Iran REC 2021

Green Energy Development in Korea and New Technology Trend

Nov. 21, 2021

Presenter: Kang, Sung Jong/CEO

KOREA NEW & RENEWABLE ENERGY ASSOCIATION

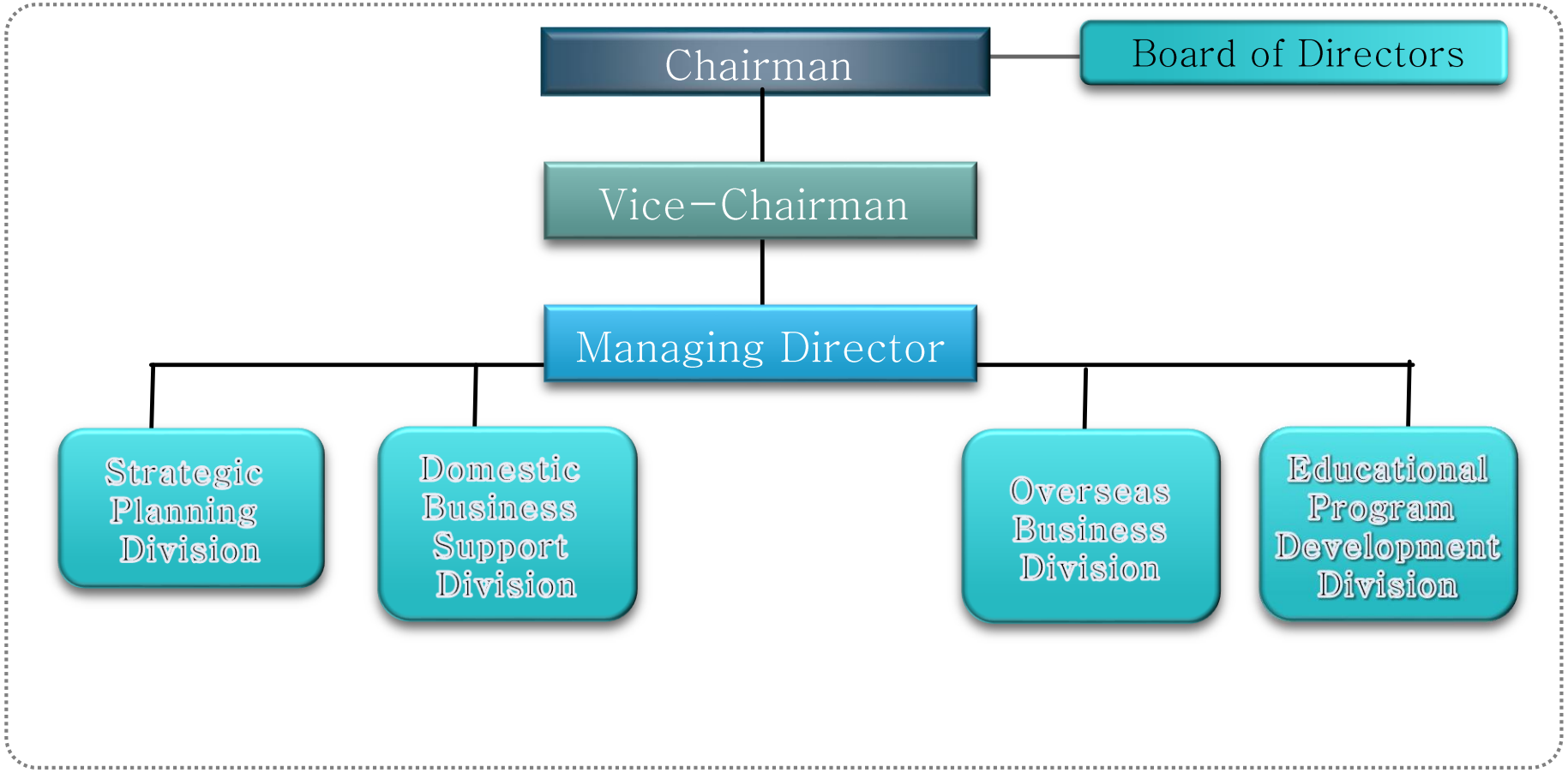
Goals

1. Protect and Enhance Rights and Interests of our Members
2. Contribute to boosting Renewable Energy Industry and National Economy through promoting Technology and Exports

History

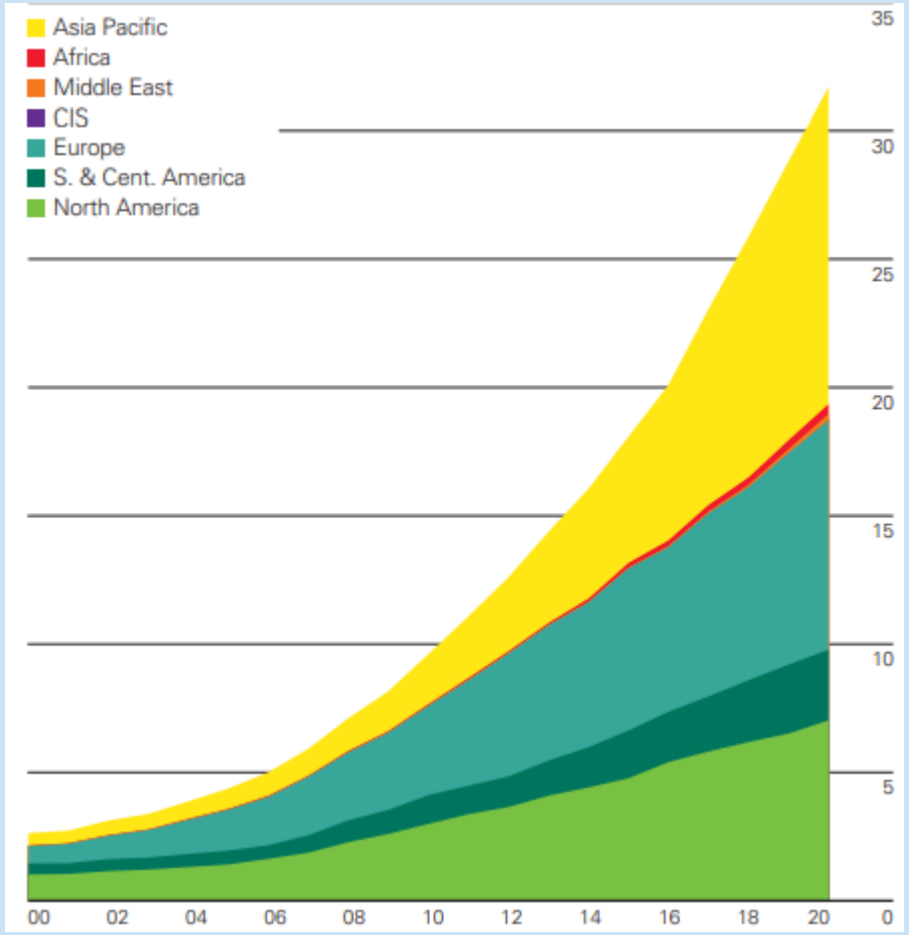
Mar, 2001	established as Korea Small Hydropower Association
Sep, 2001	renamed as Korea Alternative Energy Association
Jan, 2003	designated by Korea government to issue Tariff Reduction Certificates
Jan, 2005	renamed as Korea New and Renewable Energy Association
Apr, 2007	designated by Korea government to issue Installation Certificates
Mar, 2011 ~	designated by Korea government to conduct ‘Overseas Support Program’

KOREA NEW & RENEWABLE ENERGY ASSOCIATION

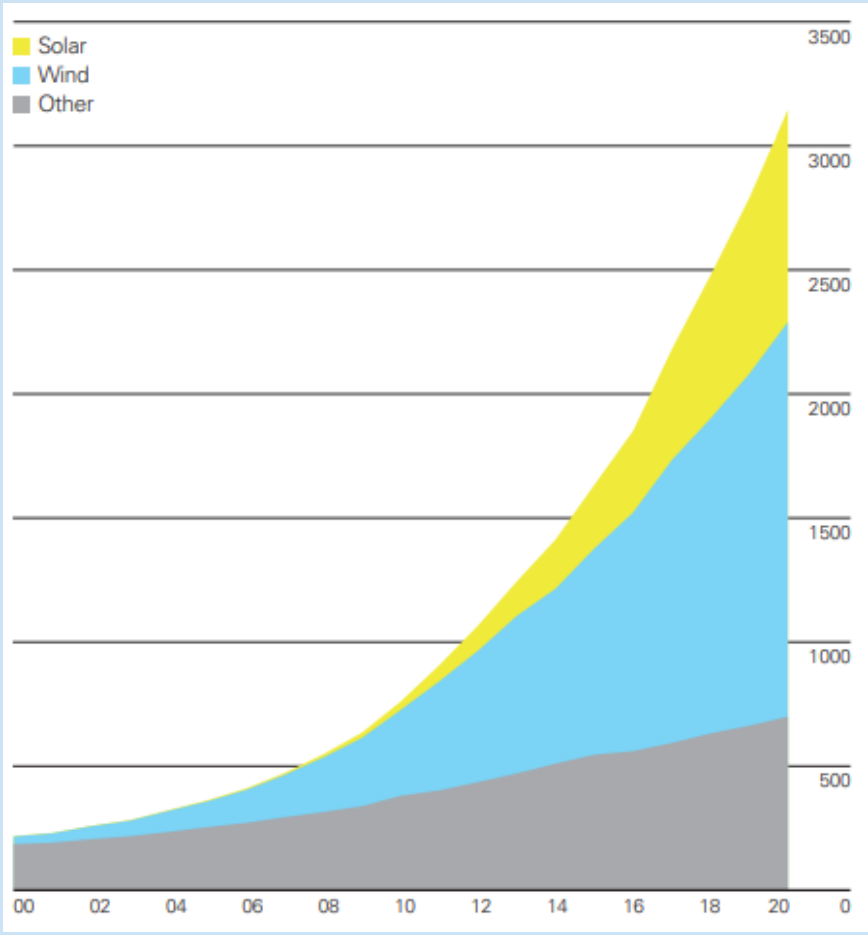


GLOBAL RENEWABLE ENERGY STATUS

Global RE Consumption in Regions



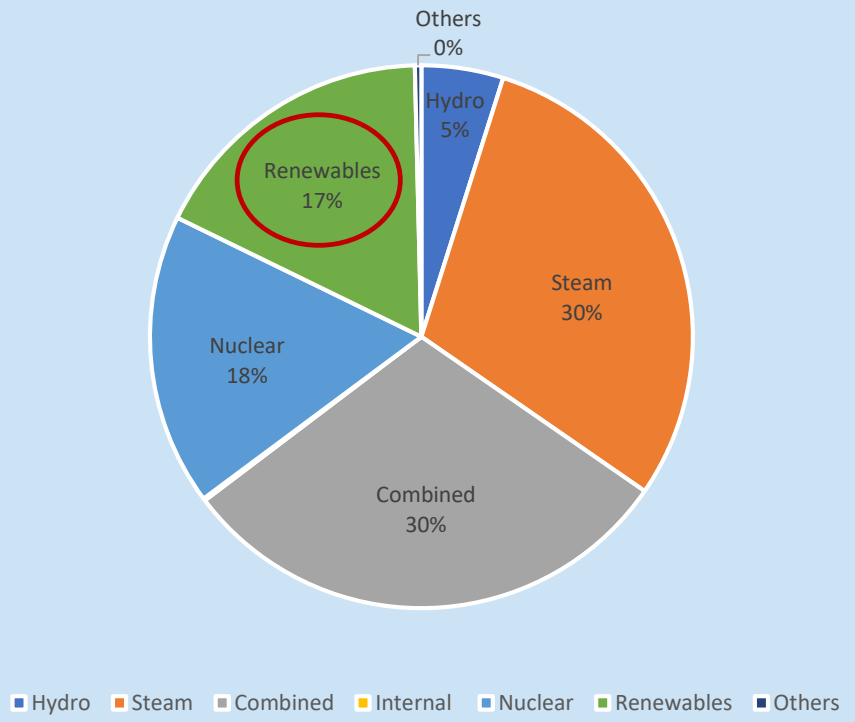
Global RE Sources



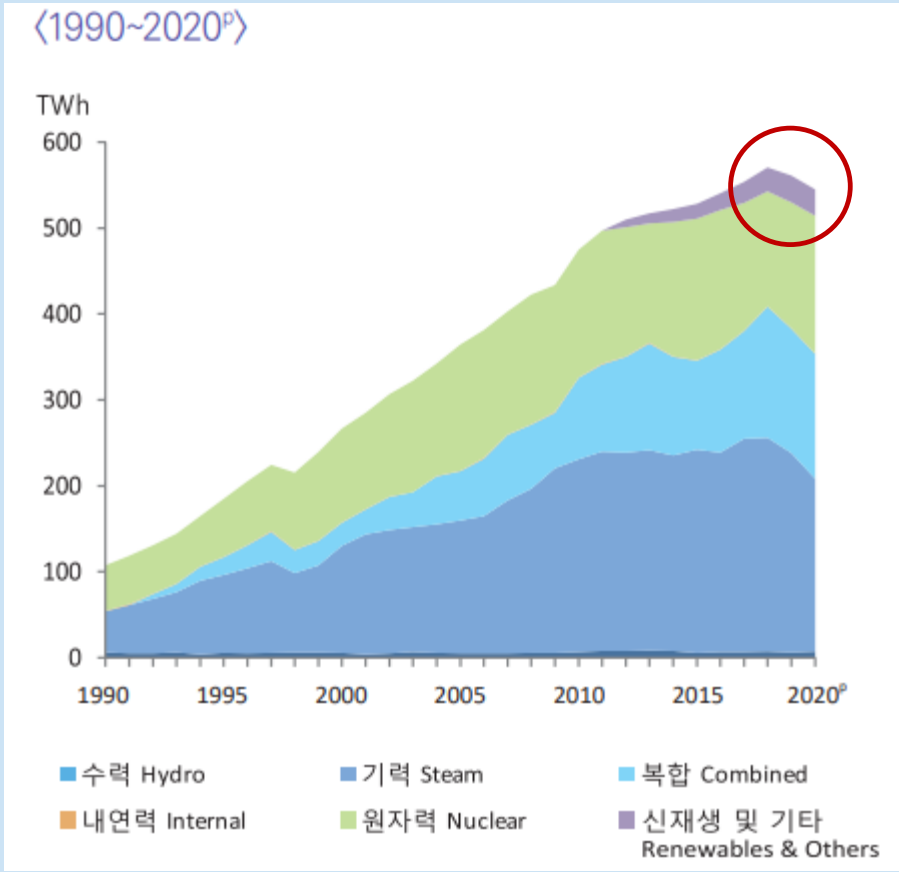
* Source : BP Statistical Review of World Energy(2021)

KOREA RENEWABLE ENERGY STATUS

Korea Energy Capacity (Acc. ~ Jul, 2021)



Korea Power Generation



* Source : Monthly Energy Statistics(KEEI, Oct 2021)

KOREA GOV. SET A GOAL TO ACHIEVE NET-ZERO EMISSION BY 2050

reducing GHG by 40% (~ 2030)

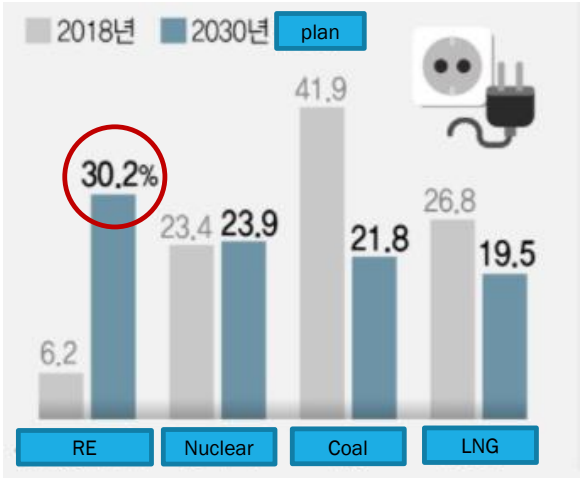
- Korea Gov. added details in **"Carbon Neutrality Roadmaps"**

- To eliminate all thermal power generation(fossil fuel, LNG) – zero emissions in the supply sector

- To get rid of coal-fried power generation

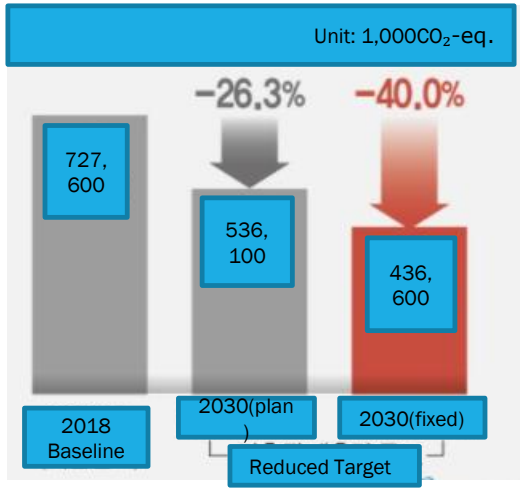
- **RE shares : 6.2% (2018) → 30.2% (2030p) with 100GW capacity**

Power Capacity (Sources)	GHG Reduction



Gray : 2018
Blue :
2030(p)

Unit : ten-thousand CO_2-eq.



KOREA RENEWABLE ENERGY MARKET STATUS

Korea Gov. has developed major RE sources… :

Solar PV





Profiles (2019)	
Companies	97
Employees	7,567
Sales	App. US$ 42 billion
Investment	App. US$ 0.18 billion

* The number of solar thermal companies : 7

Wind

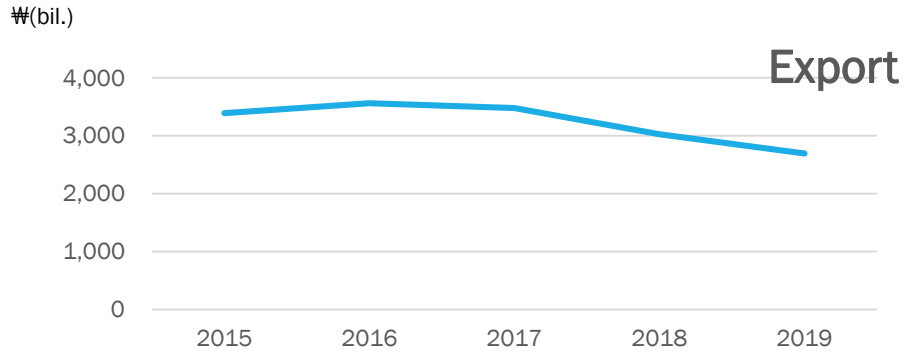


Profiles (2019)	
Companies	18
Employees	1,545
Sales	App. US$ 9.5 million
Investment	App. US$ 0.18 billion

KOREA RENEWABLE ENERGY MARKET STATUS

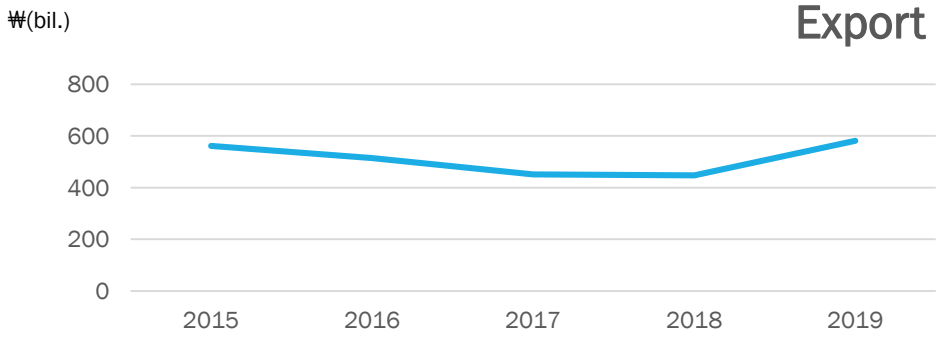
* Major companies and Export

Solar PV



Major companies			
Cell	Hanwha Q Cells	Polysilicon	OCI
	Hyundai Heavy Industry		Hanwha Q Cells
	LG Electronics		Hankook Silicon
	Shinsung E&G	S-Energy	Hansol Technics

Wind



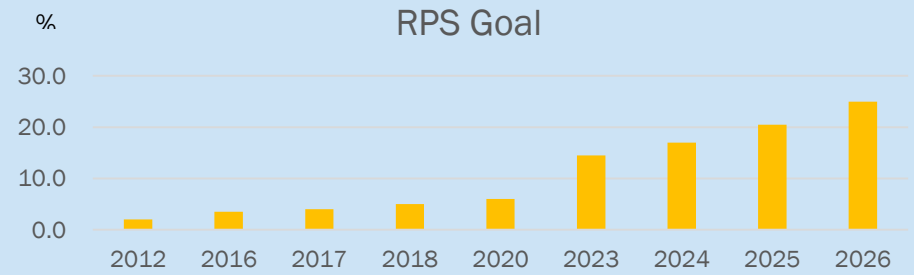
Major companies			
Turbine	Doosan Heavy Industries	Tower	CS Wind
	Hyosung		
	Unison	Forging	Taewoong
	Hanjin		

* Source : Statistics of Renewable Energy Industry in Korea (KEA, 2020)

RENEWABLE ENERGY PROGRAMS IN KOREA

RE Deployment Programs

1. Renewable Portfolio Standard(RPS, 2012 ~)



2. RE Mandatory Programs : Mandatory use of RE in public buildings (size of 1,000㎡, newly constructed)

RE Obligation Rate (%)				
2014	2017	2018	2019	2020
12	21	24	27	30

3. Subsidy Programs : individual Houses, Towns, rental housings

# of Installation (2004-2019) (thousand)				
S. PV	S. Thermal	Geothermal	Etc.	total
381	27	15	3	426

4. PV Rental Program, Agricultural Solar Villages Program

Renting solar PV facilities and paying some portion of the money they saved from the reduced bill

Rental Service Provider : Rental fee profit, REP

* REP : Renewable Energy Point

* Source : New & Renewable Energy White Paper (KEA, 2021)

RENEWABLE PROGRAMS IN KOREA

- **K-RE100**
  - Companies and other electricity consumers to selectively purchase and use electricity generated from RE sources
  - Launched in 2021, 280 companies participate in this program

Green Premium	pay a premium on existing electricity bills to purchase electricity generated solely from RE
REC	All Korean electricity consumers can purchase RECs for the purpose of demonstrating use of RE. (* Previously, only large-scale power producers were allowed)
Third party PPA	MOTIE's issuance of required administrative notifications and KEPCO's revising of its terms & conditions
Investment	(Corporates as a consumer) Direct investment in RE projects
Self-generation	Use electricity though the installed own generators (consumers including corporates)

RENEWABLE PROJECTS IN KOREA

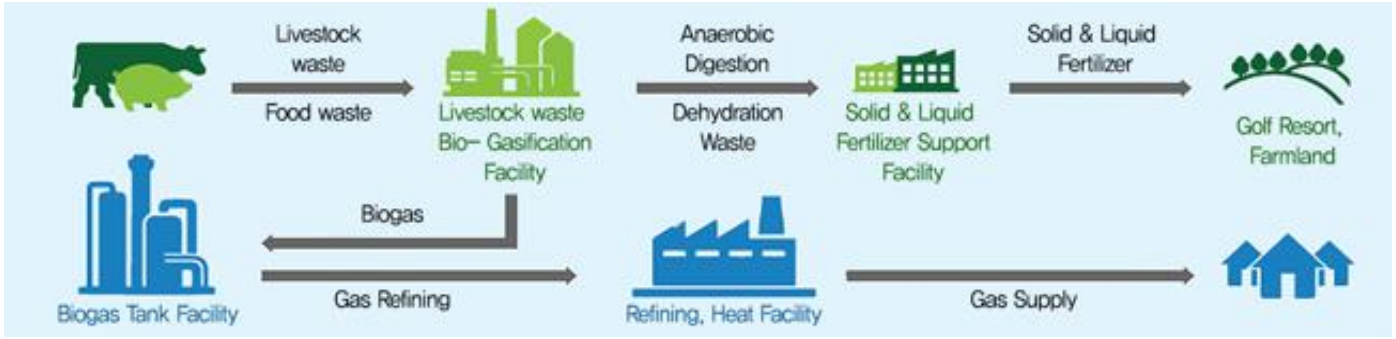
- Eco-friendly Energy Town : Renewable Energy, Biogas facilities, Hydrogen R&D Townhouse complex, etc.

  - started to build "Eco-friendly Energy Town" since 2014

Hydrogen R&D Townhouse Complex in Samcheok, Kangwon

Anaerobic Digestion, Solar PV in Jeju

Bio-Gasification, Anaerobic Digestion, Solar PV in Samcheok, Kangwon



RENEWABLE PROJECTS IN KOREA

- 3 Offshore Wind Energy Deployment Plans

- One of the global top 5 countries in offshore wind energy generating 12GW by 2030
- Create a harmonious environment to collaborate with the fishing industry and residents

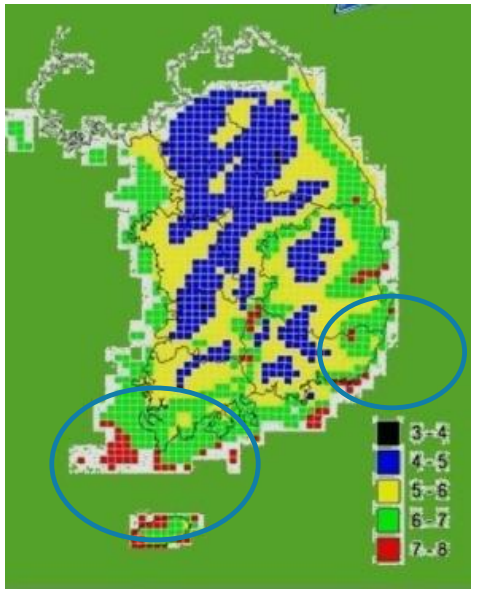
1	Government-led site development and simplified licensing and permit process
2	Increase resident acceptance and decrease environmental effects
3	Strengthen the industry competitiveness with large projects

Creating 87,000 new jobs

12GW (~ 2030)

Sharing the profits from generating wind energy with local communities

Shinan Project
- Stage1 : 4.1 GW(2023~)
- Stage 2 : 4.1GW(2026~)



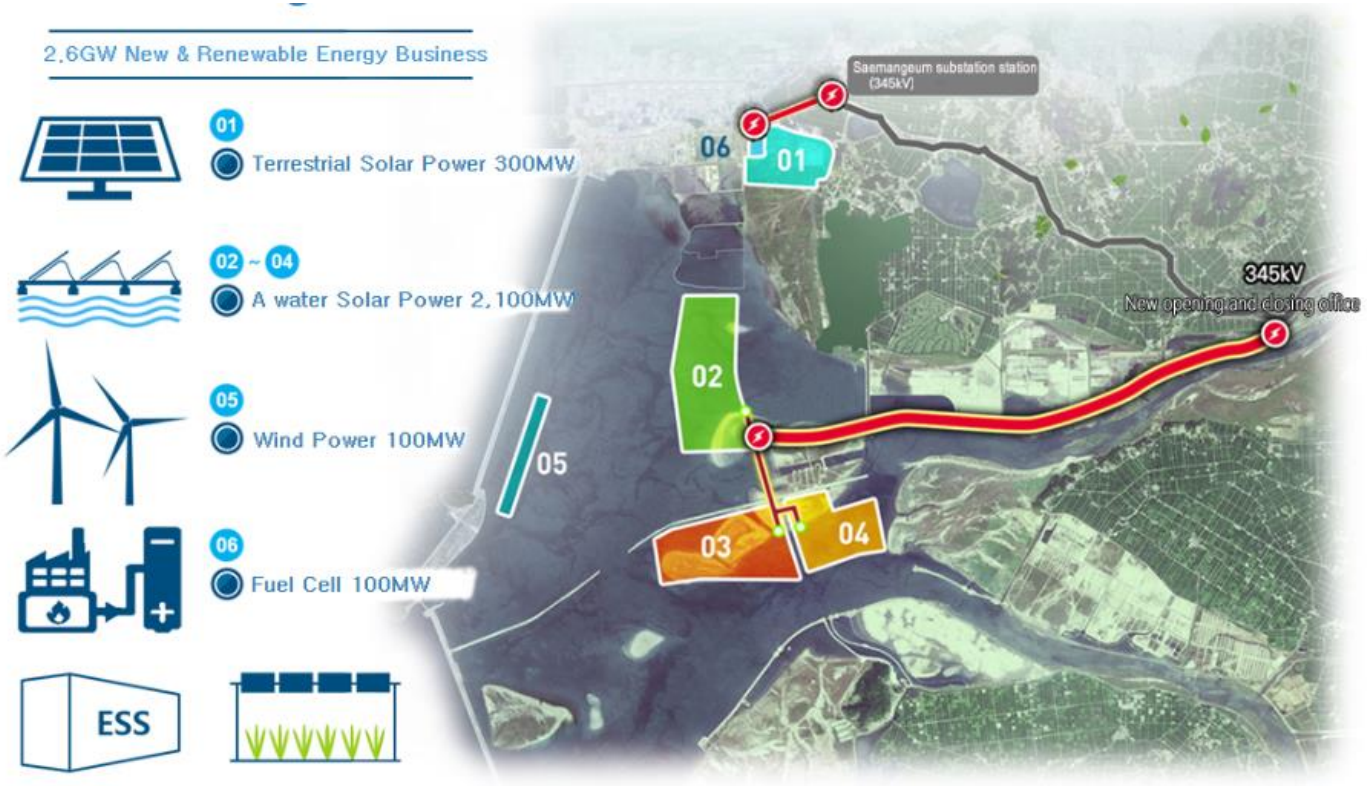
Ulsan Project
MOUs with 6 investors
Launched from 2023

4.6GW(Southeast)

RENEWABLE PROJECTS IN KOREA

- 2.6GW New & Renewable Energy Deployment Plans

- Plant site, Saemangeum is the world's longest seawall connecting Gunsan and Buan city
- By utilizing Saemangeum's abundant natural energy sources, pursues a renewable energy business focusing on solar energy



Creating 20,000 new jobs: 2.6GW (~ 2030)

Reduction of GHS: 1,350,000tCO_2-eq. for 10 years

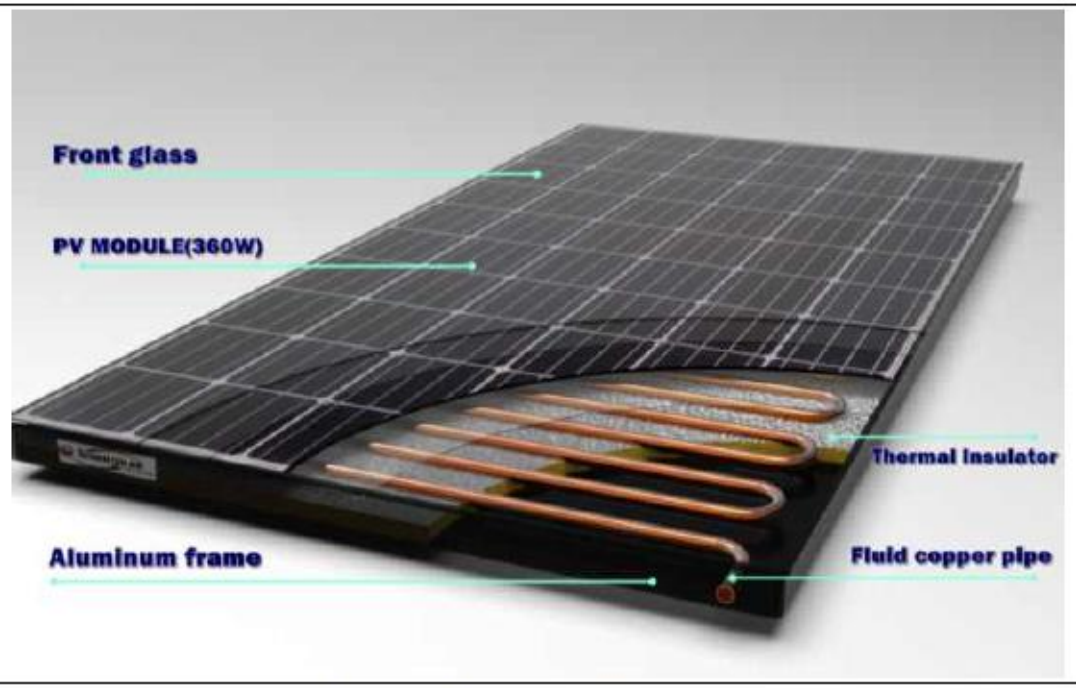
NEW TECHNOLOGY TREND

- **Photovoltaic & Solar Thermal Multi Module**

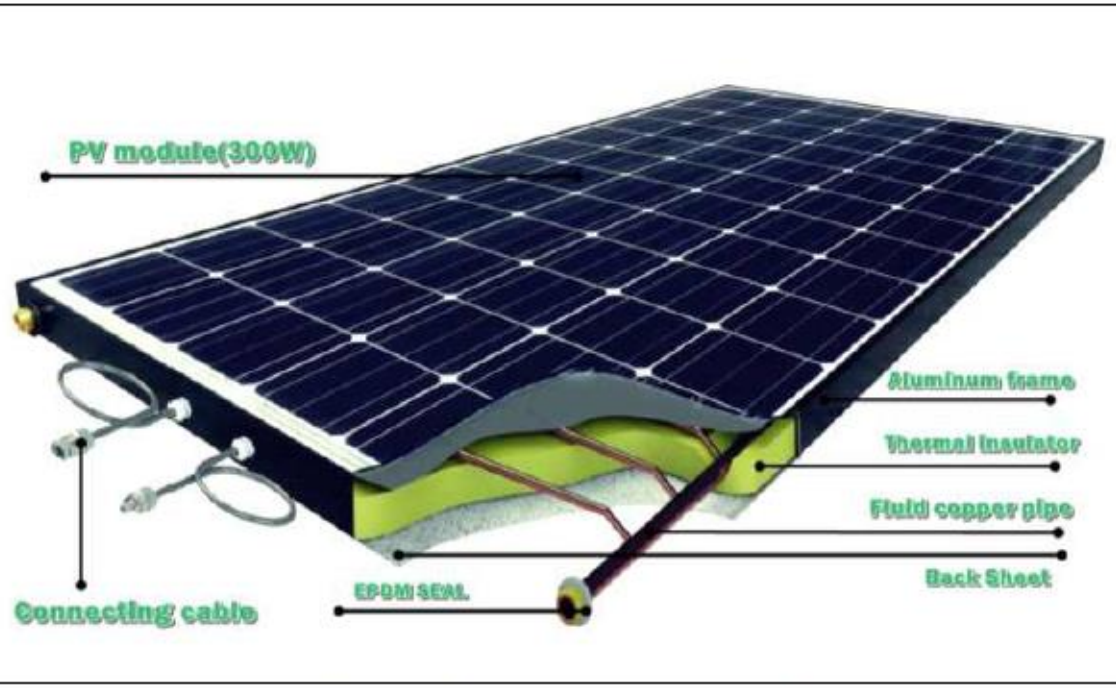
- Hybrid module with Solar Collector and PV module that produces both thermal and electrical energy

√ Heat Pipe type – Apply Aluminum Flat Heat Pipe to Solar Collector

√ Liquid PV & Thermal type: Apply Liquid tube + Absorber to Solar Collector

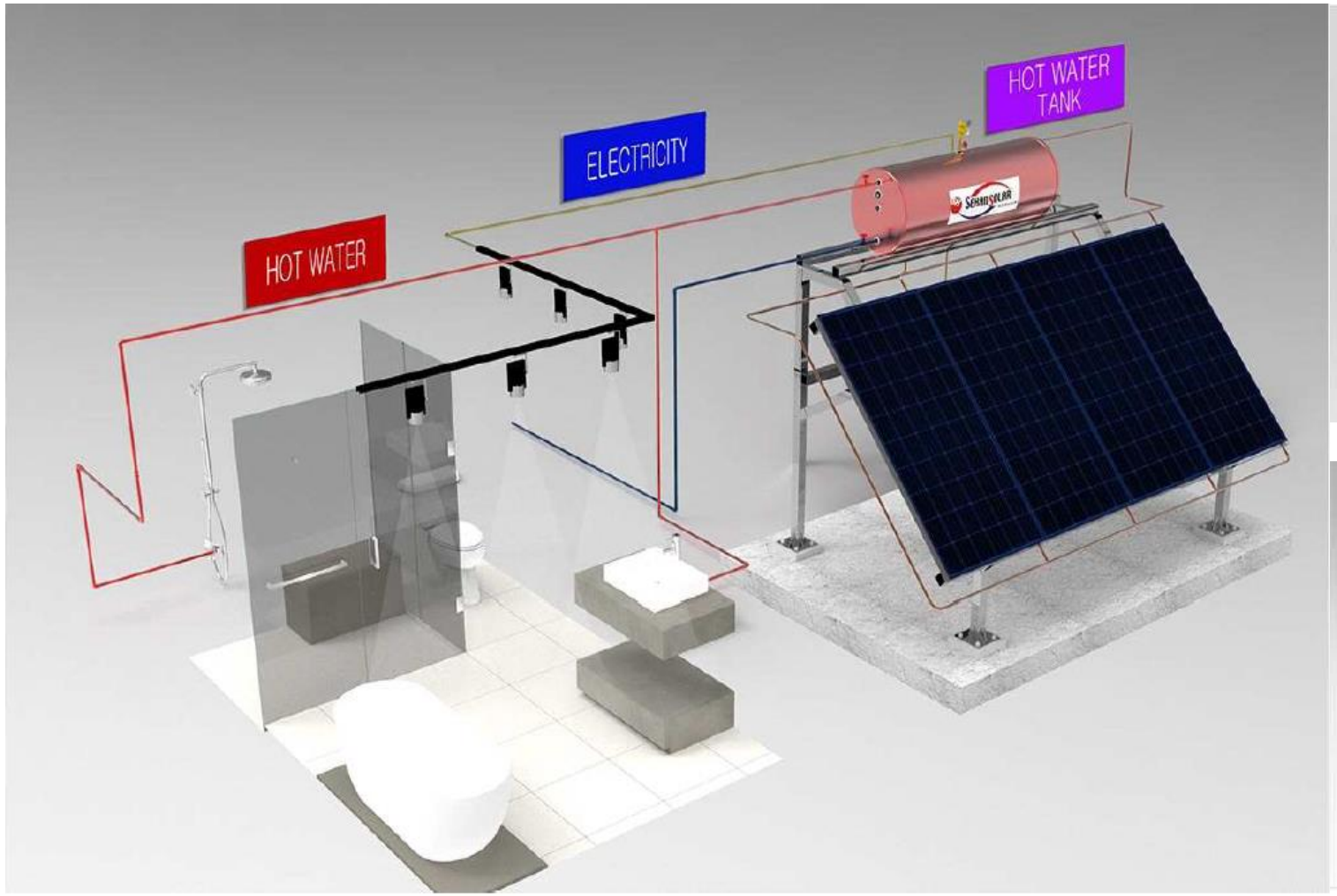


1EA : PV 360W/Thermal 2㎡



1EA : PV 300W/Thermal 1.95㎡

☞ Concept Design & Application Cases



Capacity : Solar thermal – 2*4=8㎡ / PV – 300W*4=1.2 kW/h

NEW TECHNOLOGY TREND

- **Floating PV Power Generation System on the Reservoirs of Dams**

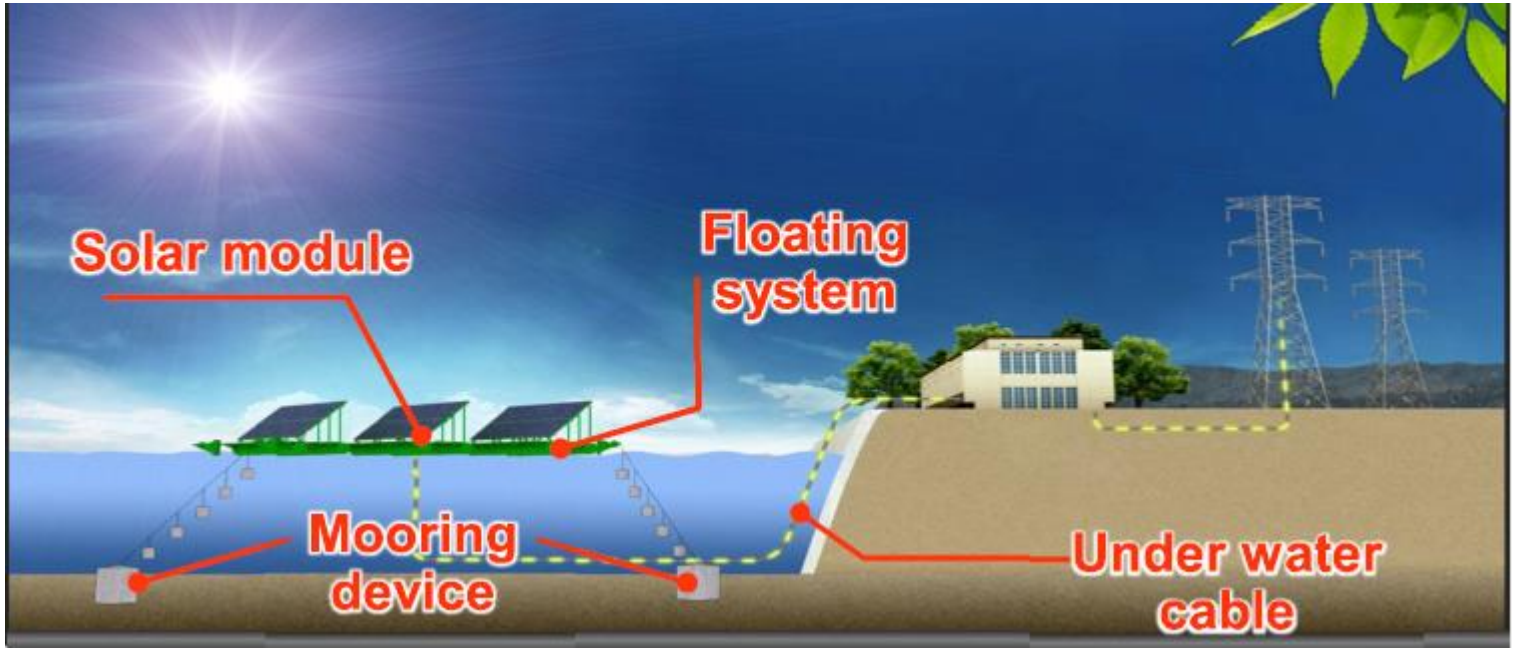
- Core Technology

√ Solar Module adequate for Water Surface

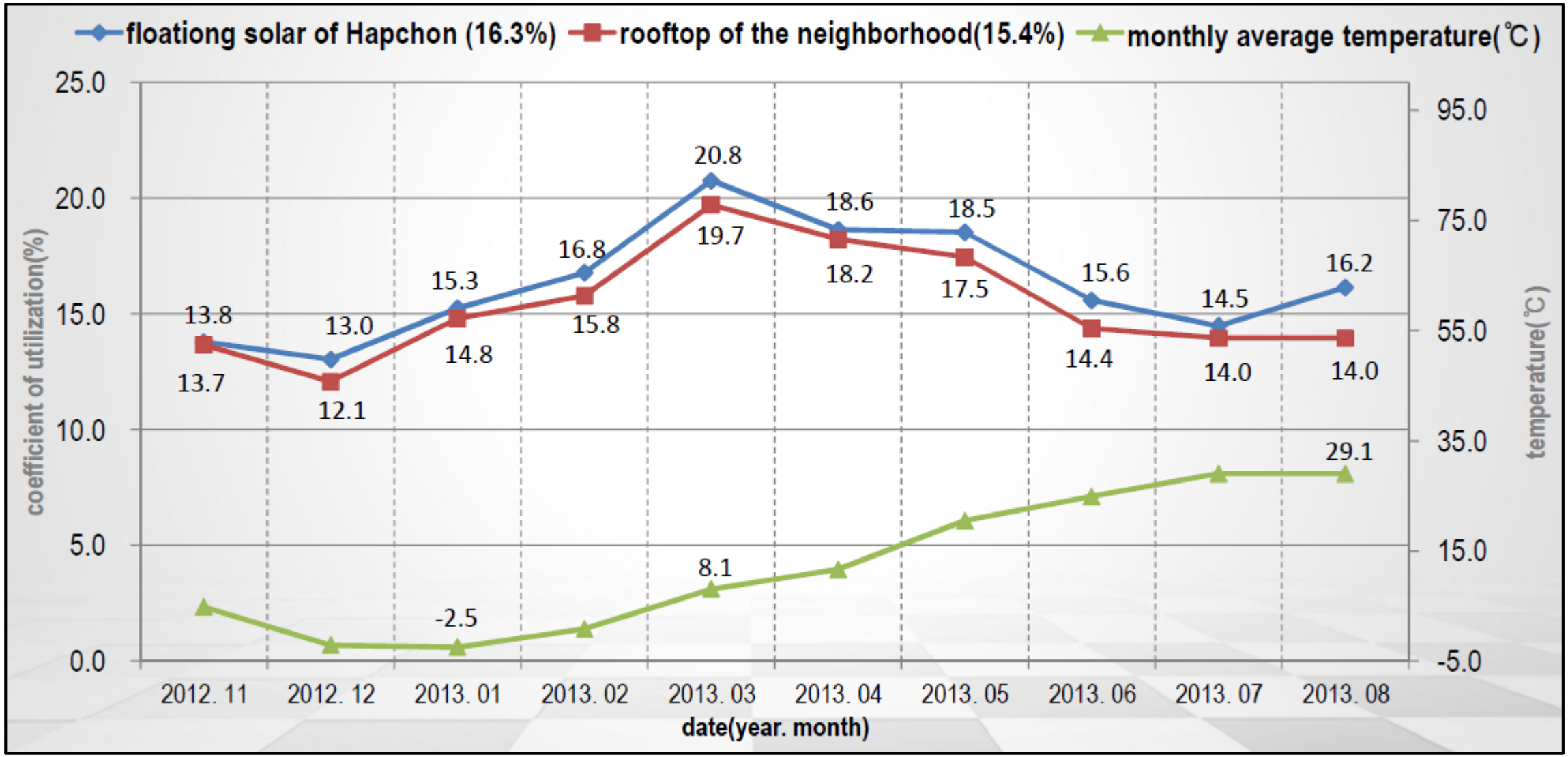
√ Stable Floating System

√ Mooring Device that stabilizes the buoyancy tank

√ Under water cable that sends that generated electricity to a land power station



☞ Comparison using rate of Land and Floating PV



☞ Application Cases

NEW TECHNOLOGY TREND

- Waste to Energy

- Policy Objectives

√ Maximize the processed waste in order to minimize the amount of waste disposed at landfill sites

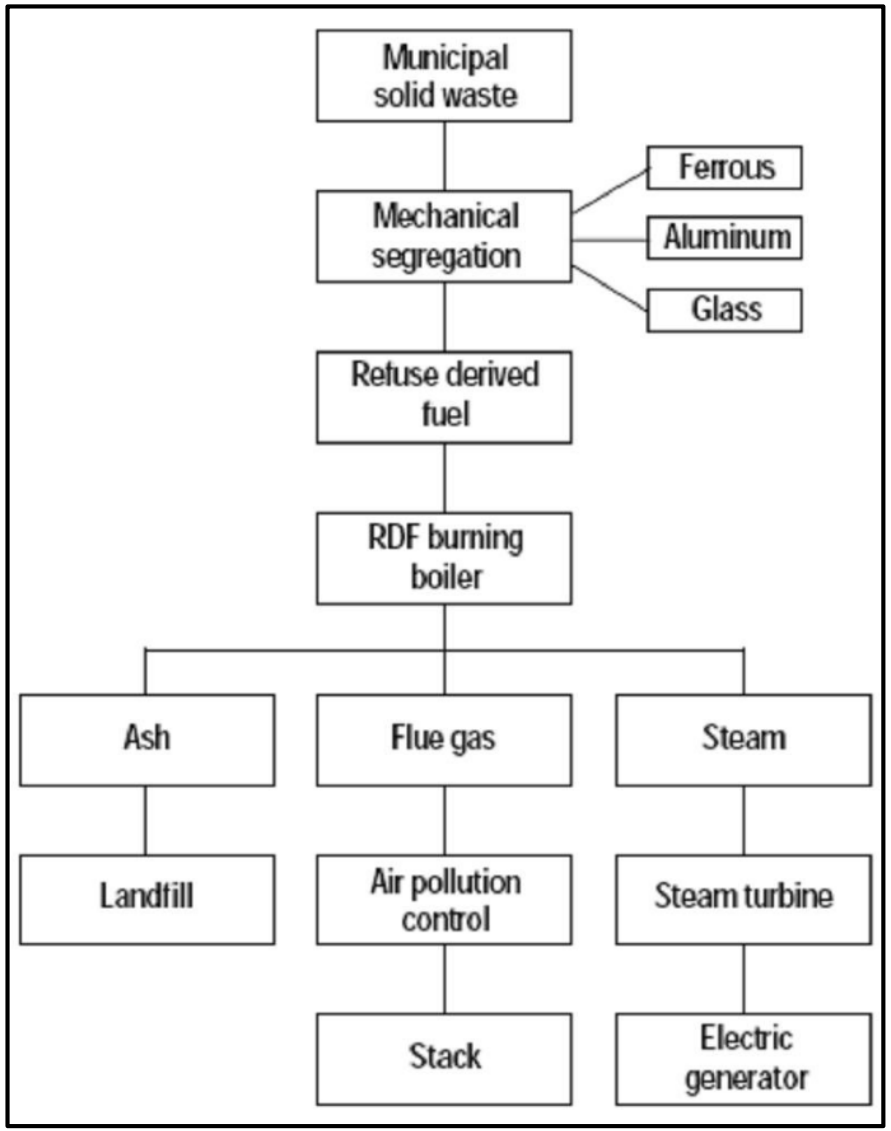
√ Install an appropriate amount of waste disposal facilities to maximize the resource recovery rate

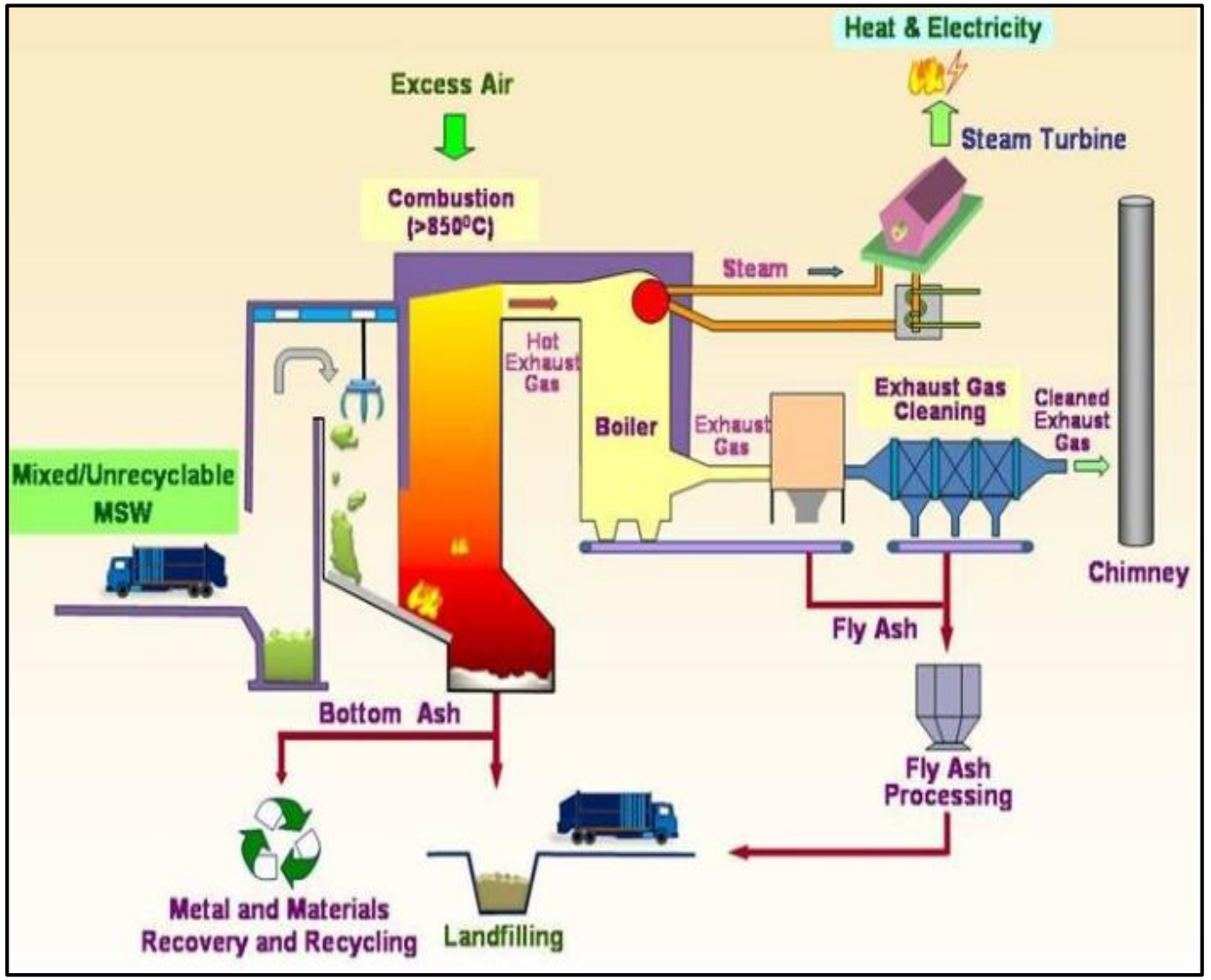
√ Minimize toxic materials in the incineration process and improve safety for local residents

√ Complex coordination with supplementary facilities for local residents to improve welfare

Situation for Informal Landfill in Iran (Source: UNIDO)

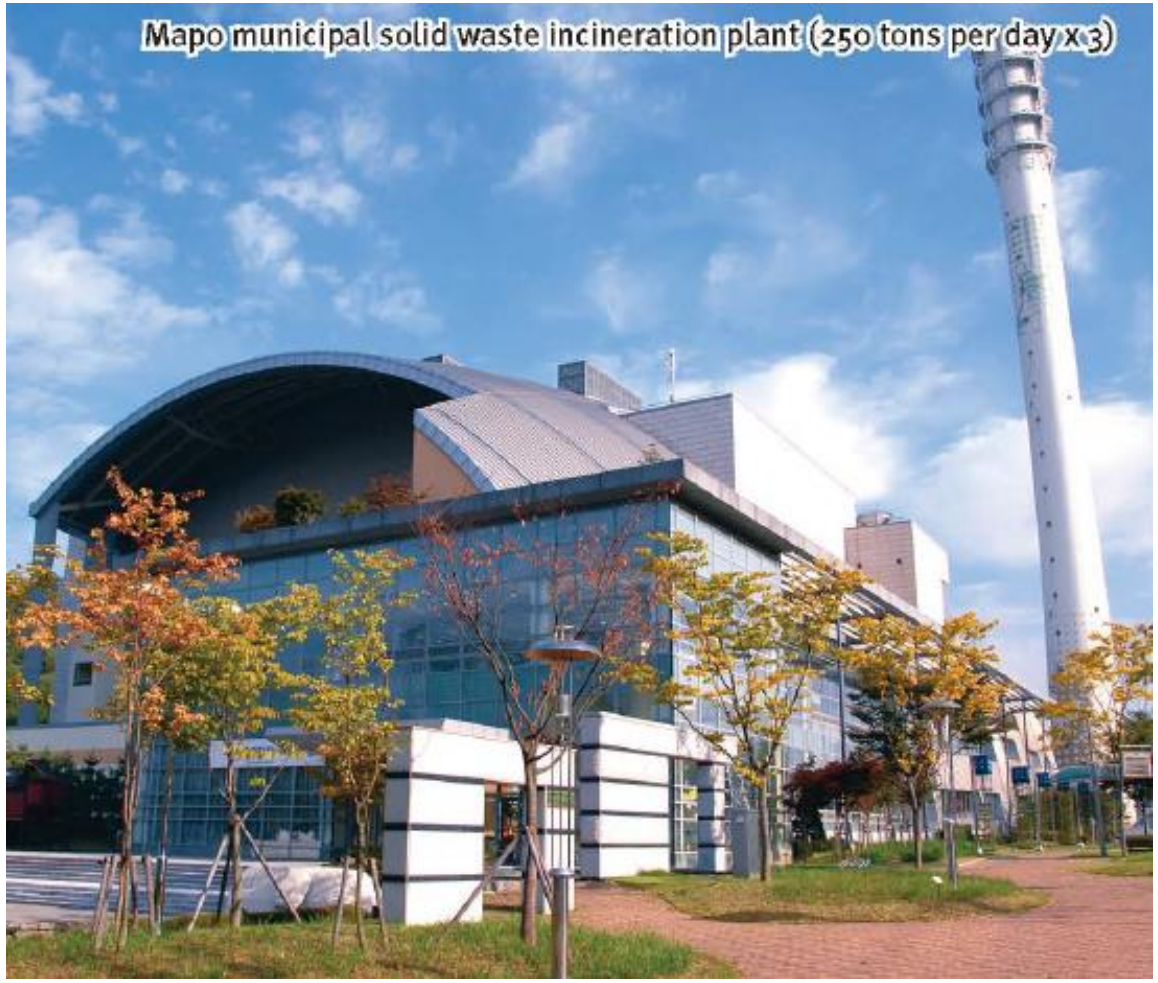
☞ Flow Diagram





☞ Application Cases

1. Mapo Resource Recovery Facility



Incineration Capacity: 250t/day x 3 sets

2. Ulsan Resource Recovery Facility

Incineration Capacity: 200t/day x 2 sets

NEW TECHNOLOGY TREND

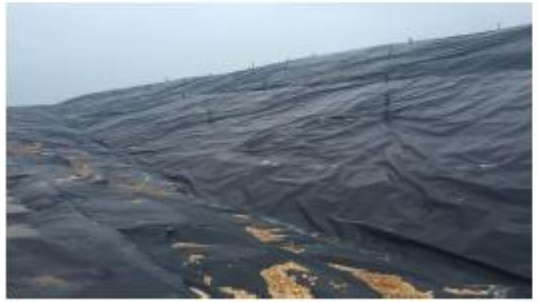
- **Landfill Gas (LFG) to Energy**

- Applying LFG collection facility & Reuse facility

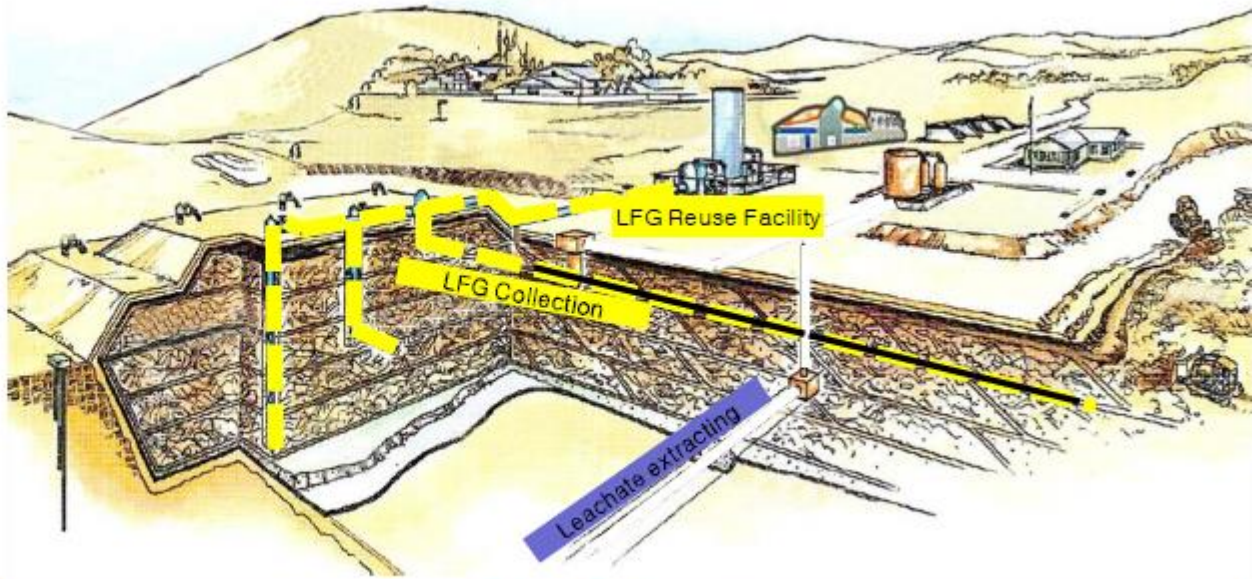
√ Installation of backup LFG collection facility (including blower) for an efficient operation of the facilities

√ Change of the existing collecting well ⇒ Improve efficiency and quality of LFG

√ Installation of LFG reuse facility: Electricity generation and Odor control due to enhanced LFG collection



AS - IS



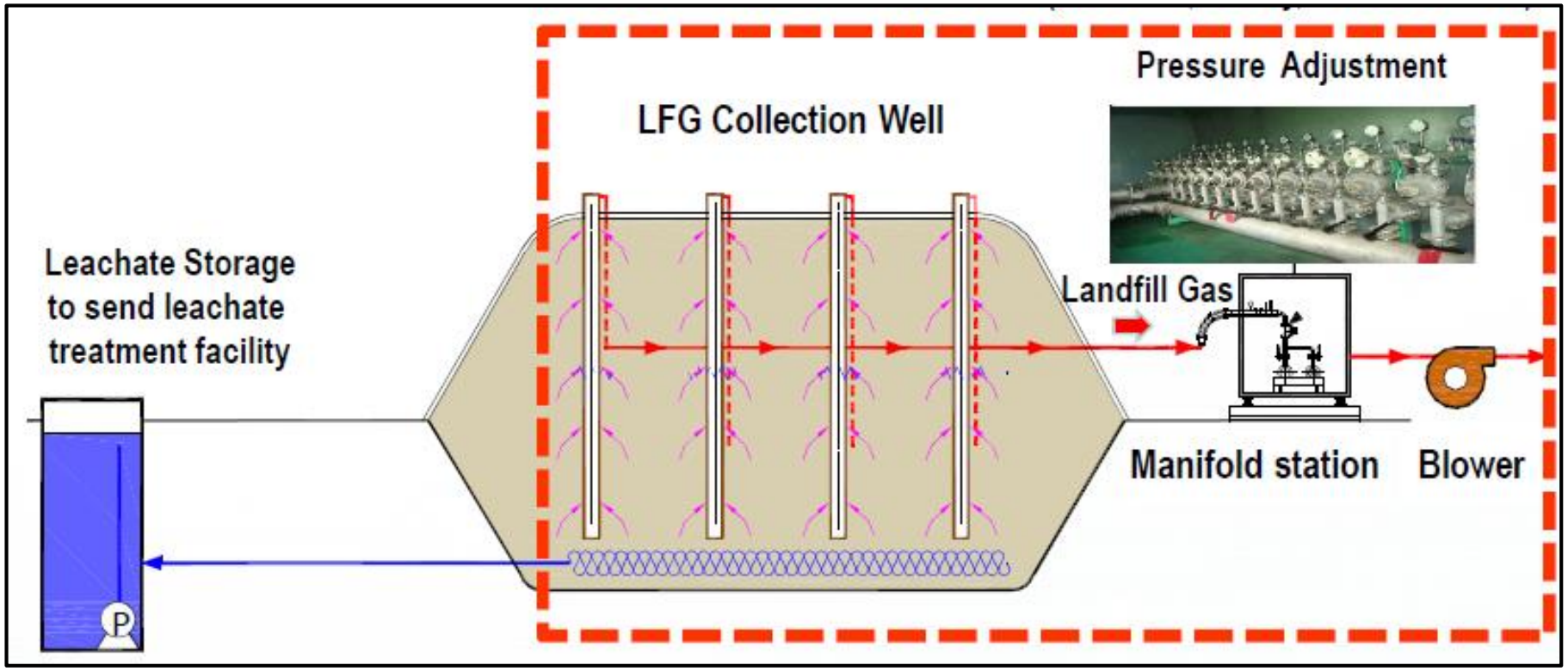
TO - BE (Suggest)

☞ Basic Concept

1. LFG Collection System (Flow Rate, Quality, Pressure Check)

√ Pressure control collection system: enhanced LFG collection

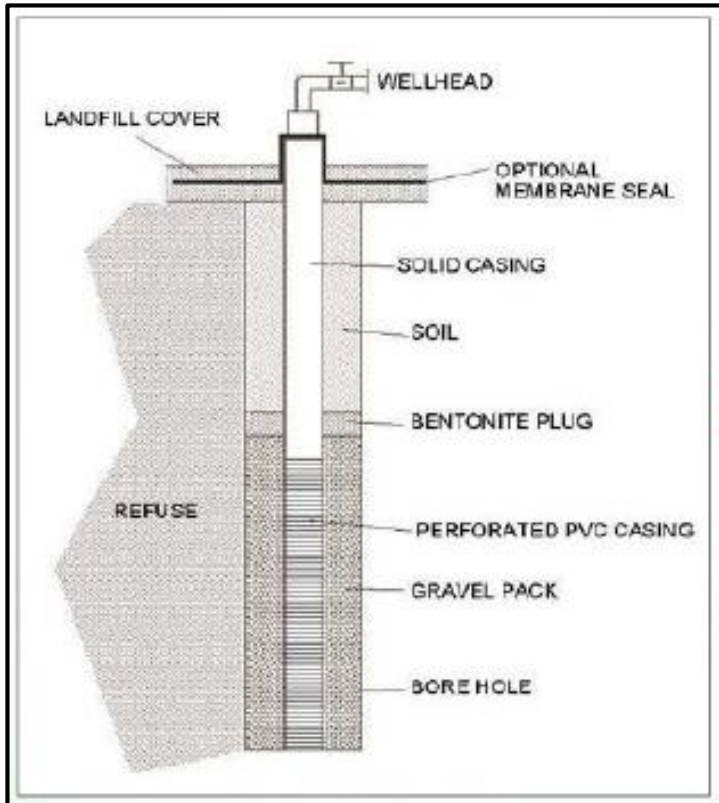
√ Changing LFG collection well: Odor Control (H_2S, Ammonia, etc.)



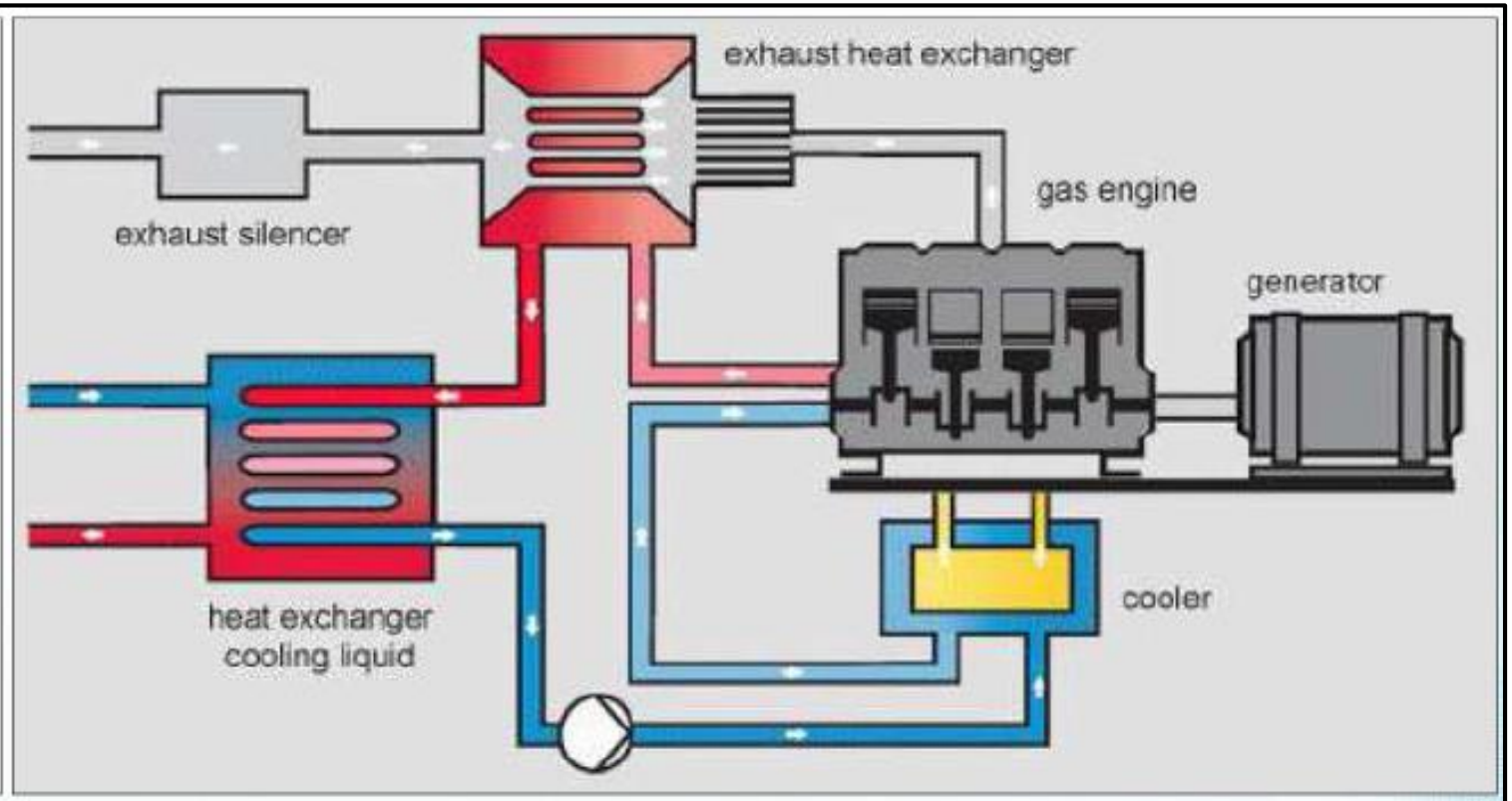
2. Reuse of LFG

√ LFG collection well: Vertical & Horizontal type ⇒ Optimization of the collection efficiency for LFG

√ Securing Renewable Energy Sources ⇒ Electricity



LFG collecting well



Cogeneration with gas engine diagram

Partnership

Expertise

and

Reliable Technology

for

Sustainable Energy

in Iran

All-together

Thank you

Contact : (Albert) Kang Sung Jong
albert.kang@hurem.co.kr
+82 (0)10 2030 6682