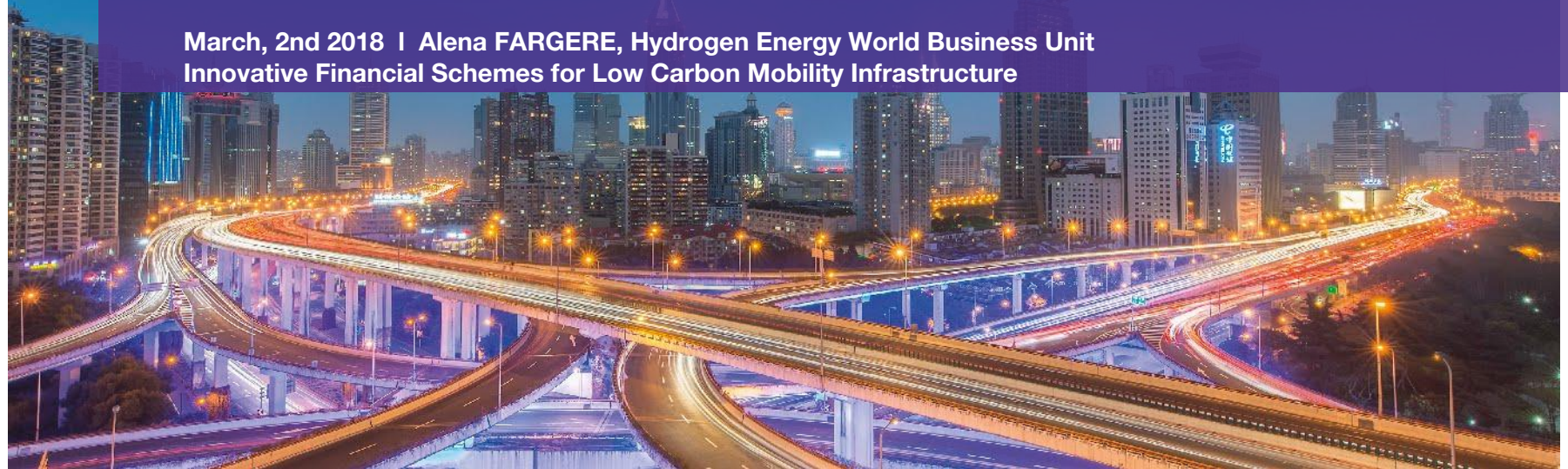


## Hydrogen Company

# FCEV: Growing momentum and challenges of mass market deployment

March, 2nd 2018 | Alena FARGERE, Hydrogen Energy World Business Unit  
Innovative Financial Schemes for Low Carbon Mobility Infrastructure



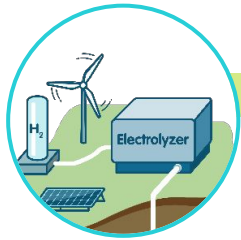
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# Hydrogen has seven roles in the energy transition

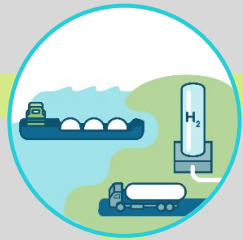
## SOURCES OF ENERGY

## BACKBONE OF ENERGY SYSTEM

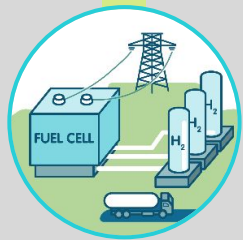
## END USES



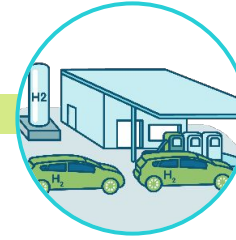
1. Enable **large-scale, efficient renewable energy** integration



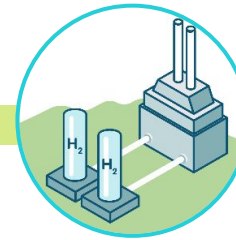
2. **Distribute** energy across sectors and regions



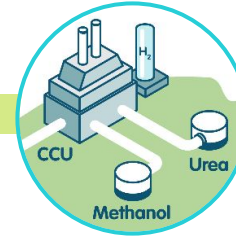
3. Act as a **buffer** to increase system resilience



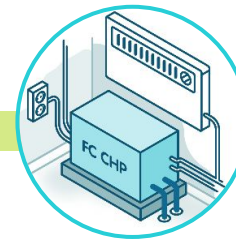
4. Decarbonize **transport**



5. Decarbonize **industry energy use**



6. Serve as **feedstock** using captured carbon



7. Help decarbonize **building heating**

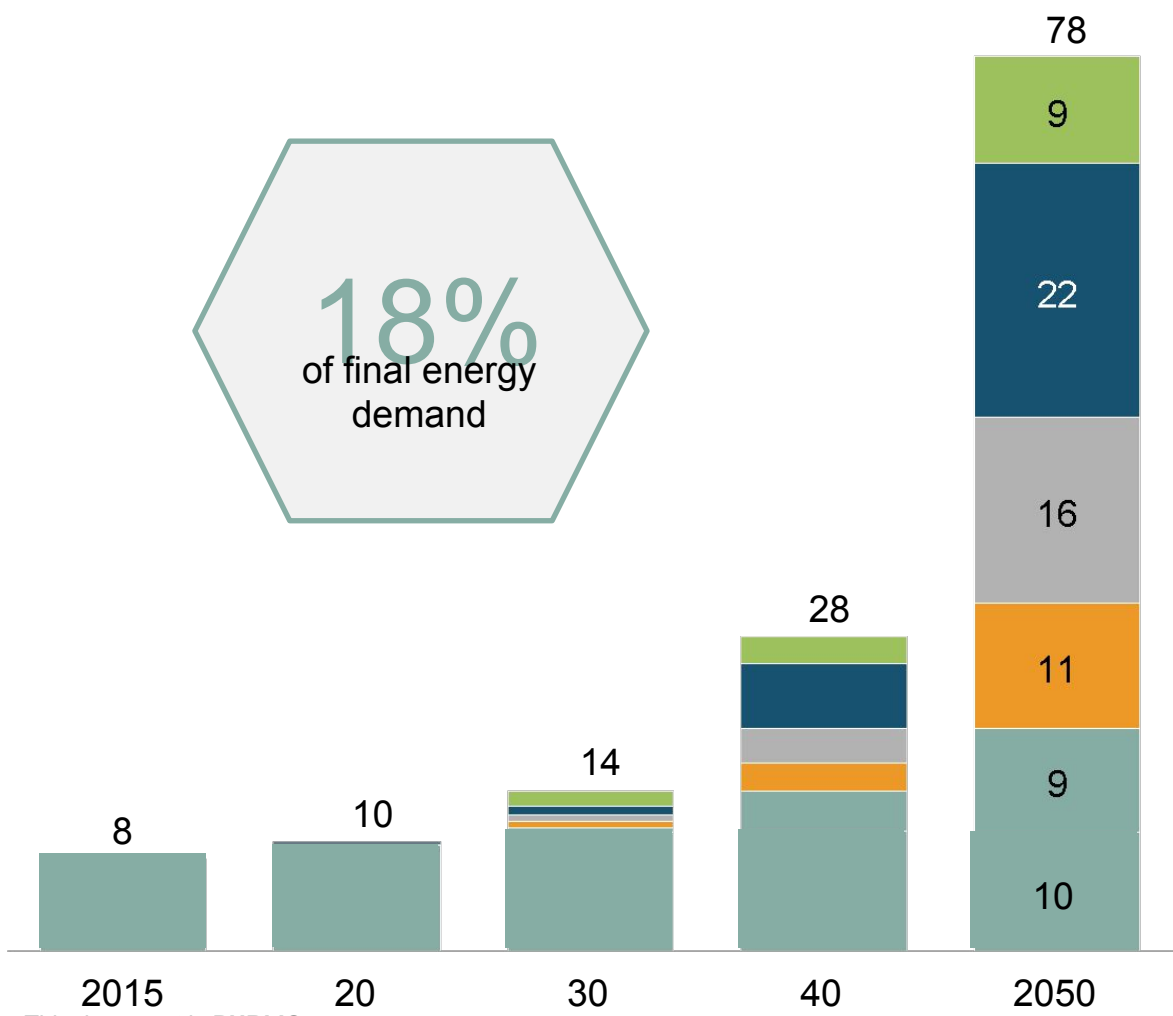
### Energy vectors

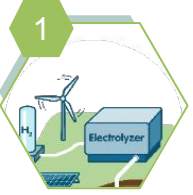
Hydrogen


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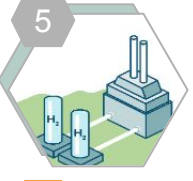
# Hydrogen provides 18% of energy demand in a 2° world

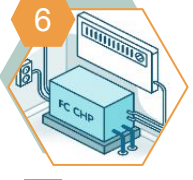
18%  
of final energy  
demand

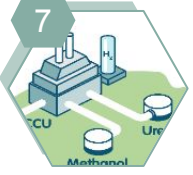


- 

**1** Power generation, buffering
- 

**4** Transportation
- 

**5** Industrial energy
- 

**6** Building heat and power
- 

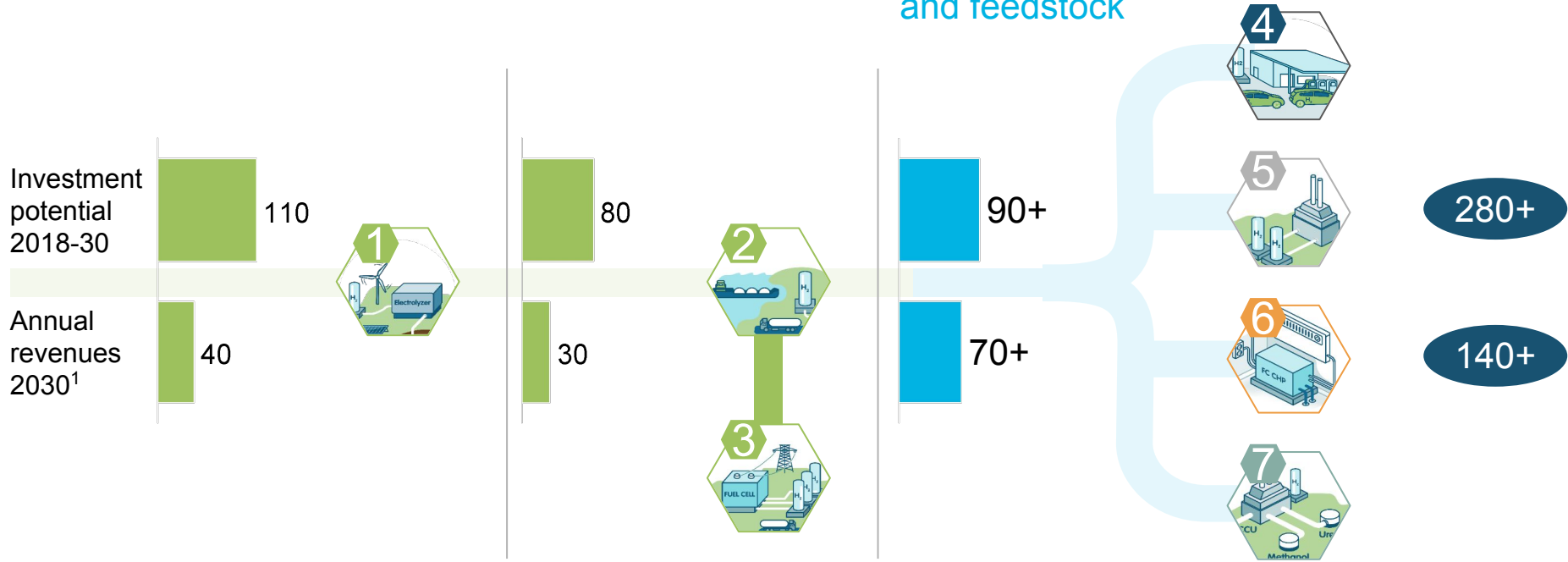
**7** New feedstock (CCU, DRI)  
Existing feedstock uses

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# \$280bn invested until 2030 build \$140bn+ annual market

\$ billion<sup>1</sup>

Enable the renewable energy system → Decarbonize end uses — Total  
 Hydrogen production ..... Storage, transport, and distribution ..... End-uses in transportation, industry energy, buildings and feedstock



<sup>1</sup> Excluding existing feedstock uses, Considering only hydrogen value-added

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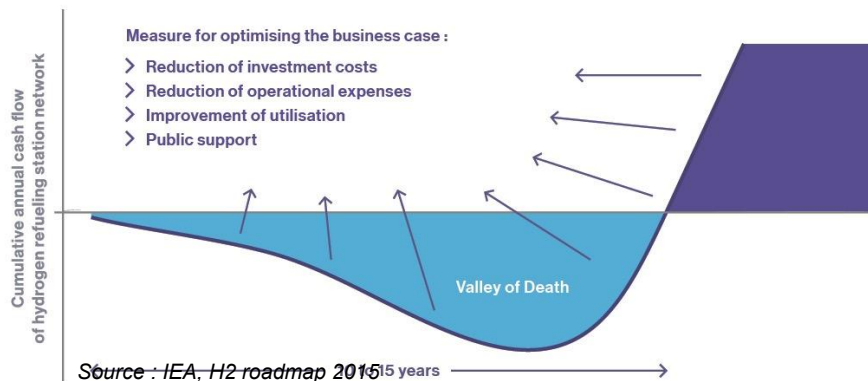


# Finding solutions to the infrastructure challenges

## Main issues

- Under-utilization of Hydrogen Stations and “Valley of Death” periods
- Alignment of stakeholders (industry players, financial sector, policy makers)

### H2 Station – cash flow curve



## Main opportunities

- Profitable business cases
- International scale up creates a virtuous circle

## Open questions

- Use of virtuous policy/financial tools to derisk and accelerate scale up
- Use of dedicated shared investment vehicles

## Advantages

- Attract private capital into H<sub>2</sub> infrastructure development (banks, funds)
- Limited impact on budget/public debt → Strong leverage effect

2015 → 2017

The confirmation of a growing momentum



© Toyota

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6

2018

Hydrogen Energy WBU

World leader in gases, technologies and services for Industry and Health

 **Air Liquide**  
creative oxygen

# 2015 → 2017: Building up scale all over the world!



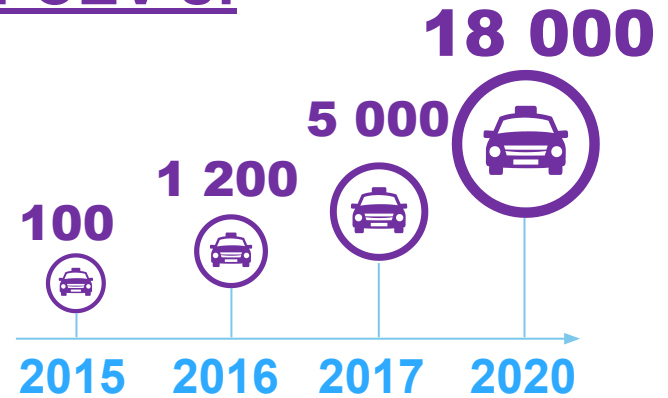
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# US / California – the ZEV effect



Anaheim H2 station

## FCEV's:



## Southern CA Hydrogen Stations

### ● Retail: Open

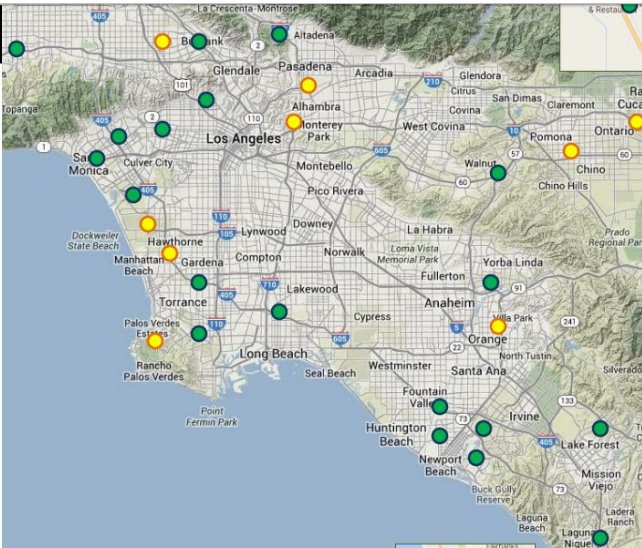
- Anaheim
- Costa Mesa
- Del Mar
- Diamond Bar
- Fairfax-LA
- Harris Ranch
- Hollywood
- La Cañada Flintridge
- Lake Forest
- Long Beach
- Playa Del Rey
- San Juan Capistrano
- \*Santa Barbara
- Santa Monica
- UC Irvine
- West LA
- Woodland Hills

### ● Other: Open

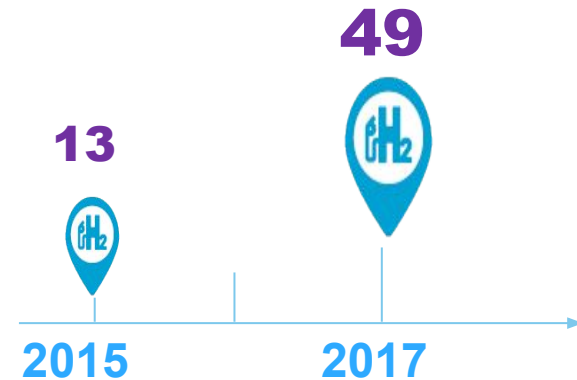
- Burbank
- Fountain Valley
- Harbor City
- Newport Beach
- \*Thousand Palms - SunLine Transit
- Torrance

### ● Retail: In Development

- Cal State LA
- Chino (upgrade)
- Lawndale
- LAX (upgrade)
- North Hollywood
- Ontario
- Orange
- Rancho Palos Verdes
- Thousand Palms

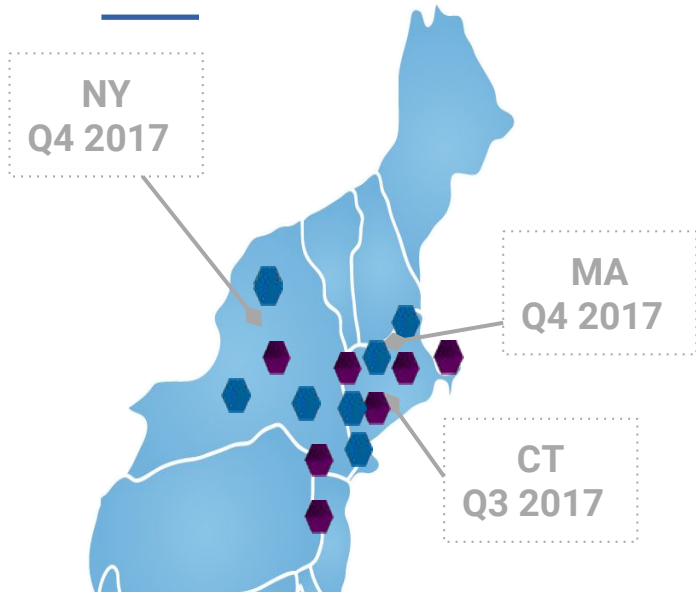


## H2 stations:





# US - Conquering the Northeast



## New York

Bronx, NY  
Hempstead, NY  
Brooklyn, NY



## Connecticut

Hartford, CT



## Massachusetts

Braintree, MA  
Mansfield, MA



## New Jersey

Site location TBA



## Rhode Island

Site location TBA

Network of 12 Stations

Start-up over Q3-Q4 2017

Dedicated H<sub>2</sub> supply chain by

Project in collaboration with

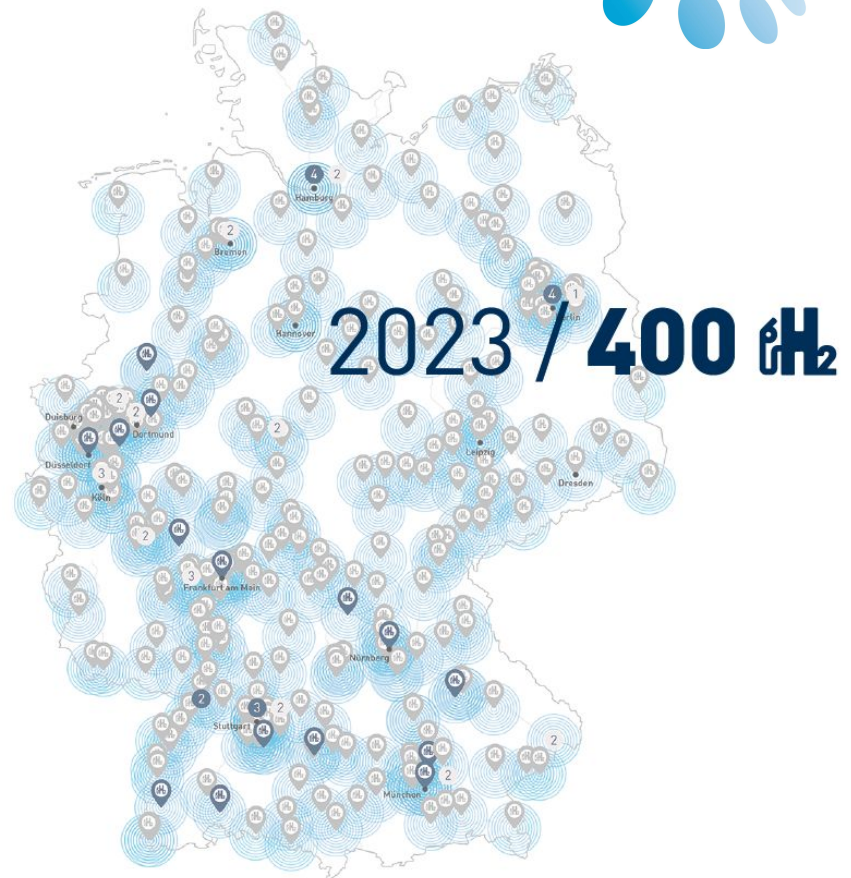


# Germany – H2 Mobility: Deploying at full speed!



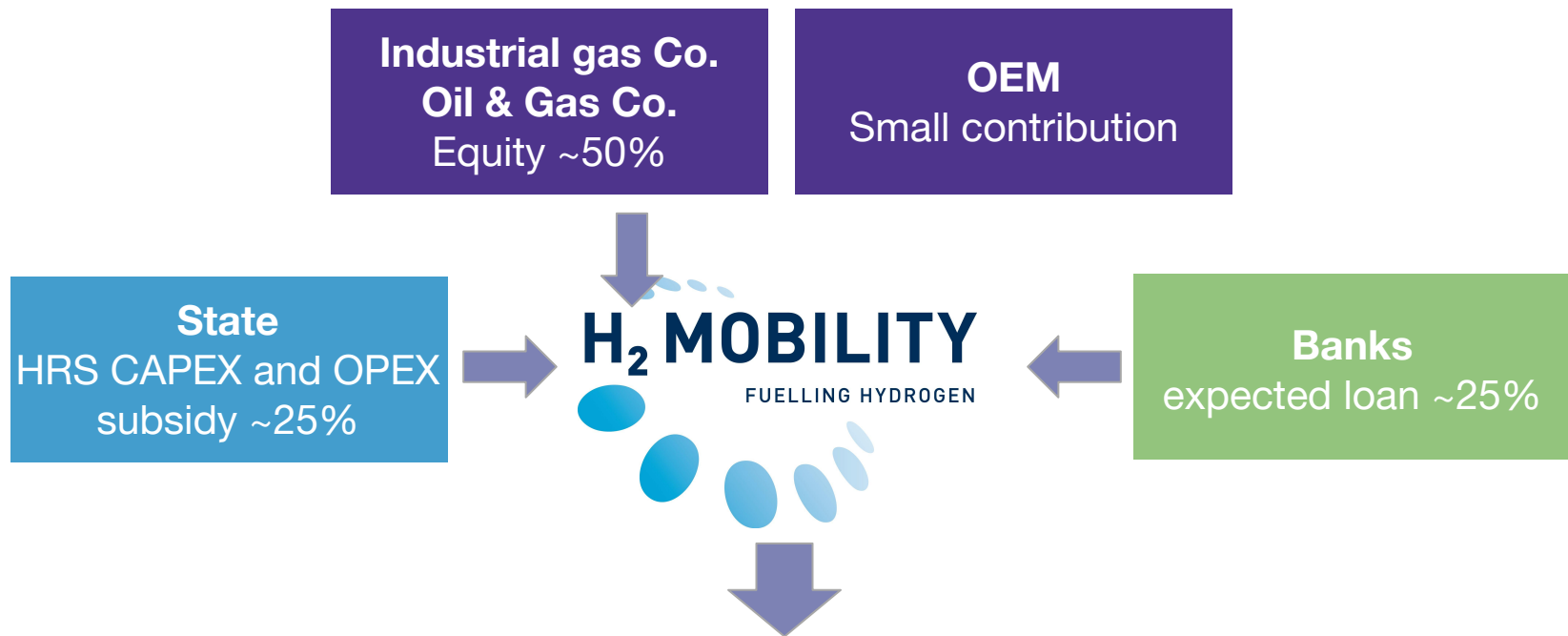
**Air Liquide, Daimler, Linde, OMV, Shell and Total** have agreed an action plan for the construction of a Hydrogen station network in Germany

- **400 Hydrogen Stations by 2023** (100 by 2017)
- **350m € investment**
- **Max. 90 km distance between each station on motorways**
- **10 Hydrogen Stations in each metropolitan area**



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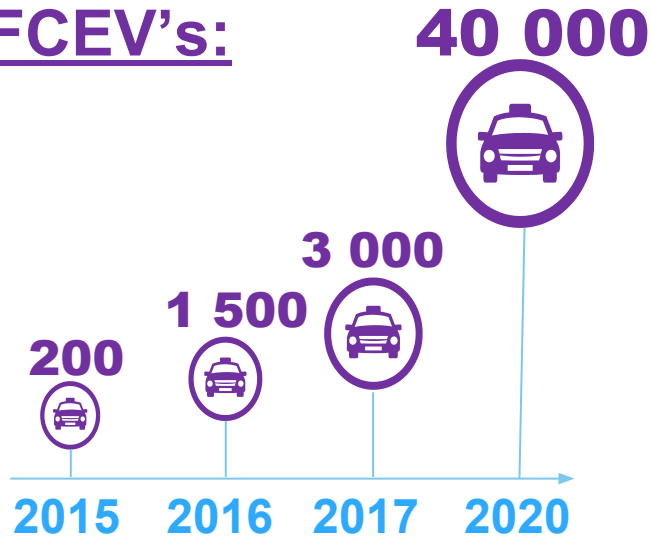
# Germany infrastructure: Joint Venture H2 Mobility



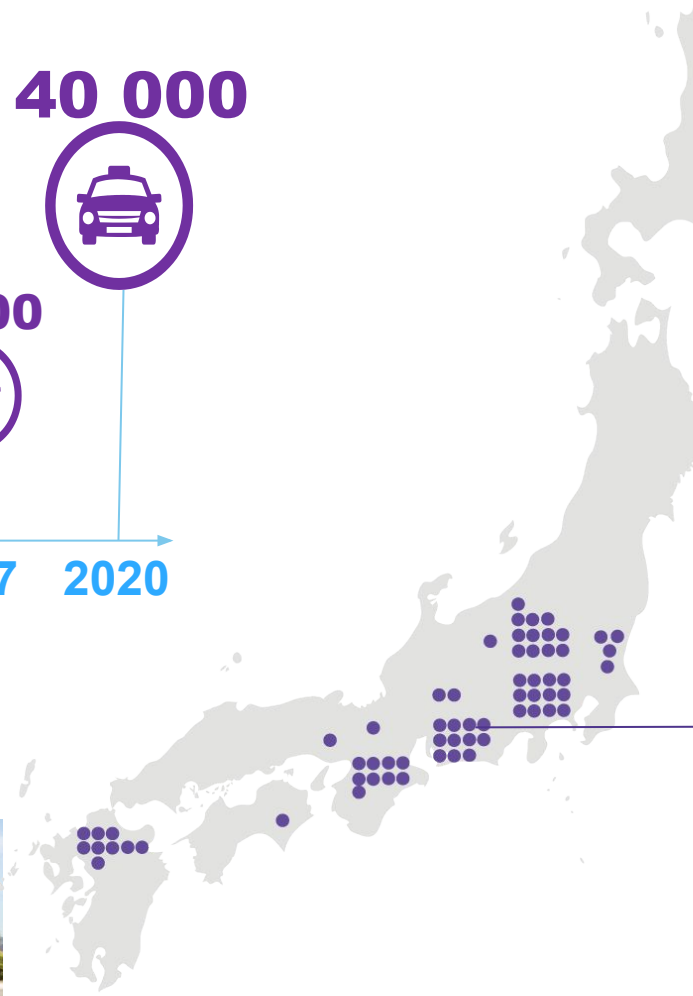
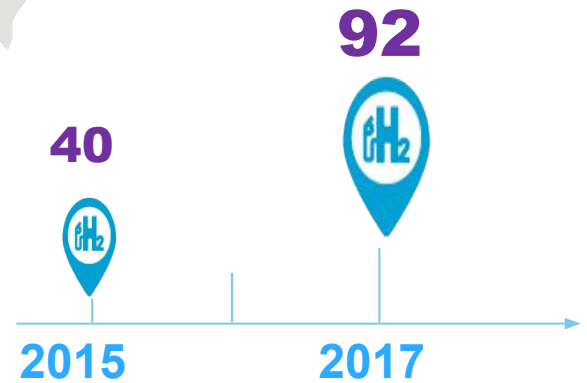
- **Network Planning**
- **HRS Procurement, Ownership & Operation**
- **H2 Procurement & Sales to end customer**
- **Customer value proposition & Branding**

# Japan: Largest H2 station infrastructure in the world

## FCEV's:

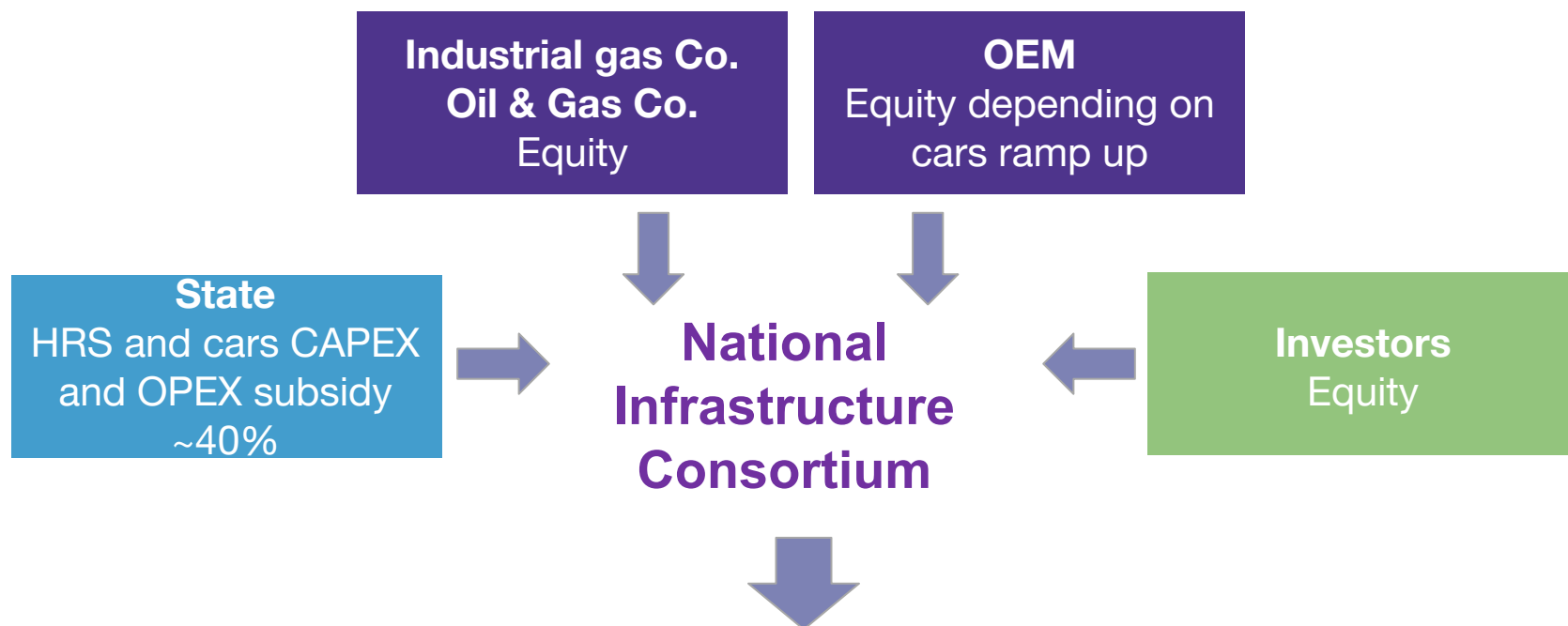


## H2 stations:



*Nagoya Atsuta*

# Japan infrastructure: Joint Venture under construction



- Network Planning
- HRS Procurement, Ownership; Operation outsourced
- Search for external stakeholders to secure financial support

# France: Innovative business models for clean mobility

## HYPE Taxi Fleet Project - Paris



**hype** The «taxi of tomorrow»

An emission-free Paris  

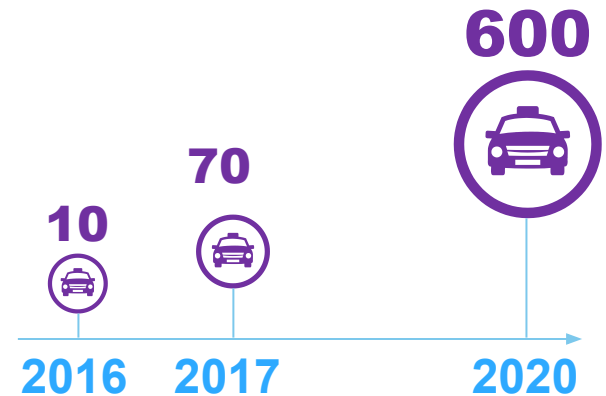
**Air Liquide**

**Key Enabler of the project**

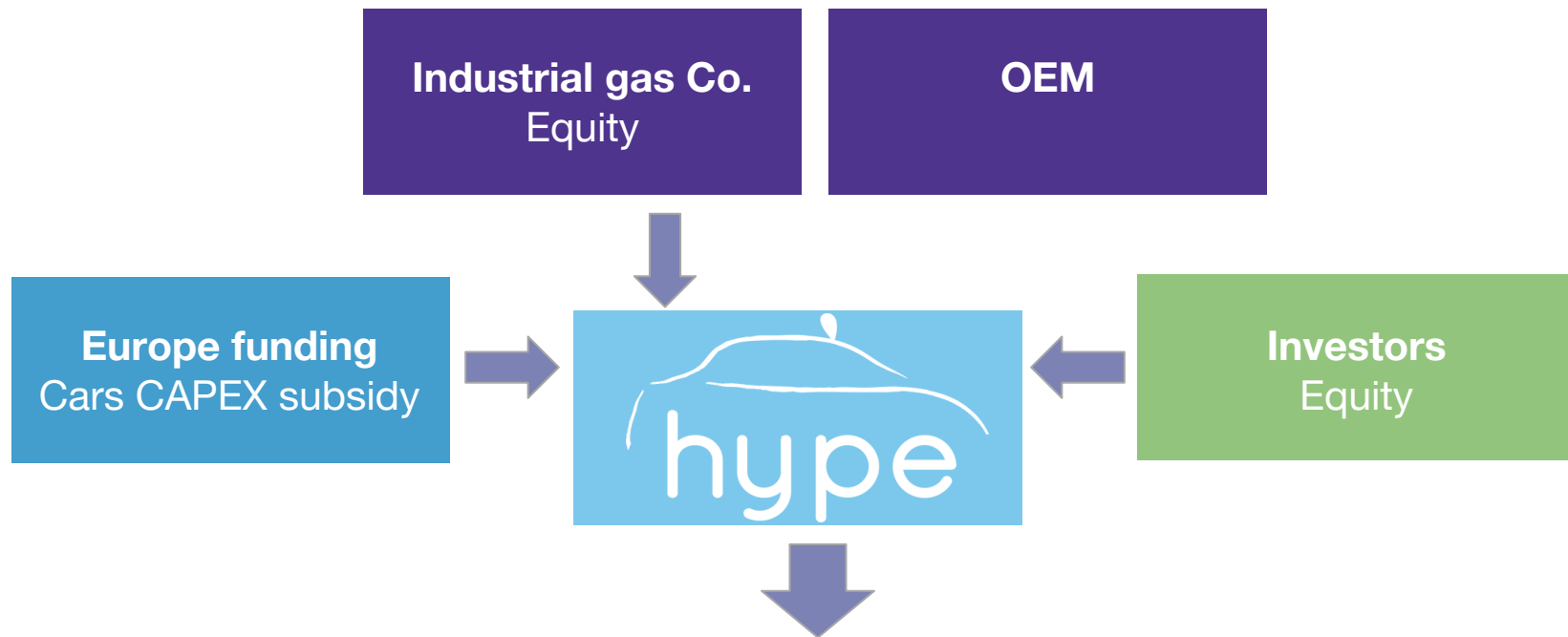
Launched in Dec. 2015, during COP 21



## FCEV taxi fleet



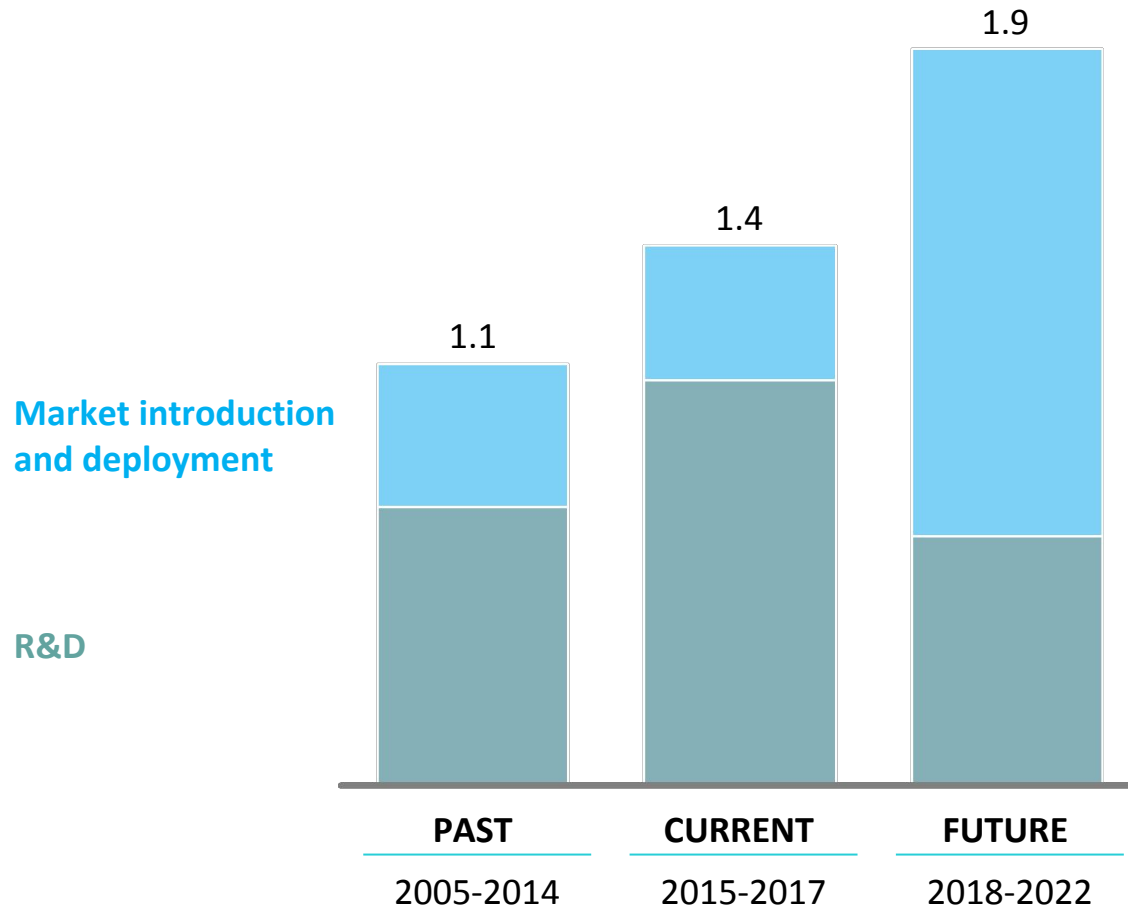
# France infrastructure: Captive fleet within taxi business



- **Cars ownership & operation**
- **Fast and significant HRS charge from D1**
- **Aligned deployment of cars and infrastructure**
- **External stakeholders secure financial support**

# Investments towards hydrogen on market development

Investments planned by Hydrogen Council members, in EUR billions per year



- Hydrogen Council members **plan to invest at least EUR 1.9 billion per year** in hydrogen technology for the coming 5 years
- Investments in market introduction and deployment are growing and are showing the **beginning of commercialization**



# Acting now

**The case for acting now: Large-scale deployment initiatives underpinned by long-term policy frameworks to attract investors**

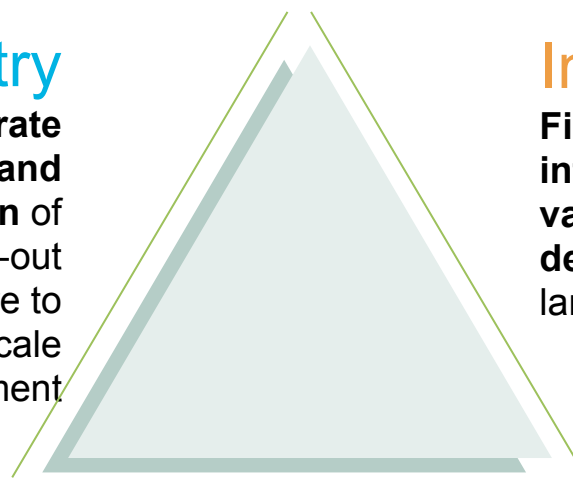
Urgency to initiate scale-up to meet **climate change targets**

**Hydrogen technology proven** in a wide range of applications

**Momentum in the industry** – Hydrogen Council is established

**Industry**  
**Accelerate development and commercialization** of products and build-out infrastructure to support large-scale deployment

**Investors**  
**Finance infrastructure and value chain development** for large-scale deployment



**Policymakers**  
**Collaborate with industry** to build national strategies and roadmaps and put in place long-term policy frameworks

# 2015 → 2017: Building up scale all over the world!



From  
1 000  
to  
10 000  
FCEVs !

From  
100  
to  
300  
H2 Stations !

**Hydrogen Council**

AirLiquide ALSTOM AngloAmerican BMW GROUP DAIMLER ENGIE  
HONDA HYUNDAI Kawasaki Shell THE LINDE GROUP TOTAL TOYOTA