FCV / Infrastructure Demonstration Program in Japan

June 5, 2012

Tetsufumi Ikeda

General Manager

FCV / Infrastructure Demonstration Project Department

The Research Association of Hydrogen Supply/Utilization Technology (HySUT)

te-ikeda@hysut.or.jp **http://hysut.or.jp/**

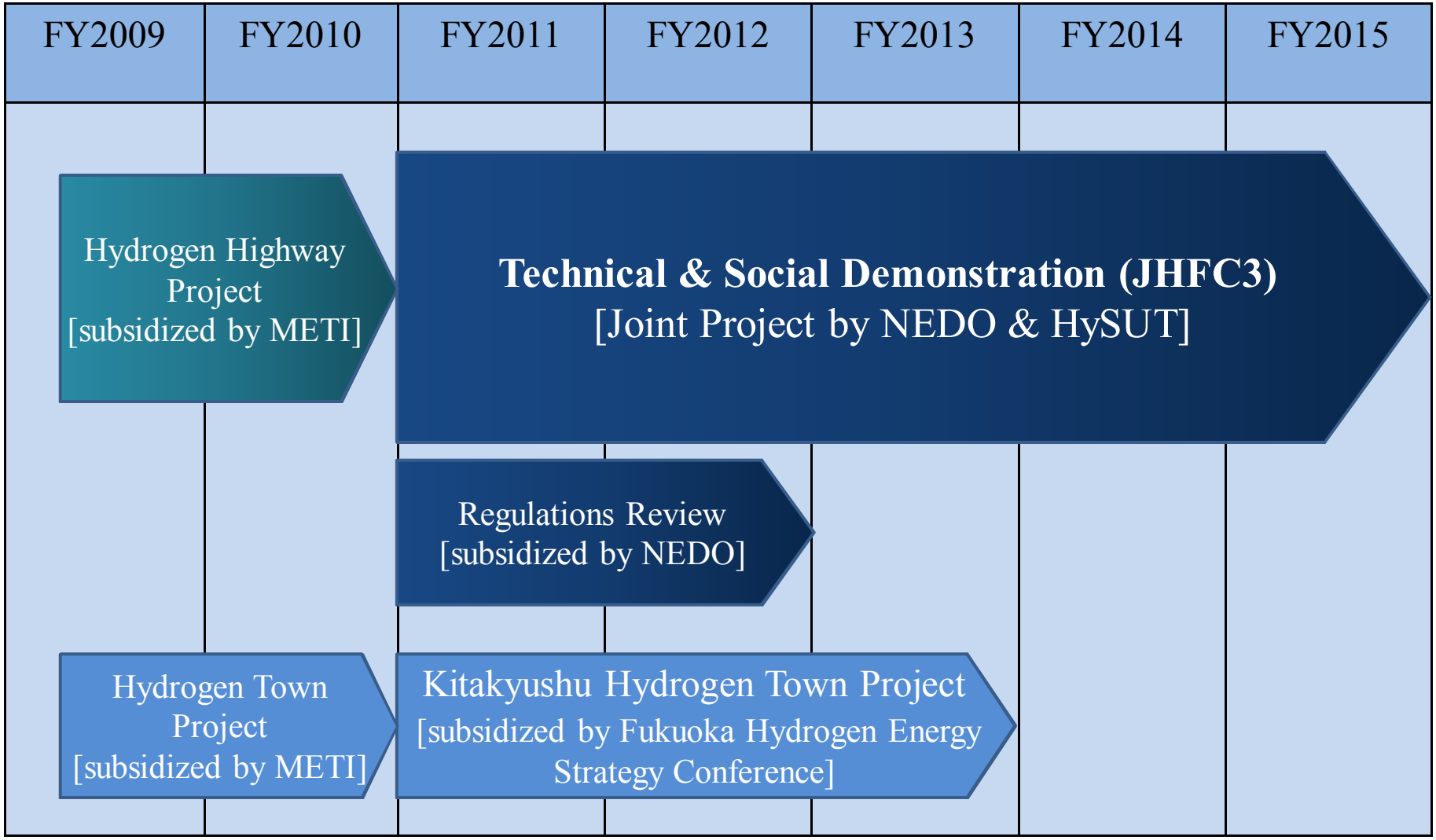
Outline of HySUT: The Research Association of Hydrogen Supply / Utilization Technology

- Goal and Objective -

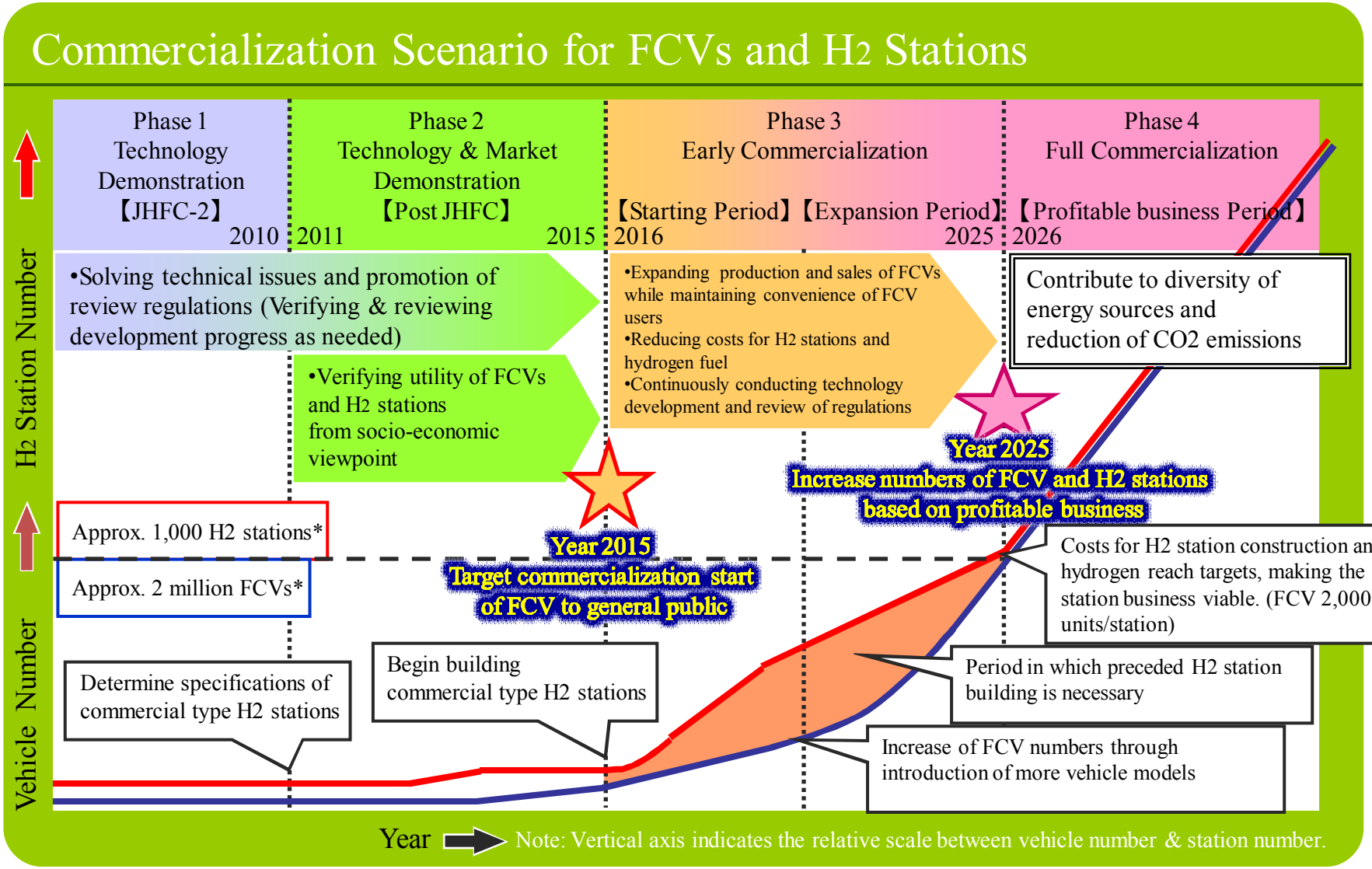
Our goal is commercialization of hydrogen supply business and FCVs by private companies. Our objective is to solve the issues of technology, consumer awareness, social acceptance and to assist business establishment through our demonstration program.

Date of establishment		July 31st, 2009
Members		18 Companies and Organizations (as of May 1st, 2012)
	Petroleum company (4)	JX Nippon Oil & Energy Corporation, Idemitsu Kosan Co., Ltd., COSMO OIL CO., LTD., Showa Shell Sekiyu K.K.
	City gas company (4)	TOKYO GAS CO., LTD., OSAKA GAS CO., LTD., TOHO GAS CO., LTD., SAIBU GAS CO., LTD
	Industrial gas & Device / Engineering company (5)	Iwatani Corporation, AIR LIQUIDE Japan Ltd., KAWASAKI HEAVY INDUSTRIES, LTD., MITSUBISHI KAKOKI KAISHA, LTD., TAIYO NIPPON SANSO Corporation
	Automotive company (3)	TOYOTA MOTAR CORPORATION, NISSAN MOTOR CO., LTD., Honda R&D CO., Ltd.
	Related organization (2)	ENGINEERING ADVANCEMENT ASSOCIATION OF JAPAN (ENAA), JAPAN PETROLEUM ENERGY CENTER (JPEC)
Term of the existence		2009 to 2015FY

HySUT's Projects Overview



Commercialization Scenario in Japan



* Precondition: Benefit for FCV users (price/convenience etc.) are secured, and FCVs are widely and smoothly deployed

Reference : FCCJ, March, 2010 http://fccj.jp/

Joint Announcement by 13 Japanese companies

On January 13, 2011, 13 Japanese companies (automakers and hydrogen fuel suppliers) jointly announced the launch of FCVs in the Japanese market in 2015 and the development of the hydrogen supply infrastructure.

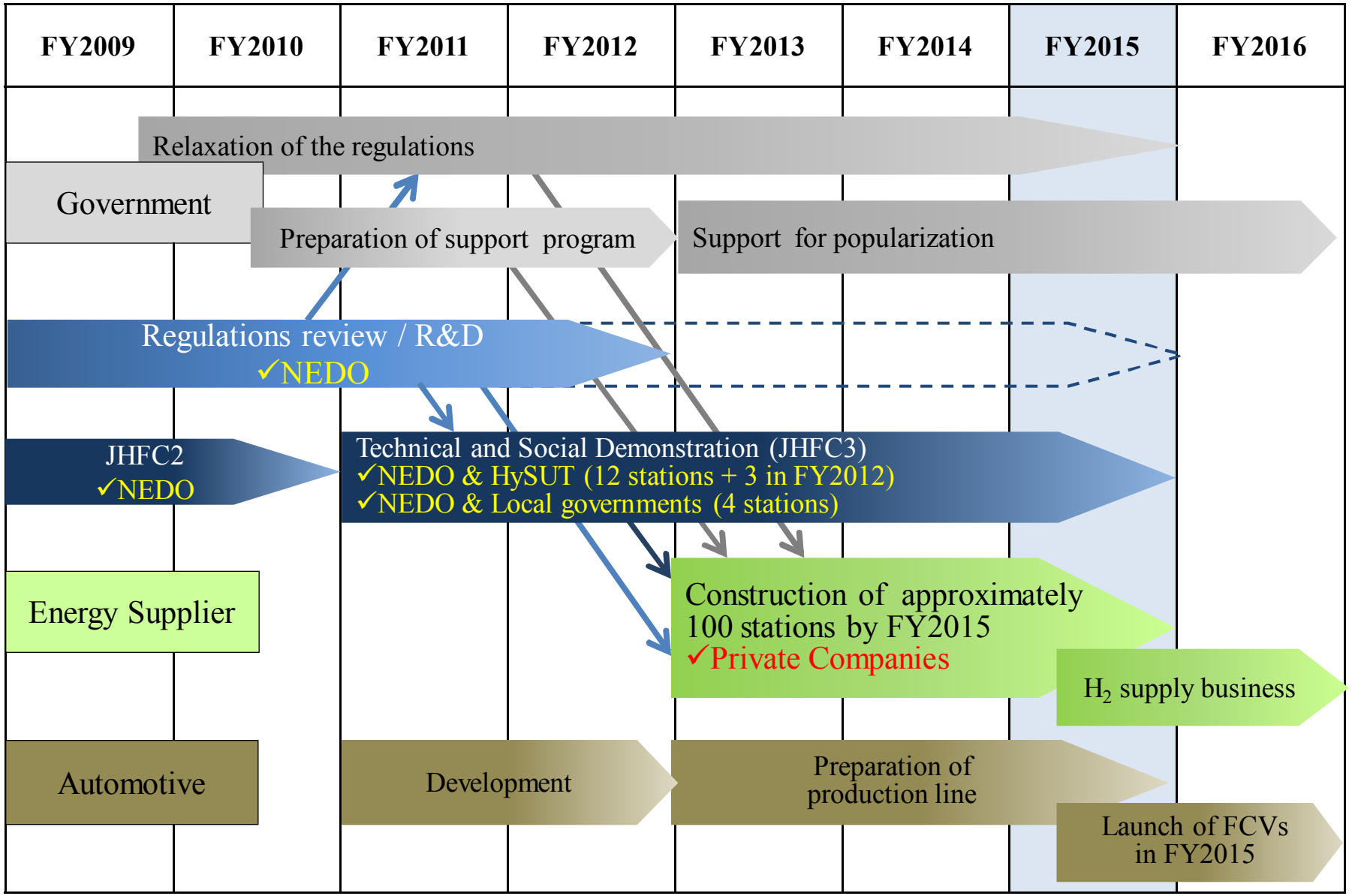
1. Automakers are aiming to launch FCVs in the Japanese market—mainly in the country's four major metropolitan areas—in 2015.

2. Hydrogen fuel suppliers are aiming to construct approximately 100 hydrogen fueling stations by 2015.

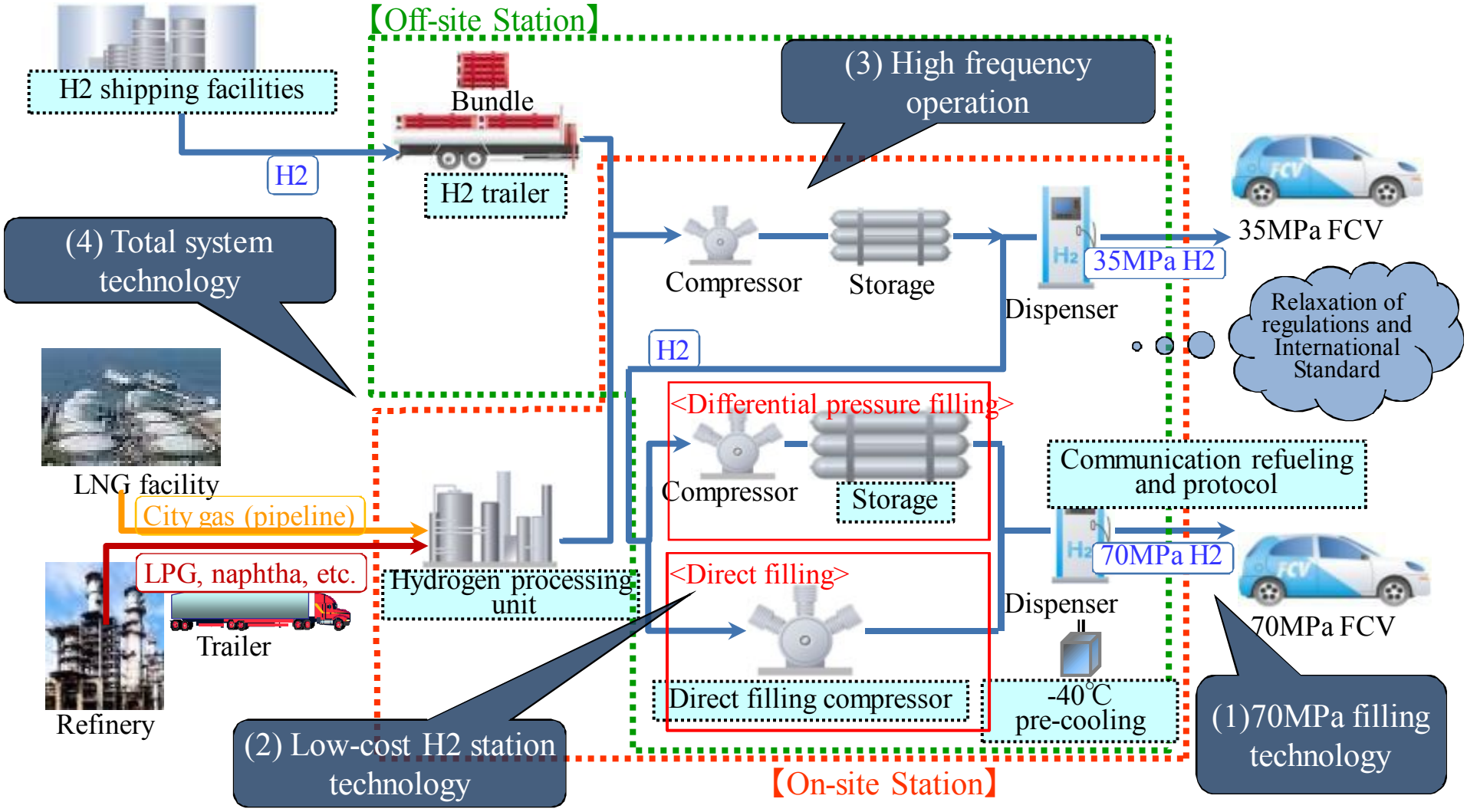
3. Automakers and Hydrogen fuel suppliers will work together to Stations on the expressway expand the introduction of FCVs and develop the hydrogen supply network throughout Japan.

*Source: NEDO June, 2011

Roadmap to Commercialization



Overview of Technical & Social Demonstration (JHFC3)



Demonstration Schedule 2011 - 2013

		FY2011	FY2012	FY2013
(1)	**70MPa filling technology** ✓ Communication refueling ✓ Protocol ✓ -40℃ pre-cooling	➢Preparation ➢Spec. study	➢Remodeling ➢Introduction	➢Demonstration
(2)	**Low-cost H2 station technology** ✓ Differential pressure filling ✓ Direct filling	➢Preparation ➢Spec. study	➢Remodeling ➢Introduction	➢Demonstration
(3)	**High frequency operation** ✓ Durability data of the facilities	➢Demonstration		
(4)	**Total system technology** ✓ Commercial model stations ✓ Large scale shipment system and Hydrogen trailer ✓ Study on convenience and practicability of H2 infrastructure through demonstration run	➢Spec. study ➢Spec. study ➢Demonstration	➢Construction ➢Construction ➢Demonstration	➢Demonstration ➢Demonstration

Hydrogen Stations used for the Demonstration Program

Yokohama-Daikoku (70/35MPa, Off-site)

Tokyo-Suginami (35MPa, Off-site)

Nikko (35MPa, Off-site)

Senju (70/35MPa, On-site)

Yokohama-Asahi (70/35MPa, On-site)

○ JHFC3
2) Regional
Demonstration
Project

Yamanashi (35MPa, Off-site)

Narita (35MPa, Off-site)

Kitakyushu (35MPa, Off-site)

Kyushu-Univ. (35MPa, On-site)

Osaka (35MPa, On-site))

Tosu (35MPa, On-site)

Kasumigaseki (70/35MPa, Off-site)

Kansai-airport (35MPa, Off-site)

Centrair (35MPa, On-site)

Haneda (35MPa, On-site)

Ariake (70*/35MPa, Off-site)
*Scheduled

FCVs and FC Buses used for the Demonstration Program

FCVs prepared for the program

FCHV-adv (Toyota)

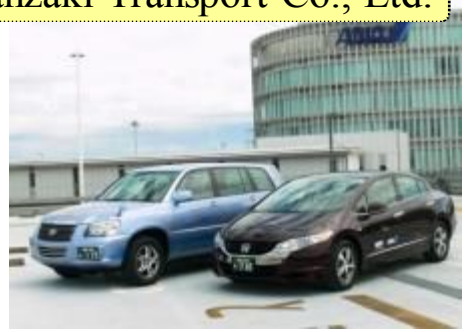
X-TRAIL FCV (Nissan)

FCX CLARITY (Honda)

Other FCVs leased from automakers

Fleet Demonstration

Manzaki Transport Co., Ltd.



FCHV-adv (Toyota)
FCX CLARITY (Honda)
ANA Welcome-home Taxi Service

Airport Transport Service Co., Ltd.

FCHV-BUS (Toyota, Hino)
Airport Limousine

Eastern Airport Motors Co., Ltd.

X-TRAIL FCV (Nissan)
Airport Taxi

ANA CHUBU AIRPORT CO., LTD.

FCHV-BUS (Toyota, Hino)
Ramp Bus

Activities of FY2011

➢ Total operation data of the 12 hydrogen stations

Station	Filling Data			Hydrogen Processing Unit		Compressor or Liq. H2 Pump
	H2 (kg)	Number of filled vehicles		Operation (h)	Production (Nm3)	Operation (h)
		FCV	FC Bus			
Yokohama-Asahi	92.6	55	2	292.5	2,399.8	69.3
Yokohama-Daikoku	618.3	146	0	-	-	210.0
Senju	483.6	99	0	2,770.6	41,171.0	207.5
Ariake	541.9	160	16	-	-	580.1
Tokyo-Suginami	214.9	135	1	-	-	46.0
Haneda	1,884.2	147	213	7,997.0	128,473.0	592.0
Narita	616.8	389	2	-	-	174.6
Centrair	825.1	8	217	563.1	22,710.0	201.2
Osaka	172.6	109	0	946.7	17,122.1	107.6
Kansai-airport	100.3	50	0	-	-	-
Kasumigaseki	532.0	252	0	-	-	104.3
Nikko	47.4	25	0	-	-	68.0
Total	6,129.7	1,575	451	-	211,875.9	-

Activities of FY2011

➢ Testing items for refueling technologies

Station	Testing Item	Refueling Pressure	Vessel Volume	Target Pressure Ramp Rate (MPa / min)	Initial Pressure (MPa)
Senju	Const. pressure ramp rate control	70MPa	80L 120L 160L	28.2 20.0 15.7, 20.0	10 20 20
	Pre-cooling				
	Non-communication refueling		(2 FCVs)	J2601 B-70 (8.26～11.28)	5, 20, 40
	Lower pressure ramp rate control		160L	0.9, 1.3, 1.8	5
Yokohama-Daikoku	Const. pressure ramp rate control	35MPa	(3 FCVs)	5.0, 7.5, 10.0	5, 15, 25
Ariake	Const. pressure ramp rate control	35MPa	139L	0.9, 1.8, 6.4, 10.4, 15.1	5
	Pre-cooling		139L	7.0, 8.8, 9.6, 10.2, 13.9	5
	Continuous refueling		(3 FCVs)	7.8	Arbitrary (ca.10)
Yokohama-Asahi	Pressure loss evaluation	70MPa			

Activities of FY2011

➢ Results of hydrogen analysis (1)

(unit: ppm)

Component		On-site Station			Off-site Station			Detection Limit	Method of Analysis	ISO
		Senju	Yokohama-Asahi	Haneda	Tokyo-Suginami (Delivery)	Tokyo-Suginami (Receiving)	Tokyo-Suginami (Dispenser)			
Carbon Monoxide		<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	GC-FID	0.2
Carbon Dioxide		<0.01	1.10	<0.01	<0.01	<0.01	0.02	0.01	GC-MS	2
Hydro carbons	Methane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	GC-FID	2
	Others	<0.05	0.15	0.05	<0.05	<0.05	<0.05	0.05	GC-FID	2
Sulfur Compound		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	IC	0.004
Formic Acid		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	IC	0.2
Ammonia		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	IC	0.1
Water		0.6	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	Dew point meter	5
Oxygen		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	Oxygen meter	5
Argon		1.39	0.08	1.50	0.32	0.22	0.05	0.03	GC-MS	100
Nitrogen		0.18	0.91	0.12	0.21	0.49	0.45	0.03	GC-MS	100
Helium		<3	<3	<3	<3	<3	<3	3	GC-TCD	300

Activities of FY2011

➢ Results of hydrogen analysis (2)

	On-site Station			Off-site Station					ISO
	Senju	Yokohama -Asahi	Haneda	Ariake	Tokyo-Suginami	Narita	Yokohama -Daikoku	Kasumigaseki	
Weight of particle (mg/kg)	0.0091	0.0088	0.011	0.014	0.0067	0.019	0.015	0.047	1
Mean particle size (μm)	20	21	23	27	33	23	8	29	-
Dispenser filter opening (μm)	10	10	10	10	5	10	10	50	-

Activities of FY2011

➢ Results of the fleet demonstration

Transportation Company	Vehicle	Run Distance (km)	Number of Refueling	Refilled H2 (kg)
Airport Transport Service	FCHV-BUS(#951)	17,548	127	2,479
	FCHV-BUS(#952) (Operation ended 9/2011)	10,841	83	
ANA CHUBU AIRPORT	FCHV-BUS(#785)	4,327	104	
	FCHV-BUS(#786)	5,165	115	
Manzaki Transport	Toyota FCHV-adv	28,779	255	725
	Honda FCX CLARITY (Operation started 9/2011)	16,977	132	
Eastern Airport Motors	Nissan X-TRAIL FCV	10,289	76	
Total	-	93,926	892	3,204

Activities of FY2011

➢ Demonstration run around Tokyo metropolitan area

Total 8 FCVs gathered in Nikko on March 22, 2012.

Toyota FCHV-adv (Toyota): 3 cars
Toyota FCHV-adv (Yamanashi prefecture): 1 car
Honda FCX CLARITY (Honda): 2 cars
Nissan X-TRAIL FCV (Nissan): 1 car
Nissan X-TRAIL FCV (Nikko city): 1 car

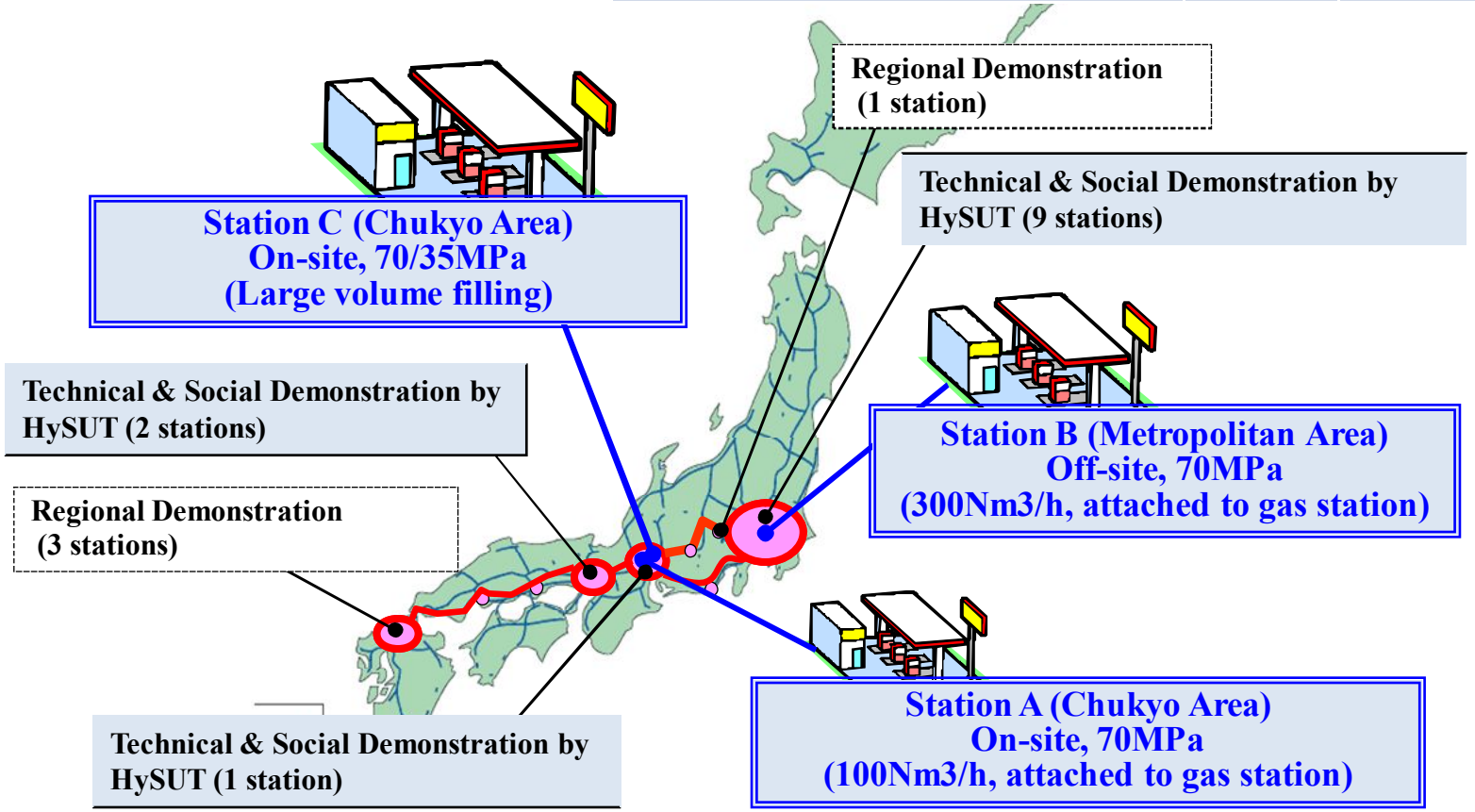
Plans for FY2012

➢ Demonstration of the commercial model station

3 Commercial model stations are planed to be constructed in FY2012.

Number of Public Accessible Hydrogen Stations in Japan

	FY2011	FY2012
Technical & Social Demonstration by HySUT	**12**	**15**
Regional Demonstration	4	4
Total	**16**	**19**



Plans for FY2012

➢ Demonstration of the commercial model station

Station		A	B	C
Type		On-site	Off-site	On-site
Raw Material		LPG	Compressed Hydrogen	Natural Gas
Location		Chukyo area	Metropolitan area	Chukyo area
Characteristics		Attached to Self Gas Station in the city area	Attached to Self Gas Station in the suburbs	Large volume filling capability up to 2,400Nm3/h
		✓ Total planning from site selection to construction ✓ Smaller area and shorter construction period ✓ Cost reduction		
Specification	Pressure	70MPa	70MPa	70/35MPa
	Filling Protocol	Available	Available	Available
	Filling Type	Differential Pressure	Differential Pressure / Direct Filling	Direct Filling
	Facilities	•80MPa CFRP Storage Vessel •Package type unit	•80MPa CFRP Storage Vessel •Package type unit	•Package type unit

JHFC3's Role to the Development of Hydrogen Infrastructure