International Partnership
for Hydrogen and Fuel Cells
in the Economy

IPHE

Enabling the Clean Energy Transition Through Global Collaboration

HyENet Workshop

Brussels, 18 November 2019

Patrice Millet
DG Research & Innovation, European Commission

IPHE – Who are we?

- **International governmental partnership** to advance hydrogen and fuel cells
- **19 Member Countries and the European Commission**
- Formed in 2003

More information at: www.iphe.net

Examples of IPHE Activities

- **Regulations, Codes, Standards and Safety (RCSS)**
  - **Foster RCS harmonization** across countries\
  - **Share safety information**, best practices, lessons learned
- **Education and Outreach (E&O)**
  - **Create unbiased factual** materials
  - **Increase stakeholder engagement** through workshops, policy forum events, education events
  - **Share information** on status, gaps, analysis, opportunities, etc.

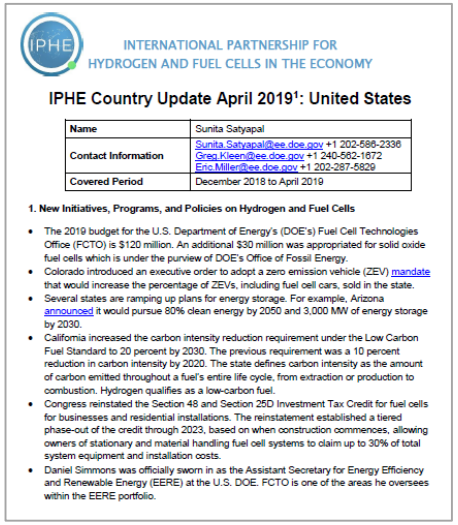
Leverage Partnerships to Accelerate Progress

Ministerial Meetings, Hydrogen Council, IEA, Mission Innovation, Clean Energy Ministerial, all with a view to address Ministerial priorities

Example of information sharing- new Center for H_2 Safety & RCSS WG

CENTER FOR Hydrogen SAFETY

Examples of IPHE Member Deliverables - Country Updates



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update April 2019[1]: United States

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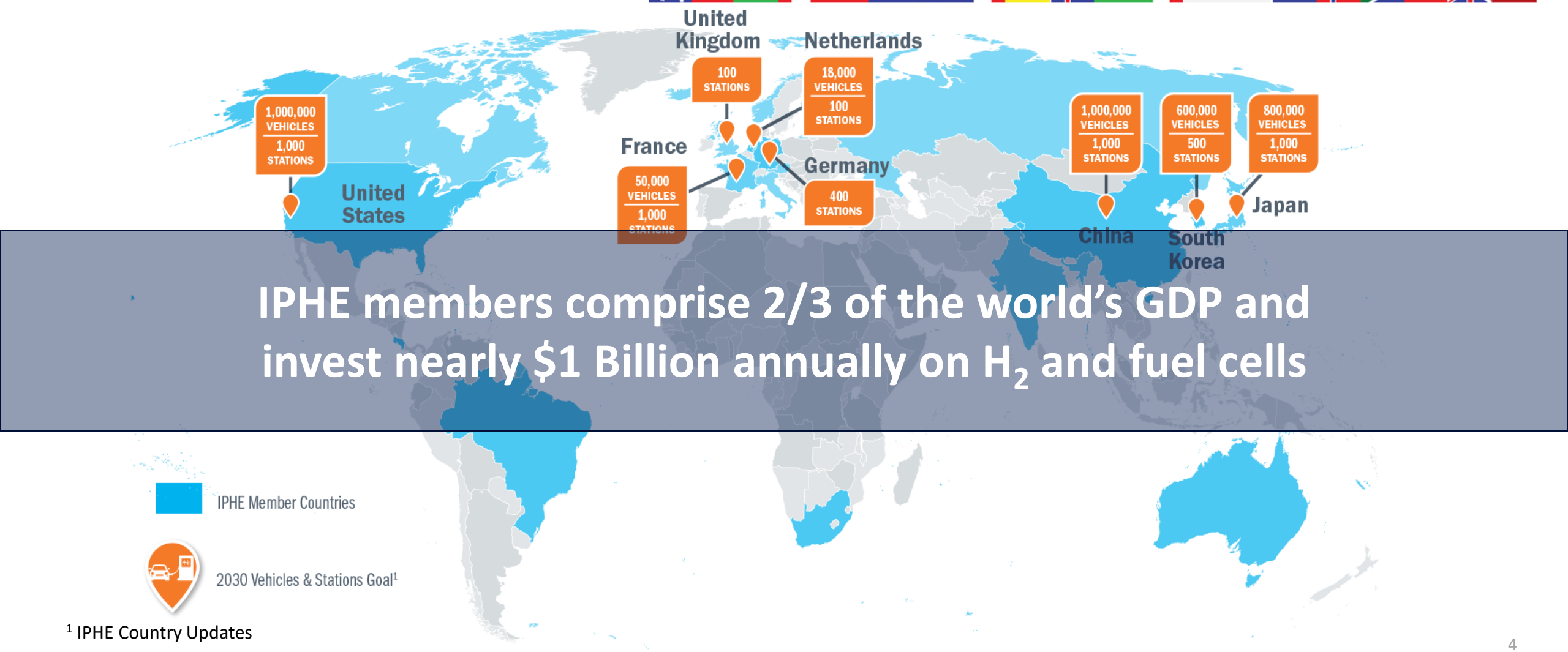
Covered Period	December 2018 to April 2019

1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

- The 2019 budget for the U.S. Department of Energy's (DOE's) Fuel Cell Technologies Office (FCTO) is $120 million. An additional $30 million was appropriated for solid oxide fuel cells which is under the purview of DOE's Office of Fossil Energy.
- Colorado introduced an executive order to adopt a zero emission vehicle (ZEV) mandate that would increase the percentage of ZEVs, including fuel cell cars, sold in the state.
- Several states are ramping up plans for energy storage. For example, Arizona announced it would pursue 80% clean energy by 2050 and 3,000 MW of energy storage by 2030.
- California increased the carbon intensity reduction requirement under the Low Carbon Fuel Standard to 20 percent by 2030. The previous requirement was a 10 percent reduction in carbon intensity by 2020. The state defines carbon intensity as the amount of carbon emitted throughout a fuel's entire life cycle, from extraction or production to combustion. Hydrogen qualifies as a low-carbon fuel.
- Congress reinstated the Section 48 and Section 25D Investment Tax Credit for fuel cells for businesses and residential installations. The reinstatement established a tiered phase-out of the credit through 2023, based on when construction commences, allowing owners of stationary and material handling fuel cell systems to claim up to 30% of total system equipment and installation costs.
- Daniel Simmons was officially sworn in as the Assistant Secretary for Energy Efficiency and Renewable Energy (EERE) at the U.S. DOE. FCTO is one of the areas he oversees within the EERE portfolio.

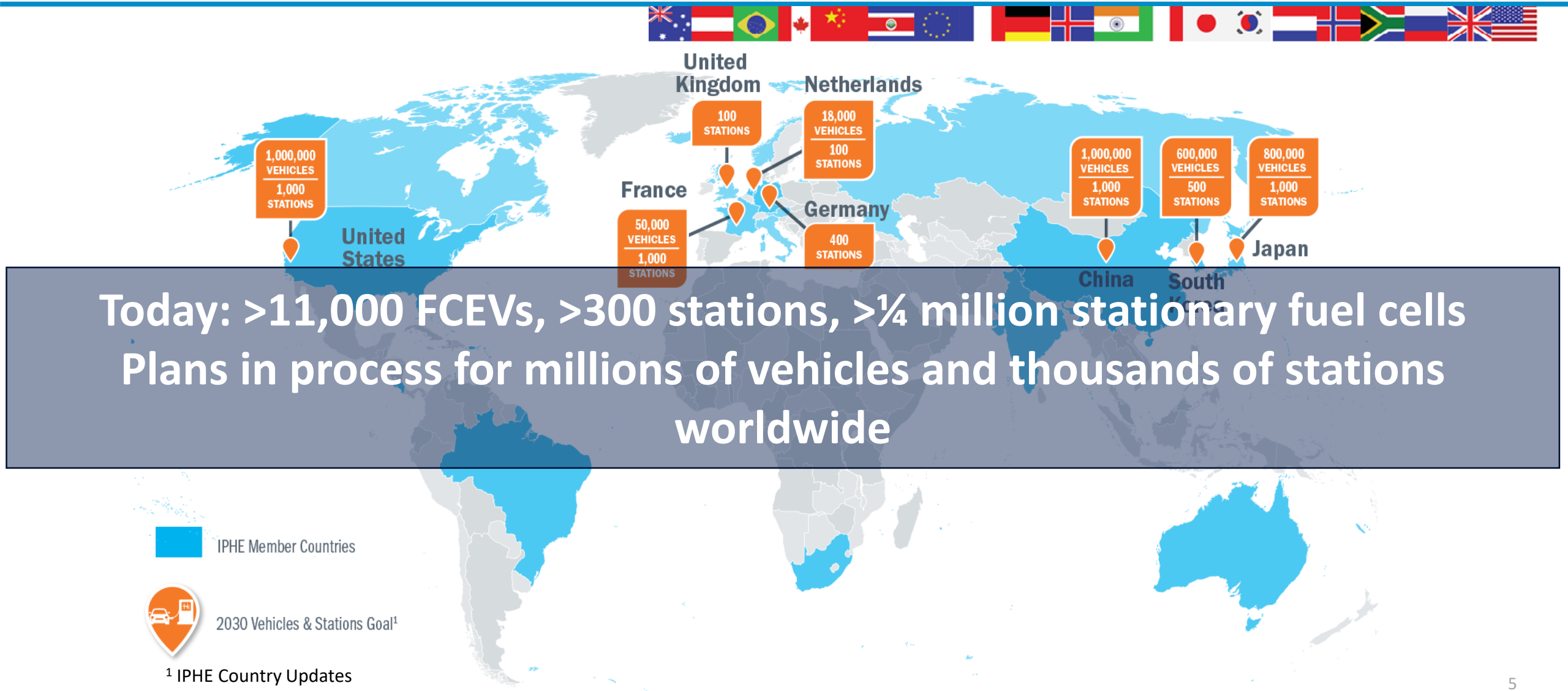
IPHE Global Reach



IPHE members comprise 2/3 of the world's GDP and invest nearly $1 Billion annually on H_2 and fuel cells

[1] IPHE Country Updates

Global Activities and Commitments are Strong



Today: >11,000 FCEVs, >300 stations, >¼ million stationary fuel cells
Plans in process for millions of vehicles and thousands of stations worldwide

[1] IPHE Country Updates

International Collaborations

Government- Led

CLEAN ENERGY MINISTERIAL
Advancing Clean Energy Together

Focus areas

2019

H_2

International Energy Agency
Secure • Sustainable • Together

R&D TCPs, policy, analysis, reports

FC H_2

MISSION INNOVATION
Accelerating the Clean Energy Revolution

2017

H_2

Hydrogen Energy Ministerial (HEM)

First meeting- October 2018

IPHE

Formed in 2003, over 20 countries and EC
2/3 of world's GDP
~ $1B/year in funding

www.iphe.net

UN Global Technical Regulations (GTR) H_2

Industry- Led

Industry Associations

Hydrogen Council

Launched in 2017
Over 50 CEOs

Center for Hydrogen Safety

Launched in 2019
Industry & Govt

Widespread Commercialization

Increasing Priority: Enabling and Harmonizing Regulations, Codes and Standards

Hydrogen and Fuel Cells Focus

Key Drivers: Based on National Circumstances

1. **Energy Security**
   - Security of Supply and Ability to Switch
2. **Energy System Resiliency and Stability**
   - Effective Use of Variable Generation – grid services, storage at system-wide and community scale
   - Moving from Centralized to Distributed Generation
3. **Economic Growth: Innovation & Technology Leadership**
   - New Products and Supply Chains, Same Products Made Sustainably
   - Skilled Jobs and Manufacturing Opportunities
   - Taxpayers Return on Research, Development & Demonstrations
4. **Environmental Performance**
   - Clean Air / Local Air Quality, Climate Change, Noise

Economies Recognizing the Role of Hydrogen

Announcements and/or New Initiatives
United States

Budget

- **$120M budget for 2019 under the U.S. Depa**
  Office R&D activities
- **$45M funding announced on Mar 2019** to g
  and heavy duty applications ($15M)

Collaborations

- **U.S. DOE and Michigan State** collaboration a
- **Global safety collaboration** (collaboration wi

New RD&D Activities and Initiatives

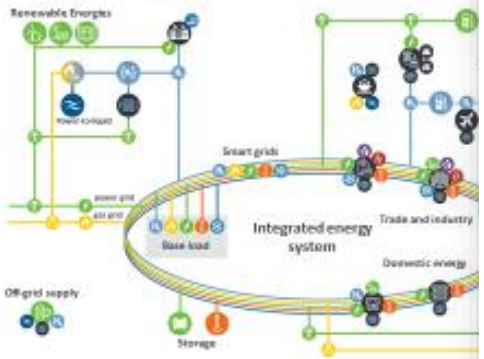
- **H-Mat Consortium launched** to focus on hyd
- **Multiple states announced activities coverin**
  - Colorado – Zero emissions vehicles mandate in
  - Arizona- Plans to increase energy storage capa
  - California – Carbon intensity reduction require
- **Industry plans to build new hydrogen liquef**

31st IPHE Steering Committee - Vienna, Austria

Announcements and/or New Initiatives
Germany

HYLAND

Next step for the deployment of technologies



31st IPHE Steering Committee - Vienna, Austria

Announcements and/or New Initiatives
Japan

The Strategic Road Map for Hydrogen and Fuel Cells ~ Industry-academia-government action plan to realize Hydrogen Society ~ (overall)

- In order to achieve goals set in the Basic Hydrogen Strategy,
- ① Set of new targets to achieve (Specs for basic technologies and cost breakdown goals), establish approach to achieving target
- ② Establish expert committee to evaluate and conduct follow-up for each field.

		Goals in the Basic Hydrogen Strategy		Set of targets to achieve	Approach to achieving target
Use	Mobility	FCV 200k by 2025 800k by 2030	2025	• Price difference between FCV and HV (¥3m → ¥0.7m) • Cost of main FCV system (FC ¥20,000/kW → ¥5,000/kW; Hydrogen Storage ¥0.7m → ¥0.3m)	• Regulatory reform and developing technology
		HRS 320 by 2025 900 by 2030	2025	• Construction and operating costs (Construction cost ¥350m → ¥200m; Operating cost ¥3m/year → ¥15m/year) • HRS components cost (Compressor ¥90m → ¥50m; Accumulator ¥50m → ¥10m)	• Consideration for creating nation wide network of HRS • Extending hours of operation
		Bus 1,200 by 2030	Early 2020s	• Vehicle cost of FC bus (¥105m → ¥52.5m) ※ In addition, promote development of guidelines and technology development for expansion of hydrogen use in the field of FC trucks, ships and trains.	• Increasing HRS for FC bus
	Power	Commercialize by 2030	2020	• Efficiency of hydrogen power generation (26% → 27%) ※ 1MW scale	• Developing of high efficiency combustor etc.
	FC	Early realization of grid parity	2025	• Realization of grid parity in commercial and industrial use	• Developing FC cell/stack technology
Supply	Fossil fuel +CCS	Hydrogen Cost ¥30/Nm3 by 2030 ¥20/Nm3 in future	Early 2020s	• Production: Production cost from brown coal gasification (¥several hundred/Nm3 → ¥12/Nm3) • Storage/Transport: Scale-up of Liquefied hydrogen tank (thousands m³ → 50,000m³) Higher efficiency of Liquefaction (13.6kWh/kg → 6kWh/kg)	• Scaling-up and improving efficiency of brown coal gasifier • Scaling-up and improving thermal insulation properties
	Green H2	System cost of water electrolysis ¥50,000/kW in future	2030	• Cost of electrolyzer (¥200,000m/kW → ¥50,000/kW) • Efficiency of water electrolysis (5kWh/Nm3 → 4.3kWh/Nm3)	• Demonstration in model regions for social deployment utilizing the achievement in the demonstration of Namie, Fukushima • Development of electrolyzer with higher efficiency and durability

International Collaborations on Safety

Industry & Governments Partner: Access to 110 countries, 60,000 members through AIChE

AIChE

Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Hydrogen Council

CENTER FOR Hydrogen SAFETY
Connecting a Global Community

HYDROGEN Safety Panel

HYDROGEN Emergency Response Training Resources

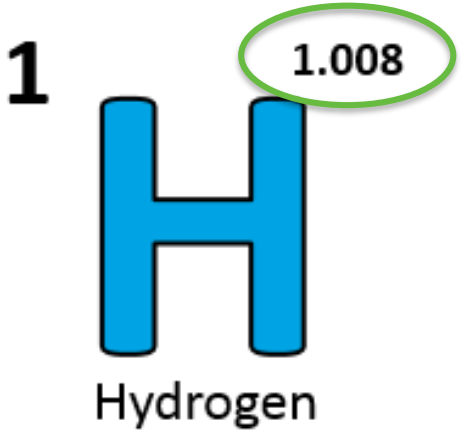
See: www.aiche.org/CHS to join

International Collaborations on Outreach and Education

Celebrate National Hydrogen & Fuel Cell Day

October 8 or 10/08

(Held on its very own atomic- weight-day)



Information and Training Resources to Increase Awareness

H2tools.org

INCREASE YOUR H2IQ

IPHE 2.0 – Common Theme Items identified

1. Finalize RCSS compendium
2. Develop a mechanism to track progress on Global Action Agenda
3. Establish common definition of clean hydrogen to facilitate international trade
4. Develop 2 pager for minister level audience
5. Increase visibility on website (i.e. short videos)
6. Develop a 2 pager country specific covering a specific rotating theme for each meeting (why, how and impact)
7. Share info (at the working level) on specific RCSS issues (i.e. tunnels, station footprint, hydrogen storage at large scale, hydrogen blend %) and identify ways to address those
8. Compile specific business cases for deployment and show why they are working