



International Partnership
for Hydrogen and Fuel Cells
in the Economy

Hydrogen and Fuel Cells Policies in Republic of Korea

IPHE Industry and Policy Forum

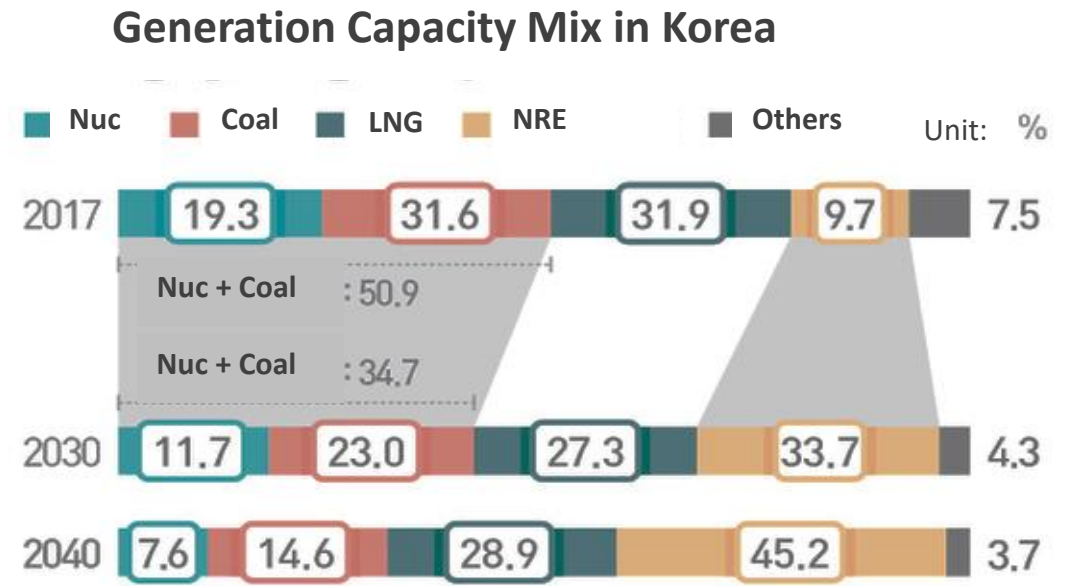
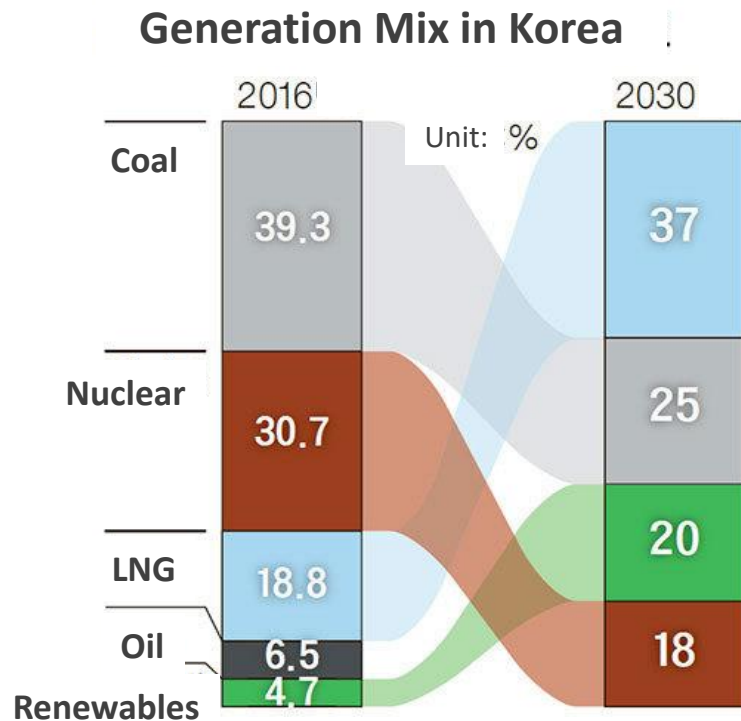
10 April 2019

Vienna, Austria

Renewable Energy 3020 Initiative (Republic of Korea)



- The 8th Basic Plan for Electric Power Supply (Dec, 2017)
- 20% NRE contribution in generation mix by 2030



Hydrogen Roadmap Korea

(Republic of Korea)



- **Nation's future growth engine**
 - **420K job creation (75% of 2018 car industry employees)**
 - **43 trillion KRW earnings (2.5% of 2017 GDP)**
- **Energy security**
 - **10.4 Mtoe contribution to final energy consumption (5% of 2040 final energy consumption)**
 - **56,000 GWh power generation (10% of 2017 total)**
- **GHG abatement**
 - **2.7 Mt CO2 abatement**

Snapshots 2040 in Hydrogen Roadmap

(Republic of Korea)



- **2.75 M FCEVs (15% of 2018 total number)**
- **600 MW residential FCmCHP (940K households, 25% of 2017 Seoul households)**
- **80K FCEV Taxis (33% of 2018 total number)**
- **40K FCEV Buses (85% of 2018 total number)**
- **30K FCEV Trucks (total number of 2018 public duty trucks)**

National Assets and Existing Infrastructures

(Republic of Korea)



- **Technical progresses and track records accumulated by industries in FCEVs and FC power generation**
- **Competitive petrochemical complexes located in three coastal areas with excellent geographical coverage favorable for H₂ transport**
- **Well-organized nationwide public LNG pipeline network to support local hydrogen production and supply in the early and/or intermediate stage**

National Vision in Hydrogen Economy

(Republic of Korea)



		2018	2022	2040	
Goal	FCEVs	1.8K	81K	6.2M	
	FC power generation	Com. & Utility	307MW	1.5GW	15GW
		Res. & Building	7MW	50MW	2.1GW
	H2 supply (ton/year)	130K	470K	5.26M	
	H2 price (KRW/kg)		6,000	3,000	

	Preparation (2018~2022)	Expansion (2023~2030)	Leading (2030~2040)
Strategy	<ul style="list-style-type: none"> Ecosystem buildup Infrastructure investment Legislative support 	<ul style="list-style-type: none"> Build-up and scale-up of H2 supply-demand system 	<ul style="list-style-type: none"> Overseas H2 production C-free H2 supply system

Implementation Roadmap (Republic of Korea)



		2018	2022	2040
Mobility	FCEVs	1.8K	81K	6.2M
	• Passenger cars	1.8K	79K	5.9M
	• Taxis	-	-	120K
	• Buses	2	2K	60K
	• Trucks	-	-	120K
	HRS	14	310	1,200
Trains, Ships, Drones		Complete R&D and validation by 2030		

		2018	2022	2040
Energy	FC Power Generation			
	• Utility, Commercial	307.6MW	1.56GW	15GW
	• Residential, Building	7MW	50MW	2.1GW
	Hydrogen gas turbine	Complete R&D and validation by 2030		

		2018	2022	2030	2040
Supply & Price	Supply (10K ton/year)	13	47	194	526
	Production Pathway	• Byproduct (1%) • SMR (99%)	• Byproduct • SMR • Electrolysis	• Byproduct • SMR (50%) • Electrolysis • Overseas H2	• Byproduct • SMR (30%) • Electrolysis • Overseas H2
	Price (KRW/kg)	Public policy	6000	4,000	3,000

Impacts Witnessed

(Republic of Korea)



- **A declaration of phase change from demonstration to deployment through true market transformation of FCH technologies**
- **Long-awaited policy coordination realized by multilateral collaborations in infrastructure investment between many bodies including government and private sectors**
- **‘Basic plan for green car deployment’ finally included long-term targets of FCEVs, HRS, and infrastructure (MOE)**
- **MOE and MOLIT actively involved in installing 150 and 160 HRS’s by 2022, respectively to close the demonstration phase (MOCIE)**
- **A special purpose company called HyNet, driven by public-private partnership (H2KOREA) committed to installing 100 HRS’s by 2022**
- **Hydrogen Roadmap Korea to be reinforced by legislative support by Parliament with so-called ‘Hydrogen Economy Law’**

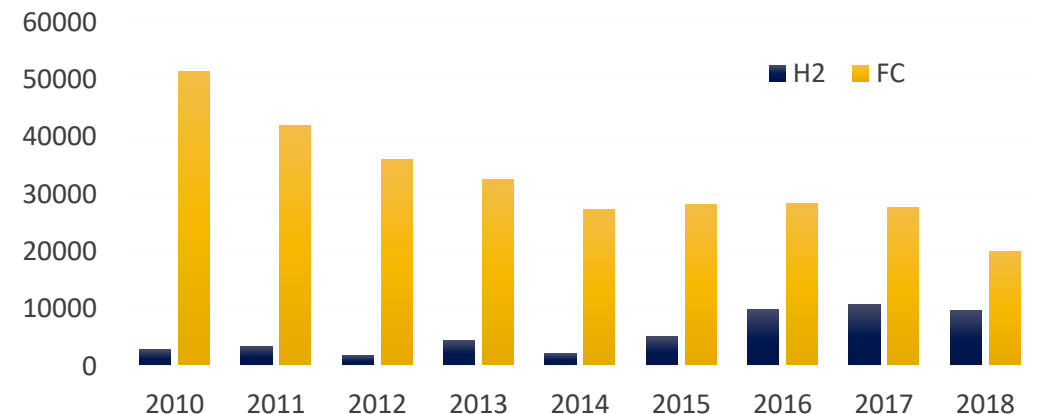
R&D Roadmap under Development

(Republic of Korea)



- **National R&D Roadmap to be ready by the end of this year including all aspects of FCH technologies, covering R&D needs from participating six government ministries**
- **Five working groups: production, delivery, use in transport, use in power generation, and safety, environment, and infrastructure**
- **2 trillion KRW expenditure expected in 10 year covering period excluding deployment budget (separately by the end of this year)**

R&D Budget by MOCIE (Million KRW)



Hydrogen and Fuel Cell Deployment

(Republic of Korea)



- **The 4th Action Plan for NRE Development and Deployment (Amendment of 10-year plan every 5 year)**
- **Hydrogen and Fuel Cell has been handled under the NRE basic plan, charged by MOCIE (Ministry of Commerce, Industry, and Energy)**
- **Some changes expected by Hydrogen Roadmap Korea in combination with Hydrogen-related legislation**
- **Some of public policies effective for FC deployment as follows;**
 - **RPS (renewable portfolio standard)**
 - **Green Home Program**
 - **Public Building Obligation**
 - **NRE Building Certification (City of Seoul)**

RPS (Renewable Portfolio Standard) (Republic of Korea)



- **Utility companies supplying over 500 MWh annually should provide annual target percent through NRE means**

Year	2012	2016	2017	2018	2019	2020	2021	2022	2023~
Req'ment (%)	2.0%	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0

- **FC capacity exceed 300 MW as of Dec., 2018**
- **Main player: MCFC and PAFC**
- **Issues:**
 - **Variation of REC (renewable energy certificate), SMP (system marginal price) and gas prices**

Green Home Program

(Republic of Korea)



- FCs in Green Home Program are very similar to ENE-FARM in Japan.
- Cumulative number of installed units is about ~2000 as of Dec, 2018, compared to 270K units in Ene-Farm through 2017.
- Policy needs to be refined in order to overcome high gas price, low electricity price and small market size

	Green Home	Ene-Farm
Learning rate	0.147	0.185
Compound annual Growth rate	10% (2010-2013)	47% (2009-2014)

- Cost reduction requires appropriate market size as well as market growth rate under relevant business environment

NRE Obligation for Public Buildings

(Republic of Korea)



- **New and reconstructed public buildings with 1000 m² or more floor area are required to satisfy the annual target percent of NRE energy use.**

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020~
Req'ment (%)	10	11	12	15	18	21	24	27	30

- **Recently, small FCs in 3-50 kW tend to increase (57 kW in <1 kW unit vs. 228 kW in 3-50 kW unit, 2017)**
- **They are concentrated in urban area (in relatively big cities)**
- **NRE building certification by local government like City of Seoul also makes contribution to FC deployment by providing additional incentives such as increased floor to site ratio, tax credit, and REC with correction factor up to 6.35 for FCs**

Thank you



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