7 (4 years)
- Burgets : 466 billion won
  (National expenditures : 277, Private : 239)
- Scale : 30 Cars (Tucson : 18, Sportage : 12), 4 Buses



Demonstration project

- Period : ‘09. 12 ~ ‘12. 12
- Burgets :234 billion won
- The whole country : 100 hydrogen FCV supply
- Ulsan : 33 hydrogen FCV supply, Installed 2 charging station



Hydrogen Town Construction Project in Ulsan

Project name

- 2012 Demonstration of Hydrogen Town Project

Project object

- Utilizing by-product hydrogen that occurred from industries, hydrogen and fuel cell industry growth and construction of the green city of Ulsan.

Project contents

- Location : Deoksin village, Onsan-eup, Ulsan
  (Company housing of LS-Nikko Copper Inc. and Onsan-eup office)
- Installation capacity : 195 kW (1 kW 140 FCs, 5 kW 9 FCs, 10 kW 1 FC)
- 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.

Geographical information

- Location : National Industrial Complex in Ulsan city in 3km radius
- Place : Company housing of LS-Nikko Copper Inc. and an accessary builidng
  (Company housing : 140 family among 296 family)
  Onsan-eup office of Onsan-eup site
- Address : Duksin-ri, Onsan-eup, Ulju-gun, Ulsan

Main gate

Company housing view

Set up place of fuel cell

Source		Target area	Distance
Piping of Onsan-eup	Piping of Isu chemical CO., LTD.	Company housing of LS-Nikko Copper Inc.	Within 1 km
National Industrial Complex in Onsan	S-Oil Co., LTD.		Within 3 km
National Industrial complex in Ulsan	Samsung BP Co., LTD.		Within 7 km

HYUNDAI MOTOR GROUP

-Hyundai Motors-

Hydrogen-FuelCell Research and Development

FCEV Development History of Hyundai-Kia Motors

200 SUVs & 9 Buses
> 4 million km

US DOE Fleet
('04 ~ '09)
32 SUVs

1st Domestic Fleet
('06 ~ '10)
30 SUVs, 4 Buses

2nd Domestic Fleet
('09 ~ '12)
100 SUVs

Global Demonstration
('12 ~'15)

• 2000 ~ 2002

- Santa Fe FCEV (75 kW)
- Member of CaFCP ('00~)

• 2004 ~ 2005

- Tucson FCEV (80 kW)

• 2006

- Tucson FCEV I (80 kW In House Stac
- FC-BUS (160 kW In House Stack)

• 2007

- Tucson FCEV-II (100 kW)
- FC-BUS I (200 kW)

i-Blue Concept car

• 2008 ~ 2009

- Borrego
- FC-BUS II (200kW)

• 2012 ~

- Tucson ix35 FCEV (100kW)
(Small Production)

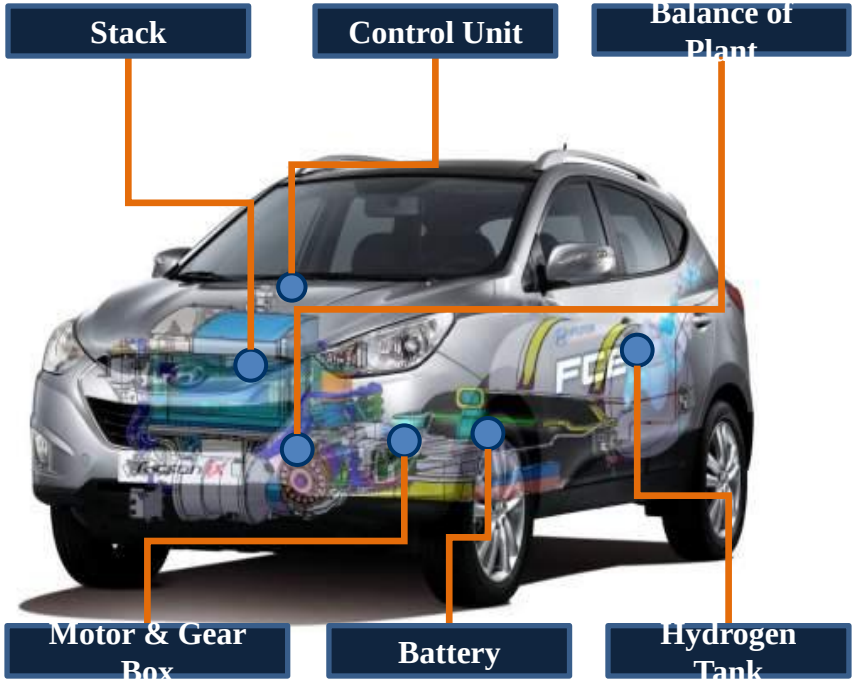
FCEV Development – Tucson ix35 SUV (2012)

FCEV – Tucson ix35 SUV

- Model for Small Series Production (2012~2015)
- Fuel Cell System Modularization for Easy Assembly in an Existing Production Plant

Item	Specification
Fuel Cell Power	100 kW
Battery	Li-Ion
Motor System	AC Induction Motor
H_2 Tank	70 MPa
Driving Range (NEDC*)	588 km (365 miles)
Max. Speed	160 kph (100 mph)

*New European Driving Cycle



FCEV Demonstration - EXPO 2012 Yeosu Korea

- **Period: May, 12, 2012 ~ Oct. 12, 2012 (3 Months)**
- **Participants: 100 Countries/ 10 Million Visitors**
- **Hyundai Motor's Sponsorship**
  - **Drive and Ride of 30 FCEVs (25 SUVs and 5 Buses)**
  - **One Stationary PEMFC Power Plant**

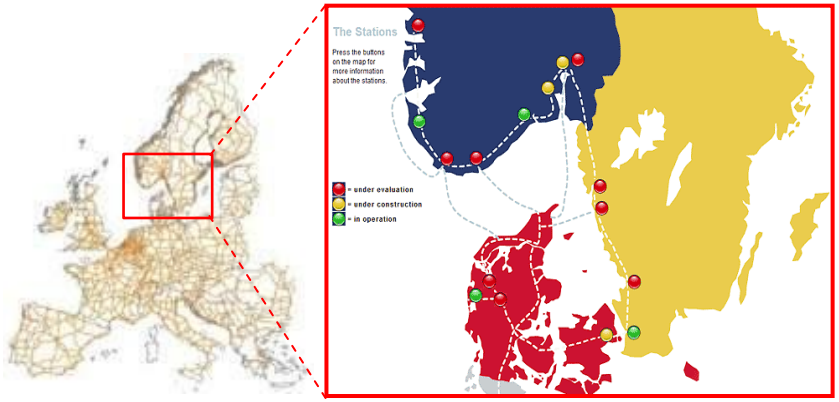
Drive and Ride

EXPO 2012 YEOSU KOREA

Power Plant

MOU for Deployment of FCEV in Europe

- **FCEV Test & Deployment Project with Scandinavian Countries (Jan. 31, 2011)**
  - **Norway, Sweden, Denmark and Iceland**
  - **FCEVs developed by Hyundai-Kia's proprietary technology will be supplied.**



Construction of H_2 Refueling Stations (Scandinavian Hydrogen Highway Partnership)

- **MOU with CEP (Clean Energy Partnership) (Feb. 25, 2011)**

Present CEP Members

Hydrogen Fueling Station Roadmap in Korea

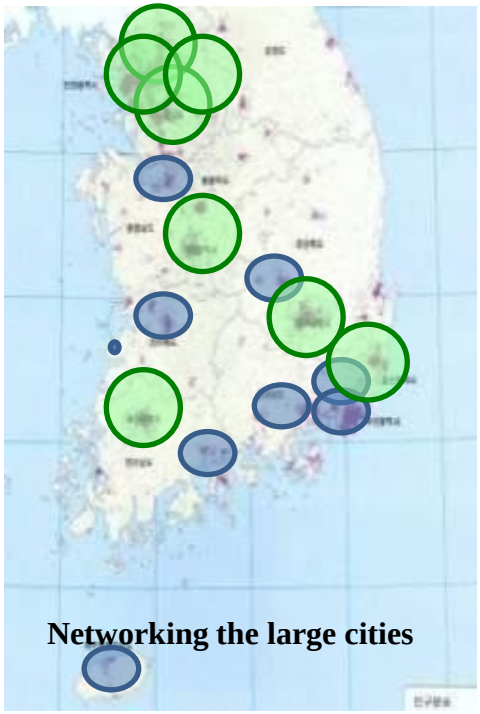
Phase 1 (~ 2012)
13 Stations

Focusing on densely-populated area
+H_2 production sites

Phase 2 (~ 2015)
43 Stations

Spreading out to large cities

Phase 3 (~ 2030)
500 Stations



Networking the large cities

: ~10 stations

: ~50 stations

Hydrogen infrastructure roadmap announced by Korean government (2010)

Timeframe	~ 2012	~ 2013	~ 2015	~ 2020
Number of Hydrogen Fueling Stations*	13	18	43	168

*Accumulated

FC BUS Fleet – Domestic Program

Period	**Dec. 2010 ~ Dec. 2013**
Fleet Location	**Incheon International Airport (Parking Lot ⇔ Terminal),**