



**Advanced Fuel Cells**  
*Implementing Agreement*

IEA Annex 30 Workshop (20 April, 2015)

# 2014 Energy Technology Innovation Roadmap

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Fuel Cell Research Center, **KIST**



## [ THE LEADING CONTRIBUTOR IN SCIENCE AND TECHNOLOGY IN KOREA ]



### Seoul Headquarters

- Established in 1966
- Multidisciplinary research institute of science and technology in Seoul
- Land area: 271,527 m<sup>2</sup>



### KIST Gangneung



### KIST Jeonbuk

[ THE LEADING CONTRIBUTOR IN SCIENCE AND TECHNOLOGY IN KOREA ]



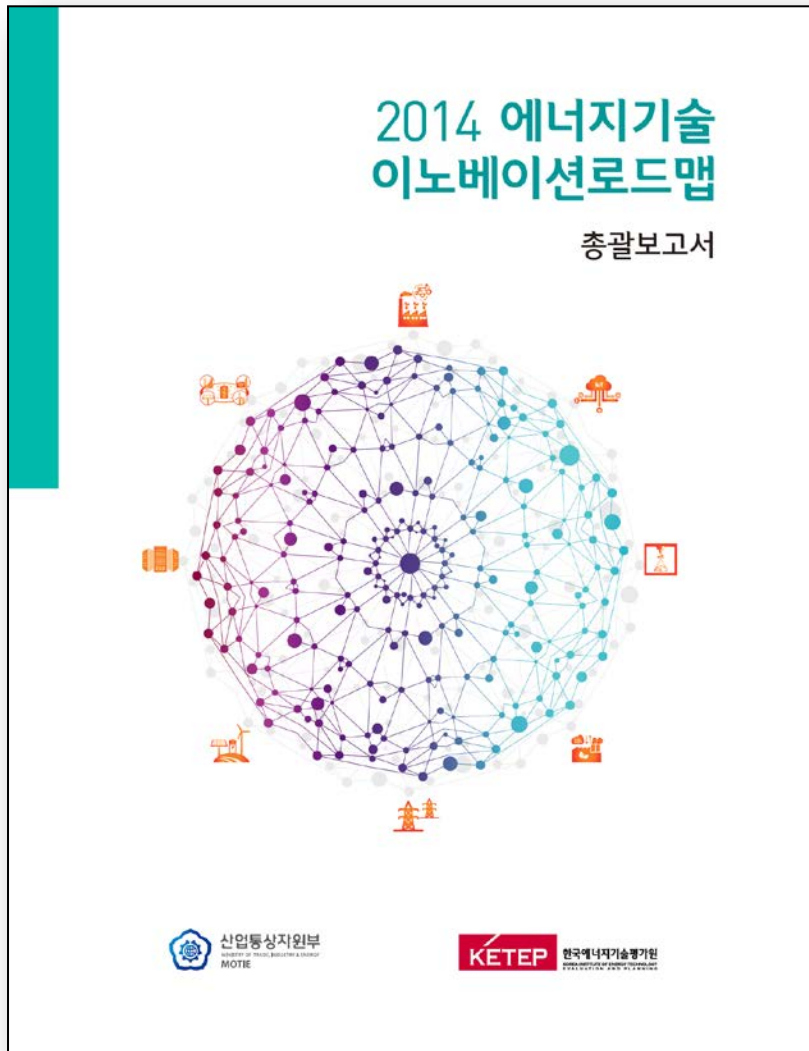


## Fuel Cell Research Center

- High-temperature fuel cells
- Low-temperature fuel cells
- Hydrogen production / storage



- Since 1989
- ca. 20 staff members
- ca. 40-50 students, postdocs, interns
- Several cooperations with Korean industry (Hyundai, Samsung, ...)
- international cooperations: ENEA (Italy), Technical University of Denmark (DTU), Next Energy (Germany), Jagiellonian University (Poland), ...



- Released in Dec., 2014 by
  - MOTIE (Ministry of Trade, Industry & Energy)
  - KETEP (Korea Institute of Energy Technology Evaluation and Planning)



**MOTIE**  
MINISTRY OF  
TRADE, INDUSTRY & ENERGY

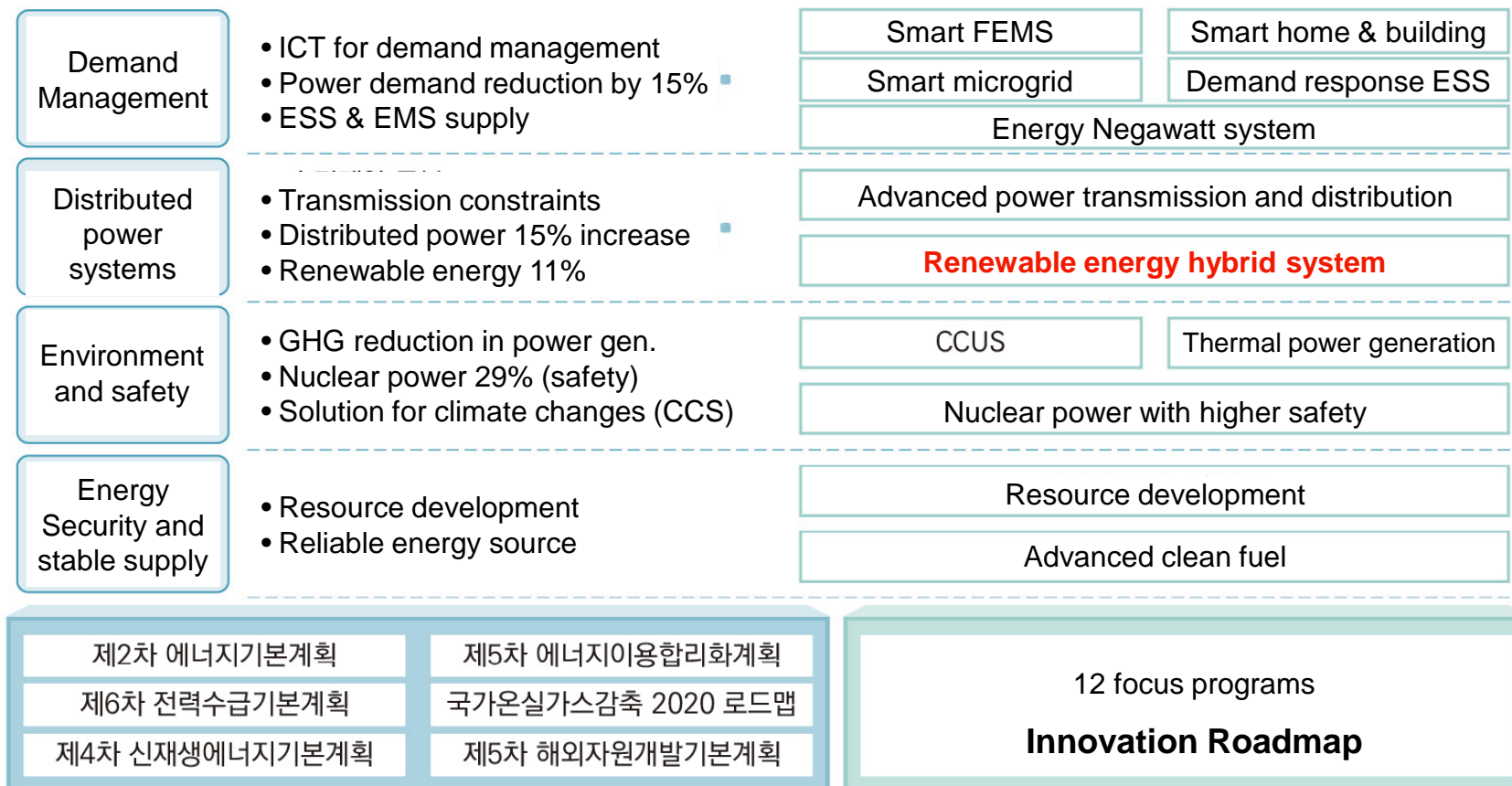


KOREA INSTITUTE OF ENERGY TECHNOLOGY  
EVALUATION AND PLANNING

Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea

## ■ 제2차 에너지기본계획 등 정부정책의 비전 및 목표와 정합성 확보

- 고효율 사회구현을 위한 선도적 수요기술, 청정·안전한 사회친화형 에너지공급 기술 발굴로 에너지정책 내 핵심과제를 구성하는 R&D 요소 실효성 강화



Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea

# Transmission

Energy supply

전달

Energy demand

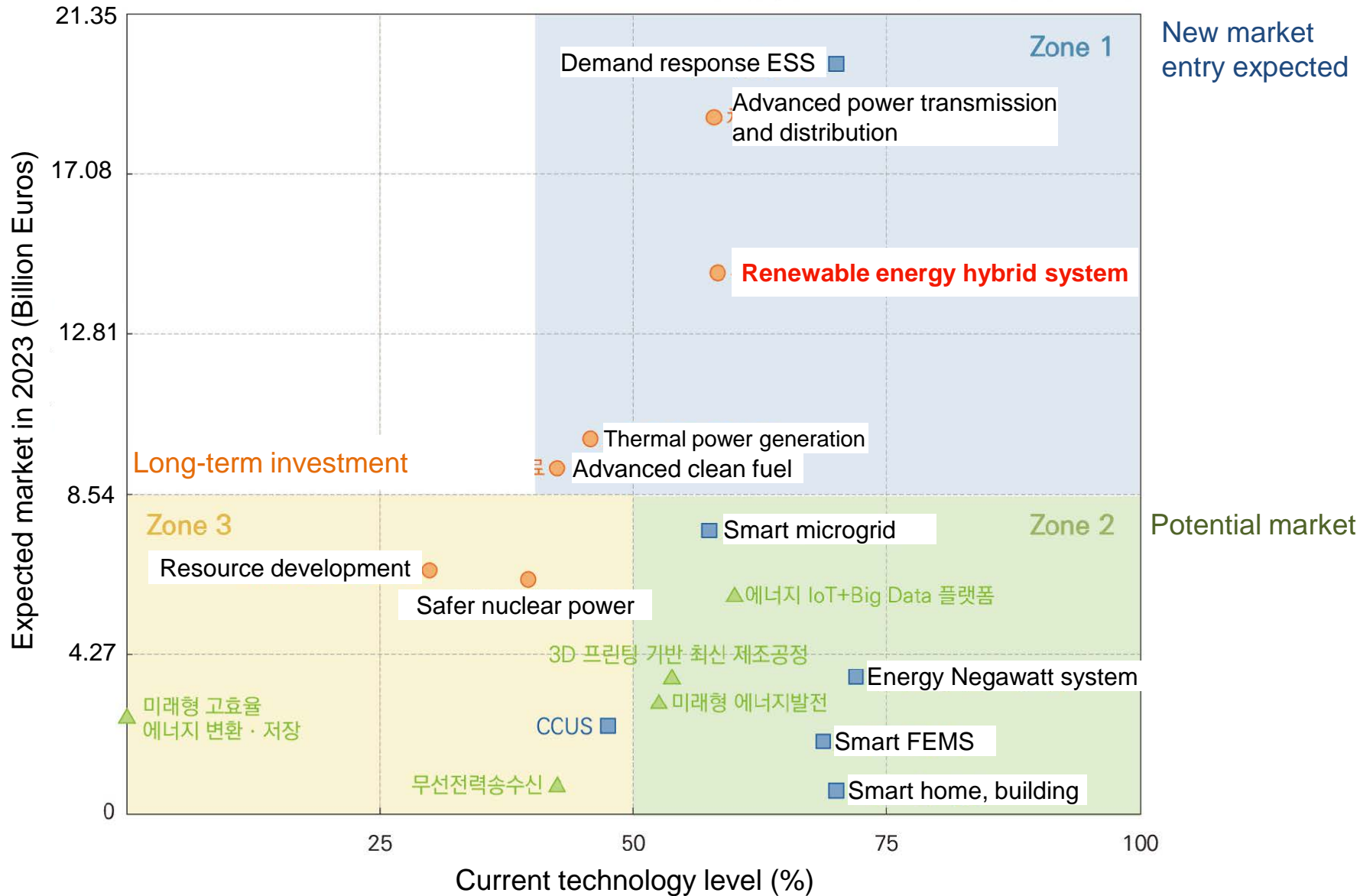
전주기 에너지 시스템



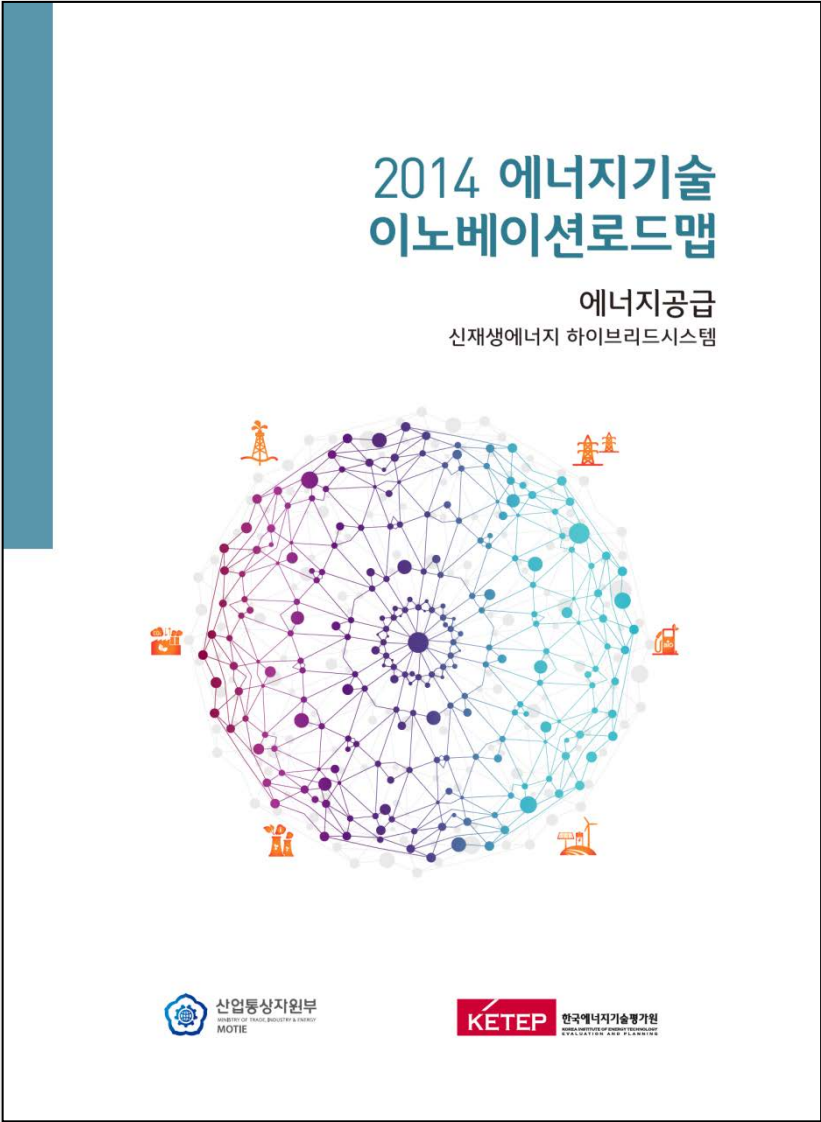
중점 프로그램	1 차세대 전략 자원개발 Resource development	2 Thermal power generation	6 차세대 송배전 Advanced power transmission and distribution	7 Smart home, building (H · B & EMS)	8 Smart FEMS * 산업단지 최적화, 업종별 효율화
	3 Safer nuclear power	4 Renewable energy hybrid system (풍력, 태양)	5 Advanced clean fuel * 바이오연료, CTL, GTL 등	9 Smart microgrid	10 Energy Negawatt system
	12 CCUS				

Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea

# Market & technology level







## 1. Renewable energy in Korea: 3.66% (2012)

- Electric power generation: + 46.6% in 5 years

## 2. Government plan to increase up to 11% by 2035

- Estimated investment: 132 billion euros
- Government funding of 26 billion euros for technology development, supply, and loans

## 3. Renewable energy hybrid system

: fusion system of two or more technologies including renewable energy

- (1) Urban renewable energy power plant
- (2) Stand-alone energy independence system
- (3) Advanced power-to-gas hybrid solution

Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea

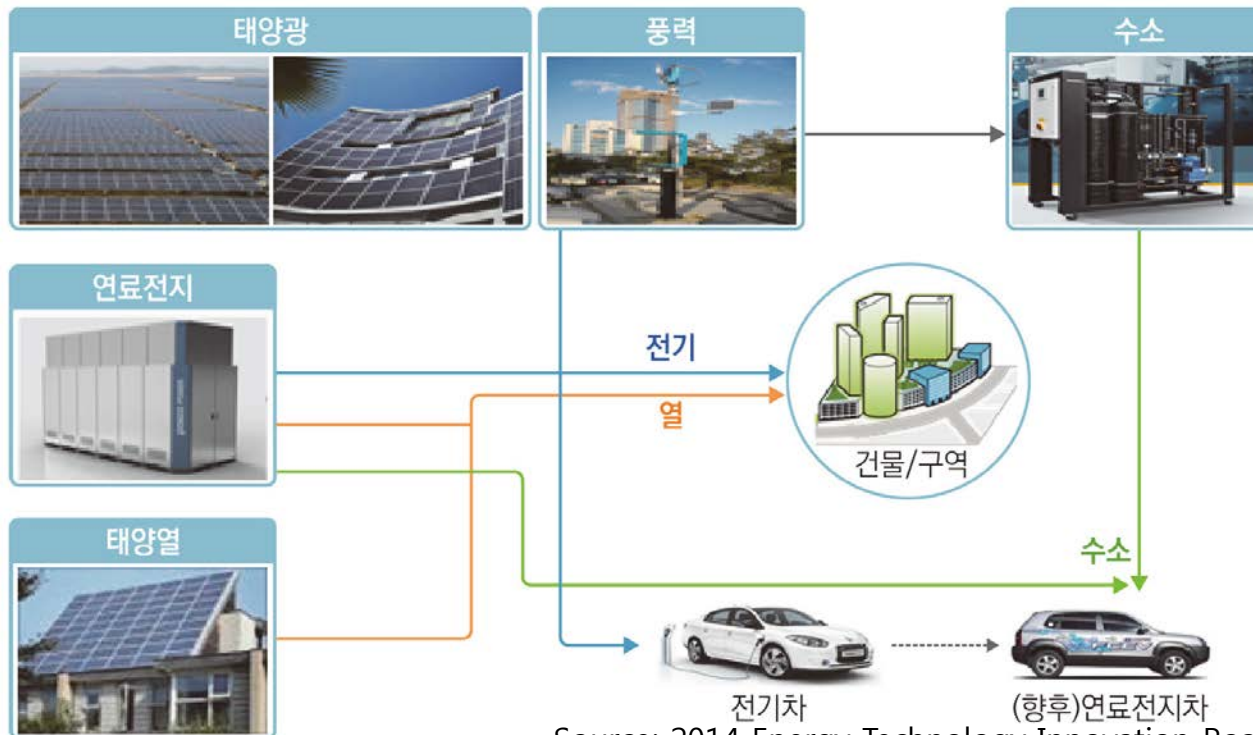
# (1) Urban renewable energy power plant

- Electricity and thermal energy supply/management system

- Renewable energy component technology
- Energy network technology

2 or more energy production systems  
(including renewable sources)

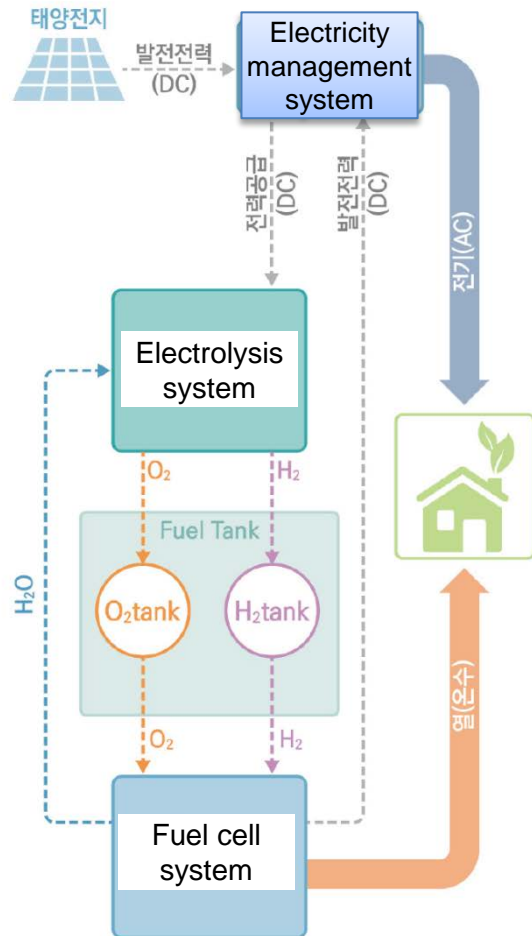
+ Energy storage system



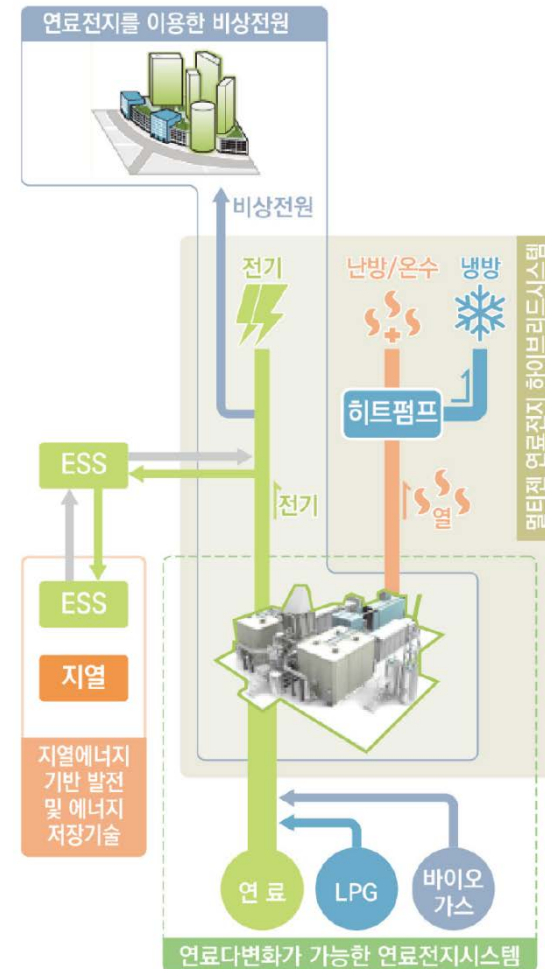
Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea

# (2) Stand-alone energy independence system

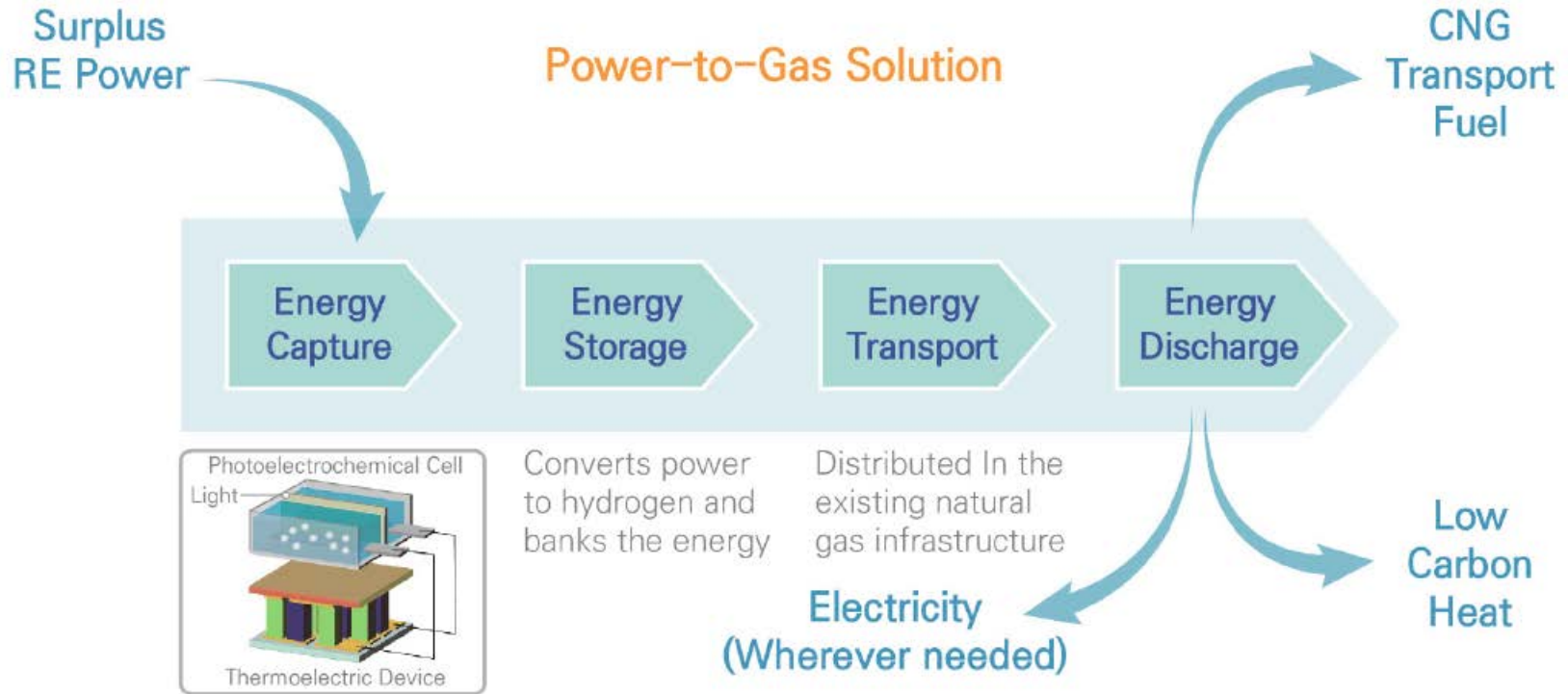
Fuel cell-solar cell hybrid system



Bio-fuel cell-heat pump-geothermal-ESS



# (3) Advanced power-to-gas hybrid solution



Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea

## 1. Renewable energy hybrid system

- 1.6 B\$ (2012) → 21 B\$ (2020)
- Annual growth by 38%

## 2. Urban renewable energy power plant

- 0.47 B\$ (2014) → 1.6 B\$ (2020)
- Annual growth by 26%

## 3. Stand-alone energy independence system

- 5.7 B\$ (2014) → 23.9 B\$ (2020)
- Annual growth by 21%

## 4. Fuel cell-solar hybrid system

to replace diesel power generators in islands and mountain area in Korea

- Korea market: 79 M\$ (2018) → 4.1 B\$ (2023)
- Share: 20% (2018) → 90% (2023)

Source: 2014 Energy Technology Innovation Roadmap, by KETEP, Korea