Hydrogen town Demo project

2014.6

Korea Hydrogen Industry Association

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Selected Target Area (Ulsan)

- Uljugun Onsanmyun districts
  - Deoksinri
  - Isu Chemical

- Uljugun Cheongryangmyeon Sangnam districts
  - Sangnam
  - Samsung BP

- Ulsan Seonamdong
  - Seonamdong
  - Taekwang

### Target Areas

<table>
<thead>
<tr>
<th>Target area</th>
<th>Details</th>
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<tbody>
<tr>
<td>Uljugun Onsanmyun Deoksinri</td>
<td>- Moorim P&amp;P company housing: 34 households</td>
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<td>- LS company housing: 16 buildings 298 households, Two-story building</td>
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<td>- Korean Paper company housing: 200 households</td>
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<td>- A lot of shopping center and within 2 km of Onsan national industrial Complexes</td>
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<td>Uljugun Cheongryangmyeon Sangnam</td>
<td>- Many schools and Single-family Housing in this area</td>
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<td>- Petrochemical complex within 2 km</td>
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<td>Namgu Seonamdong</td>
<td>- Large city within 1 km of Taekwang industry</td>
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Summary of Hydrogen town Demo project

Project name: 2012 Hydrogen town Demo project

- New growth industry development and green city, implementation of fuel cell field by using pure hydrogen from industry

- Installed area: Deokksin town, Onsan-eup, Ulsan (LS Nikko copper housing and PR building, Onsan-eup town hall)
- Installed capacity: 195kW (1kW 140ea, 5kW 9ea, 10kW 1ea)
- Project period: 2012.8 ~ 2018.4 (69 months)
  - Installed period: 2012.8.10 ~ 2013.5.31 (9 months 20 days)
  - Operation period: 2013.4.10 ~ 2018.4.9 (60 months)
- Budget: 8.7 million$ (government: 5.2, municipalities: 1.8, private: 1.7)
- Consortium: Techno Park, Ulsan
  - Project operation and PR building: Techno park, Ulsan
  - Manufacturers of fuel cell: Hyundai Hysco, Fuelcell Power, GS Caltex, Hyosung
  - Safety management: SDG
Location: Onsan industrial complex within 3km
Spot: LS Nikko Copper housing (company housing: 140/296 of household, Gymnasium, Public relation building, etc.) Onsan town hall
Address: Duksin-ri, Onsan-eup, Ulju-gun, Ulsan
Application of fuel cell system

Supply and installation to hydrogen town 195 kW scale, participating in 4 manufacturers that are producing fuel cell

- 5 kW
  - Hyosung
  - GS Caltax

- 10 kW
  - Hyundai Hysco
  - Fuelcell Power
Project location of hydrogen town
Construction of Hydrogen infra

- Plumbing hydrogen within LS Nikko Copper housing
  - Plumbing hydrogen for supplying hydrogen fuel at town
  - Connection from SPG piping to installed area of fuel cell in front of Onsan hall

Underground plumbing in housing

Hydrogen piping at household

Regulators
Installed status in LS Nikko Copper

- 총 세대 (Total houses): 295세대
- 설치세대 (Installation houses): 140세대
Power generation monitoring system

Operation status of fuel cell at hydrogen town

Gross generation: kW
Accumulated generation: GWh
Total heat production: Kcal/s
Accumulated heat production: Gcal
CO₂ reduction: ton

Real time generation
Public relation Hall

Communication errors: Alarm Operating stop
Installation of Fuel cell (System scheme)
Installation of Fuel cell (5kW 6ea & 10kW 1ea)

Installation site in LS-Nikko Copper company house

Panel and fuel cell installation

Pipe connections at basement

External hydrogen pipe connections
Installation of Fuel cell (Exhibition hall 5kW 1ea)
Hydrogen gas:
- Classified as flammable gases with Methane (city gas) _Article 2 of the Enforcement regulations by high pressure gas safety law
- According to construction of Korea Gas Safety Corporation
  - KGS FP211.2.5.1.3_low pressure gas piping material

Test Report for Fuel Cell Certification:
- Test report of Korea Gas Safety Corporation’s product certification standards (Certification standards for renewable energy equipment)

Installation of various valves and sensors for guaranteed Safety:
- Gallery installation for ventilation
- Installation of stack internal/external gas shut-off valves and sensors
- Installation gas pressure alarm devices, internal temperature of the unit and fuel cell stack temperature alarm
- Built-in alarm and auto Shutdown in case of abnormal operation
- Monitoring of remote control systems

Safety Check Inspection:
- Gas leakage check (Quarterly)
- Leakage detection of supply manifold: Hydrogen gas meter (every 6 months)
- Check the operating status of gas leakage detector (every 6 months)
- Flowmeter check: Flow calibrator (every 3 years)

* Safety inspection management for 5 years by SDG
Hydrogen Town Opening

- July 09, 2013: Opening ceremony of hydrogen town
- Attendants: About 200
- Major events: Awards, Public relation building admission & cutting ceremony
Hydrogen safety management

*Check Hydrogen at fuel cell room*

*Hydrogen check at metering*

*Check Hydrogen in house*

*Safety training in house*

Safety inspection report for every 3 months

Continued Cooperative

Professional safety manager

Fuel cell system checking Piping management in house
Project achievements

- **Major visitors**
  - Hydrogen fuel cell manufacturers, Companies related to hydrogen production, supply and distribution
  - Related organizations of Seoul, Pohang, Gyeongbuk & others
  - College students and the general public
  - Environmental NGOs
  - The Press
Project 2014 (Facility)

Installation of Hydrogen analysis equipment

- Installing valve for final quality analysis of Hydrogen supplied to hydrogen town
- Installation site of sampling valves: Total 3 points, 2 gauge spots (Onsanmyun office, LS-Nikko Copper), Fuel cell Exhibition hall

Exhibition hall: Hydrogen sampling

Antistatic device

- Installation antistatic device in LS-Nikko Copper, Onsanmyun

Gauge spot: Hydrogen sampling

Hydrogen sampling

Gauge spot: LS-Nikko Copper, Onsanmyun

Installation of ground rod
Expected Benefits

**Economic effects**

- Annual fee savings of LS-Nikko Copper company for 140 housing residents: about 40 thousands $
- Annual energy production 2,637 MWh (1,623 MWh/yr. + 1,014 MWh/yr.)
- Energy cost savings of about 41% less than using fossil fuel
- Cost reduction of 24% compared to fuel cell using LNG

**Environmental improvement effects**

- When installing 195kW of pure hydrogen fuel cell, annual replacement of fossil energy 331.4 TOE (1.789toe/kW × Fuel cell operating ratio(95%) × 195kW = 331.4toe)
- Annual greenhouse gas (carbon dioxide) emissions reductions 991.9 TCO2
- The effects of planting young pine trees 3,816,000

**Other effects**

- Industrial development and foundation for industrialization related in new market of hydrogen fuel cell
- Operational experience gained by various data acquisition systems of hydrogen town
- Leading city image to green environment and enhancing technology
- Promotion and education effects related Hydrogen energy
Thank you for your attention!

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