Lake Sihwa Restoration Project

Water and Green Growth Case Study

2015. 5. 28.

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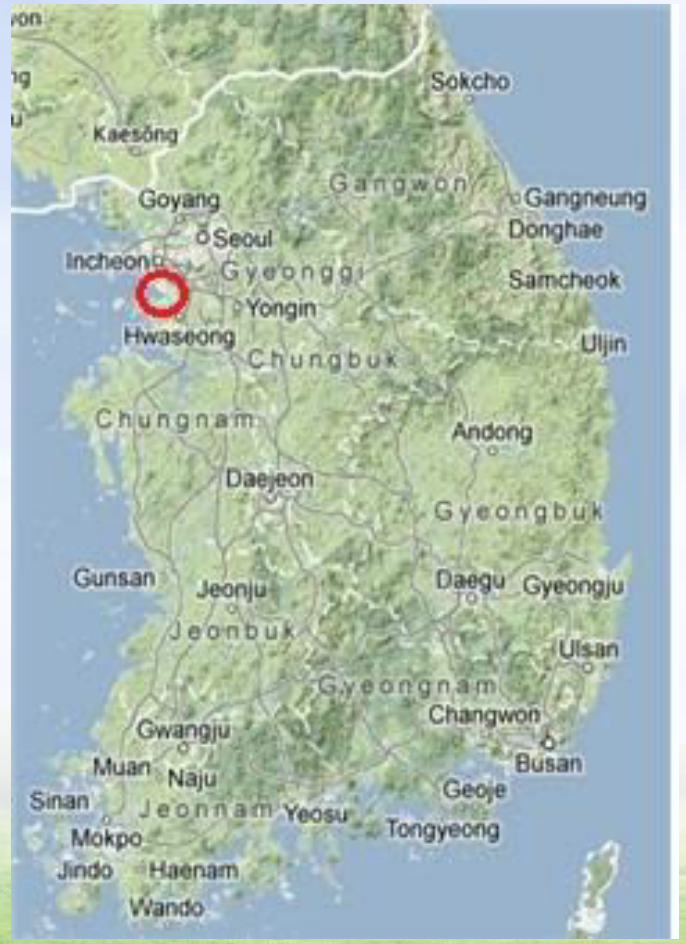
About Lake Sihwa

- A man-made lake
- The world's largest Tidal Power Plant



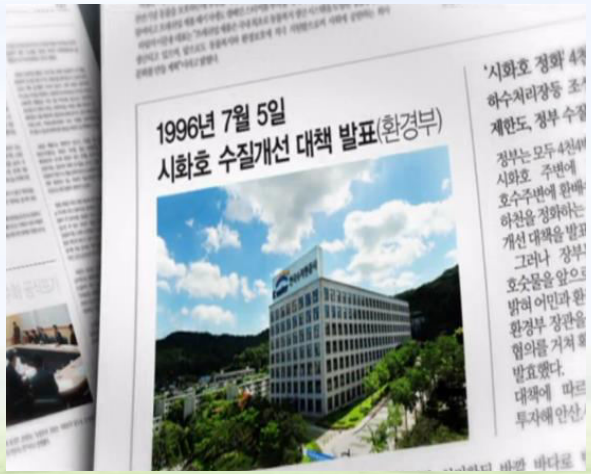
Background and Challenges

Development
Reclaim the Sihwa district

Water pollution
Untreated wastewater discharge

Societal issue

President ordered to restore the water quality



Overview of Lake Sihwa Project

('75-'96) Development policy resulted in lake water quality degradation

('96-'12) The efforts of government and various stakeholders led to GG

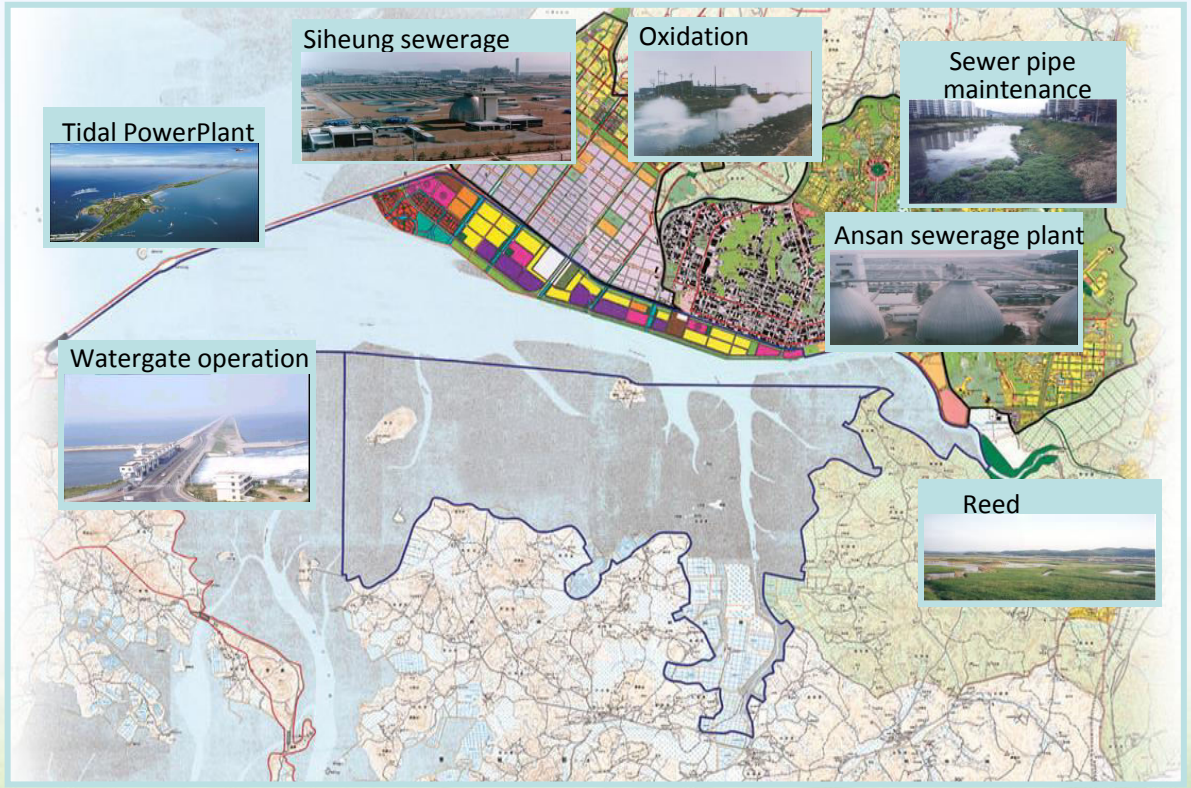
Project overview

- **Project duration: 1975 - 2012**
  (Phase 1: 1975-1996.4)
  (Phase 2-1: 1996.5-2003.12)
  (Phase 2-2: 2004.1-2012)

- **Investment : USD 805.4 mil.**

- **COD : 17.4ppm(1997) → 3.1ppm(2012)**

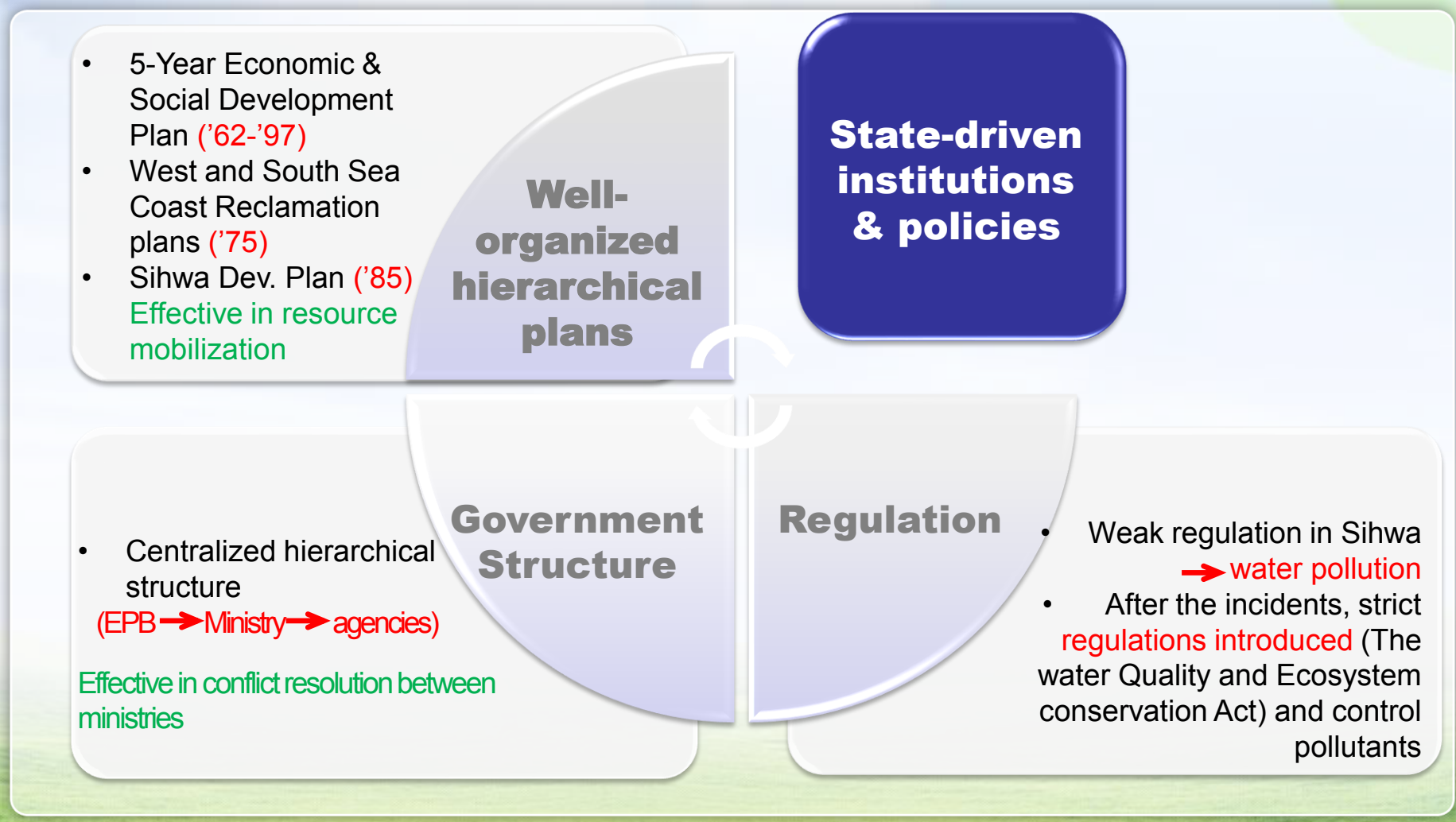
- **Output(bill. USD) : 17.2(1994) → 101.2(2011)**



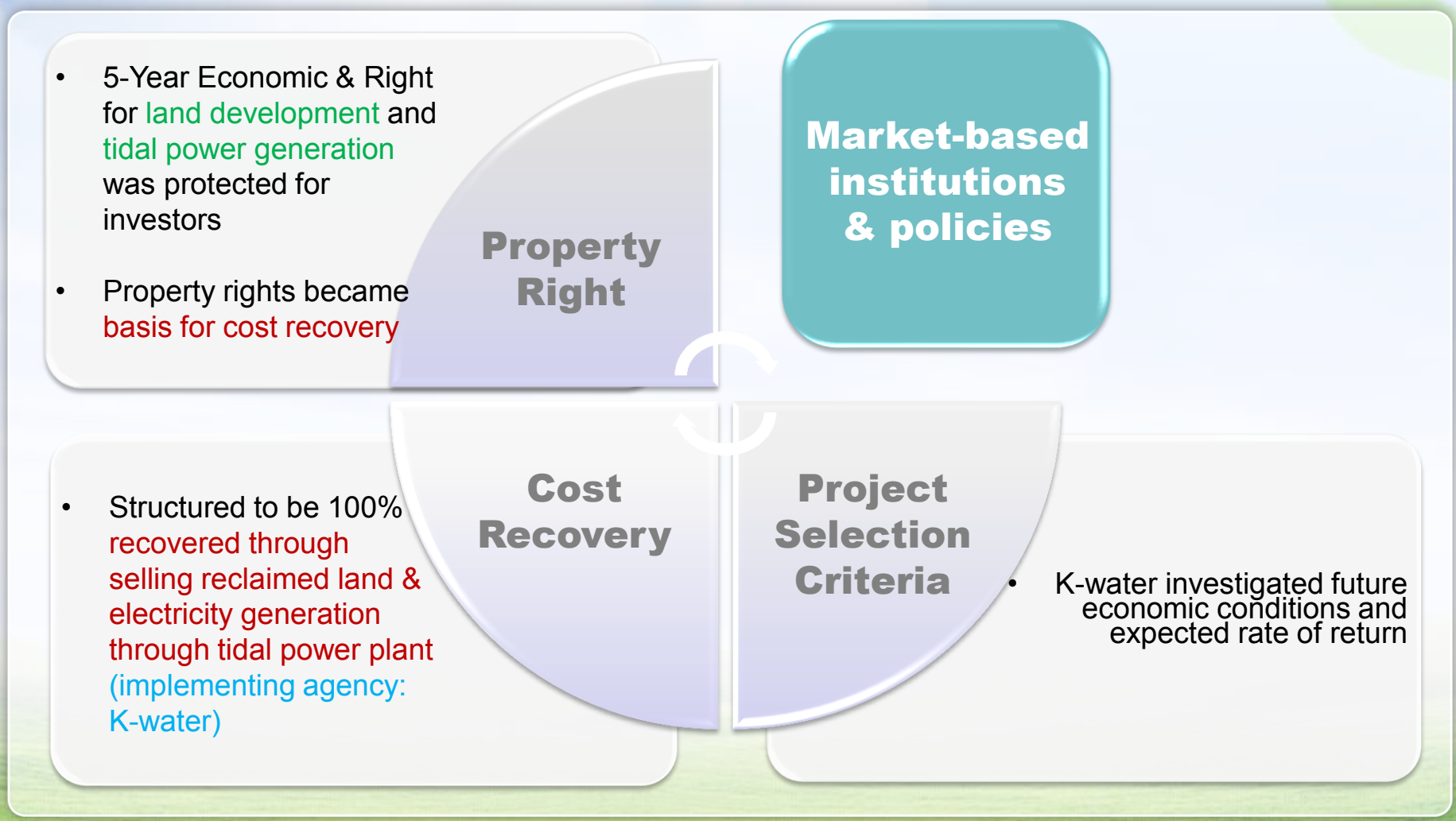
Chronological Table

Political factors	Presidednt Park Jeonghee (~1979)	Jeon Duhwan (‘81-‘88)	Noh Taewoo (‘88-‘93)	Kim Youngsam (‘93-‘98)	Kim Daejoong (‘98-‘03)	Roh Muhyun (‘03-‘08)	Lee Myungbak (‘08-‘12)
	Strong centralized state	Transition period for small government		1st local government head election (1995)	Decentralized state		
				Env. Office -> Ministry of Env. (1994)			
	Military junta		Democratizat-ion (‘87-‘92)	Civilian government			
Economic factors	Heavy chemical industry promotion (1970s)	Reorganization of industry (‘81-‘87)	Econ. liberalization (‘87-‘92)	Globalization, Tech. intensive ind. promotion (1993-1997)	Innovation-led economic growth (2000s ~)		
	Strong governmental intervention	Growth of labor power		World econ. Recession/ policy failure -> 1997 financial crisis (IMF)	Market-driven economic growth with tech-intensive and innovation-led industry/ Promotion of value added business		
		Growth of conglomerate					
Environmental and social factors	Weak environmental movement	Birth of environmental NGO and growth		1st env. move :Dong River (‘91-‘98) Nakdong Phenol leak (‘91)	Spread of environmental movement		
Main events	Southern & Western Tideland Develolpment Plan(1975)	Sihwa seawall construction began(1987)		Water quality improvement plan announced(1996)	Sihwa comprehensive management plan established(2001) Construction of a tidal power plant added(2003) Environmental improvement roadmap confirmed(2004)		

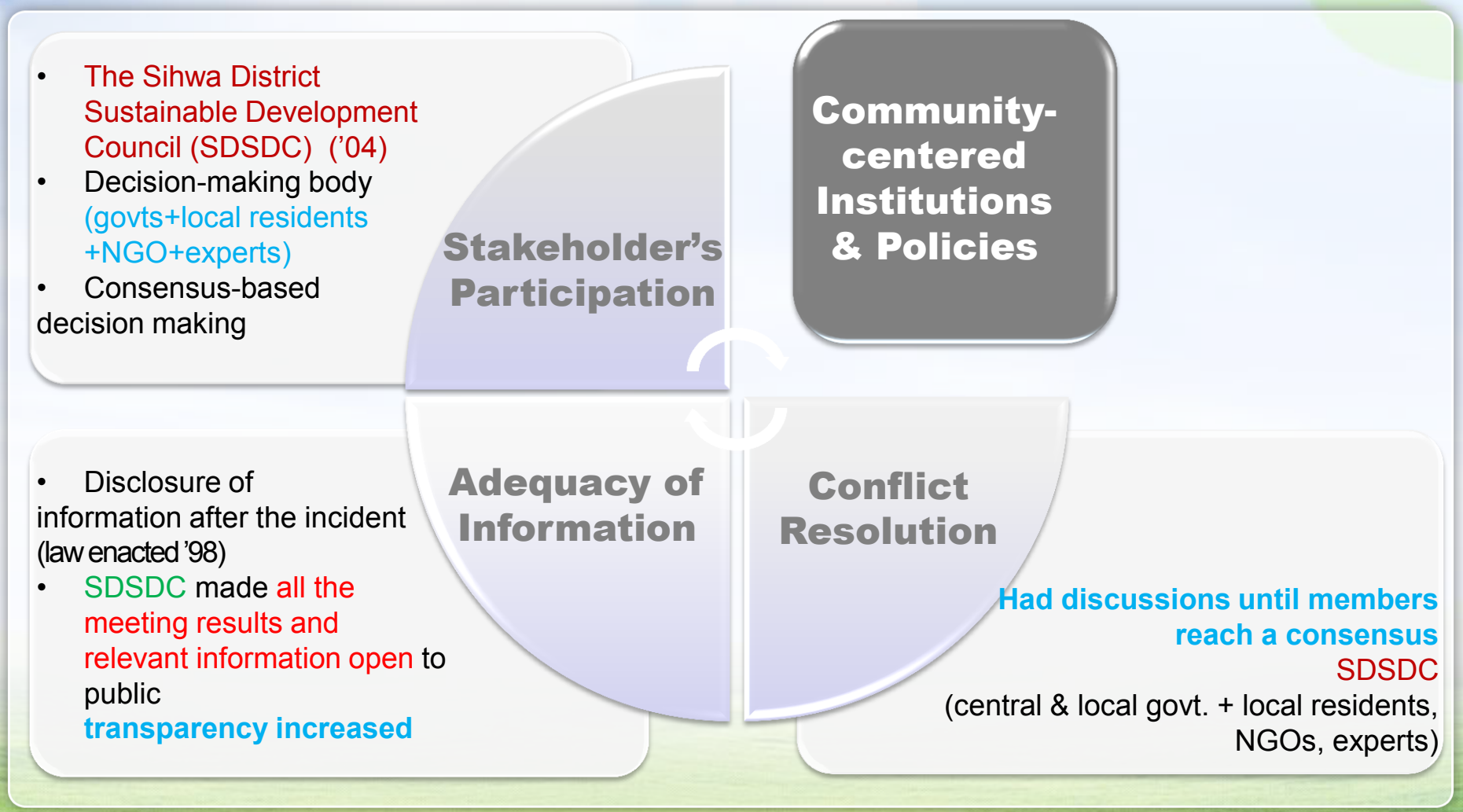
State-driven Institutions and Policies



Market-based Institutions and Policies

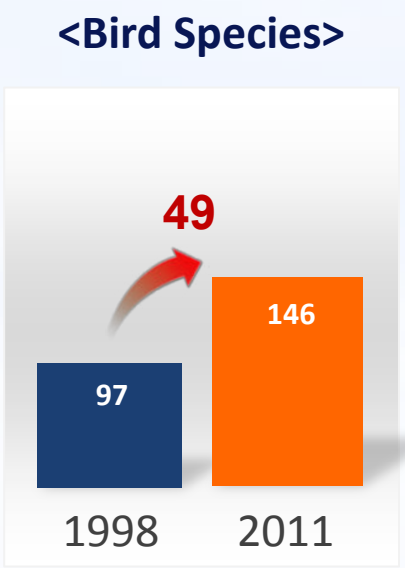


Community-centered Institutions and Policies



Environmental Performance

Water Quality Improvement and Increase in Biodiversity



Source: MEIS, National Marine Environmental Monitoring System, K-water(2005, 2013)

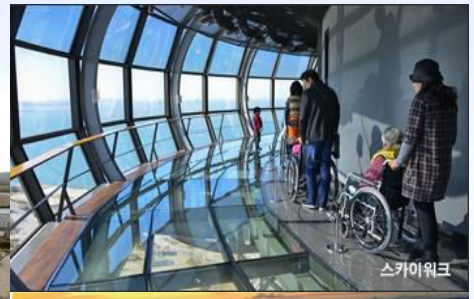
Social Performance

Advancement of Stakeholder's Participation through the SDSDC

- Re-establishment of trust between government and local residents
- Actually affected the project
- Transparency in project implementation

Improvement in Quality of Life

- More Leisure space
- Water quality improvement, Bad odor disappearance



Economic Performance

Economic Concentration Effect of industrial Complex

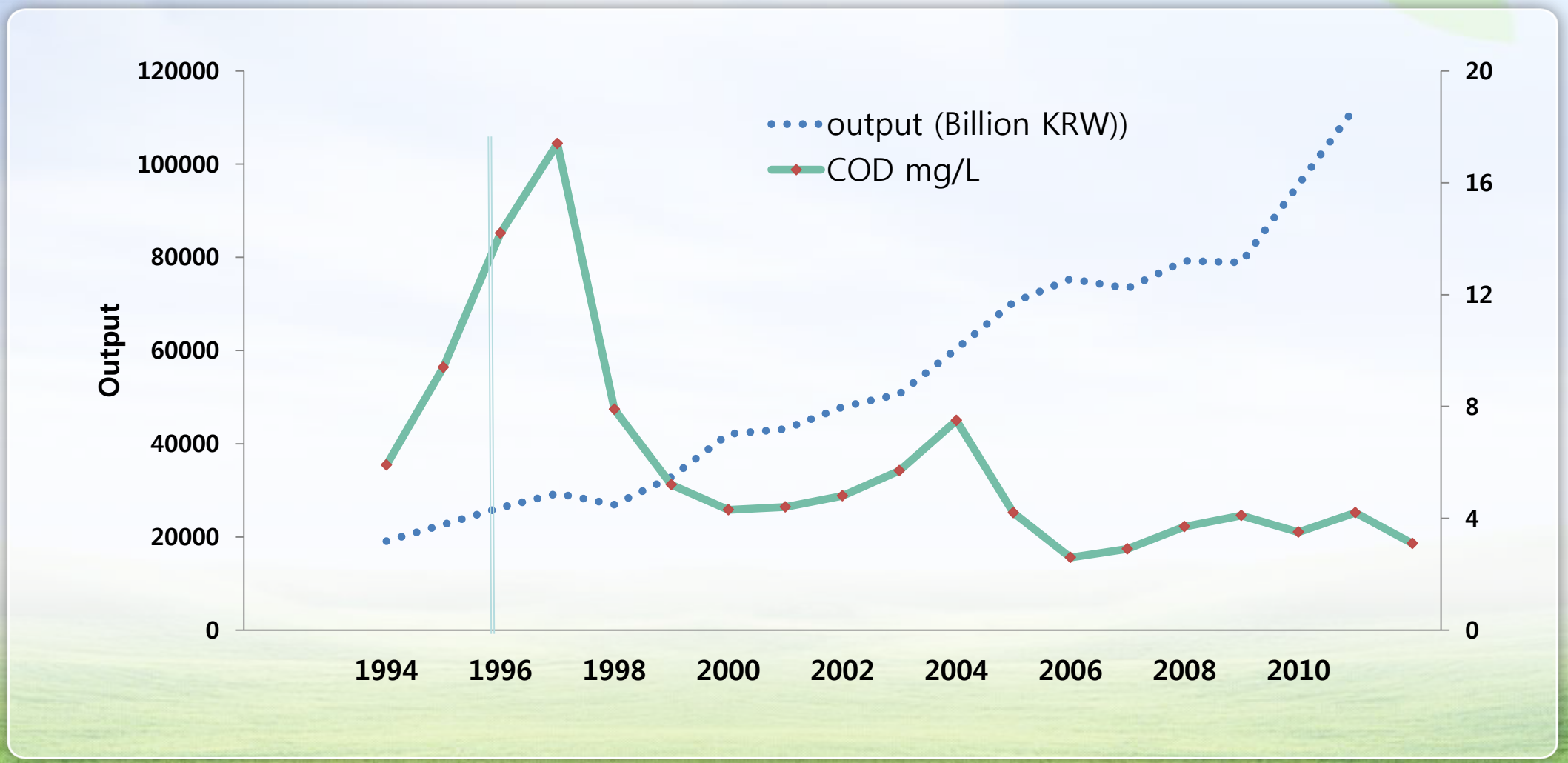
	1994		2009			
	Gyeonggi Province (B)	Sihwa District (D)	Gyeonggi Province (A)	Sihwa District (C)	(A/B) *100	(C/D) *100
No. of businesses	24,207	3,729	20,112	6,312	83.1%	169.3%
No. of Employees (monthly average)	761,168	183,053	726,109	246,134	95.4%	134.5%
Output	75,398	19,077	235,753	78,941	312.7%	413.8%
Value Added	35,188	7,927	96,161	29,518	273.3%	372.4%

(units: Businesses, employees, billion KRW)

Source: Gyeonggi Province

Evidence of WGG

Decoupling



After the Project


Songsan Green City


Sihwa Reed Wetland


Sihwa Tidal Power Plant &
Moon Observation Tower

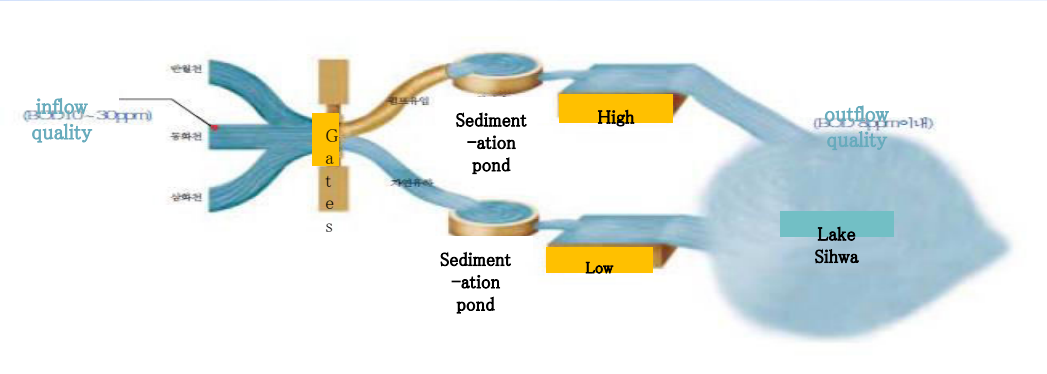

Sihwa Multi-techno Valley


Sihwa Seawall &
Tide Power Plant

Technical aspect (1)

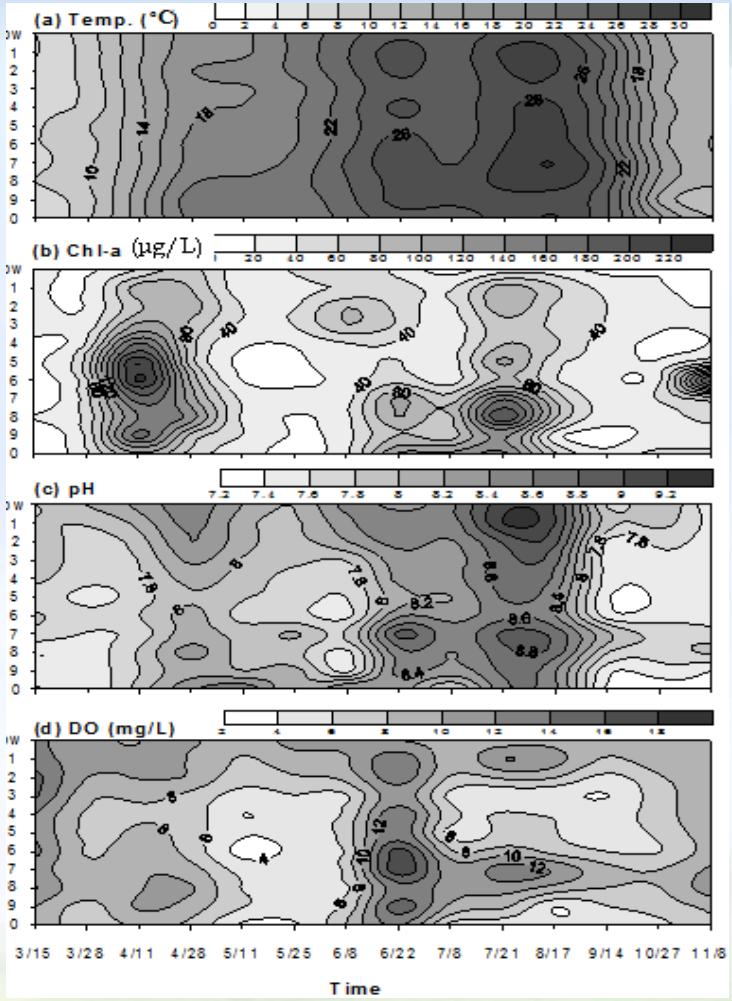
Constructed Wetlands

Designed considering structure of wetlands, shapes of area, concentration of flow, stay time, depth, plants, and soil environment, etc.



Sub-wetlands	Area	
Banwol Wetland	High wetland	19ha (190,063m²)
	Low wetland	23ha (225,889m²)
Donghwa Wetland	High wetland	15ha (152,500m²)
	Low wetland	11ha (113,499m²)
Samhwa Wetland		7ha (68,672m²)

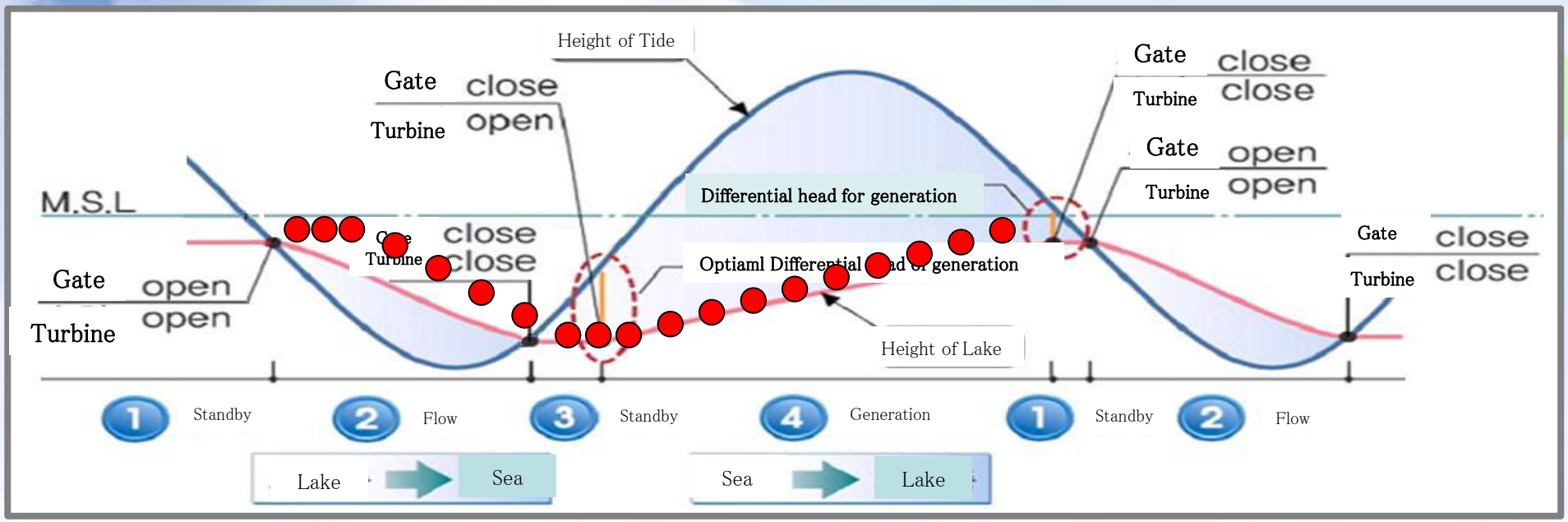
- High wetland : Bottom E.L. + 3.5m
- Lowe wetland : E.L. + 1.5m
- Closed water : 0.5 ~ 0.6m deep, Purifing water pollution, Plants
- Open water : 1.0 ~ 1.1m deep, Habitat space, oxygen, etc

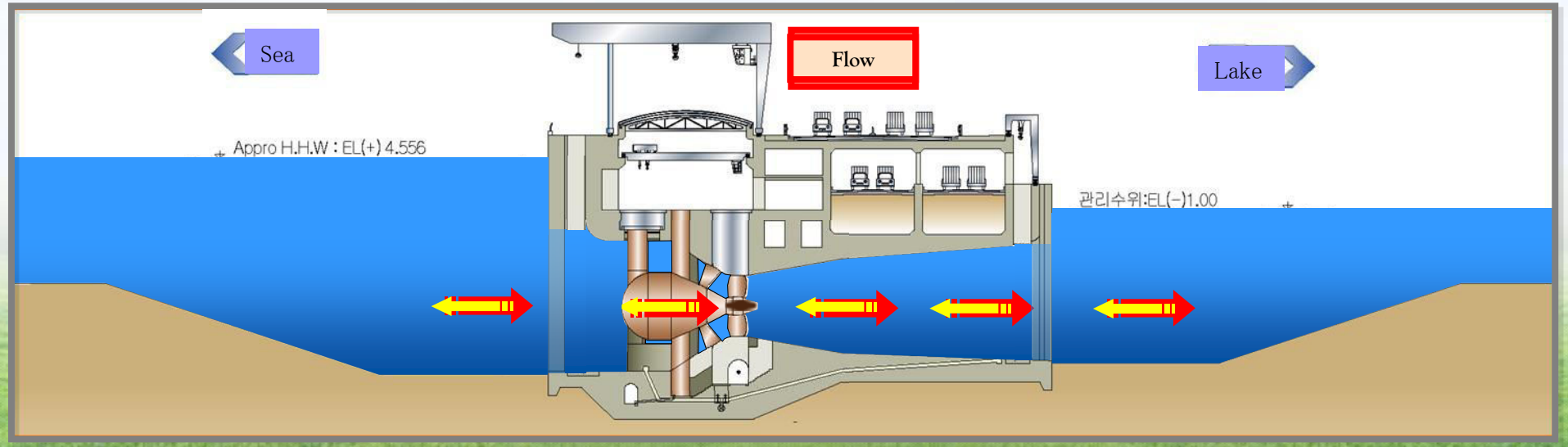


Temporal and spatial distributions of temperature(a), chlorophyll-a(b), pH(c), and dissolved oxygen(d).

Technical aspect(2)

Tidal Power Operation Control





Tidal Power Operation Control

- Collecting and monitoring data
  Height of tide, height of Lake, differential head, amount of water flow, volume of lake Sihwa, etc.

- Developing and upgrading Simulator for optimal operation of tidal power based on operating data

- Decision-making of Optimal operation based on data

Evidence of 'Implementation'

What actions have been taken?

1. Institutional: regulations, Water Act
   non-institutional: Environmental movement, civil activity
2. Hardware: establishment of the sewage treatment facilities
   software: capacity building, ecological park tour
3. Long-term: eliminate non-point pollutant
   Short-term: improvement of water quality
4. Technical approach
   Tidal power, Wetlands : Monitoring and analyzing Data for Designing, Operation and Management

Lessons Learned from Sihwa case

- Green growth is actually feasible not only in theory but in real world
- Context-based policy mix is important to attain Green Growth
- Stakeholder's participation is also important for inclusive growth
- Cost-effective way for inclusive growth in a long-term perspective

THANK YOU

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