Status on Activities for Hydrogen Infrastructure in Japan

September 26th, 2016

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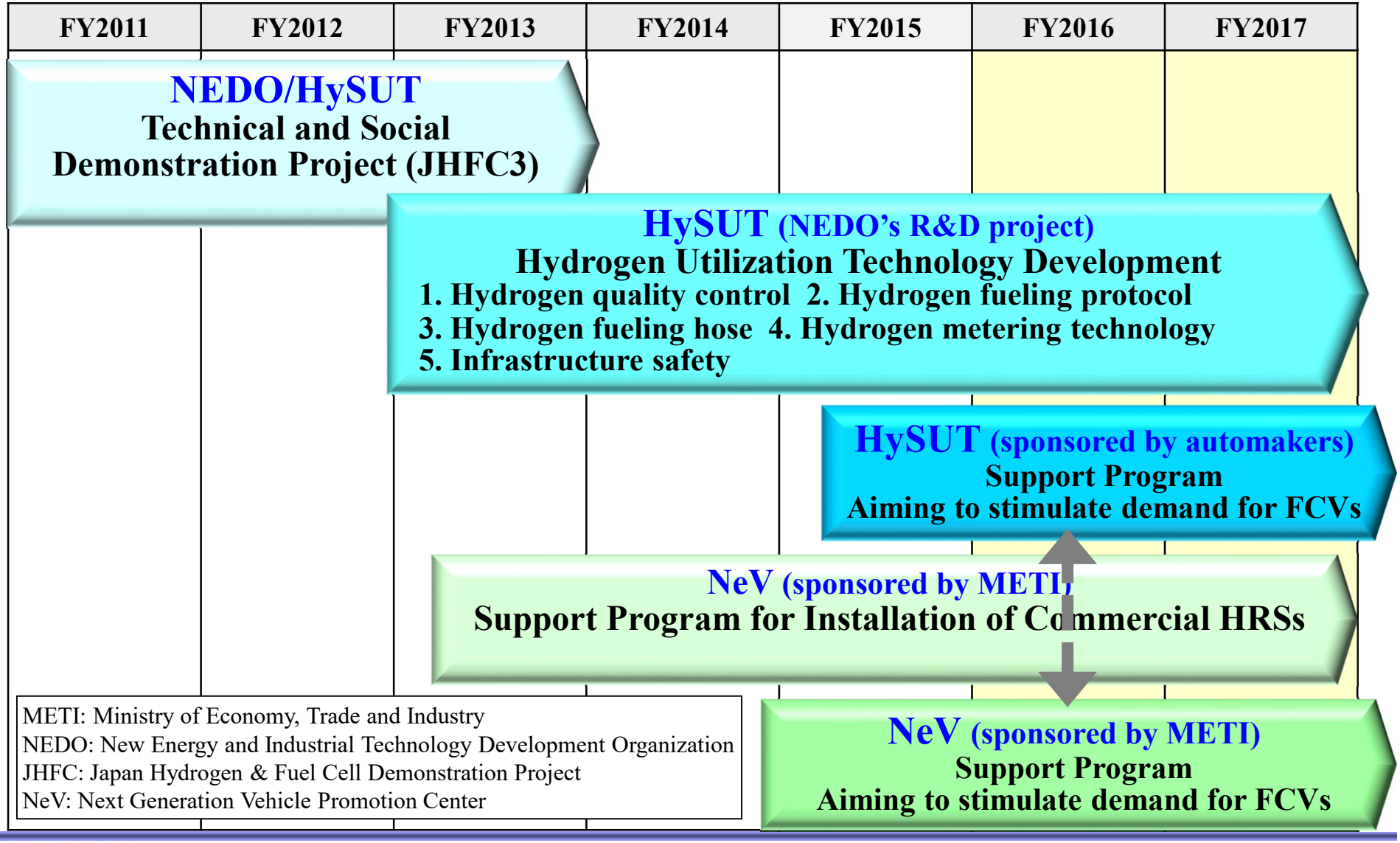
Support Programs for Commercialization



HySUT Update

HySUT
The Research Association of Hydrogen Supply/Utilization Technology

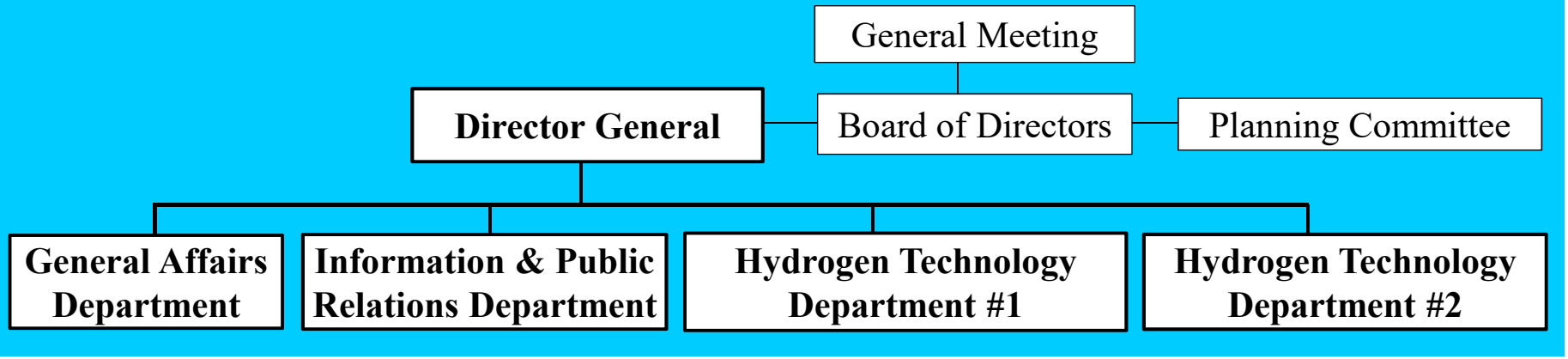
April 1st 2016

HySUT
The Association of Hydrogen Supply and Utilization Technology

1. Technology Development
✓Fueling, Quality, Metering etc.
✓Guidelines
✓ISO/TC197

2. Safety and Reliability
✓Future Technology
✓Training and Education
✓Database, Safety Control

3. Support Program
✓HRS Operation
4. Others
✓Public Awareness
✓International Collaboration



Revised Roadmap by METI (March 2016)

New Target Number for FCV and HRS

FCV *(in stock)*

40,000 units (by 2020)
200,000 units (by 2025)
800,000 units (by 2030)

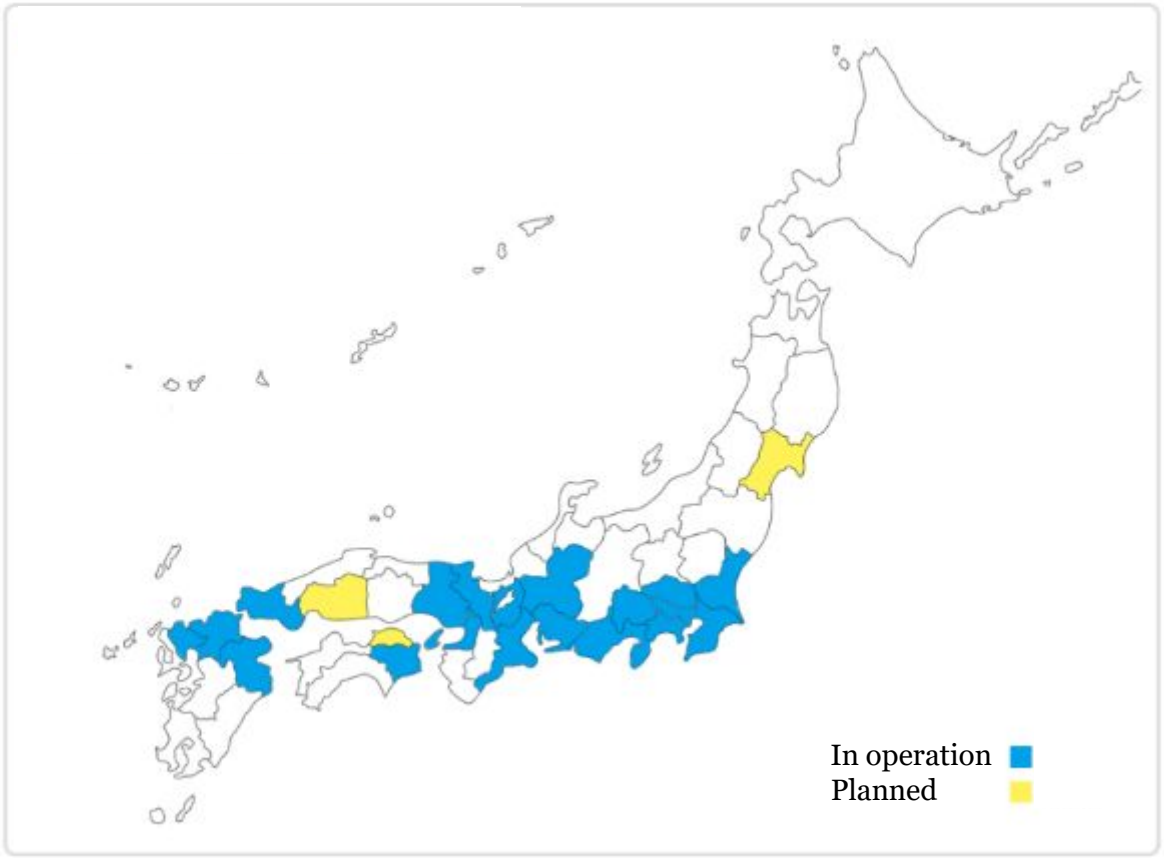
Hydrogen Refueling Station

160 stations (by 2020), 320 stations (by 2025)
** full scale HRS (refueling 6 FCVs / hour)*
100 small scale HRSs
w/ renewable energy (by 2020)

Commercial HRSs in Japan as of June 2016

78 HRSs	
Area	
Tokyo area	35
Nagoya area	20
Osaka area	11
North Kyushu area	12
Type	
Off-site	36
Mobile	29
On-site	13
HRS Owner	
JX Energy	36
Iwatani	14
Nimohyss (Mobile)	5
Others（12companies)	23

HRS Area Map as of 2016/6

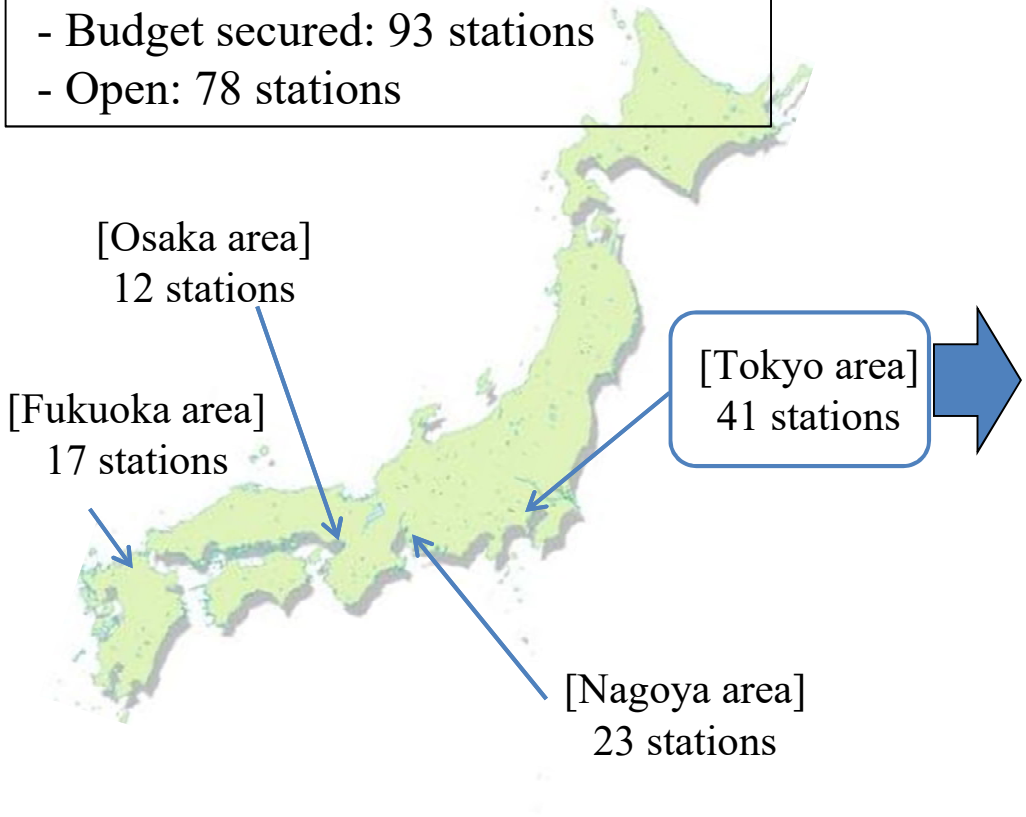


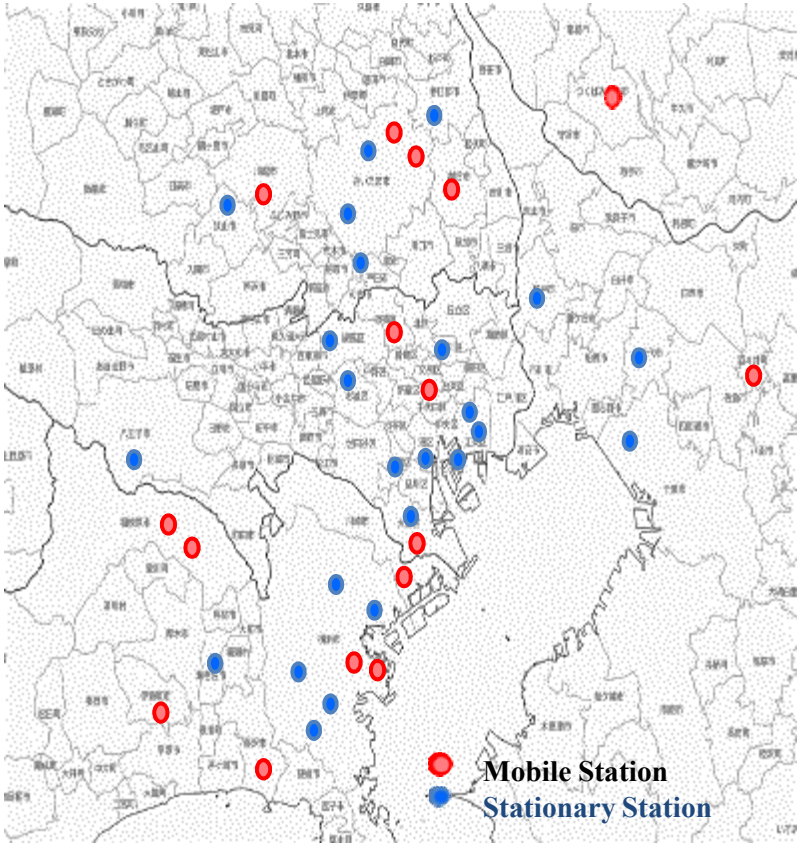
http://fccj.jp/hystation/index.html#hystop

Commercial HRSs in Japan

- Target: 160 HRSs in 4 major metropolitan areas by 2020, 320 by 2025
- METI subsidizes around 1/2 or more of capex and 2/3 of opex

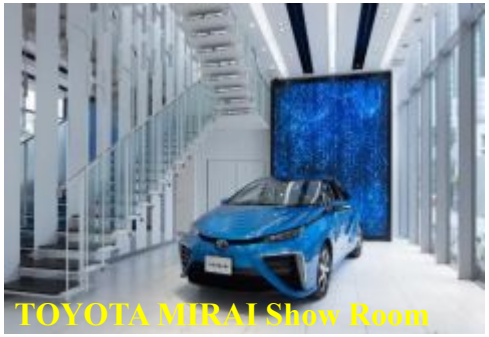
Status of HRSs
- Budget secured: 93 stations
- Open: 78 stations



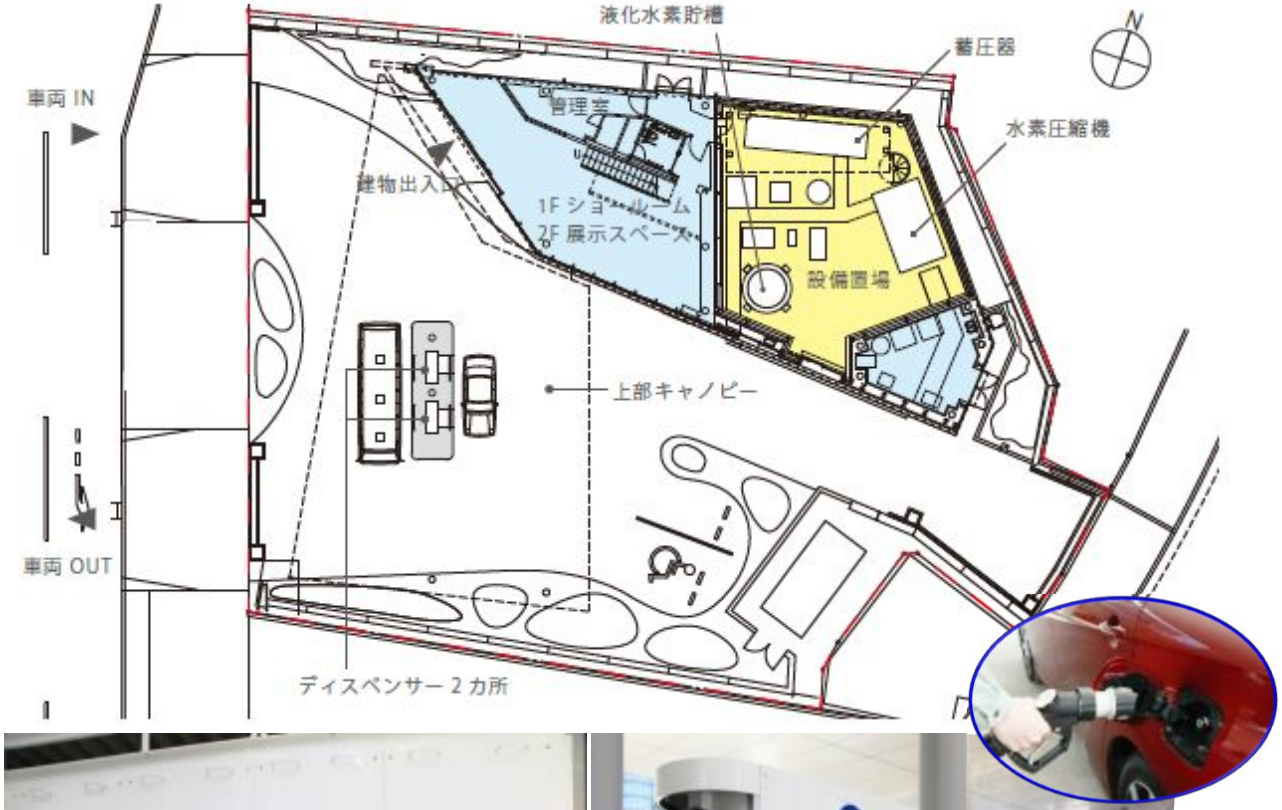


Source: Fuel Cell Commercialization Conference of Japan

Iwatani's Shibakoen HRS in Tokyo



TOYOTA MIRAI Show Room



LH Tank (24kL)

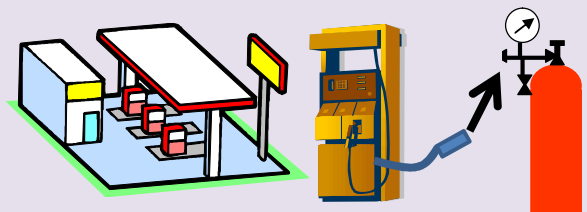
Compressor (IC-90)

Storage Bundle (82MPa, 300LX3)

Dispenser / JPEC-S 0003 (2012)

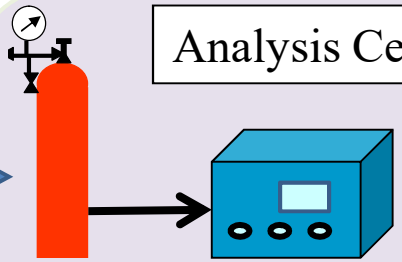
Hydrogen Quality Control (NEDO's R&D Project)

✓Establishment of Quality Control Guideline
✓Analysis Cost down by development of abbreviated analysis method



HRS

Sampling cylinder
(14MPa)



Analysis Center

Analyzer
(several types)

Dispenser

Sampling Apparatus for
High Pressure Hydrogen

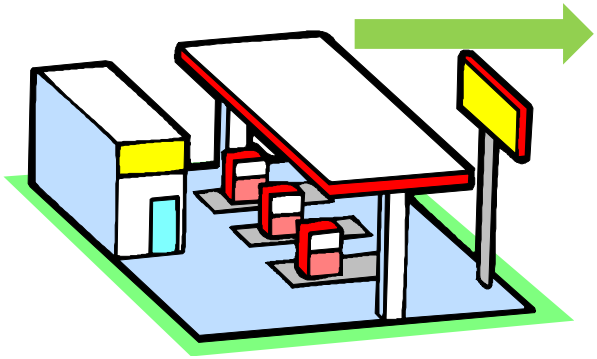
Test Results of Commercial HRSs

All 12 HRSs satisfied ISO14687-2 Sampling Date: 2014/12/1 - 2015/3/9

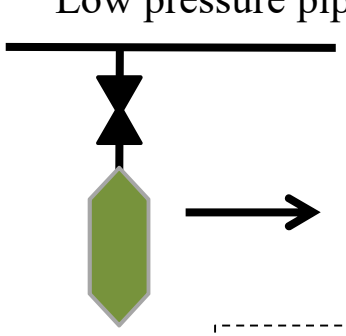
	Measured Value(ppm)	Method	ISO (ppm)
H2O	Ave. 1.1	DPM	5
CH4	<0.1	GC-FID	2
Non-CH4	<0.2	GC-FID	2
O2	Ave. 0.17	O2 Meter	5
He	<20	GC-TCD	300
N2	Ave. 4.5	GC-HPID	100
Ar	Ave. 0.7	GC-HPID	100
CO2	Ave. 0.2	GC-FID	2
CO	<0.1	GC-FID	0.2
S compounds	<0.001	IC	0.004
HCHO	<0.01	HPLC/DNPH	0.01
HCOOH	<0.01	IC	0.2
NH3	<0.01	NH3	0.1
Halogen	<0.05	IC	0.05

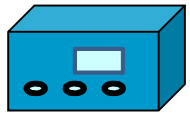
Research and Development Efforts

Sampling at low pressure line & on-site analysis



Low pressure pipes





- Simple way
- Multi-components analysis
- Lightweight

Simple Analytical Instrument

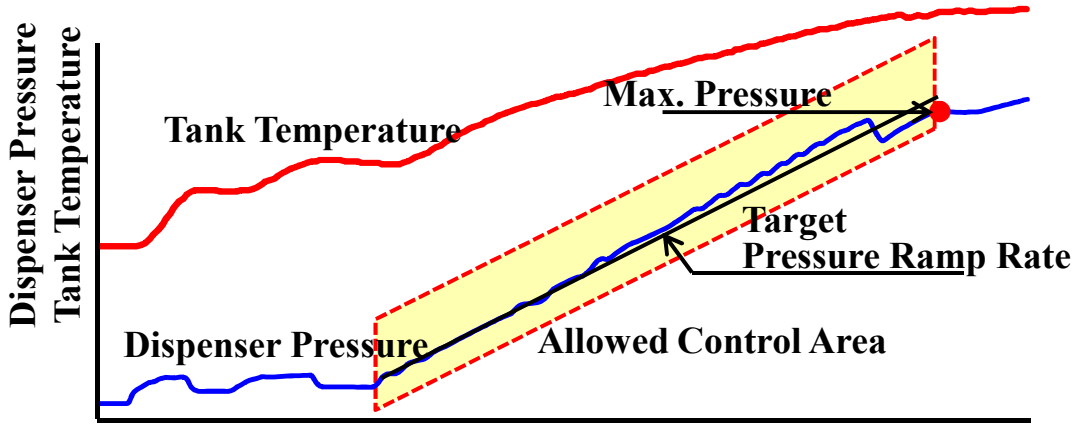
Sampling cylinder(<1MPa)

TOF-MS (Time of Flight Mass Spectrometer)

Hydrogen Fueling Protocol (NEDO's R&D Project)

✓Establishment of Fueling Performance Validation Guideline
✓R&D for fueling protocol technology

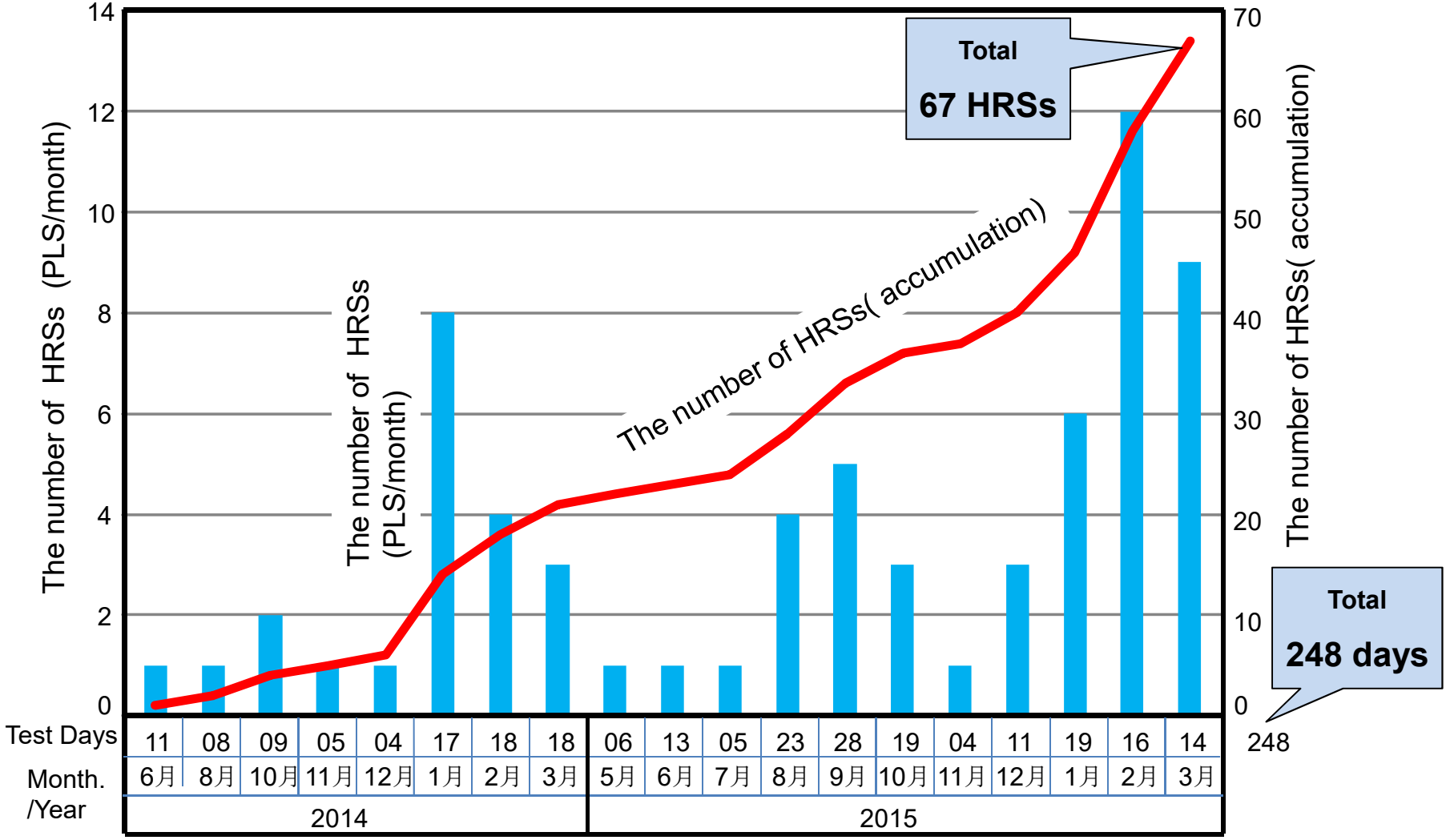
Subjects		Assignment
National Standard	Fueling Protocol (JPEC-S 0003)	JPEC
	Fueling performance Validation Guideline	**HySUT**
International Standard Harmonization (SAE J2601)		JARI
Technology Development	Validation Test	JARI
	Simulation	Kyushu University
Characterization of high pressure hydrogen		Kyushu University



Testing Truck

Fueling Performance Validation at Commercial HRSs

67 Commercial HRSs were validated and all HRSs satisfied JPEC-S (2012) / Guidelines (2013)



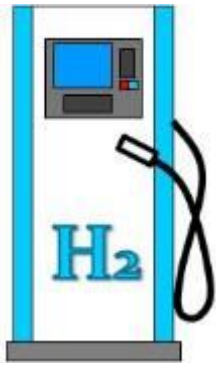
Specifications of HDTA in Japan

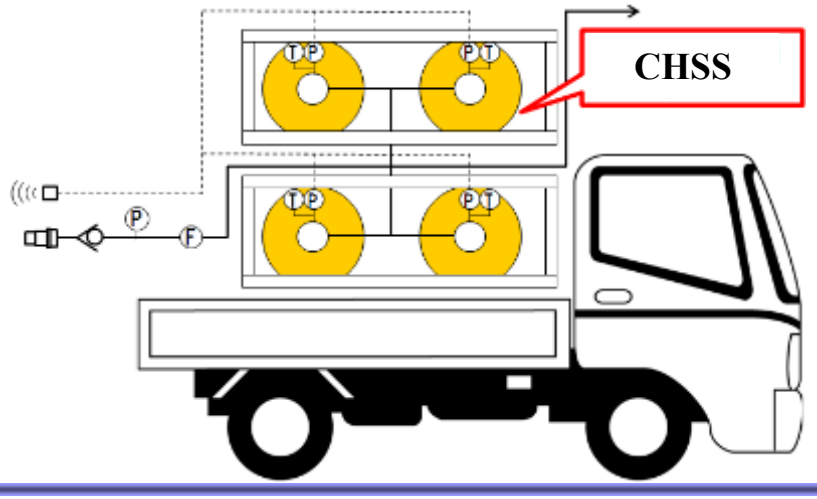
HySUT HDTA Ver.1 (2014/1 – 2016/3)

Item	Specifications
Fueling module	Mobile type equipment
Tank	General composite tank according to KHK -S0128 (2010)
Component with Tank	Component according to JARI S 002(2004) **MOP: 70 MPa**
Component for High pressure H2 gas	Special Materials according to Exemplified Standards (Regulation)
Safety Devices	◆ Safety valves at pipe line ◆ Heat operation type safety valves near the accumulator ◆ H2 detectors including handy type ◆ Electrical Shutoff Valve connected with H2 detectors ◆ Shield（punching metal etc.,）

HySUT HDTA Ver.2 (2016/9 -)

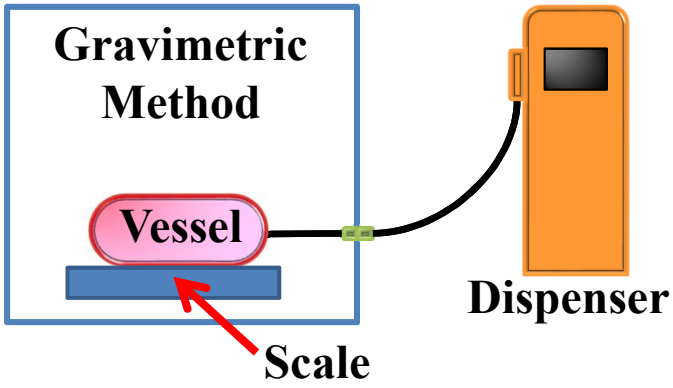
- **MOP:87.5 MPa**
  (satisfies gtr No.13)
- with Mass flow meter
  (to watch the max. flow anytime)





Hydrogen Metering Technology (NEDO's R&D Project)

✓Establishment of Hydrogen Metering Guideline.
✓R&D for calibration technology, Gravimetric Method and Master Meter Method.



Testing Apparatus

✓Outer size: W1950 mm x D2000 mm x H2000 mm
✓Weight: 1200 kg
✓Vessel Capacity: 36 L x 3 (70 MPa: 4.3 kg, 25 ℃)
Type IV : KHKS0128, Attachment : JARIS002
✓Vessel temperature specification: -40~85 ℃
✓Scale resolution: 1g

Japan Industrial Standard (JIS)

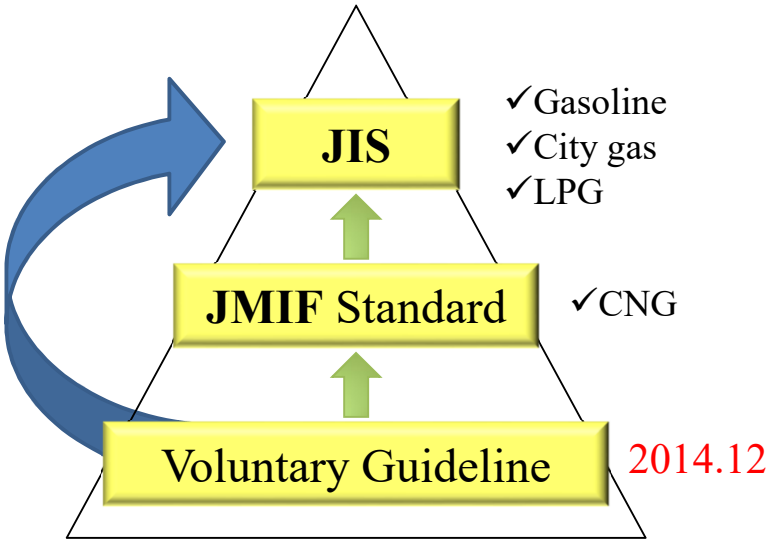
Measurement Act

- Defines "Specified measurement instruments" ⟺ business in a certain scale
- Refer to Japanese Industrial Standards (**JIS**) in detail

~~JMIF~~ → JIS
Japan Industrial Standard

OIML (R-139)
International Organization of Legal Metrology

Supports new technology development of measuring instruments



Roadmap of measurement scheme of hydrogen for FCVs by FCCJ

2014.12 **FCCJ Voluntary Industrial Guideline published**

~~FY2019 Establish **JMIF Standard** (Self Standard)~~

~~FY2023-2025 Number of FCVs: 200,000 - 1,000,000 move to **JIS**~~

2015. 5 JIS committee started

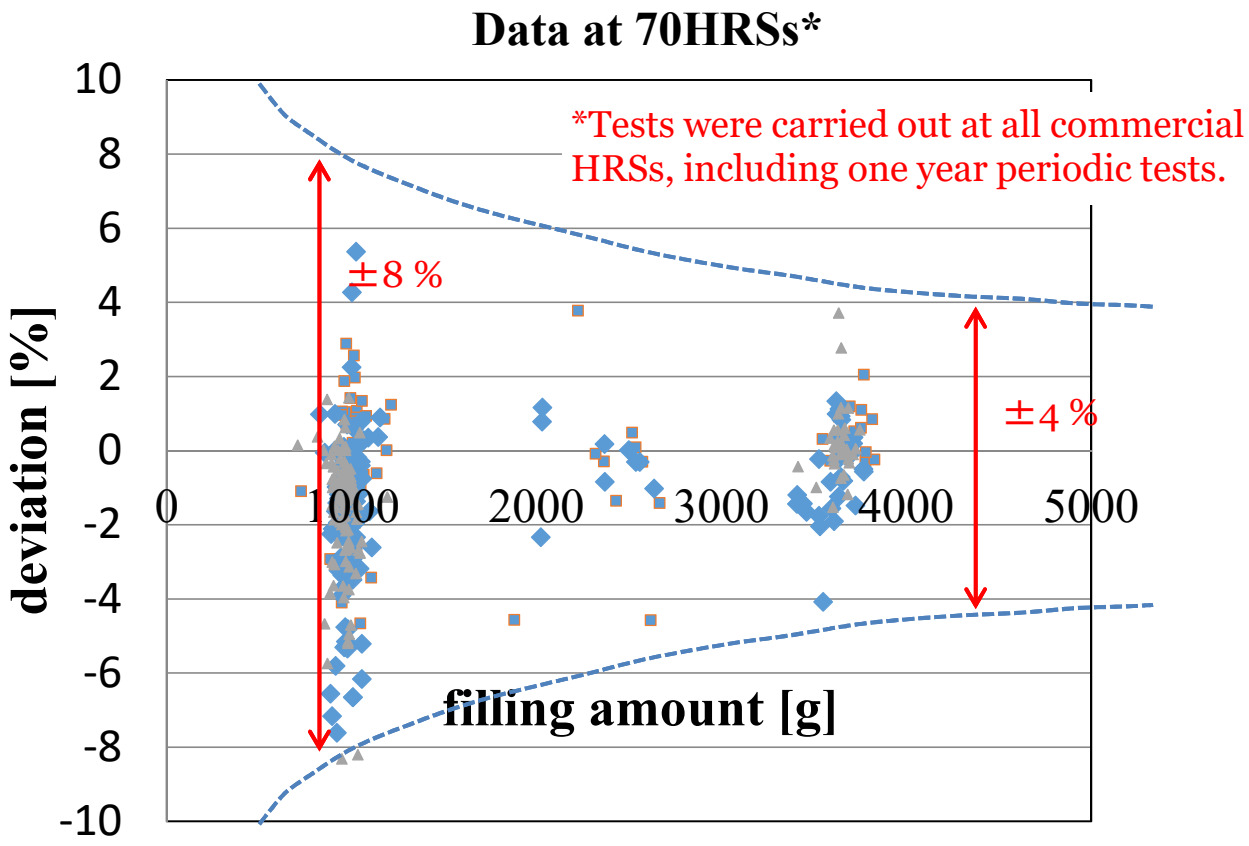
2016. 5.20 JIS has been published

Japan Industrial Standard (JIS)

JIS B 8576 : Hydrogen metering system for motor vehicles

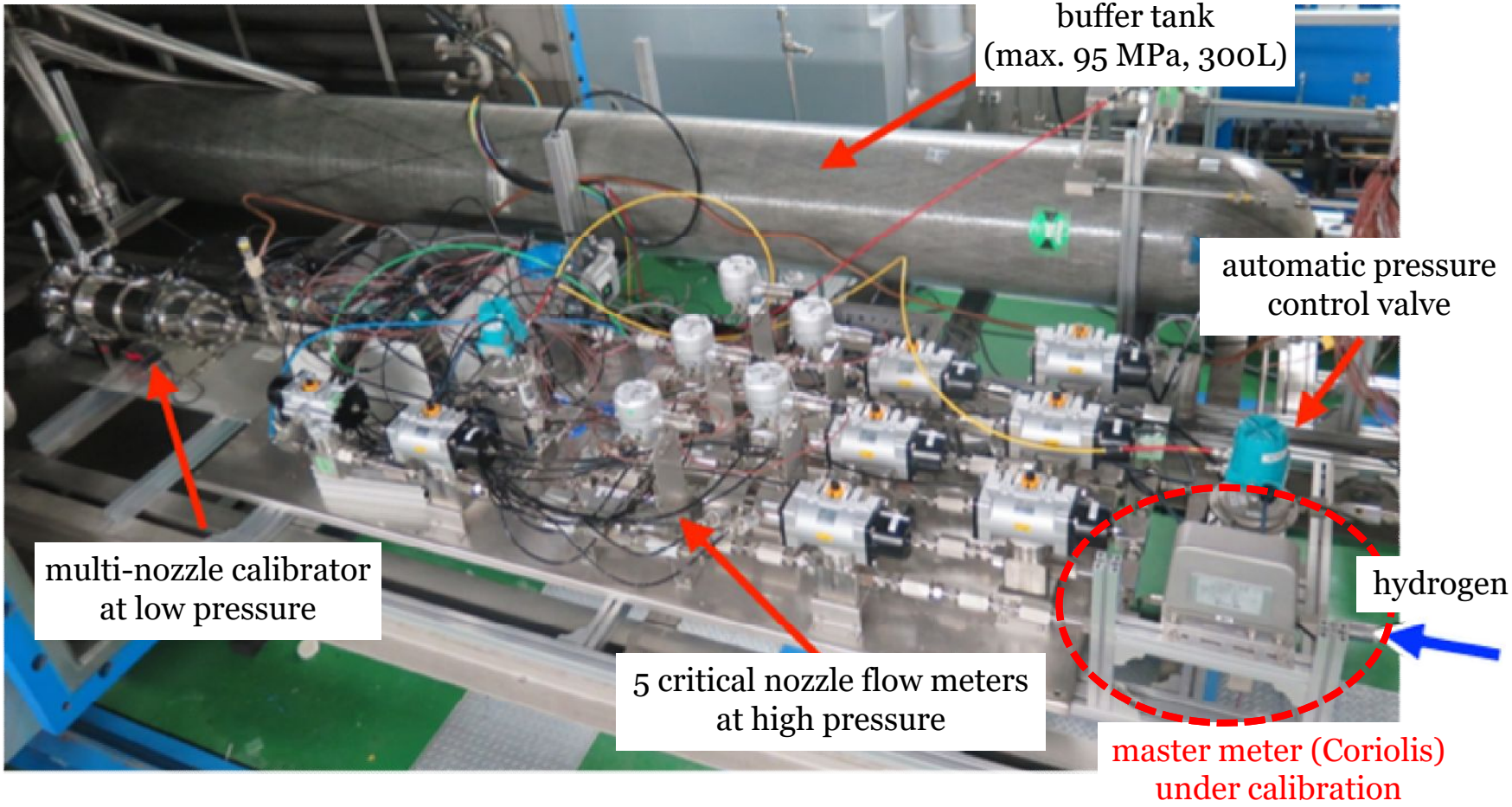
Accuracy class	Maximum permissible error (MPE)	MPE in service (Maintenance)
2	1.5 %	2.0 %
3	2.0 %	3.0 %
5	4.0 %	5.0 %
10	8.0 %	10.0 %

Metering Performance Validation at Commercial HRSs



Deviation indicates {(HRS – Mass Scale)/Mass Scale} x 100 %.

Master Meter Method for Metering Performance



Safety and Reliability Technology for HRS
(NEDO's R&D Project)

- ✓Incident/Trouble Data Collection and Construction of Reliability Database.
- ✓Training and Education for HRS Operators.
- ✓Development of Safety and Reliability Improvement Technology for future.
- ✓Enhancement of Social Acceptance.

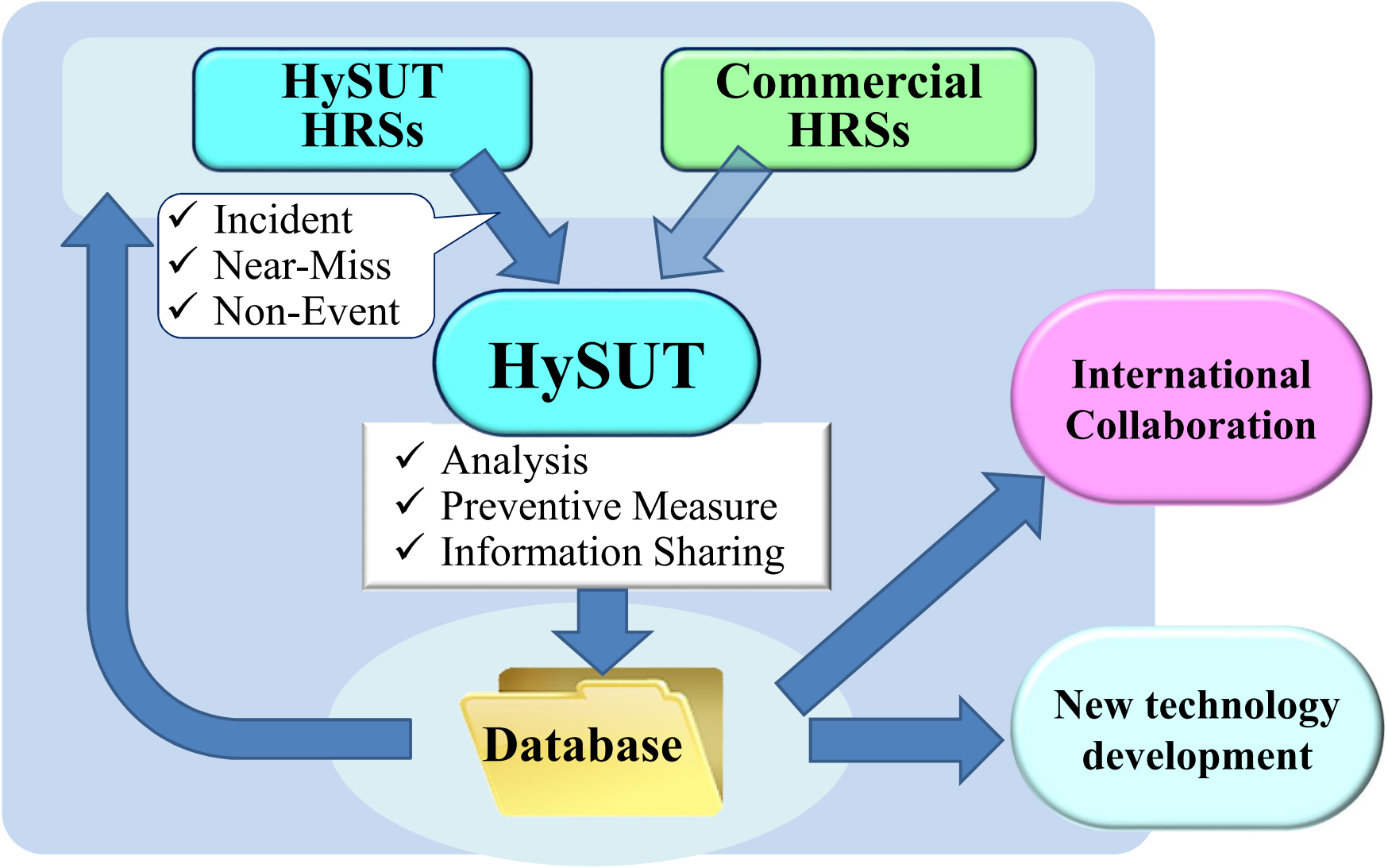
Construction of Reliability Database

Hydrogen Refueling Station

Training & Education

Enhancement of Social Acceptance

Application of Reliability Database



International Collaboration

✓Start collaboration with NREL in 2015, reporting events of 70MPa HRS.

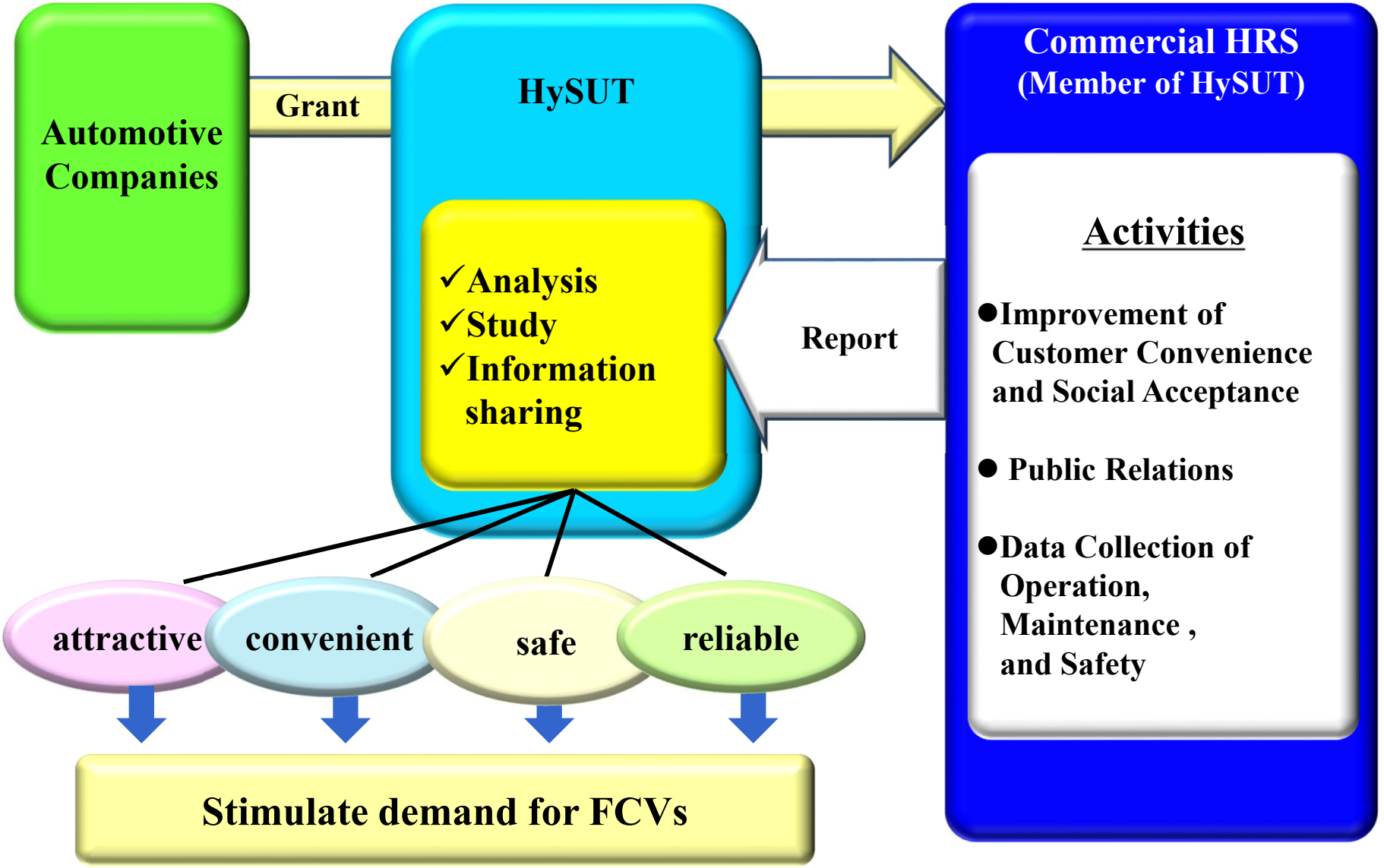
	GENERAL														
#	Event Date	Component Name	Equipment Type[2]	Equipment Unique identifier (like P&ID Tag)	Failure Mode[2] (Includes Preventative Maintenance and Upgrade)	Maintenance Type2	Direct Labor Hours	Labor Cost	Parts Cost	Station Operating Hours at Event	Station total kg H2 dispensed at time of event	Hours on Component at event	Station begin downtime (date/time)	Station end downtime (date/time)	DETAILED EVENT DESCRIPTION
1															
2															
3															

	SAFETY						
DETAILED EVENT DESCRIPTION	Event Addresses a Safety Issue	SEVERITY	Hydrogen Leakage	Injuries	Physical Damage	Root Cause(s)	SONS LEARNED/MEASURES TAKEN

Social Acceptance Activity
FC EXPO at Tokyo Big Sight (March 2016)

(1) Exhibitions in the booth
Hydrogen Refueling Station Model
FCVs
(total 30,000 visitors)
(2) Presentations by METI, NEDO, and HySUT members (total 2,700 audiences)
(3) Outdoor exhibition and FCV ride & drive
(total 420 participants)

Support Project by HySUT to stimulate demand for FCVs



Thank you very much for your attention!
Merci de votre attention!
Vielen Dank für Ihre Aufmerksamkeit!

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