

7AB. Task 7AB Development of Hydrogen Refueling Station

7AB. 1 Targets of Research and Development

In “the hydrogen use international clean energy system technology (WE-NET) phase II program”, a solid polymer electrolyte water electrolysis type (in Takamatsu city) and a natural gas reforming type (in Osaka city) of hydrogen refueling stations (on-site system) were developed since fiscal 1999. In both cases, hydrogen was produced inside the station. For accelerating the introduction of hydrogen fuel cell vehicle in wide ranges, it is also necessary to develop a hydrogen refueling station using hydrogen obtained from the by-product gas in the chemical engineering process, of which a considerable amount of supply is expectable already at the moment. The object of this research and development project is to develop a hydrogen refueling station, into which hydrogen is transported from the outside the station (off-site system).

In fiscal 2001, we completed the design of the entire system for the hydrogen refueling station. The specification and design of the component apparatuses were also accomplished. We started to manufacture some apparatuses. The investigation on a layout of the station site and installation of utility equipment were made. Further, we developed a dispenser and studied the technology for filling control of hydrogen.

7AB. 2 Results of Research and Development Results in Fiscal 2001

7AB.2.1 Production bases of salt electrolysis plants and their annual hydrogen production

The salt electrolysis plants are source of hydrogen for off-site system hydrogen refueling stations. There are 35 plants in 27 companies dispersed all over the Japan. The number of salt electrolysis plants in jurisdictional areas of local regional bureaus of economy, trade and industry is shown in Table 7AB.2.1-1

The annual hydrogen production in fiscal 2001 was about 1.2 billion Nm³, the usages of which were ca 50 % for chemical industry, ca 40 % for fuel and ca 10% for the others. The transitions of usage of electrolysis hydrogen and trend statistics are shown in Table 7AB.2.1-2.

7AB.2.2 Fundamental specifications for off-site system hydrogen refueling station

The fundamental specifications for the hydrogen refueling station using hydrogen trailers as the hydrogen source were determined. The determined specifications are as follows:

(1) General

- a. Filling capacity : Supposing 5 passenger-cars to be filled successively (35Nm³/car)
- b. Filling pressure : 25 MPaG and 35 MPaG

Table 7AB.2.1-1 Number of salt electrolysis plants in jurisdictional areas of local regional bureaus of economy, trade and industry

Bureau of economy, trade and industry	Number of Plants
Hokkaido	1
Tohoku	2
Kanto	10
Chubu	3
Kinki	3
Chugoku	6
Shikoku	3
Kyushu	6
Department of economy, trade and industry, Okinawa general bureau	1
As of March 31, 2001	

Table 7AB.2.1-2 Transition of usage of electrolysis hydrogen and trend statistics

	1997	2001	2006
H ₂ generation (Nm ³ /year)	1.1x10 ⁹	1.2x10 ⁹	1.2x10 ⁹
Chemical industry	45 %	50 %	54 %
Fuel	47 %	42 %	38 %
Discharged	5 %	5 %	4 %
Others	3 %	3 %	2 %

c. Hydrogen supply purit	: hydrogen	99.99%
	: Dew point	-60
	: Oxygen	2 ppm
	: Nitrogen	50 ppm
	: Carbon monoxide	1 ppm
	: Carbon dioxide	1 ppm
	: Hydrocarbon	1 ppm

(2) Major Equipment

a. Hydrogen supply source

- Hydrogen trailer : 2,600 m³ type (load capacity : ca 2,030 Nm³)
- Pressure : 19.6 MPaG (max)
- Volume capacity : 660L x 20 cylinders

b. Hydrogen compressor unit

- Type : Diaphragm type
- Capacity : 100Nm³/h (when the inlet pressure is 10 MPaG,)
- Suction pressure : 10 to 19.6 MPaG
- Delivery pressure : 40 MPaG

c. Gas storage unit

- Capacity : 3,120 L (240L x 13 cylinders)
- Filling pressure : 40MPaG

d. Hydrogen dispenser unit

- Possible H₂ filling pressure : 25 MPaG and 35 MPaG
- Filling nozzle : compatible with WEH (Germany) product

(3) Safety measure

- a. For vehicles : Overload prevention function
- b. For station : Hydrogen gas leakage detector and alarm device, fire detector, electrostatic eliminator, fire prevention and extinguish equipment, earthquake detector, emergency shut-down device, vehicle collision prevention device, various interlock functions etc.

(4) Hydrogen filling for vehicles

Hydrogen is filled to vehicles in 2 stages, from hydrogen trailers and from the gas storage.

7AB.2.3 Location and layout planning

The station was located in an area of the main factory of Tsurumi Soda Co., Ltd. in Tsurumi Ward, Yokohama City, Kanagawa Prefecture, Japan. As the result of investigation of layout, the hydrogen refueling station has a total area of 470 m² including buildings and the frontage facing the city road of 14.6 m.

7AB.3 Future Subject in Research and Development

In fiscal 2002, the remaining component apparatuses of the hydrogen refueling station yet manufactured in previous fiscal year will be manufactured and installed on the site. The operation of the hydrogen refueling station will be started and the verification of the total system will be done.

The items to be performed and the research and development subjects in the next year are as follows:

(1) Manufacture of the component apparatuses and construction of hydrogen refueling station

The component apparatuses for the hydrogen refueling stations, except the dispenser unit manufactured in the previous year, will be manufactured and installed on the site. The test operation and tuning will be done.

(2) Construction of the security equipment for hydrogen refueling station

The security system for operation of the hydrogen refueling station will be studied and installed.

(3) Test operation and verification of the total system

a. Test operation

The operation data in environment of practical use will be obtained by filling hydrogen into fuel cell vehicles and test tank containers.

b. Verification of total system

The total system constructed in the previous year will be adjusted suitably using the obtained data. The safety measures will also be verified.