Carbon Neutrality with Water

December 7, 2022

Ogeuk Kwon

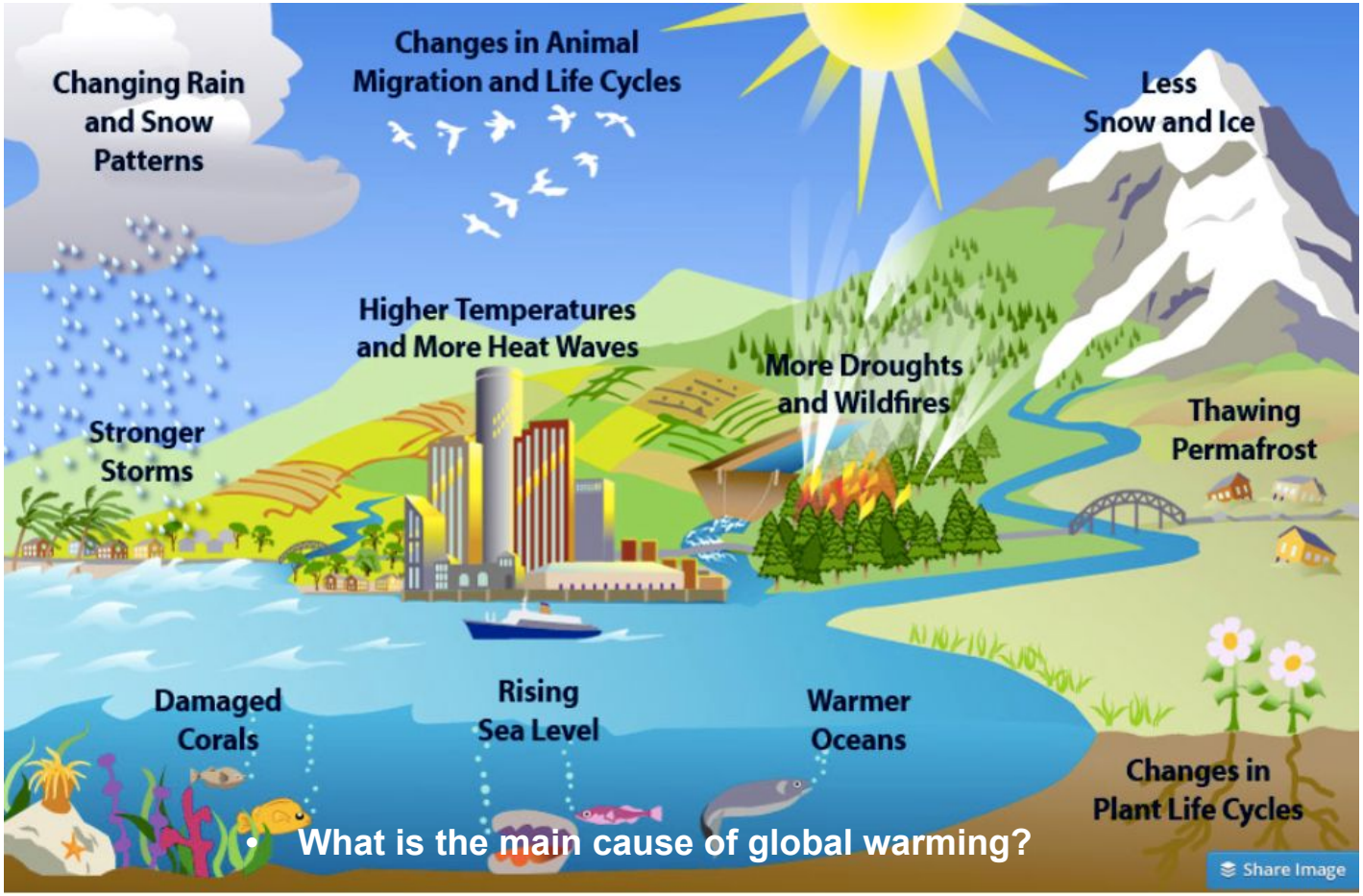
K water

Contents

Climate change

1. Climate change & Global warming

The century-scale average temperature of the Earth

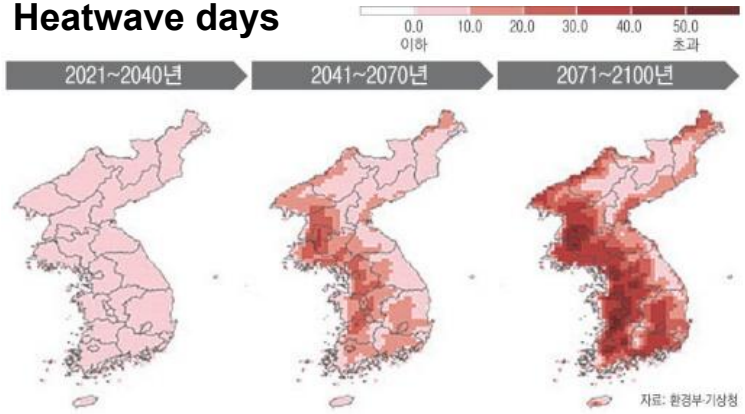


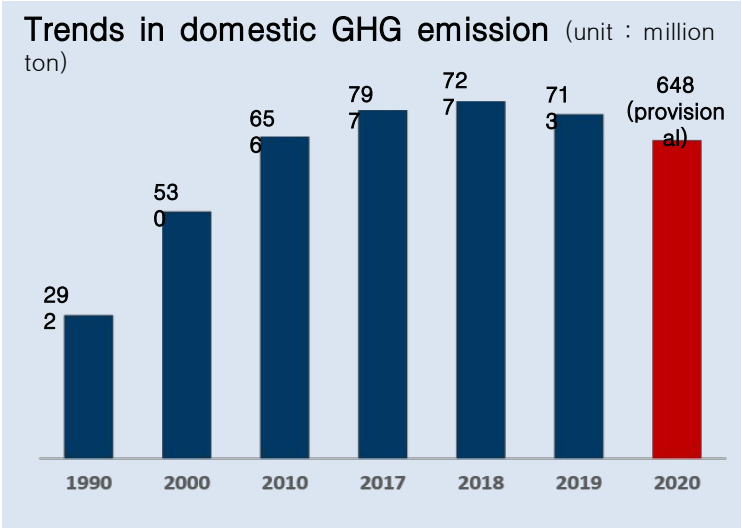
https://www.joboneforhumanity.org/

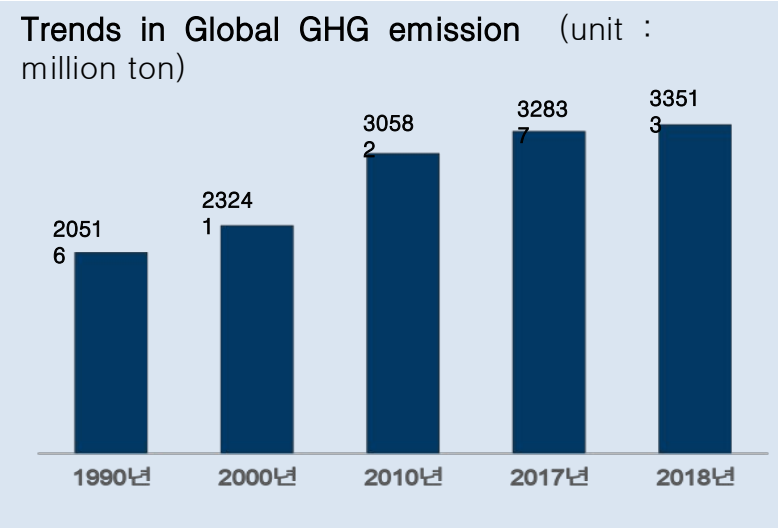
1. Climate change & Global warming

Climate change

Global warming worse due to the use of fossil fuels
International community aware of the seriousness of climate change







2. Paris Agreement

Kyoto protocol

Only put the obligations to reduce GHG emissions on developed countries

Paris agreement

Features

- All parties(developed and developing countries)
- Determine their own NDCs (Nationally Determined Contributions)
- Renew an NDC every five years
- Report the national greenhouse gas inventory and information on mitigation policies and support

IPCC 1.5℃

IPCC(The Intergovernmental Panel on Climate Change) Special Report on Global Warming of 1.5°C

- Limit the increase to 1.5°C above pre-industrial levels.
- Emissions decline by 45% from 2010 levels by 2030
- Reaching net zero around 2050

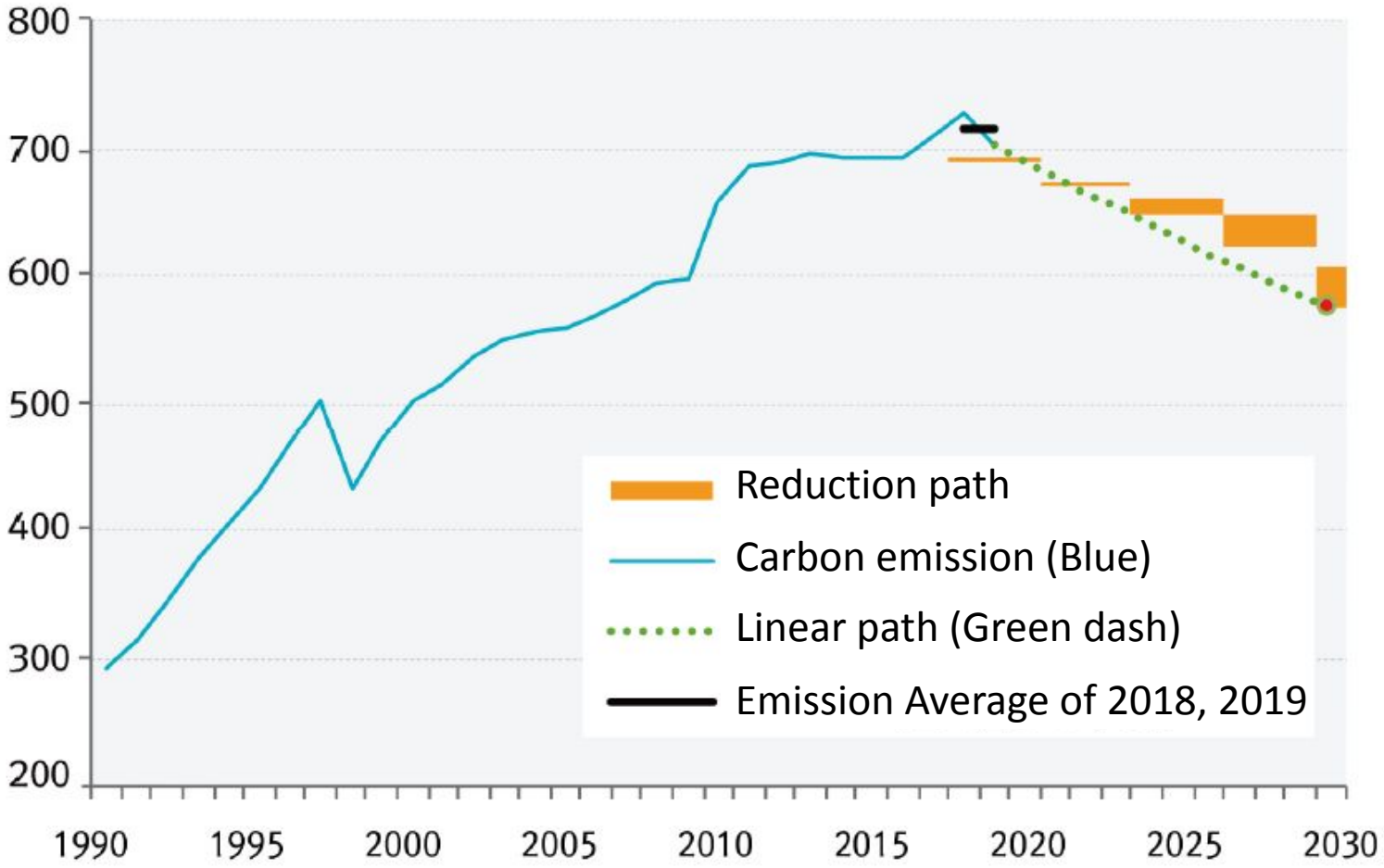
Global Response

Time for Action

- The youth “school strikes for climate” to demand action from political leaders
- Come together to take climate action
- Civil society, academia call for urgent action.

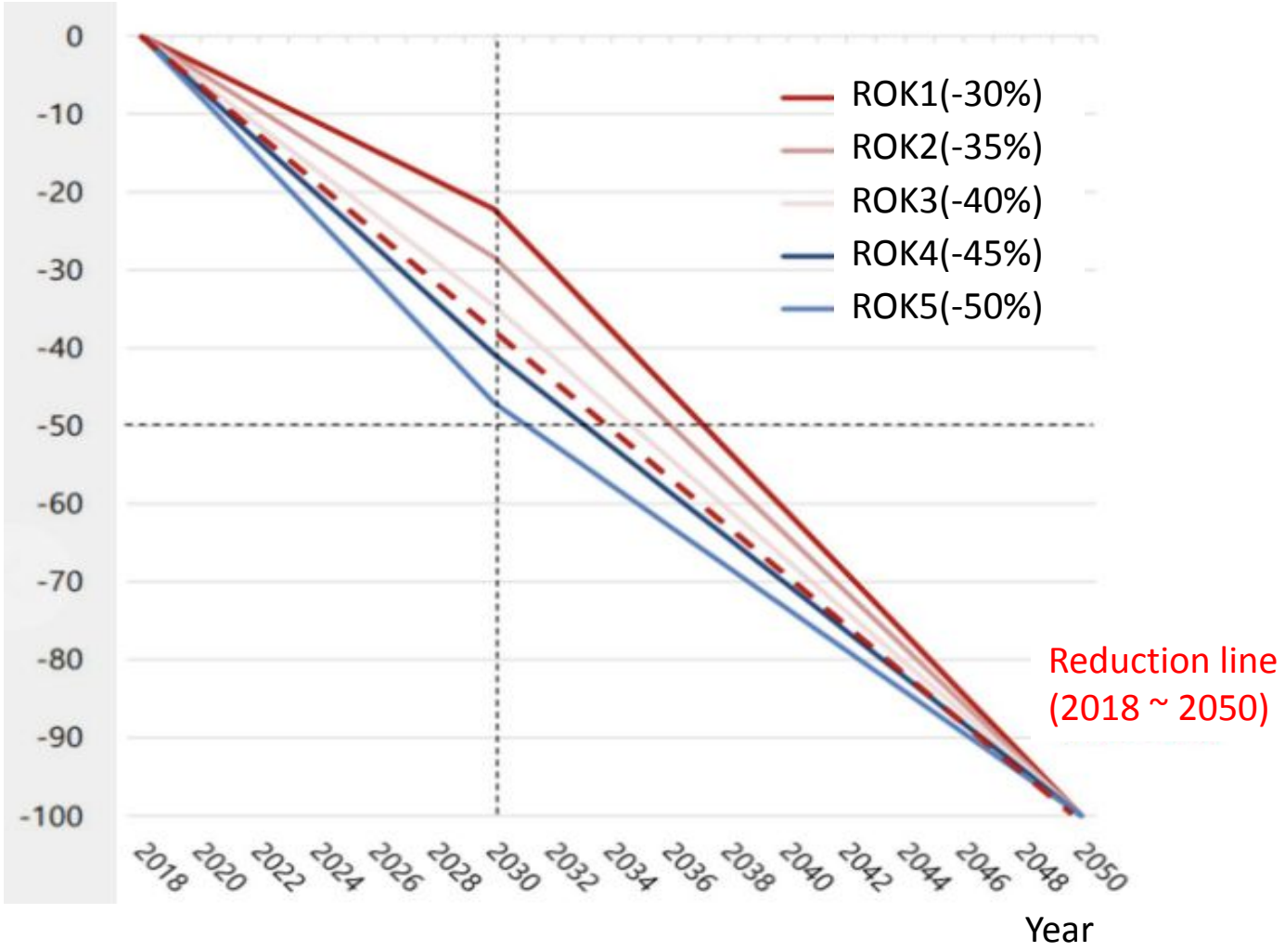
3. The Plan of Republic of Korea

Reduction path of national carbon emission



3. The Plan of Republic of Korea

The reduction scenarios of carbon emission



4. Key elements for Carbon Neutrality

Five key elements

Clean power & Hydrogen

renewable energy(solar, wind, hydro) should be the central sources of energy supply

Energy efficiency

the most eco-friendly and economical energy resource

Commercial deployment of carbon removal

commercially deploy future technologies,

Scaling up the circular economy

Lifecyle approach is the key to ensuring product recyclability which minimizes the resource and energy inputs.

Enhancing carbon sinks

strong carbon sinks(Land, forests, and marine ecosystems) that absorb and store CO2

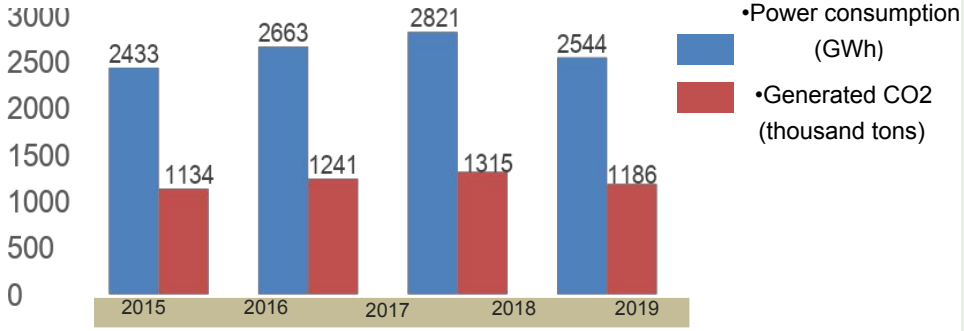
Carbon Neutrality with water

1. Waterworks

Status of GHG Emissions from Waterworks Facilities(Last 5 Years)

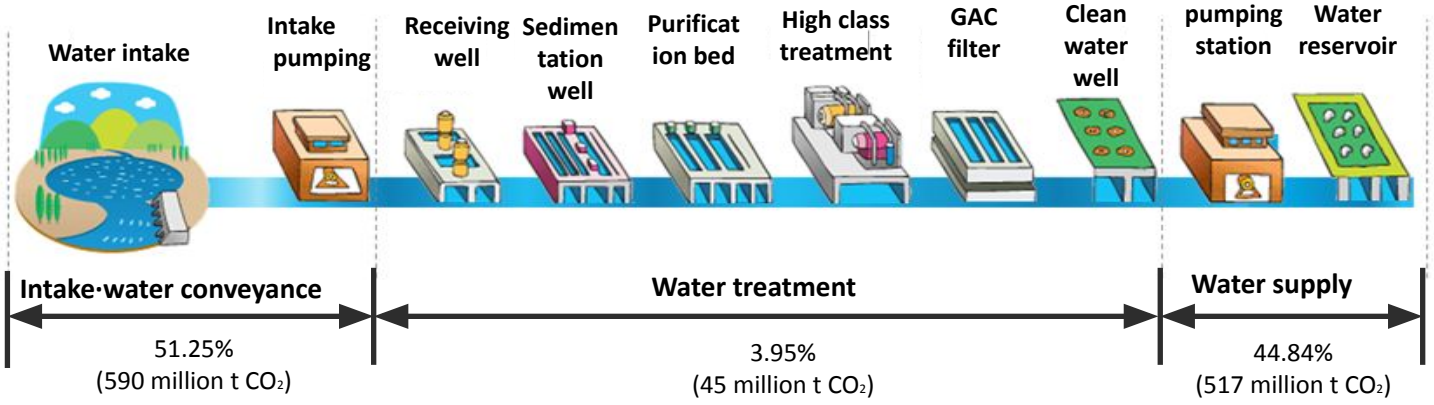
Years	Power consumption (GWh)	Generated CO_2 (thousand tons)
2015	2,433	1,134
2016	2,663	1,241
2017	2,821	1,315
2018	2,544	1,186
2019	2,475	1,153

•Annual power consumption and CO2 generation(Table)



•Annual power consumption and CO2 generation(Graph)

GHG emission schematic diagram of waterworks



- **Around 96% of GHG emission is from intake and supply pumping (transporting facility)**

GAC : Granular activated carbon

1. Waterworks

Carbon Neutral Status of K-water

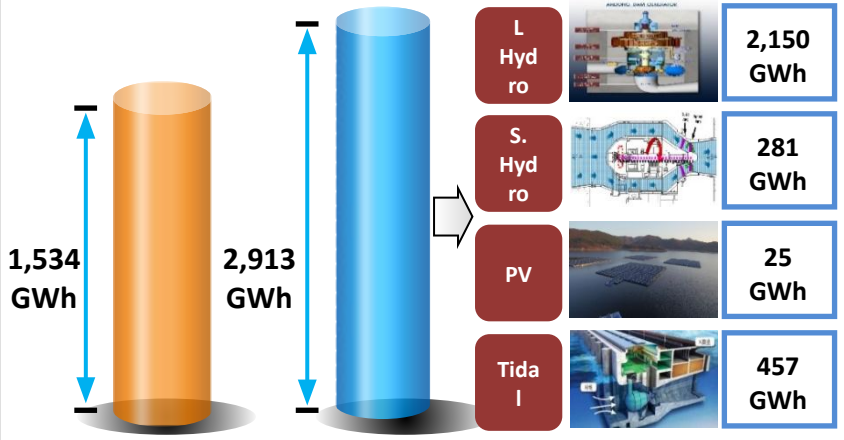
K-water Energy usage

(Consumption) 1,534GWh/year (730 Million CO2 emission)
(Production) 2,913GWh /year (1,338Million CO2 reduction)

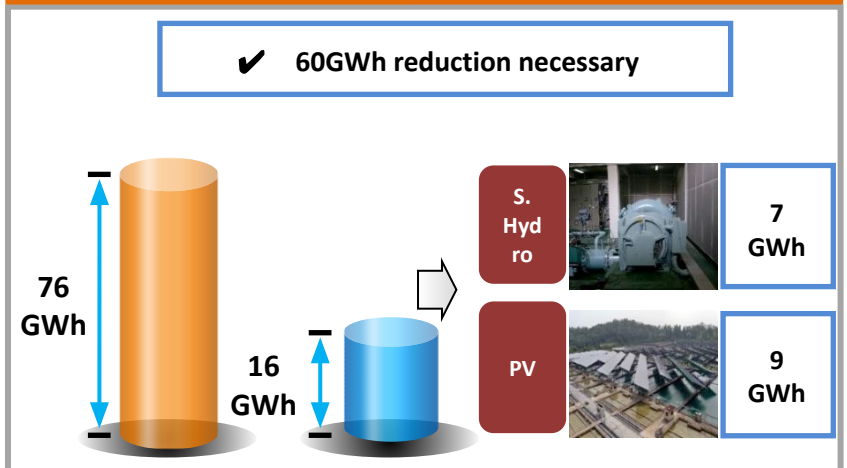
Purification Plants

(Consumption) 76GWhGWh/year (35 Million CO2 emission)
(Production) 16GWh/year (7Million CO2 reduction)

Production 1.8 times bigger than consumption(K-water)



Production only21% of consumption (wide area purification plants)

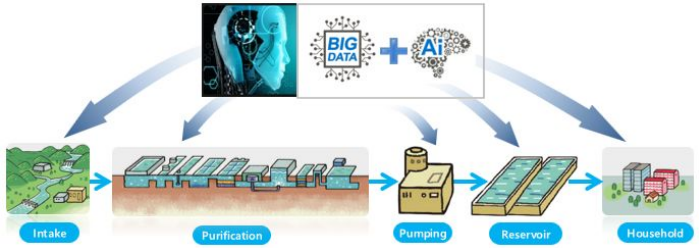


1. Waterworks

AI Purification plant

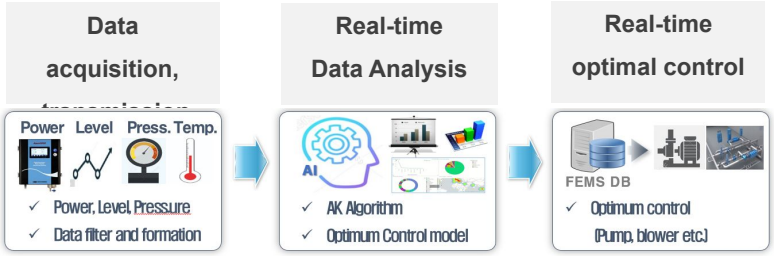
① AI Autonomous Operating System

- Purification process automation based on big-data and artificial intelligence



② Energy Management System (EMS)

- Energy management system with monitoring, analysis, and control through AI



③ Adoption of high-efficiency facilities

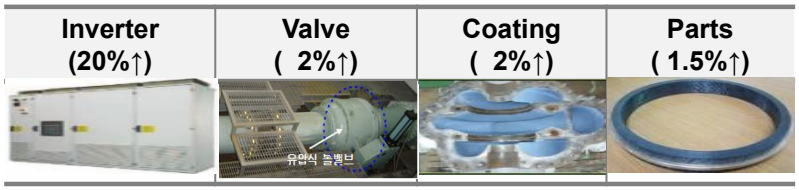
- Adopting high-efficiency facilities
- (Main facilities) Motors, Transformers, LED, Inverter, Water treatment facilities

④ Improvement of pipeline facilities(pump)

- Improvement of Pump efficiency
- (inverter) Pump optimal operation for variable load with speed control

* (Valve) Combined non-return butterfly valve

* (etc.) Pump coating, parts improvement



1. Waterworks

Hwa-seong A.I Water Treatment Plant

Hwa-seong pilot project

Step 1 — Data Collection & Analysis
- 3 year data collection
- Operator Interview
- Main Factors Selection

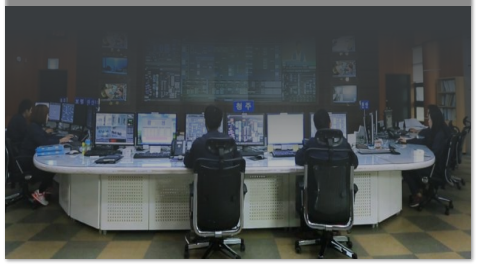
Step 2 — A.I. Algorithm Development
- Facility Automation
- Machine Learning
- Deep Learning

Step 3 — A.I. Model Simulation
- 8 treatment Process A.I. Model Simulation

Step 4 — Trial Operation
- A.I Modifying
- A.I Optimization
- Realtime Operation

As-is

Operator
- Human Decision making
  - Experience, Expectation



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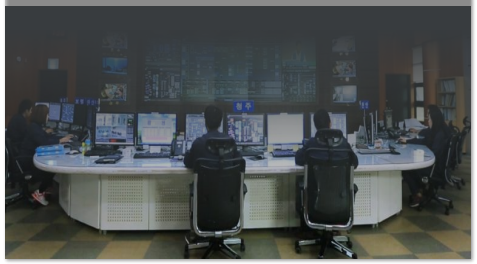
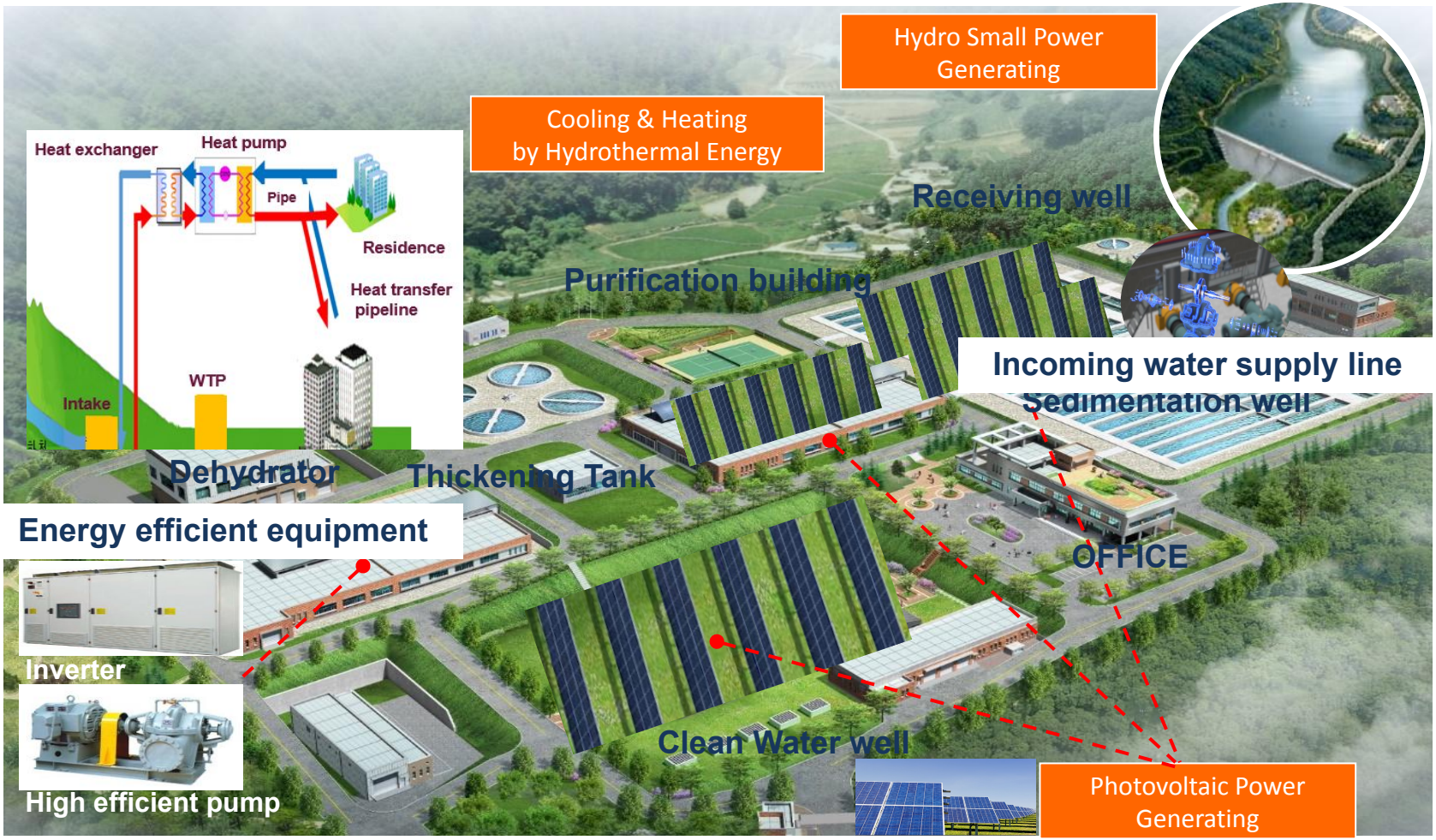


2. Water Purification Plant

Carbon neutrality of water purification plants

Adopting Renewable Energy

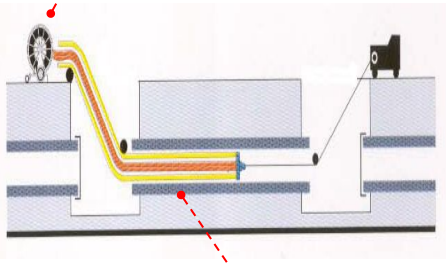


2. Water Purification Plant

Purified water is sent to distribution reservoi

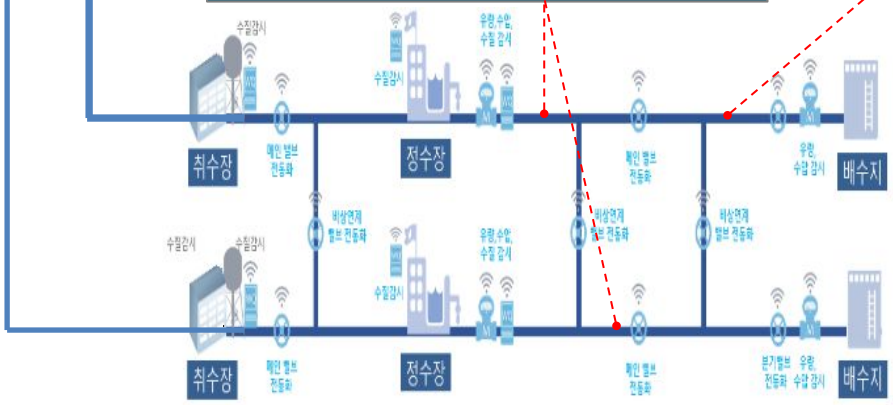
the lining method for rejuvenating the conduit

① Pipe Rejuvenating



Aged Pipe line based on the conditions

② Pipe Dualization

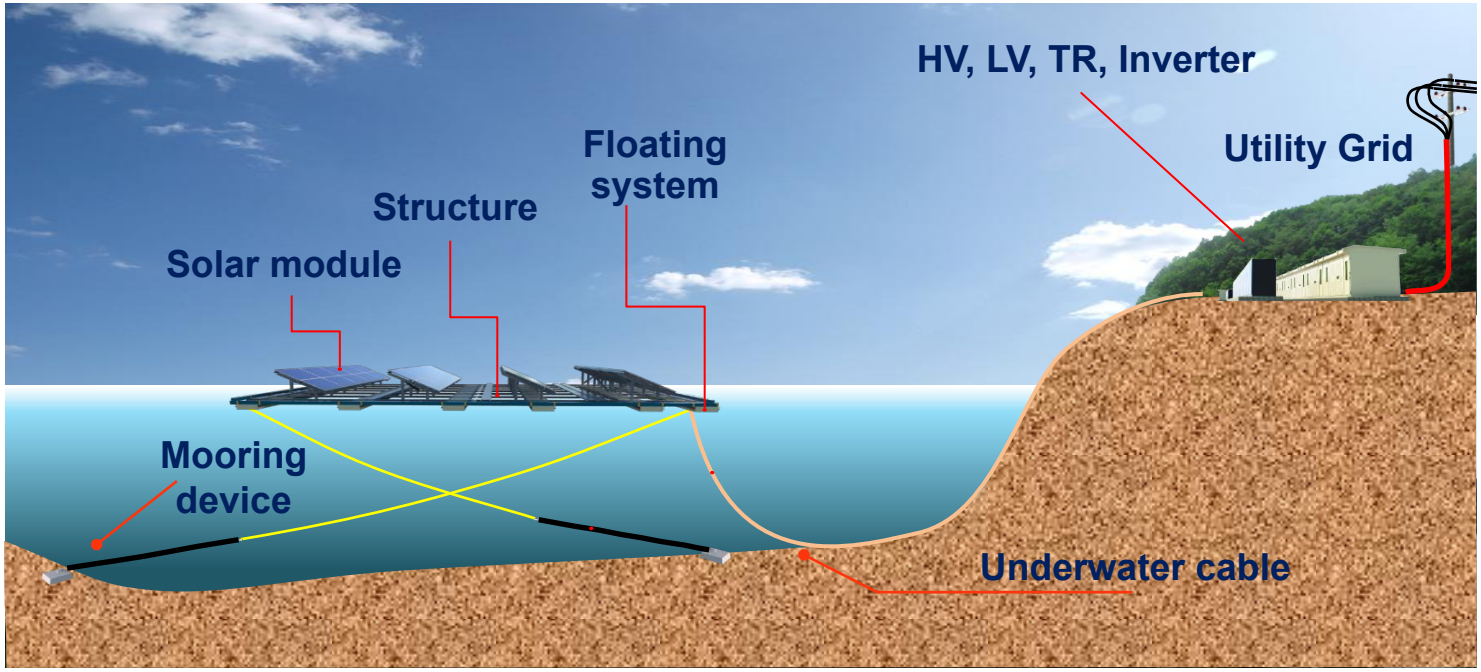


secure the water supply and reduce water friction losses

3. Floating PV

Cope with global climate change

Floating PV System Concept (Dam surface, first time in the world)



Core Technology

- **Suitable** PV module for water environment
- **Mooring device** to adapt the change of water levels
- **Stable floating** system
- Underwater cable **connection** to local power grid

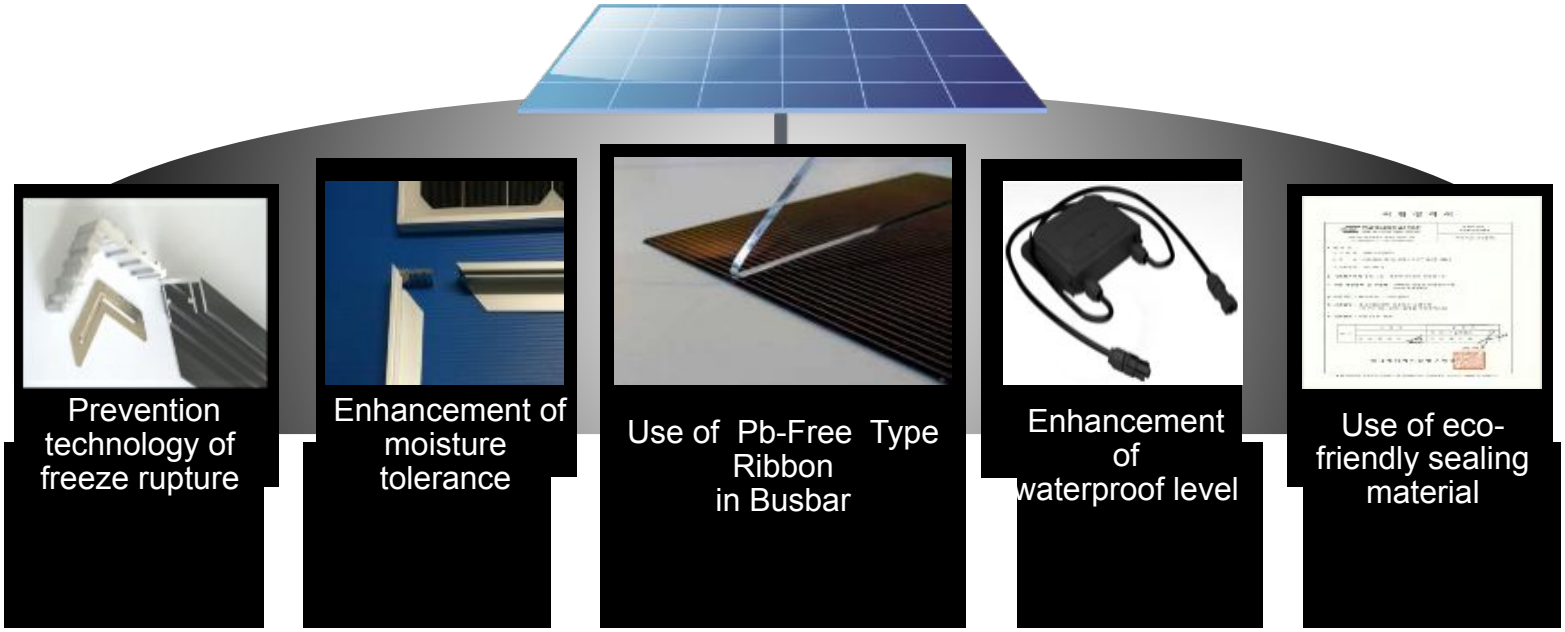
3. Floating PV

Floating PV(Photovoltaics)

3. Floating PV

Floating PV(Photovoltaics)

✔ **Eco-friendly Customized PV Module** (No lead(Pb), non-acidized encapsulant(POE), improved water-proof rating)



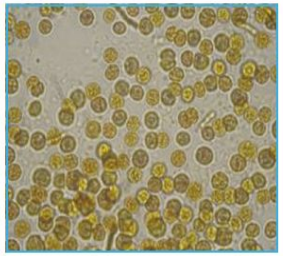
Type	Lead(Pb)	Encapsulant	Waterproof
Existing	Small amount of lead content	EVA	IP64
Floating	Elimination of lead	POE (non-acidized)	IP67 and over

3. Floating PV

Conducting Environmental Monitoring (Since 2011)

✔ Monitoring items


Water quality


Plankton


Benthic Organism


Sediment


Birds


Fish

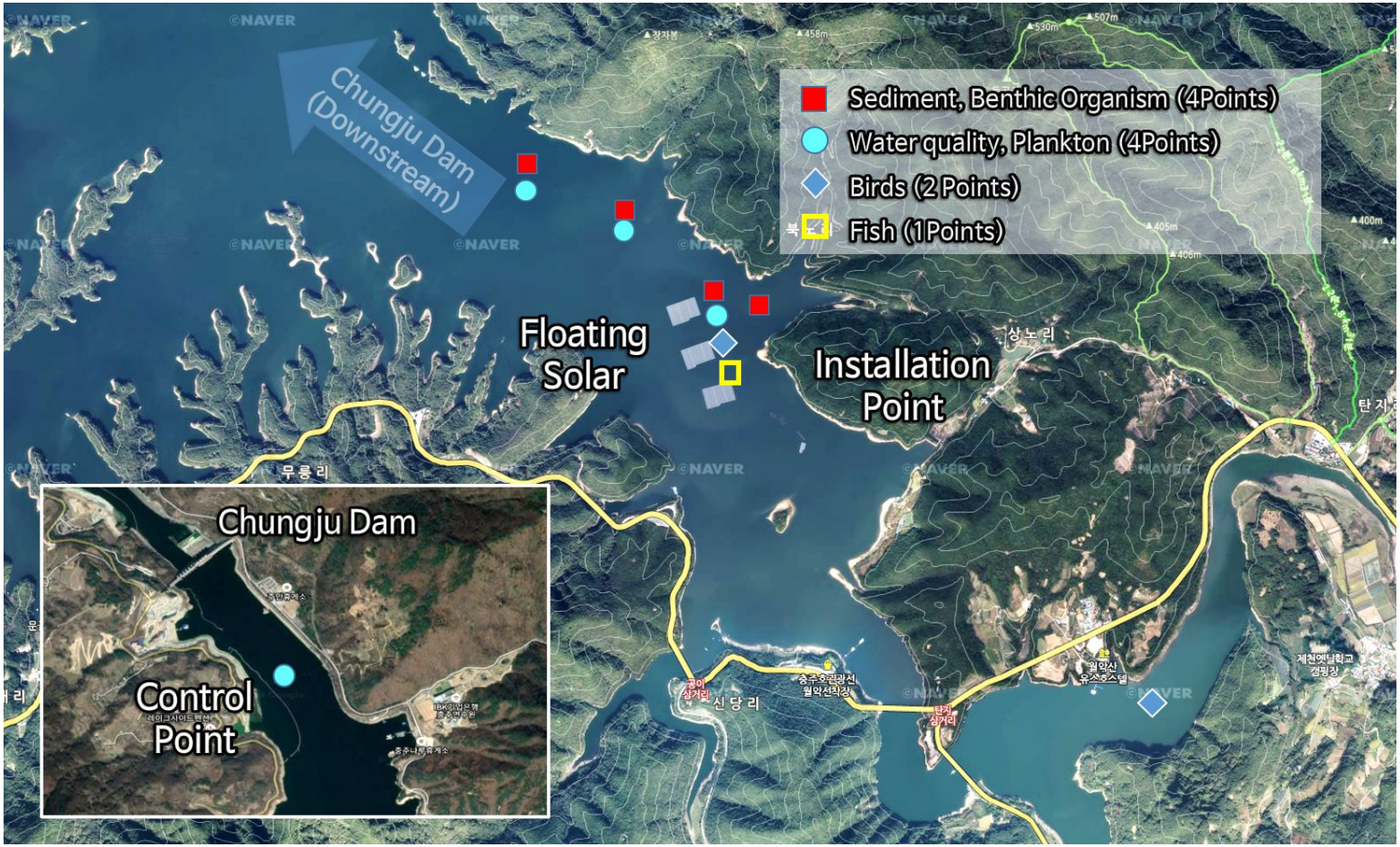
✔ Monitoring cycle & points

Location	Period	Cycle	Investigation points	Item
Hapcheon	’11~	Every month(water quality), Quarter (ecosystem)	2~4 points (Installation and Control points)	Water quality (34 items), Sediment (11 items), Aquatic ecology (fish, birds)
Boryeong	’16~	Every month(water quality), Quarter (ecosystem)		
Chung-ju	’17~	Every half term		

* Monitoring Cycle, points and period were determined by results of EIA consultation

3. Floating PV

Chungju Dam FPV



* Monitoring points were determined by results of EIA consultation
* Control Point : Existing Water quality Observation Site (before FPV installation)

3. Floating PV

Monitoring & Safety Results

✔ Environmental monitoring & safety evaluation

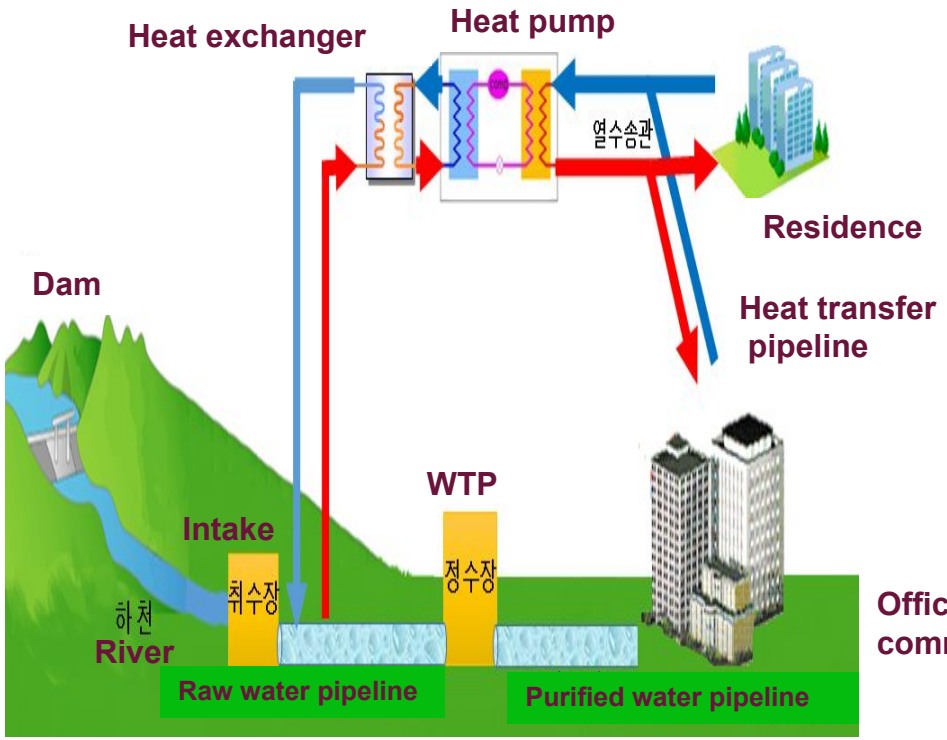
- Confirmed that there is no impact on water quality and ecosystem caused by facilities

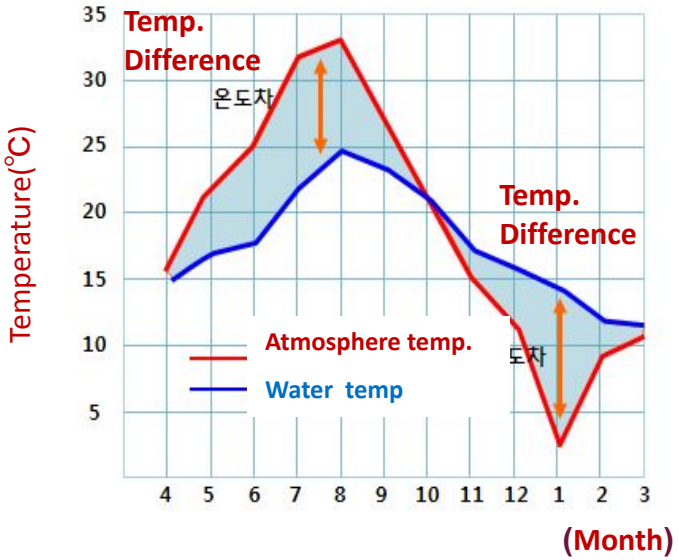
Water Quality	- **Not detected any pollutants** related with "Human health protection standards" in all category - No difference in water quality grade before and after of installation
Sediment (heavy metals)	- Detected but below the baselines ⇒ No harmful effects for benthic organism
Plankton	- **No difference in species & population** by installation (Except for seasonal issues)
Fish	- **Increasing species** & population of juvenile fish under the floating system
Birds	- No facility damage - Increasing species & population compared to the previous research data

4. Hydrothermal Energy

Hydro thermal (use the different temperature)

Hydrothermal Energy Concept



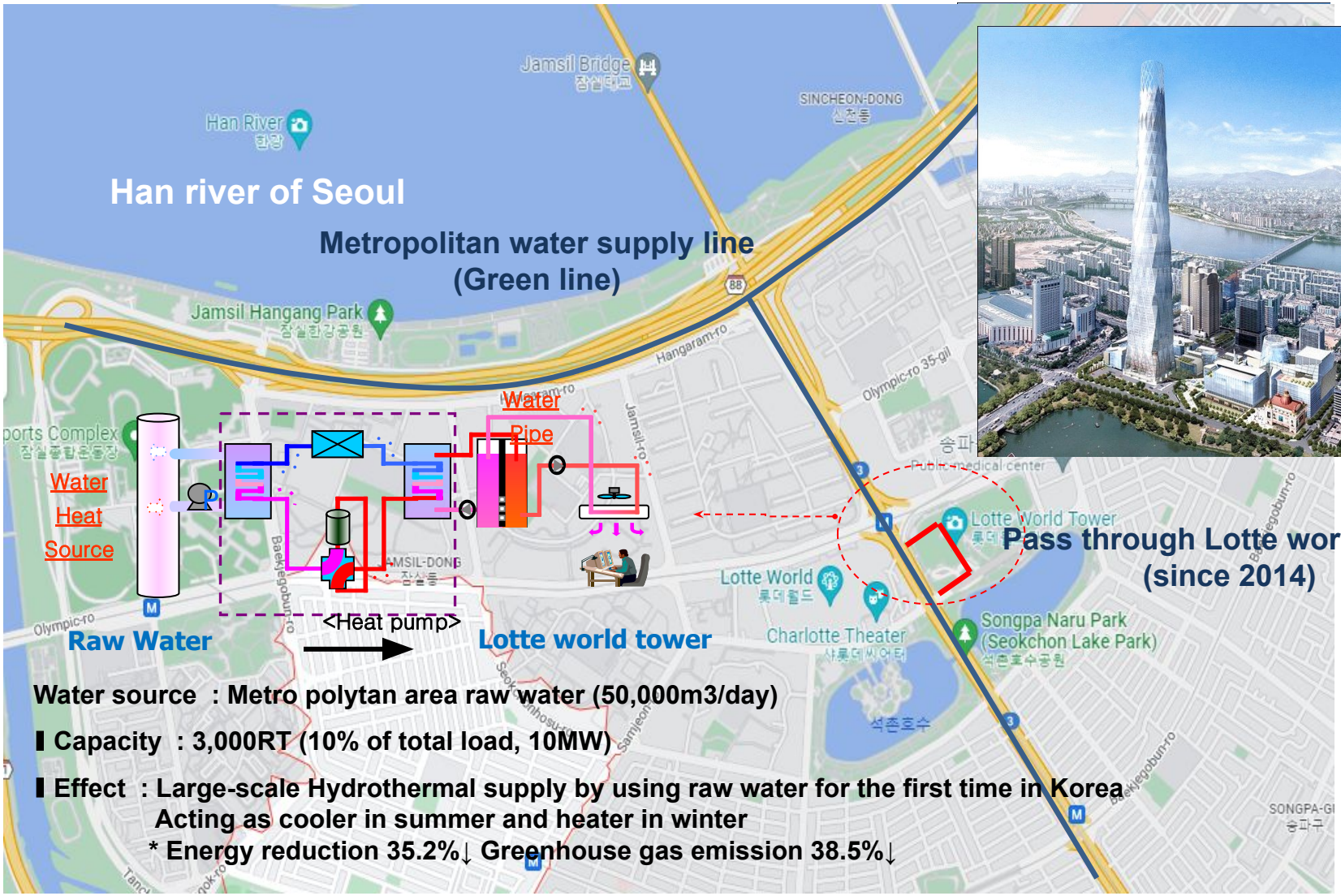


Office,
commercial building, etc.…

Raw water can be utilized from water source to purification plants or purification plants to distribution reservoirs

4. Hydrothermal Energy

Hydrothermal(Metropolitan water supply line)



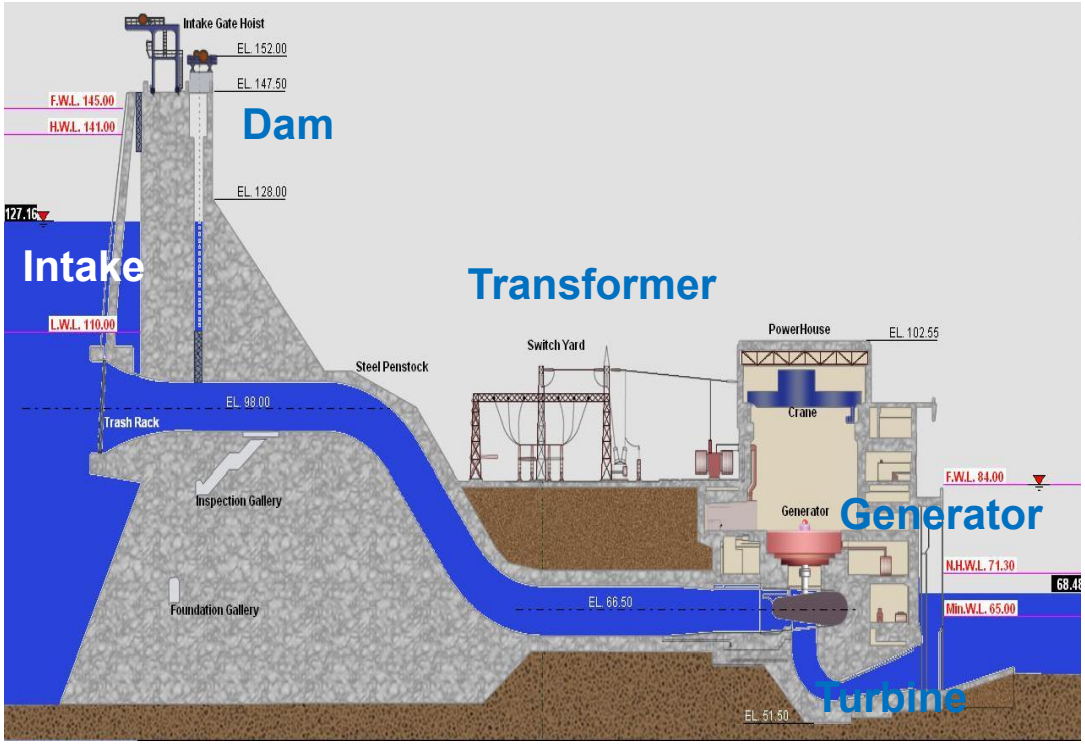
Water source : Metro polytan area raw water (50,000m3/day)

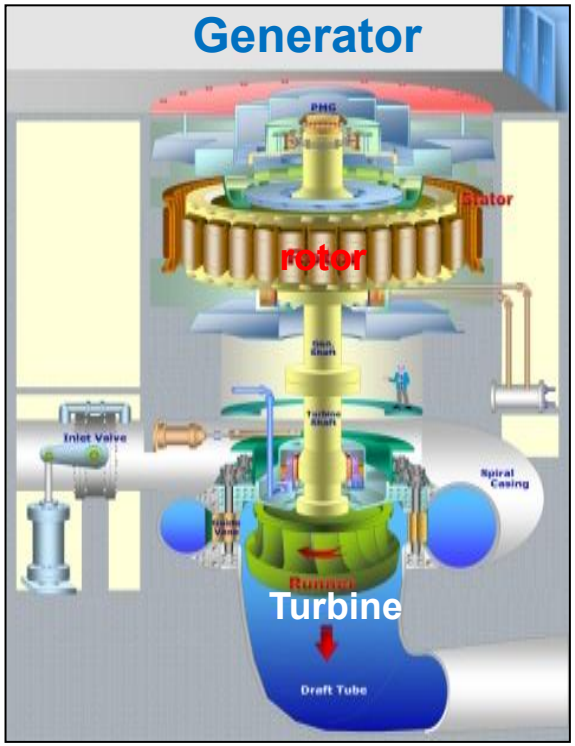
▌Capacity : 3,000RT (10% of total load, 10MW)

▌Effect : Large-scale Hydrothermal supply by using raw water for the first time in Korea
Acting as cooler in summer and heater in winter
* Energy reduction 35.2%↓ Greenhouse gas emission 38.5%↓

5. Hydro Power

Hydropower





Put into hydro turbine into water pipe line

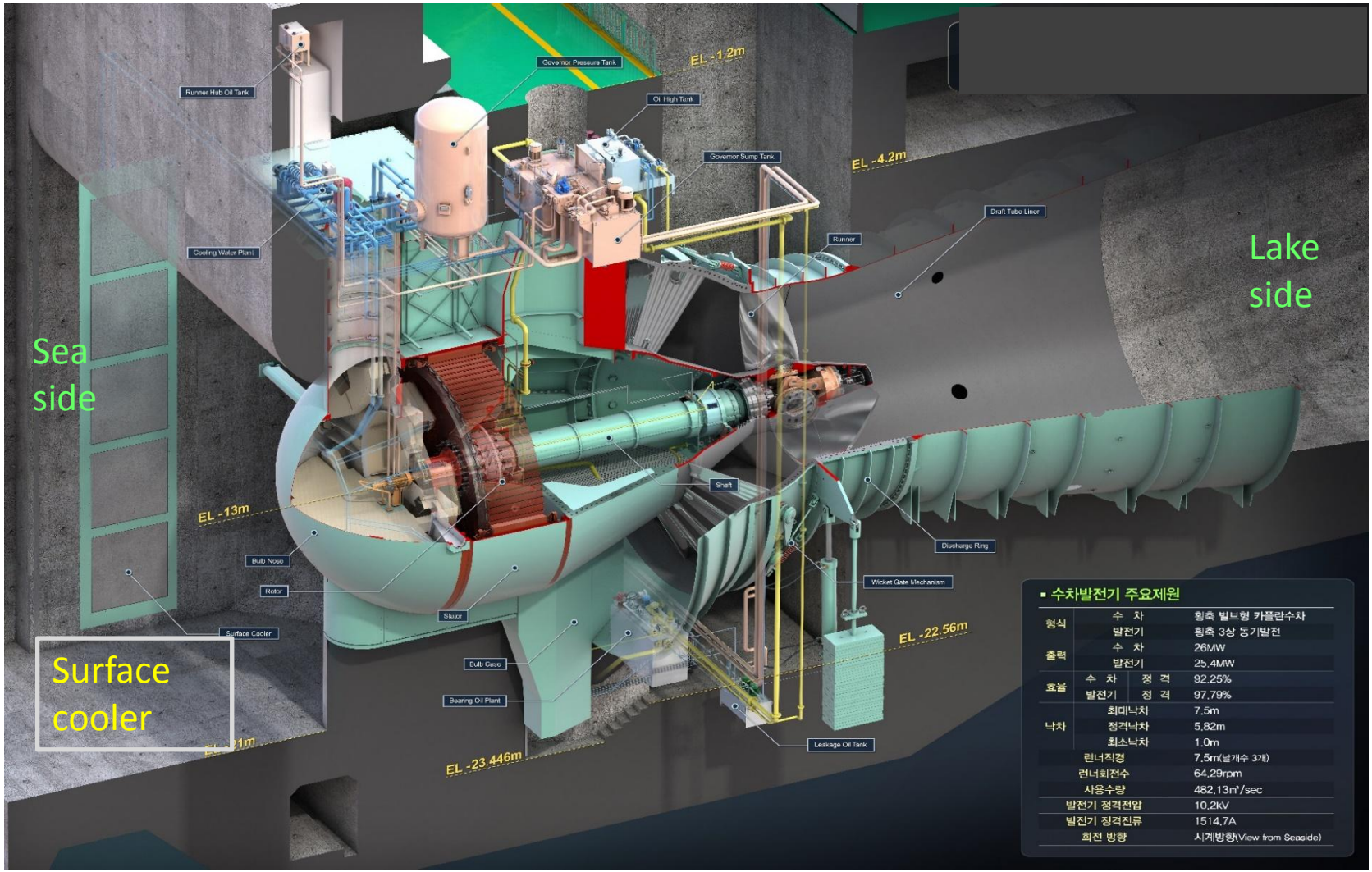
6. Tidal Power

Sihwa Tidal Power Plant

- Location : Sihwa tide embankment, Ansan city
- Facilities : 254MW (with 10 turbine-genreators) , 8 Roller gates (15.3m×12m)
- Annual Generation : 552.7GWh
- Generation type : Rising tide (one way, single tide cycle)
- Project Cost : $572 million (Period : ’03 ~ ’18)

6. Tidal Power

Sihwa Tidal Power Plant



▪ 수차발전기 주요제원

형식	수 차		횡축 벌브형 카플란수차
	발전기		횡축 3상 동기발전
출력	수 차		26MW
	발전기		25.4MW
효율	수 차	정 격	92.25%
	발전기	정 격	97.79%
낙차	최대낙차		7.5m
	정격낙차		5.82m
	최소낙차		1.0m
런너직경			7.5m(날개수 3개)
런너회전수			64.29rpm
사용수량			482.13㎥/sec
발전기 정격전압			10.2kV
발전기 정격전류			1514.7A
회전 방향			시계방향(View from Seaside)

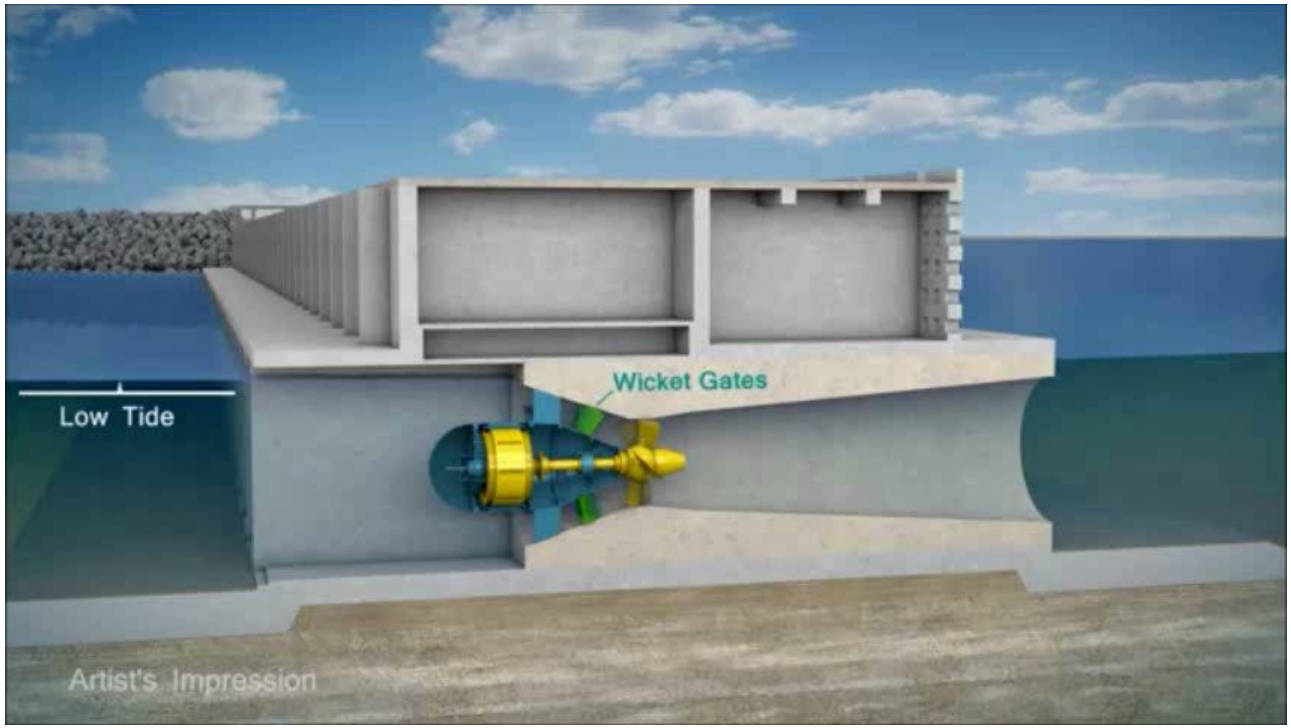
6. Tidal Power

Generation type

Single Tide-Cycle
(flood tide)

Double Cycle

Single Ebb-Cycle
(Ebb tide)

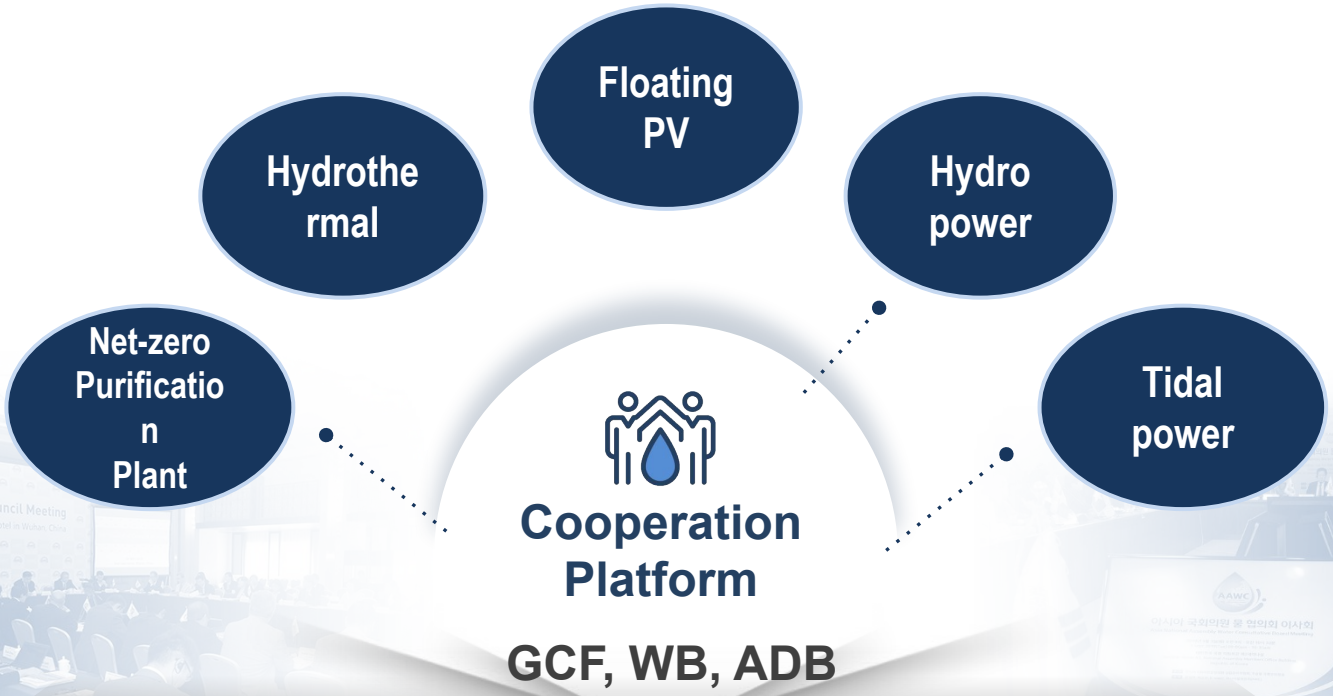


Plan for future works

1. Future works

As a reliable partner

K-water reducing carbon emission in water related areas



K-water strengthen its role on Carbon Neutrality

- Explore opportunities for cooperation and collaboration

Thank You

K water

Drone cam on Hapcheon FPV

Thank You for your attention