

[Expert Workshop : International best practices to promote eco-friendly cars ; International Transport Forum]

The Coming Hydrogen Economy and Vision 2030

25. Jan. 2021

HYUNDAI MOTOR COMPANY
FUEL CELL CENTER

Paradigm Shift and Green New Deal

- Key Factors of Industrial Revolution: Network, Power Source, Transportation Jeremy Rifkin <The Green New Deal(2020)>
- Global Movement towards De-carbonization in the 21st Century

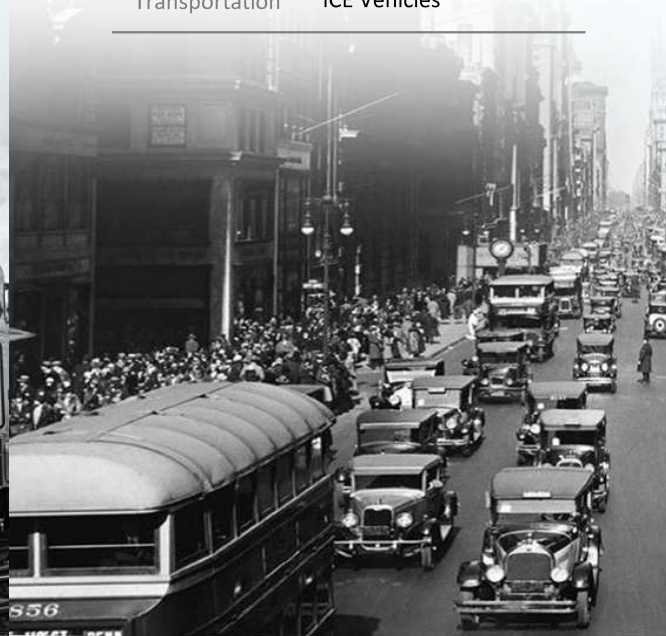
19c

Network	Printing, Telegraphy
Power Source	Coal
Transportation	Railroads



20c

Network	Phone, Radio, TV
Power Source	Petroleum
Transportation	ICE Vehicles



21c

Network	IoT, 5G
Power Source	Solar, Wind, Hydrogen
Transportation	BEV, FCEV, Autonomous, PAV



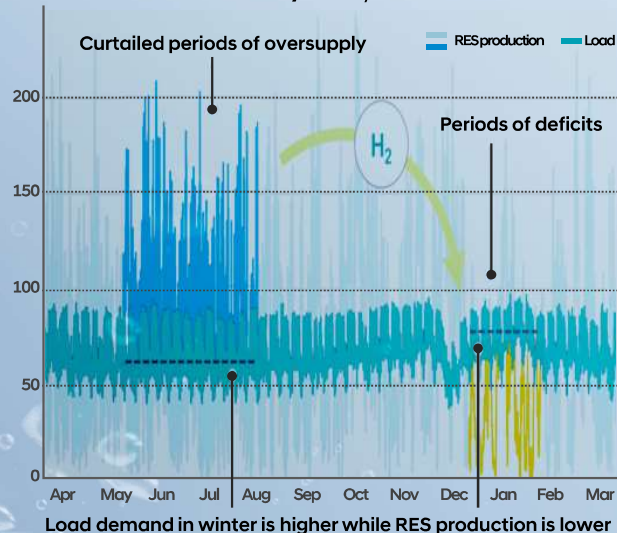
Renewable Energy & Hydrogen

- Due to the limitation of renewable energy production (regional/temporal variation), it is essential to utilize hydrogen to compensate for that.

Renewable Energy Balance

- Compensate the renewable energy's regional/temporal variation

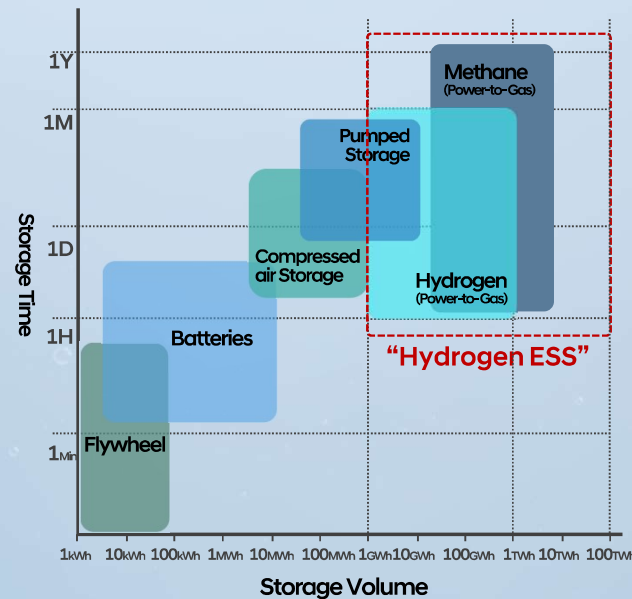
Simulation for Germany 2050, in GW



Source : EC 2050 scenario, McKinsey analysis

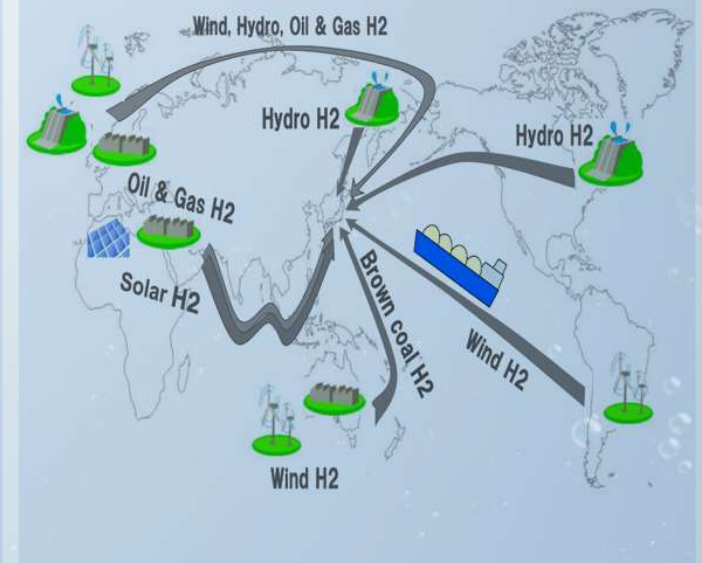
Bulk Energy Storage

- Suitable for long-term (exceeding 1yr), bulk (exceeding 1TWh) storage



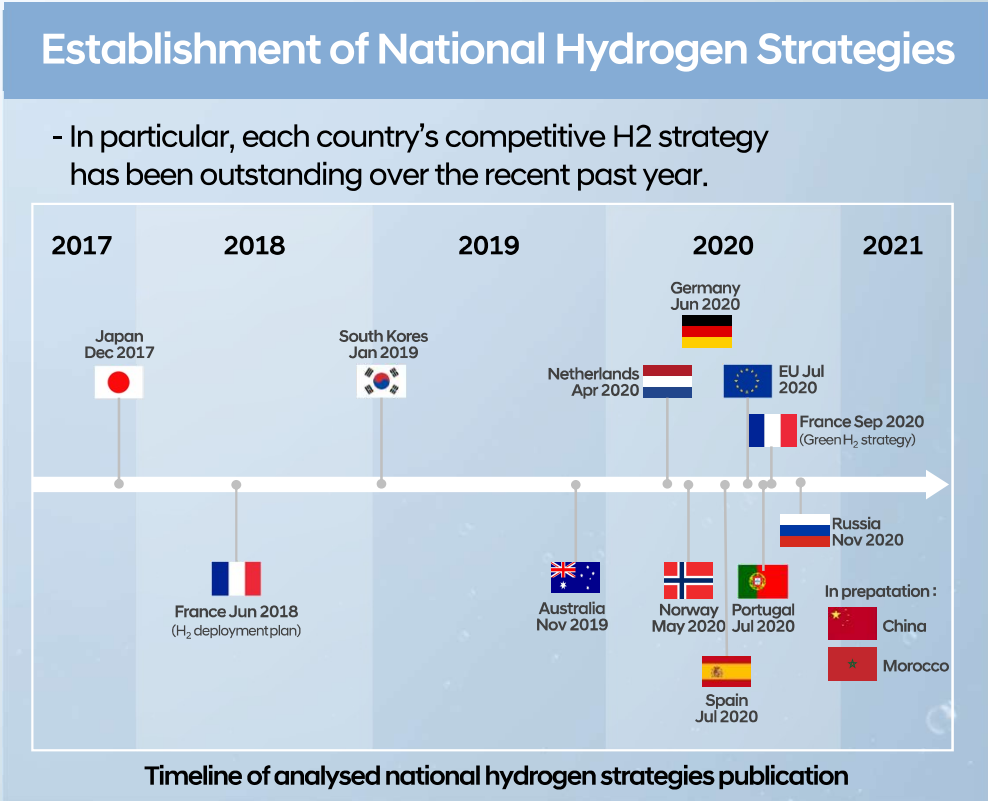
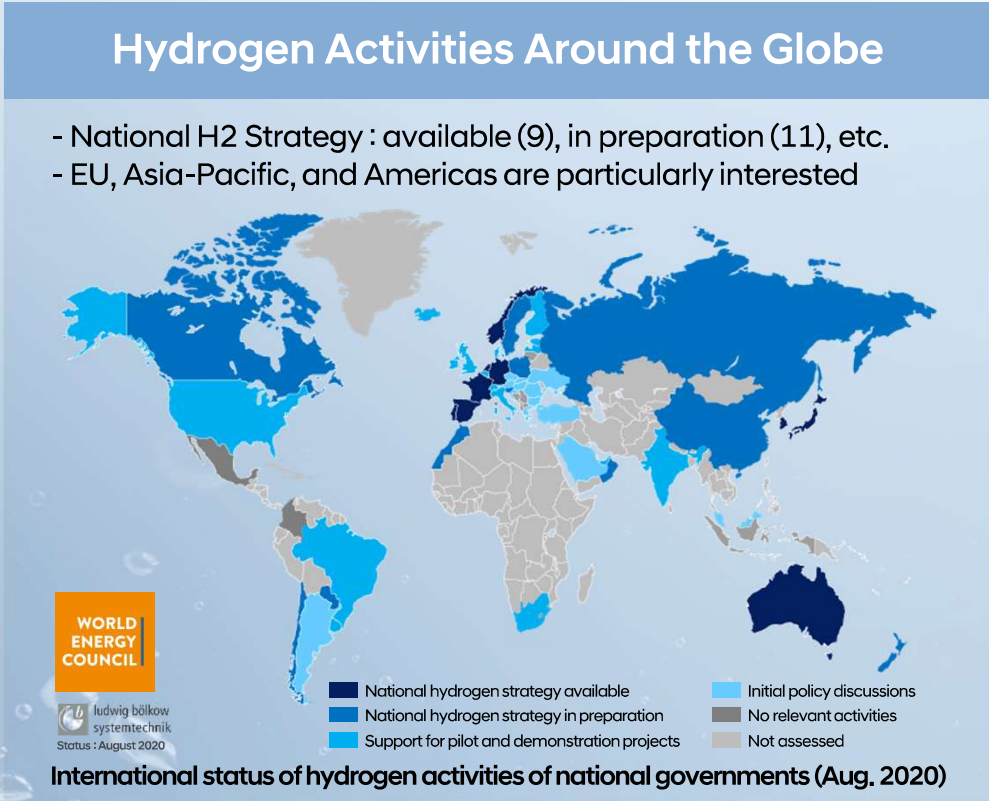
Long-distance Transportation

- Efficient for long-distance transportation (small energy loss)



Efforts to Lead Hydrogen Society

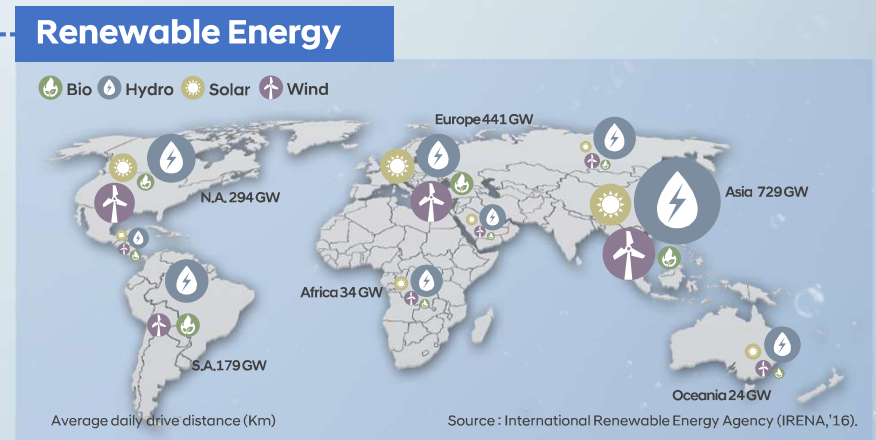
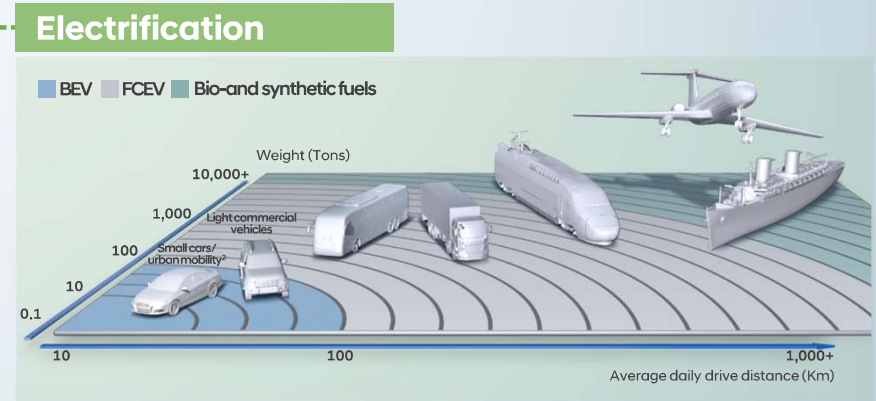
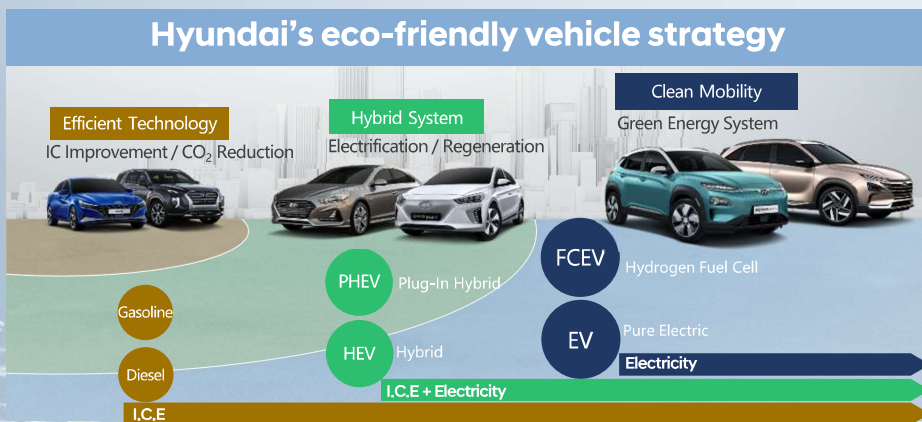
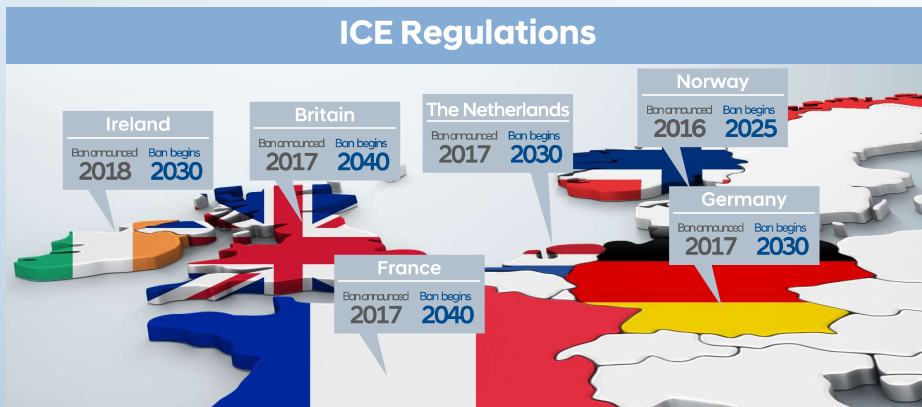
- **Countries around the world recognize the importance of hydrogen and are competing to lead the way.**
 - In 2020, 7 countries announced their national H2 strategies; competition is expected to intensify in the future.



Source : International Hydrogen Strategies ('20.9, World Energy Council)

Markets and Forecast for Eco-friendly Cars

- Establishment of Various Eco-friendly Technology Strategies: Fuel Efficiency Improvement & Electrification
- BEV and FCEV will be mainstream due to regulations, mobility diversification, and renewable energy expansion.



History of Hyundai's FCEV

- Since 1998, HMC accumulated fuel cell technology know-how for 20 years to secure unique technology.
- HMC mass-produced the world's first FCEV(2013); it released NEXO(2018) with successful localization of parts(99%).



1998

Initiated
Fuel Cell
Development

2000

First Developed
FCEV model
(Santa Fe-based)

2004

Independent
Development
of Stack

2005

Independent
Development
of Fuel Cell System

2013

**1st Generation FCEV
(Tucson ix)**
"The world's 1st
mass production"

2018

**2nd Generation FCEV
(NEXO)**
"Superior maximum range
and energy efficiency"

Tucson ix



- World 1st Mass-produced Tucson FCEV ('13)
- USA 2015 WARD's 10 Best Engine
- Deployed in 18 countries since 1st delivery to Copenhagen

NEXO

- Refuelable within 5 minutes
- The world's-best driving range (609km)
- Durability : 160,000km /10 years
- USA 2019 WARD's 10 Best Engine



German
automobile
journal

Auto und
Motor Sport
(20. 6)

"Long range,
short charging time.
There is no shortage of
family cars in everyday life"

FCEV Development Status/Truck & Bus

- Mass-produced the world's first Fuel Cell Electric truck('20. 7) and expanded global export of truck & bus
- Focused on government demonstration projects such as coach buses, mid-sized trucks



[Shipping the first 10 units of XCIENT Fuel Cell ('20.7)]

	FC Stack	190 kW
	Motor	350 kW
	H2 Tank Capacity	32 Kg
	Drive Range	400 km

Type	Content	Development Vehicle
Bus	<ul style="list-style-type: none"> • 3rd Generation Fuel Cell Bus development completed and operating → City Bus : City Bus Pilot Program → Coach : Police Force Bus, Long Distance Bus 	<p>City Bus ('20)</p> <p>Coach Bus ('22)</p>
	<ul style="list-style-type: none"> • Expanding line-up from 2020 such as Express Coach, Mid-Duty Truck → Mid-Duty Truck : Garbage Truck, Road-cleaning Truck → Heavy-Duty Truck : Swiss H2 Energy : Supply 1,600 trucks by 2025 	<p>Mid-Duty Truck ('23)</p> <p>HDC-6 Neptune ('24)</p>

Hyundai's Fuel Cell Technology

- **3-steps of technology development:** (1st) Performance (2nd) Durability (3rd) Cost-reduction
- **PV: Cost-reduction / CV: Durability / Next gen. Mobility: Performance**

Private Vehicle

Performance

Durability

Cost

Commercial Vehicle

Performance

Durability

Cost

UAM / Next gen. Mobility

Performance

Durability

Cost



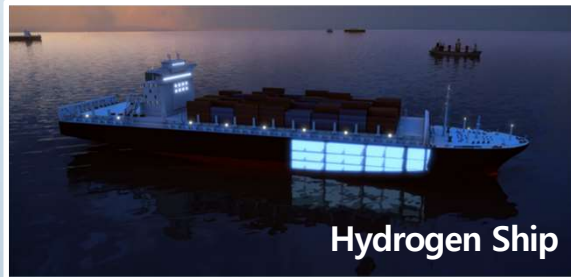
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HTWO

Hyundai's Fuel Cell System Brand, HTWO

- In Dec.2020, Hyundai launched 'HTWO' as its full-scale FC system business → ship, train, generator, UAM ...
- The two 'H' means 'Hydrogen for Humanity', a sustainable energy for humanity.



Hydrogen — Humanity

Global Partnership



INEOS INEOS (UK)



Supplying fuel cell system and accelerate the global hydrogen economy ('20. 11)



Aramco (Saudi)



Supplying FCEV and developing carbon fiber ('19. 6)



LS LS Electric (Korea)



Developing fuel cell generator ('20. 12)



GRZ GRZ Technology (Switzerland)



Supplying fuel cell system ('20. 9)

Global Partnership : H₂ Council

- Through the H₂ Council (launched in 2017) Hyundai is making effort to enlarge hydrogen society (members : 13 → over 90)



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HTWO

Hyundai Fuel Cell System Brand : HTWO

• Hyundai will start FC system business in four major hubs, and will expand the business areas around the world.

Expand FCEV supply



Expand Fuel Cell system business



Promote FC business by cooperating with the new government



Create FC market & Preoccupy a leading position



Together for a better future!

**“As a first mover in the forthcoming hydrogen economy,
we will lead a society that uses hydrogen as its main source of energy.”**

Euisun Chung, Chairman of Hyundai Motor Group

